PATHWAYS
OUT OF
POVERTY

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SELECTED ESSAYS FROM THE ANGELO KING INSTITUTE FOR ECONOMIC AND BUSINESS STUDIES

Edited by

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De La Salle University Publishing House
2016

Pathways Out of Poverty
Selected Essays from The Angelo King Institute for Economic and Business Studies

Published and distributed by
De La Salle University Publishing House
2401 Taft Avenue, Manila 0922, Philippines
Telefax No. (632) 523-4281
Email: dlsupublishinghouse@dlsu.edu.ph
Website: http://www.dlsu.edu.ph/offices/publishing-house/default.asp

The De La Salle University Publishing House is the publications office of De La Salle University, Manila, Philippines.

Cataloguing-in-Publication Data

HC
79
.P6
P37
2016

Pathways out of poverty : selected essays from the Angelo King Institute for Economic and Business Studies/edited by Marites M. Tiongco—Manila : De La Salle University Publishing House, 2016
415 p. ; 23 cm.

ISBN: 978-971-555-643-9

1. Poverty—Philippines—Economic conditions. 2. Poverty—Philippines—Social conditions. I. Tiongco, Marites M.

Cover Design: Shedina de Guia

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Editor’s Preface

Pathways Out of Poverty

This book is the first of the Angelo King Institute (AKI) book series titled “Essays on Poverty Pathways.” The twelve chapters of this book are outcomes of the research thrust of AKI on poverty, hunger, and food security. It synthesizes country-level and provincial research results of poverty and food research areas, which contributes to empirical knowledge and research methods for measuring poverty, inequality, and food insecurity.

Each chapter offers robust empirical findings grounded on theory and salient recommendations on how to reduce poverty and end hunger. However, much still remains to be done in understanding the causes of poverty and how to eradicate it in order to achieve sustainable and inclusive growth. This collection of essays on poverty pathways enumerates some of the causes of poverty, which include a) high levels of population growth; b) high levels of inequality; c) weakness in generating employment and low quality jobs generated; d) lack of education and health care; and e) exposure to economic crisis and natural disasters. In spite of the remarkable economic growth and the many government efforts to reduce poverty for more than four decades, the absolute number of people living below the poverty threshold has remained persistently large, at an incidence rate of 23%–25% in the first semester of 2012.

Organization of the Book

A brief summary of the highlights and key findings of the individual chapters is presented in this Editor’s Preface. This section will guide readers about the content, structure, and organization of the book. The first part of the book is all about poverty and its causes, and the second part is about poverty in relation to consumption and food security. Most of the empirical analyses used survey data such as the Community-Based Monitoring System (CBMS), Annual Poverty Indicator Survey (APIS), and the Family Income and Expenditure Survey (FIES).

In Chapter 1, Rivera and See (pp. 1-25) focused on the linkage between rapid population growth and poverty. They traced the factors that would reduce family size using the Community-Based Monitoring System (CBMS) survey for Pasay City, Eastern Samar, and Agusan del Sur in 2005–2006. The three provinces were selected to represent the geographical divisions of the Philippines, that is, the three islands Luzon, Visayas, and Mindanao. The factors that determined the optimal number of children were access to basic sustenance such as water, electricity, housing, food, and education and employment status of the household head. Results of the binary logistic regression revealed that households' population dynamics in the three provinces responded differently to educational attainment and availability of basic needs. For instance, in Eastern Samar, access to basic utilities and the structural design of the house's walls increase the likelihood that a family has less than five children. Higher levels of educational attainment in Pasay and Agusan del Sur indicate a decrease in the likelihood of larger family size. These findings suggest that policymakers must look into the socioeconomic context and underlying awareness in each location because the environment where an individual resides may significantly influence the likelihood of having more or less than five children. Thus, the government can address rapid population growth by providing households with access to basic needs, aside from promoting the use of modern contraceptives.

Chapter 2 provide insights to better understand the depth of food inequality in the Philippines by estimating Lorenz curves and Epanechnikov kernel densities at the regional and national levels. Aliping, Pizarro, Reyes, and Rivera (pp. 26-65) examined the complexity of food inequality by identifying factors that facilitate food consumption and assessed the effectiveness of government programs to reduce the incidence of hunger. Estimates of the Engel curve using APIS showed evidence of food inequality at varying depths. What is worth noting is that food distribution in the Philippines does not favor any region, but there are regions that have less food inequality compared to the national food distribution. Central Visayas, for instance, has one of the worst food distribution and food inequality, in contrast to NCR, which has the lowest incidence of food poverty. Southern Mindanao has the least state of food poverty probably because of its rapidly expanding agri-business, which augments food production and distribution to all households. Thus, the government must invest in technology that will enhance food production in the regions that have the potential to supply food to the entire country such as Central Luzon and Southern Mindanao. Aliping, Pizarro, Reyes, and Rivera (the authors) also used CBMS data of Pasay City (2005), Eastern Samar (2005), and Agusan del Sur (2006) to determine whether the government's poverty reduction programs can reduce the probability of hunger incidence; the CBMS survey will be employed since it contains the variables for the constructs hunger and government programs. Results showed that there is heterogeneity in food consumption among households because of different levels and sources of income. It is clear that people should have access to jobs that will provide them stable incomes; thus, resources should be allocated to provision of sustainable livelihood programs.

To address the food poverty gap between regions and augment food distribution and consumption of the poor households, the government provided cash and food grants. This is examined in Chapter 3 by Conchada and Rivera (pp. 66-90). They compared the effects of food and nonfood grants of the government on the state of hunger and school participation using CBMS household survey data from Eastern Samar and Agusan del Sur. Results showed that nonfood grants such as providing access to credit have significant influence on the incidence of hunger but were counterintuitive. It is possible that money borrowed from credit programs may not necessarily address the food insecurity concerns of the household because it is used for other purposes such as paying off another debt. Long-term benefits from the credit program will only be realized if the financial support is used for income-augmenting purposes such as sustainable livelihood programs and entrepreneurial activities. Other demographic variables such as income and household size turned out to significantly affect school participation and incidence of hunger. School participation rate among children of ages 6 to 12 can be increased through nonfood-grant programs such as scholarship programs. Feeding programs may also be considered to increase school participation. The small but positive effect of income on school participation could be due to the fact that income is transitory for most families living below the poverty line since they do not have permanent work. Government programs should also address this issue by generating employment opportunities that would provide a permanent source of income to the poor households.

In Chapter 4, Co, Arcilla, and Ocampo (pp. 91-112) determined correlates of hunger using the 2005 CBMS data of Pasay City. They measured hunger in terms of food threshold and the responses of household heads as to whether they have experienced food shortage in the past three months. The bivariate contingency and multiple logistic regression analyses showed that household size, household heads' highest educational attainment, and households whose housing units are not owned are positive correlates of hunger incidence. Moreover, the results showed that informal settlers, households living in dwellings with light/salvaged wall and roofing materials, and those without adequate water and toilet facilities tend to have a higher incidence of hunger. The local government of Pasay offered relocation to informal settlers, and those who are willing to be relocated back to their provinces were given financial assistance to help them resettle. The role of education in alleviating the food conditions of the poor should also be emphasized. Higher educational attainment of heads of families will allow them to land jobs and enable them, among other things, to own consumer durables, which is another significant correlate of hunger among households. Again, providing scholarship grants will encourage household heads to send their children to school.

In the absence of appropriate panel data, Aliping, Rivera, and Pizarro (pp. 113-137) used a repeated cross-section and pseudo panel analysis using education as a primary variable to estimate the dynamics of poverty. They estimated the upper bounds and lower bounds of poverty mobility in order to better understand why households move from a state of being poor to nonpoor or nonpoor to poor or remain in the current state. Results suggest that there are households who have the tendency to remain in their current state (i.e., being nonpoor), and these are households who have invested on human capital and have stable employment. Those household heads that have acquired skills and education are more prepared to deal with economic shocks and catastrophic events. The authors recommended that the government should not only expand and strengthen the country's basic education system but also provide opportunities for every Filipino to acquire skills suited for specific jobs from technical-vocational courses.

In Chapter 6, Rufino (pp. 138-167) estimated the schooling and employment choices of Filipino children and their relationship with poverty using the multinomial logit model. He used the Annual Poverty Indicator Survey (APIS-2011) to determine the factors affecting the decision of children (or parents/guardians) to study or to work. Among the attributes included in the analysis are the child's and household head's demographic characteristics and household socioeconomic and locational characteristics. Despite the implementation of legislations that provide every Filipino free and compulsory education in elementary and high school, Rufino (the authors) found 39% of child labor incidence in the country in 2011, particularly for the ages of 16–17 years old. The variables that determine the decision to work or go to school are the age and sex of the child, marital status, family size, per capita household expenditure, presence and number of younger children (6 to 12 years old) in the household studying, household head's educational attainment, provision for electricity to the household, household's engagement in self-employment activities, urbanization, regional location, and poverty status of the household.

Chapters 7–12 compose the second part of the book, which discusses issues on consumption and food security.

As food is the priority item in the household's consumption basket, Chapter 7 by Rufino (pp. 168-200) investigated the food consumption patterns using FIES data from 2003 to 2012. Very few studies have looked at the shift of preferences or consumption patterns because of improved purchasing power of the individual and time constraints in preparing food at home. The main contribution of this chapter is the estimation of on consumption patterns of food away from home (FAFH) through the Working–Leser Engel curves using FIES data. One interesting result of this study is that the poor households allocate a higher share of their income to FAFH than rich households. The results of the study point to a steady convergence, over time, of the proportion of food eaten at home (FAH) and the proportion of FAFH, with more and more Filipinos increasing their consumption of FAFH, to a point during the modern times, when this major food consumption category becomes a necessity consumption item rather than a luxury good, as it was before.

In Chapter 8, Rufino (pp. 201-270) described the consumption profile of poor households (belonging to the lowest 20% income quintile) in Metro Manila using the 2009 FIES data. He demonstrated that poor households allocate half of their limited income to food and 18% to house rent. The remaining amount is spent on other basic needs such as education, medical care, and apparel. The poor families in Metro Manila are composed of four members, with a 46-year-old high-school-educated household head, with an average income of P117,087 and total expenditure of P115,433. It may be difficult for a poor Filipino family to make both ends meet, but it is able to pay income tax and can even save a small amount.

Chapter 9 is about the impact of access to schools and economic centers on poverty and gender equity. Filone (pp. 271-333) applied a generalized cost model to measure accessibility of households to schools and economic centers by determining road networks in ten provinces where CBMS data is available from 2006 to 2011. He measured poverty in terms of income below the food and poverty thresholds and food shortage. His key findings suggest that food shortage is not a good indicator of poverty, which means that being may not necessarily mean that they experience food shortage, regardless of gender, compared to the other measures of poverty. Households whose incomes are below the food threshold and those who experienced food shortage between genders are also consistent with the result of those whose income is below the poverty threshold. However, those who experienced food shortage are consistently lower than the other two measures of poverty. More males than females are below the poverty and food thresholds. As expected, the number of dropouts increases as children move up from elementary (6–12 years old) to high school (13–16 years old), particularly males. In terms of access to schools, access to the nearest high school is correlated with the proportion of males and females not attending high school. Unlike elementary schools, not all barangays have high schools. The government should also put up more high schools where there are a high number of high school students. Consequently, more males than females are unemployed, but in terms of proportion at the barangay level, males are fewer than females, probably because there are few females who belong to the labor force. Availability of infrastructure such as roads has no effect on unemployment at the barangay level, but poverty incidence is lower in areas where there is a good road. Access to market and economic centers is more positively correlated with the proportion of poor households below the poverty threshold but not in the case of proportion of unemployed, probably because of opportunities for self-employment like farming and fishing. Thus, livelihood opportunities and infrastructure projects should target key causes of poverty to improve household well-being.

In Chapter 10, the study of Carandang and Banaguas (pp. 334-360) identified which climate risks affect food security in Saguday, Quirino, using probabilistic modeling and deterministic simulation modeling. Results suggested that Saguday is vulnerable to climate hazards and projected that it will experience 33 typhoons, with 20 floodings that would last for 3 days. It was also projected that it will experience five droughts that will last for 2 days per drought. These occurrences will affect food production and availability. It was recommended that infrastructure support to coastal resource management be improved as well as technical capacity building to weather surveillance, disaster preparedness, and environmental infrastructure buildup. It was also recommended that implementation of environmental policy should be improved and that best practices to alleviate the impacts of climate change particularly on food production and security should be incorporated into the governance and management of Saguday.

In Chapter 11, the role of diversified agriculture in the context of food security and poverty reduction for a rapidly urbanizing Philippines was studied by Carandang, Taylor, and Calleja (pp. 361-374). They showed that urban farming such as growing lettuce hydroponically on rooftops is feasible and productive. Hydroponics is a method of growing plants using plant nutrient solutions instead of growing in soil. The plants are grown in a controlled environment, which could reduce disease and pest infestation and maintain sunlight application and shading and temperature, hence preventing crop losses. The authors demonstrated that growing vegetables hydroponically is efficient in terms of time, water, and energy used, as it requires less water, with shorter duration of growing vegetables, and less energy to get food to the plate. It reduces ecological footprints by making vegetables readily available in the urban areas and not to be packed and transported to urban areas. Thus, it contributes to food security as it reduces spoilage of perishable vegetables and transport costs.

Finally, in Chapter 12, hydroponics was compared with organic farming, also in an urban setting, by Carandang, Taylor, Calleja, Busayong, and Punzalan (pp. 375-396). They found out that lettuce grows faster in a hydroponics setup than organic agriculture, which implies that with a shorter maturation period, there will be a higher cropping intensity and thus higher overall yield. The nutrient content of the yield, growth parameters, nutritional value, and chemical contaminants were comparable using both methods for urban agriculture. Organically produced lettuce is larger and heavier than that of hydroponically produced, but the nutrient value is the same. In terms of contaminants, the authors observed that plants can pick up chemicals from the environment where they are grown so farmers have to take extra precautionary measures when growing plants in the urban areas.

The diverse topics covered in this volume reflect a cross-section of papers on research concerning pathways out of poverty and food security. The main pathway out of poverty is connected to increases in productivity and income of the poor households, whether these increases are realized in urban agriculture, entrepreneurship, and other income generating activities; or in promoting human resource development; or designing programs to end poverty that are sustainable and targeted to the poor. It has been emphasized in the first few chapters of this book that targeting of beneficiaries of poverty reduction programs should also be revisited so as to optimize the use of resources of the government and achieve inclusive growth. For example, scholarship programs can be targeted to increase school participation rates in rural areas with a high incidence of hunger and rapid population growth. It has been emphasized in all the chapters that government programs should be sustainable in order to effectively address poverty issues. There were also recommendations of tapping public-private partnerships in creating favorable business environments that generate employment, such as the *Go Negosyo* program, which aims to educate and provide network for potential entrepreneurs in the country. Such opportunity will help improve the livelihoods of the poor through better access to employment and income–generating jobs.

Marites M. Tiongco
Editor

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Addressing Rapid Population Growth Through Government-Sponsored Programs: The Case of Pasay City, Eastern Samar, and Agusan del Sur

John Paolo R. Rivera and Kurt Gerrard T. See

Rapid population growth is one of the socioeconomic problems that plague the Philippines, contributing to underdevelopment, economic stagnation, resource depletion, a low literacy rate, and a high crime rate. It also gives rise to the widespread problems of poverty and unemployment—these happen most often in developing economies where population grows faster than the economy (Todaro & Smith, 2006). In 2015, as per the reports from the Philippine Statistical Authority (PSA, formerly known as the National Statistics Office), the Philippine population already reached 100 million. The factors that contribute to rapid population growth include poverty, high incidence of hunger, a lack of job opportunities, and substandard education, which may result from one another (Cuyegkeng, 2006).

The Philippine government also initiated legislative reforms to address rapid population growth such as the legalization of the use of contraceptives (i.e., condoms, birth control pills, and IUDs), and family planning—also known as the Responsible Parenthood and Reproductive Health Act of 2012

(RH Law). It guarantees universal access to contraception methods, fertility control, maternal care, and sexual education. It promotes information on and access to both natural and modern family planning methods that are medically safe and legally permissible. It also creates an enabling environment where women and couples have the freedom of informed choice on the mode of family planning they want to adopt based on their needs, personal convictions, and religious beliefs.

However, this law is being condemned by the Roman Catholic Church (RCC) because it contains penal provisions that constitute a violation of free choice and conscience and establishes religious persecution (de Ocampo, 2009). Additionally, by making modern forms of contraceptives readily available, the youth will have little to worry about premarital sex. It is also being criticized for its mandate that the public and the private sectors will fund and distribute contraceptives and the state will disseminate information on their use through health care centers (Gopalakrishnan, 2008).

Despite the abovementioned criticisms, Bernas (2008) rationalized that the arguments for and against the law are just natural consequences of the fact that the moral rules of Philippine society and much of its civil laws are grounded on religious values. Bernas (2008) furthered that the country is a religiously pluralist society, where citizens can differ in matters of morality. Most importantly, Bernas (2008) reasoned that the law is not entirely ruinous because it also seeks to address the needs of women and the youth, especially among the poor.

While the debate between the government, health organizations, and the RCC is still a long way to go, the population is rapidly expanding at an exponential rate. Hence, it may be necessary to explore other alternatives. Rapid population growth needs to be addressed now. Although the discourse on the issue of rapid population growth is healthy for society, it continues to delay the nation's transition towards a progressive society because the issue fails to be addressed. Hence, we explore an alternative to the RH Law that will limit family size and is aligned with both the goals of the state and the faith of the RCC. In this alternative, we explore whether the access of households to basic necessities and social services will inhibit them from having a family size beyond what is deemed to be optimal. As such, our specific research objectives include

1. To determine whether access to basic sustenance of households, specifically water, electricity, housing, and food (i.e., living conditions), can influence family size;
2. To determine whether access to education will aid in limiting family size;

3. To determine whether access to employment will aid in limiting family size; and
4. To provide policy recommendations on how the government will be able to address rapid population growth without contradicting the moral values of the RCC.

Once it is shown whether the access to welfare-enhancing instruments limits household size, then it is plausible to propose an alternative solution—instead of advocating the use of contraceptives, the state can simply develop its socioeconomic policies that the RCC supports.

Poverty, Fertility, Population, and Women Empowerment

Education and Household Size

In exploring the relationship between the level of parental education and fertility, Bautista (2007) suggested that parental education has an ambiguous impact on family size. Individuals with higher levels of education are bound to acquire more meaningful income-generating opportunities than their less educated counterparts. Thus, a trade-off between the exploitation of such opportunities and childcare begins to surface—the incentives of childbearing decrease as the returns to labor-force participation increase. When parents prefer pursuing career opportunities than having children, the substitution effect dominates. In a much earlier study by Turchi (1975), any activity that requires the use of market goods and services or the consumer's time must be weighed in the context of allocating scarce resources among competing alternatives. That is, parents must be able to choose between the rewards of childbearing and the rewards from other activities that can be done should they decide not to have an additional child. Turchi (1975) also indicated the possibility of a positive relationship between education and family size. The additional income due to higher levels of education allows parents the financial capacity to have more children. In this situation, the income effect dominates.

Beyond the quantity of children, Janowitz (1976) suggested that education affects family size through direct and indirect channels. Direct influences include a higher degree of attitudinal maturity and exposure to vital information that pertain to the costs of childbearing and the availability of contraception. Indirect influences include preference towards participation in the labor force and the choice of deferring marriage as a result of much time spent for schooling. Therefore, the educational attainment of both husband and wife does impact fertility rates. Van de Kaa (1996) reinforced this finding by showing the strong interaction between quality and quantity of children. In most cases, educated parents tend to prioritize quality over quantity of children. It can be construed that there is focused spending on a few offspring as opposed to spreading income too thin amongst many children.

Poverty and Rapid Population Growth

There is a dual relationship between poverty and rapid population growth (McNicoll, 1997). Todaro and Smith (2006) provided a comprehensive explanation as to how this phenomenon is indeed applicable to many developing economies.

High population levels and growth rates are usually associated with higher levels of poverty. This is because an additional member of a household will require additional expenditures—reducing the family savings rate. Instead of spending on activities that will increase the quality of life of the household (i.e., entrepreneurial undertakings), income is spent to sustain the additional member. On an aggregate perspective, a larger population may hinder the effective and efficient provision of social services as scarce funds are distributed too thinly across a huge number of individuals.

Poverty is one of the main causes of high fertility rates. One of the most important determinants of fertility lies in intergenerational wealth flows (Caldwell, 1978). That is, in traditional societies, where net wealth flows from young generations to the elderly, children were perceived to be sources of future income. In other words, in early stages of economic development, parents expect to benefit from having many children (McNicoll, 1999).

Alternatively, low-income societies with high rates of child mortality owing to poverty and the lack of adequate resources have been shown to exhibit higher fertility rates—called the "hoarding" and "replacement" motives (Schultz, 1997). Hoarding refers to how parents bear an excess number of children to hedge against the possibility of death of an offspring. This is very likely in areas experiencing limited access to basic necessities and social services. Replacement concerns the typical response of parents to replace a child after a death. These behaviors, although require a more complex understanding of human behavior and psychology, are attributed to the diminished need to replace dying children and the institutionalization of improved social services, which reduces the economic value once conferred upon children.

Other practical reasons why having more children is crucial are the following: (1) in locations where child labor is rampant, children are expected to augment income through employment at young ages; (2) children are seen as substitute parents who will be assigned to fend for younger siblings; (3) children are used as means to acquire wealth from dowries; and (4) children are substitutes to a formal social security system, as aging parents seek support (Todaro & Smith, 2006).

Employment and Fertility Rate

In understanding the causal relationship between female labor force participation and fertility rates, a conceivable explanation can be found in the seminal work of Mincer (1962) and Becker (1965) stating that an individual's limited amount of time can be allocated between work-related activities, home-related activities, and leisure. Hence, an increased amount of time spent at work will naturally reduce the amount of time that can be spent for leisure and home-related activities. Such has been verified by the studies of Faria and Wang (2007) and El-Ghannam (2005), wherein they found a negative relationship between employment and the number of children. According to Faria and Wang (2007), the opportunity cost of women's time is the primary determinant of the inverse relationship with fertility rate. Increased wages for women makes childrearing costlier as time spent on childrearing will imply forgone returns to employment. It can be construed that women face the trade-off between employment and having children.

Other factors may also influence the type of relationship between female labor force participation and fertility rates. Rindfuss and Brewster (1996) categorized such factors into two major categories: (1) social structural factors and (2) attitudinal or ideational factors. Social structural factors refer to policies that aim to reduce the conflict that exists between employment and childrearing. The institutionalization of tax relief, parental leaves, flexible work hours, and access to childcare facilities (i.e., daycare centers and nannies) allow women to simultaneously carry out both work-related and home-related duties. Attitudinal or ideational factors refer to the role of culture and gender perceptions in determining the relationship between labor force participation and family size. The rigidity of gender roles and societal perceptions on working mothers play a role in the ability to engage in work-related activities. The proper distribution of home-related duties and appropriate childbearing practices do vary across societies.

Women Empowerment and Opportunity Costs to Childbearing

Rising women's access to opportunities may diminish fertility rates (Todaro & Smith, 2006). Thus, access to women empowerment programs can create awareness of the potential lifestyle alternatives to motherhood and childrearing. Davis, Bernstam, and Ricardo-Campbell (1986) and Garcia (2000) defined women empowerment as the provision to women of access to employment, access to education, and access to reproductive health care that is free from discrimination, compulsion, and aggression.

The facilitation of awareness campaigns, livelihood programs, and reduction of gender prejudices create possibilities where women can explore their personal development and perform childrearing without staying in the household. Likewise, as women are given access to the same economic returns enjoyed by males, excessive childbearing may be mitigated due to increased opportunity costs. Such findings warrant a growing concern for state planning for future workforce and social security needs (Chavkin, n.d.). Consequently, the decrease in birth rates led to improvements such as economic growth resulting from women's increased employment, improved health and education of children, benefits for women's health, and life opportunities.

While demographers have observed that fertility decline constitutes mortality decline attendant due to enhanced living conditions and medical advancement, they had expected fertility to level off at replacement rates. As expounded by Sorrentino (1990) and Mason and Jensen (1995), the decline in fertility is associated with mortality decline, increased longevity, urbanization, increased female education and employment, changes in family formation such as delayed marriage and first birth, increases in divorce and out-of-wedlock childbearing, technological advances in contraception, increased costs of childrearing, opportunity costs for women, increased secularity and individualism, and changes in economic and cultural aspirations.

Operational Framework and Methodology

Maximum Likelihood Estimation (MLE): The Binary Logistic Regression

The qualitative response model (QRM) involves a dependent variable that indicates in which one of m mutually exclusive categories the outcome of interest belongs in which no ordering is required for the categories (Gujarati & Porter, 2009). In this study, categorization is done on the number of children a typical Filipino household has. Each household is classified as whether it has a relatively acceptable number of children or otherwise. We have specified that the acceptable number of children for a typical Filipino household is 4 based on the statistics from the PSA (http://psa.gov.ph) showing that the average number of children per woman in 2006 is 3.2. Hence, it can also be construed that the average household size in the Philippines is 6.

We employ a binary logistic regression model. For a binary outcome data, the dependent variable, y, takes one of two values as shown by Equation 1.

$$y = \begin{cases} 1 & \text{with probability } p \\ 0 & \text{with probability } 1 - p \end{cases} \tag{1}$$

From Equation 1, y assumes a value of 1 if the number of children in the household is at most 4 and assumes a value of 0 if otherwise. There is no loss of generality in setting the values to 1 and 0 if all that is being modeled is p, which determines the probability of the outcome (Cameron & Trivedi, 2005). Equation 2 represents the model specification.

$$\ln\left(\frac{p_i}{1 - p_i}\right) = x'\beta + \varepsilon \tag{2}$$

where $p_i/(1 - p_i)$ measures the probability that $y = 1$ relative to the probability that $y = 0$, which is called the odds ratio (Gujarati & Porter, 2009). For the logistic regression model, the log–odds ratio is linear in the regressors (Cameron & Trivedi, 2005). For the complete details of this section, refer to Rivera and See (2012).

Model Specification

In tracing the influence of the availability of water, electricity, housing, education, food, and employment status on the probability that a household will have a relatively acceptable number of children, the data on household characteristics and demographics were sourced from the community-based monitoring system (CBMS) survey for Pasay City in 2005, Eastern Samar in 2005, and Agusan del Sur in 2006. These provinces were selected to capture the Philippine behavior in its entirety with sufficient and acceptable representatives from Luzon, Visayas, and Mindanao. Equation 3 gives the logistic specification of the variables influencing the probability that the household will have the optimal family size.

$$\ln\left(\frac{p_i}{1-p_i}\right)=f(WATERNEAR_i, ELECT_i, WALLSTRONG_i, ROOFSTRONG_i,$$
$$PERMANENT_i, SEASONAL_i, TEMPORARY_i, HHINCOME_i, ELEMGRAD_i, \quad (3)$$
$$HSUNDR_i, HSGRAD_i, PSUNDR_i, PSGRAD_i, COLUNDR_i, COLGRAD_i, WMSPHD_i,$$
$$WOMEN_i, HEALTH_i, SCHOLAR_i, TRAINING_i, HOUSING_i, CREDIT_i) + \varepsilon$$

where p_i is the probability that a household has four children at most, while $(1 - p_i)$ is the probability that a household has number of children greater than four. This is an indicator whether a family has the desired number of children below or beyond the usual number of children.

$WATERNEAR_i$ is a dummy variable indicating whether a household is near the source of water. It assumes a value of 1 if the distance of household from the source of water is near, and 0 if otherwise. Note that if the water source is inside the household fence or yard and/or outside the fence or yard but less than 250 m away, it is deemed to be near. On the other hand, when the water source is more than 250 m away from the household and/or the distance is undetermined, it is deemed to be far.

$ELECT_i$ is a dummy variable to indicate the presence of electricity in the household. It assumes a value of 1 if the household has electricity, and 0 if otherwise.

$WALLSTRONG_i$ and $ROOFSTRONG_i$ are dummy variables indicating the strength and type of building materials used in the construction of the walls and roofs of houses, respectively. It assumes a value of 1 if the walls and/or roofs are made of strong materials, and 0 if the walls and/or roofs are made of light materials, salvaged materials, or a mixture of strong, light, and/or salvaged materials.

$WATERNEAR_i$, $ELECT_i$, $WALLSTRONG_i$, and $ROOFSTRONG_i$ are indicators of poverty and poor living conditions. Todaro and Smith (2006) defined poverty as the incidence of not being able to afford basic needs and wants, which includes food, clothing, housing, medicine, education, and other necessary social services. Insufficiency of these elements in the household indicates that the household is enduring poverty, which then influences the decision to increase the number of children in the household as explained by Caldwell (1978), Rogers (1989), McNicoll (1997, 1999), and Schultz (1997). Hence, based on the definition of these dummy variables, all are expected to have a positive impact on the probability that the household will have at most four children.

$PERMANENT_i$, $SEASONAL_i$, and $TEMPORARY_i$ are dummy variables indicating the employment status of the household head, namely, permanent employment, seasonal employment, and temporary employment, respectively. Categories assume a value of 1 if the household head is permanent, seasonal, or temporary, and 0 if otherwise. It is expected that this variable will have a positive impact on the probability that a household has a number of children less than or equal to four in reference to the studies of Mincer (1962), Becker (1965), Rindfuss and Brewster (1996), El-Ghannam (2005), and Faria and Wang (2007). However, the magnitude of each type of employment might differ.

$HHINCOME_i$ measures the total household income. It is the summation of all sources of household income from domestic and international sources. Based from the microeconomic theory of fertility cited by Todaro and Smith (2006), this variable will have an ambiguous effect on the probability that a household will have an optimal number of children. Higher income does not necessarily imply that households will have more children because of the tendency of parents to prioritize quality of children over quantity.

$ELEMGRAD_i$, $HSUNDR_i$, $HSGRAD_i$, $PSUNDR_i$, $PSGRAD_i$, $COLUNDR_i$, $COLGRAD_i$, and $WMSPHD_i$ are dummy variables indicating the highest educational attainment of the household head, namely, elementary graduate, high school undergraduate, high school graduate, postsecondary undergraduate, postsecondary graduate, college undergraduate, college graduate, and with graduate studies, respectively. The category elementary undergraduate was dropped to avoid the dummy variable trap. It is expected that this variable will have an ambiguous impact on the probability that a household has a number of children less than or equal to four in reference to the studies of Turchi (1975), Janowitz (1976), Van de Kaa (1996), and Bautista (2007).

$WOMEN_i$ is an indicator whether the woman in the household, specifically the mother, has attended women empowerment programs and positively benefited from it. Women empowerment programs aim to improve the living conditions of women by allowing them to have access to information about opportunities outside the household, to participate in the formulation and implementation of policies. Likewise, these programs enhance women's involvement at all levels of management, including policy making and decision making, and increase women's control over the decisions that affect their lives both within and outside the household. It assumes a value of 1 if the woman attended such programs and it brought positive effects to the household. Note that in the CBMS data set, the effect of the program is categorized as negative effect, no effect, or positive effect. This is different from the highest grade completed because women empowerment programs are considered to be ad hoc programs that are forced, arranged, or done for a particular purpose, which is to promote women's welfare alone unlike formal and technical education, whose purpose is skill building. It is expected that this variable will have a positive impact on the probability that a household has a number of children less than or equal to four in reference to Sorrentino (1990), Mason and Jensen (1995), Castles (2003), Todaro and Smith (2006), and Chavkin (n.d.).

$HEALTH_i$, $SCHOLAR_i$, $TRAINING_i$, $HOUSING_i$, and $CREDIT_i$ are dummy variables indicating whether a household received health programs, scholarship programs, training programs for vocational purposes, housing programs, and credit programs, respectively. These variables represent the provision of government subsidies that will augment the lack of capacity of households to acquire such services from the private sector. It is expected that these variables will have various impacts on the probability that a household will have the optimal number of children. For instance, scholarship programs have the tendency to increase the probability that a household will have more than four children because the burden of sending their children to school will be lower.

Results and Discussion

Pasay City, Metro Manila

Pasay City is a political subdivision in the National Capital Region (NCR). It has been on the pursuit of continuously providing the basic necessities of its swelling urban population. To meet its people's health requirements, Pasay has established the Pasay City General Hospital, which provides medical services to all its residents. Moreover, as a matter of policy, Pasay places education as its top priority evidenced by the local educational system that utilizes private–public partnerships (PPP). Basic education in the city is both publicly and privately provided. From the 2005 CBMS survey, the total number of households in Pasay is 65,117, with a mean household size of 4, and a total population of 132,704. Furthermore, electricity in Pasay is distributed by the Manila Electric Company (MERALCO), and water supply is handled by Maynilad Water Services, Inc.

The marginal effects for Pasay are shown in Table 1. For the rudiments of deriving the marginal effects for Pasay, refer to Rivera and See (2012). From Table 1, poverty indicators represented by the physical characteristics of the household have varying impacts and statistical significance. For instance, the water source convenience, availability of electricity, and the physical structure of the house do affect the probability that a household will have the optimal number of children. Results show that the probability a household will have at most four children will increase if the structural integrity of the house is superior. This result suggest that the physical structure of a house indicates the income capacity of the household, such that superior physical construction of a house means that the owner may have the financial means to have it constructed. This is indicative of an improved wealth dimension of the household that induces them to prioritize the quality over the quantity of children. However, the ease of access to water source reduces the chance that a household will only have four children. An explanation for this is: regardless of wealth and income status, everyone will always have access to water since it is a common resource. Another plausible explanation can be attributed to health and sanitation purposes—water serves a primary necessity for everyday living such as for drinking, bathing, and cleaning. Thus, availability and accessibility of water increase the household size by means of improved health conditions via reduced water-borne diseases. The availability of electricity demonstrated a statistically insignificant marginal effect suggesting that electricity is not really a strong consideration for family size.

These incongruent findings just show that each poverty indicator does not categorically imply any definite conclusion. It indicates the ambiguity of how the state of poverty influences the decision to increase family size. According to Todaro and Smith (2006), increasing family size in the context of poverty has two motivations: (1) each additional member of the household is an additional mouth to feed, and this additional cost discourages the household to increase its size, and (2) each additional member of the household can be an additional source of future income, which encourages households to increase its size. As such, it can be concluded that poverty is not a strong consideration for family size because of the varying and conflicting motivations that households have towards an additional member. The decision to increase family size vis-à-vis the state of poverty is behavioral in nature.

To reinforce this claim, results have shown that the income generated by the household and the employment status of the household head showed negative and statistically significant marginal effects on the probability that a household will have at most four children. This exemplifies the ambiguity of income effect. Here, higher income provides households the financial capacity to have more children. With regards to employment, results showed that whether the household head is permanently, seasonally, or temporarily employed, the probability of having only four children in the household decreases. Just like income, being employed reinforces the capacity to have more children because there will be income to the household regardless of employment status.

Looking at the magnitude of the marginal effects, it is noticeable that when a household head is temporarily employed, the probability of obtaining the optimal household size for a Filipino family is reduced by the highest amount relative to being permanently or seasonally employed. This implies that despite a precarious state of employment, they view their children as investments that will augment family income in the future—an incentive to increase family size. Being permanently employed will permit households to increase its size because of the guaranteed streams of income in the future.

Table 1. Marginal Effects After Logit

Variables	Pasay		Variables	Eastern Samar		Agusan del Sur	
	dy/dx	$P > \|Z\|$		dy/dx	$P > \|Z\|$	dy/dx	$P > \|Z\|$
$WATERNEAR_i$*	−0.02639	0.000	$WATERNEAR_i$*	0.09788	0.023	−0.01196	0.381
$ELECT_i$*	−0.00769	0.139	$ELECT_i$*	0.09421	0.024	0.03055	0.071
$WALLSTRONG_i$*	0.01341	0.000	$WALLSTRONG_i$*	0.16016	0.012	0.01655	0.357
$ROOFSTRONG_i$*	0.00644	0.001	$ROOFSTRONG_i$*	−0.08871	0.030	0.02235	0.240
$PERMANENT_i$*	−0.01713	0.000	$PERMANENT_i$*	−0.07098	0.046	0.58016	0.000
$SEASONAL_i$*	−0.00729	0.038	$SEASONAL_i$*	−0.21618	0.000	0.65603	0.000
$TEMPORARY_i$*	−0.06330	0.000	$TEMPORARY_i$*	−0.07737	0.085	0.57027	0.000
$HHINCOME_i$	−0.00000	0.950	$HHINCOME_i$	−0.00000	0.000	−0.00000	0.441
$ELEMGRAD_i$*	−0.03513	0.000	$ELEMGRAD_i$*	−0.22077	0.000	0.44941	0.000
$HSUNDR_i$*	−0.02044	0.000	$HSUNDR_i$*	0.01597	0.673	0.30861	0.000
$HSGRAD_i$*	0.00326	0.374	$HSGRAD_i$*	−0.12308	0.014	0.55905	0.000
$PSUNDR_i$*	0.01510	0.115	$PSUNDR_i$*	Omitted		0.76249	0.000
$PSGRAD_i$*	0.03638	0.000	$PSGRAD_i$*	Omitted		0.26188	0.300
$COLUNDR_i$*	0.01095	0.005	$COLUNDR_i$*	0.12511	0.013	0.53911	0.000
$COLGRAD_i$*	0.03623	0.000	$COLGRAD_i$*	−0.20220	0.000	0.60153	0.000
$WMSPHD_i$*	−0.00721	0.873	$WMSPHD_i$*	Omitted		Omitted	

Table 1 continued...

$WOMEN_i$*	−0.01125	0.077	$FEEDPROG_i$*	−0.16053	0.039	−0.02882	0.241
$HEALTH_i$*	−0.00836	0.000	$HEALTH_i$*	0.06500	0.068	−0.04819	0.000
$SCHOLAR_i$*	−0.03377	0.000	$SCHOLAR_i$*	−0.18774	0.004	−0.08795	0.000
$TRAINING_i$*	−0.00940	0.428	$TRAINING_i$*	Omitted		−0.01608	0.589
$HOUSING_i$*	−0.00796	0.546	$HOUSING_i$*	Omitted		−0.01047	0.863
$CREDIT_i$*	−0.01671	0.157	$CREDIT_i$*	−0.21193	0.000	−0.04041	0.014
Predicted Probability	0.94287058		Predicted Probability	0.26115648		0.12417826	

* *dy/dx* is for discrete change of dummy variable from 0 to 1.

*The variable $FEEDPROG_i$ is a dummy variable that indicates government provision of feeding program. The data set for Eastern Samar and Agusan del Sur does not contain any data on the provision of women empowerment program. Instead, it provided for the provision of feeding program. Nonetheless, both variables capture government-funded programs aimed to reduce poverty.

The educational attainment of the household head also serves as a significant determinant of the probability that a household will have the optimal family size. From the results, the higher the household head's educational attainment, the higher the probability of obtaining the optimal family size. However, if the household head just finished elementary or if he/she is just a high school undergraduate, the probability of having only four children in the household decreases primarily because of the lack of schooling. Sufficient schooling provides the necessary knowledge, information, training, and guidance in building a decent home and sustainable family—having a low educational attainment implies the lack of essential parental planning. In the case of household heads being post secondary school graduates, college undergraduates, or college graduates, the probability of having only four children in the household increases. Having a higher educational attainment means that the household heads have prepared to raise the quality and quantity of children they desire. Moreover, most often, these parents are the ones who get employed, considering that education serves as a prerequisite to obtaining a stable and meaningful job. Having more children increases the opportunity loss of accepting career opportunities.

On the contrary, household heads that are obtaining and have obtained a masters or doctorate degree have the tendency of having more than four children. A practical notion is that most often than not, these people are also the ones who have attained high-paying jobs or are at least well compensated in their profession. It boils down to monetary conditions, where they believe that they have already accumulated enough resources to bear a large family.

The varying impacts of educational attainment on the probability of having an optimal family size can be explained by the reality that education has the capacity to change the mentality of households. Education can promote rationality on how households decide on their family size subject to financial constraints and other considerations. However, low educational attainment is not enough to correct the mentality of household members as seen by the negative and statistically significant impact of being in elementary, being an elementary graduate, and being in high school. This is because having low educational attainment will not offer lucrative job opportunities. Having a low educational attainment redirects the perspective of the household towards the expectations that an additional member of the family will be another source of income. It is even accompanied by the reality that children are complements to housekeeping and child labor. As such, educational attainment corrects the mentality of household members by translating how employment is perceived—an opportunity cost of increasing family size or an avenue to increase capability of households to increase family size.

From the regression results, it can be seen that employment reduces the probability of having an optimal family size. An explanation for this contradiction is the idea that education is being used as a vehicle to acquire employment that will provide the financial resource for the household to afford an additional member. Since employment, regardless of status, generates income for the household, financing an additional member of the household becomes likely.

Meanwhile, government support and/or poverty-reduction programs provided for households ought to make them consider the costs and benefits of having a larger family size. This implies that it will give them supplementary training and/or resources to raise a larger family. However, training, housing loan provisions, and credit access have shown insignificant effects on the probability that a household will have at most four children as opposed to the negative and statistically significant marginal effect of women empowerment programs, provision for health benefits, and scholarship grants. Contrary to expected results, even if women were given empowerment programs in the form of sexual education, the probability of having the optimal number of children decreases. From the results, it can be seen that these programs are ineffective to limit family size. Also, the government's attempts at women empowerment are overwhelmed by Catholic beliefs. Similarly, the government provision of health benefits and scholarship grants lessens the burden of households to raise children such that parents no longer have to worry about medical expenditures and tuition fees. Therefore, this induces a positive effect on the probability that a household will have more than four children. Such result is evident of the free-rider problem.

Eastern Samar

Eastern Samar is a province in the Eastern Visayas region occupying the eastern portion of Samar Island. It is highly rural, and 96% of the people are Roman Catholic—the dominant Catholic faith influences the events of the provincial education, politics, and social functions of the people. Commercial activities in the province are centered in Borongan (provincial capital) while tourism activities are centered in Guiuan (where the historical Homonhon Island is located). The province's major economic industries are agriculture (production of copra, corn, rice, and sugar) and fishery.

The marginal effects for Eastern Samar are also shown in Table 1. For the rudiments of deriving the marginal effects for Pasay, refer to Rivera and See (2012). From Table 1, it can be observed that water distance, the availability of electricity, and the structural integrity of walls decrease the likelihood that the number of children in a family will exceed four. Meanwhile, the structural integrity of the roof increases the probability that the number of children in the household will be more than four. Similar with Pasay, these contrasting findings demonstrate that individual poverty indicators do not generate solid conclusions indicative of the ambiguity of how poverty influences the decision to increase family size. However, it must not be discounted that the quality of life is still an essential factor in the decision-making process of families insofar as family size is concerned.

To shed more light, it is important to look at the province's poverty threshold and incidence. According to the National Statistical Coordination Board (NSCB; http://nscb.gov.ph), among the six provinces in Eastern Visayas, Eastern Samar ranked next to the highest in poverty incidence of families in 2006 with 42.7%. Moreover, CBMS (2010b) showed that the province had 63.7% of its people living below the poverty threshold in 2006. Here, it might be the case that due to poverty, households would prefer a larger family size since children are perceived as investments to escape from poverty.

In terms of access to domestic water supply, according to CBMS (2010b), in 2006, there were a total of 5,345 water system facilities. Level 1 facilities consisting of shallow and deep wells provided the domestic water requirements of majority of households in the province. This type of water source comprises 94.6% of the total number of water facilities. Other households depended on Level 2 and Level 3 water systems (superior sources of water). For power supply, electricity is directly provided by the Eastern Samar Electric Cooperative (ESAMELCO), which derives most of its power supply from the National Power Corporation (NPC). According to CBMS (2010b), as of 2006, 66.6% of all barangays in the province had been energized to serve a total of 49% of all households in the province. Moreover, as of 2009, 77.5% of all barangays have been energized. Thus, regardless of wealth and income status, everyone will always have access to water and electricity, so these elements are trivial considerations regarding family size. There is a higher probability that a higher quality of life may diminish the need for children as a source of future income and as a means to ensure social safety nets.

Employment is shown to decrease the likelihood of a family having less than five children, which is contrary to a priori expectations. Although employment may imply higher opportunity costs to childbearing and childrearing, it may also imply a higher capacity to sustain a larger family in Eastern Samar. This provides much insight to the probable bidirectional relationship between employment and family size. The choice to bear an additional child in the context of employment may be a function not only of opportunity costs but also the capacity to raise offspring given the desire to have one. Such is the case because the province's labor force and employment in 2005 and 2006 indicated that 37.1% of the total population is employed (CBMS, 2010b). Moreover, CBMS (2010b) reported an employment rate of 77.7%, which is higher in the rural areas, with 79.0%, than in the urban areas, with only 74.6%.

Household income exhibited a negative and statistically significant effect on the likelihood that a household will have an optimal family size. This can be explained by looking at the 1997 and 2000 Family Income and Expenditure Survey (FIES) conducted by the PSA. Eastern Samar's average family income was estimated at PHP 71,527.00 in 2000 (up by 28.42% from the 1997 level of PHP 55,694.00). Meanwhile, the average family expenditure in 1997 was PHP 47,625.00, which increased to PHP 61,742.00 in 2000. It is also interesting to note that the province's main source of income is entrepreneurial and family-operated activities—42.6% of the households derive their income from these activities (CBMS, 2010b). Meanwhile, 24.2% of households in the province earn from salaries and wages, and the remaining 33.2% derive income from other sources other than work such as cash receipts, gifts, pension and retirement, and rental of buildings, spaces, and other properties (CBMS, 2010b). These figures suggest that residents have a lot of alternative sources of income that will allow them to finance the cost of having a larger family size.

For education, results show that there is an irregularity in the impacts among various educational attainments. Specifically, a high school graduate is more likely to have a larger family than a high school undergraduate. Also, a college graduate will have a larger family than a college undergraduate, and a college undergraduate will have a smaller family than a high school graduate. These odd results can be explained by the state of the educational system in the province. According to CBMS (2010b), in school year (SY) 2005 to 2006, Eastern Samar had a total of 469 elementary schools, 458 of which were government and 7 were private schools, 66 were secondary schools, and 8 were tertiary schools. Among the government elementary schools, 304 were "complete" elementary and 154 were "incomplete." Incomplete elementary schools were usually located in the small and hard-to-reach barangays with few enrollees. Moreover, the vocational schools in the province have courses on agriculture, crafts and home industries, arts and trades, and fisheries. Courses in tertiary schools, apart from postsecondary, were baccalaureate degrees in management, education, agriculture, fisheries, tourism, engineering, nursing, and commerce. The only state college in the province, Eastern Samar State University, has master's programs in agriculture, education, and management and a doctorate program in educational management. It can be construed that the availability and accessibility of educational institutions and programs in the province inhibit the households from fully harnessing the intended target of education towards maintaining a sustainable family size. One can also argue that the data failed to capture the context and quality of the educational programs. It can also be argued that there is a need to upgrade, restructure, and reframe the educational system in the province to achieve its desired impact of correcting false precepts towards family size.

Lastly, results suggest an uncertain relationship between government-funded programs and family size—health programs are shown to increase the likelihood of limiting family size while scholarship and credit programs accomplish the opposite. This can be explained by the state of health facilities in the province where health programs are managed. Based on the figures of CBMS (2010b), in 2006, the province had 12 government hospitals, 10 private hospitals and clinics, 26 municipal health centers, and 104 barangay health stations. The presence of these health facilities provides access to households.

Access to scholarship and credit programs significantly increase the spending capacity of households. This supplements the idea that financial capacity may be a significant consideration in determining family size. The free-rider problem is also looming—reinforced by the joint efforts of local government, nongovernment, and people's organizations in the development of Eastern Samar. In 2006, 10 nongovernment organizations (NGOs) operated province-wide providing development services in education, potable water supply and sanitation, and health care (CBMS, 2010b). A number of NGOs served as partners of government in environmental protection, agricultural development, and policy advocacy. Additionally, households have access to 490 registered cooperatives providing credit financing, marketing, transport services, processing, and other developmental activities.

Agusan del Sur

Agusan del Sur is a landlocked province comprising the Caraga Region in the island grouping of Mindanao. It is a first-class province with a total income of PHP 729 million in 2007, according to the Provincial Accounting Office as cited in CBMS (2010a). The province has the highest level of population in the region. According to the report of the CBMS (2010a), population in the province is projected to reach 691,211 by 2017 and is growing at 1.19%. Moreover, the population of indigenous people is 33% of the total population, and children comprise half of the total population. Urban and rural population comprises 27% and 73%, respectively, of the total. Because agricultural land comprises 46% of the province's total land area, the major economic activity is crop farming and gardening where rice and corn are the major crops produced. The province is also abundant in mineral resources (gold, silver, and copper). It also keeps abreast of technological developments elsewhere, with educational institutions offering skills development courses in information technology.

The marginal effects for Agusan del Sur are also shown in Table 1. For the rudiments of deriving the marginal effects for Pasay, refer to Rivera and See (2012). From Table 1, it can be observed that both water access and the strength of materials used in home construction are not statistically significant in influencing family size, while the availability of electricity seems to increase the likelihood that a family will have less than five children. Noting that these variables serve to capture poverty incidence and quality of life, such have little to no influence to the decision-making calculus of parents in selecting a desirable family size. This is suggestive of a shortsighted approach to decisions made at the household level—may be dominated by preferences and impulse. This is a function of a lack of family planning programs and information campaigns that aim to make parents aware of the implications that successive childbearing may lead to deterioration of family well-being. As emphasized in earlier discussion, the state of poverty is expected to either (1) increase the likelihood of a larger family size if children are perceived as investments or (2) decrease the likelihood of a larger family size if children are perceived as additional mouths to feed.

Employment has been shown to increase the likelihood of a smaller family size. This reaffirms the findings of existing literatures, which suggest a trade-off between time spent in the workplace and time spent child rearing at home. Hence, the more time parents allocate for employment translates into less time allocated for home-related activities. Beyond time constraints, employment also increases the opportunity costs of having more children (i.e., forgone wages, unsatisfactory job performance, parental leaves). It is also interesting to note that regardless of permanent, seasonal, or temporary status, employment is crucial in limiting family size.

Likewise, education is shown to increase the likelihood of a smaller family size. This reaffirms findings on the inverse relationship between education and family size, that is, education plays an informational and a practical role. However, beyond the generalized relationship established between education and family size, regression results reveal that undergoing at least elementary or high school education already increases the likelihood of a smaller family. Initially, it seems to be counterintuitive as some may argue that basic education should have incremental informational and employment benefits. However, given that the study is situated in a predominantly urban area, it may be conceivable that undergoing basic education may already have extensive benefits to an individual.

It is apparent that findings in Pasay and Agusan del Sur are consistent with each other and with established frameworks. In Agusan del Sur, it can be attributed to the provision of education in urban areas. The education indicators of Agusan del Sur show an increasing trend during SYs 2004 to 2005 and 2006 to 2007 CBMS (2010a). For SY 2006 to 2007, the participation rate in elementary and secondary school is 74.95% and 44.14%, respectively. Meanwhile, the achievement rate in elementary and secondary level is 69.49% and 55.93%, respectively. It is also vital to note that dropout rates have been decreasing at both the elementary and secondary levels, bringing about a positive impact to the province. The dropout rate in the elementary and secondary schools for SY 2006 to 2007 is 5.93% and 17.57%, respectively. These show that the province is able to provide households access to education, which induces households to maintain a smaller family size.

On the other hand, government-funded health, scholarship, and credit programs are shown to increase the likelihood of a larger family size. This can be explained by how such transfers alleviate for parents the financial burden of child-rearing. This effectively decreases the perceived and actual costs of having a child thereby increasing the desirability of increasing family size. Consequently, parents find it difficult to realize the true costs of having more children because the parents and the state share the burden. However, not all government-funded programs influences family size—results show that feeding, training, and housing programs do not have statistically significant effects on limiting family size.

Zooming in on the positive contribution of health programs to the likelihood of a larger family size, it can be explained by looking at the province's crude birth rate (CBR) and crude death rate (CDR), which have been fluctuating from 2003 to 2007. According to CBMS (2010a), the CBR in 2007 is at 21.9% per 1,000 population while CDR is only at 1.84%. Moreover, the infant mortality rate (IMR) per 1,000 live births is only 4.2% and has decreased in the past five years. While the under-five mortality rate per 1,000 children aged zero to four is only 1.14%, the maternal mortality rate is 0.89% and has dropped in the past five years because of the maternal care and services provided. Similarly, the health program on feeding of malnourished children has greatly contributed to lowering the incidence of malnutrition in the province. The 2007 prevalence rate of malnutrition among children aged zero to five dipped to 16.46% from 24.44% in 2003. Also, the provincial provision of immunization activity that resulted to 91.25% of children immunized in 2007. Programs that provided access to safe drinking water and access to sanitary toilet facilities also helped improve the health conditions of the populace. In 2007, according to CBMS (2010a), the number of households served with potable water rose from 73% in 2005 to 77% in 2007. Similarly, there has been a remarkable improvement in the access to sanitary toilet from 72.53% in 2004 to 76% in 2007. In conclusion, the incidence of death in the province is not alarming, and the provision of health programs is adequate to defray the personal cost of health care allowing households further financial flexibility in increasing family size.

The probability of having a larger family size in the province is also being reinforced by its social infrastructure support—construction of 5 public hospitals, 2 private hospitals, 14 rural health units, 132 barangay health stations, and 203 day care centers. As a result, the Human Development Index (HDI) of the province improved significantly. In 2003, the HDI stood at only 0.494, but in 2006, the HDI has increased to 0.556 (CBMS, 2010a). These may have allowed households to have a larger family size—a consequence of developmental strategies implemented by their local government.

Conclusions

Rapid population growth and poverty are coupled. The poorest households are evidently those who have larger family sizes, supporting more members with limited and scarce resources. As such, the household is susceptible to the vicious cycle of poverty. Most often, the situation is worsened by the fact that the poorest social groups are unaware, uninformed, or if informed are badly informed. For instance, most poor households have an inadequate understanding of family planning methods whether natural or artificial. Although there are some who are aware of the existence of modern family planning methods, a significant number are still alarmed by its unknown side effects.

To unscramble the issue, the RH Law has been enacted in conjunction with objections from the RCC. That is, the RCC and the state have different approaches to addressing rapid population growth. The RCC prefers natural forms of birth control (abstinence, withdrawal, and the rhythm method) while the state encourages the use of artificial birth control methods. However, the fact remains that in the Philippines, a fervently religious nation, the RCC has substantial pressure on government policy and has succeeded in the mitigation of government initiatives on controlling pregnancy.

Despite the disagreements of the RCC and the state, the facts are clear and the solutions are simple—there is a need to lower the birth rate by making contraceptives available to everyone, providing family planning education to everyone, and encouraging households to think for themselves and not to listen to propagandas without basis. Rapid population growth needs to be mitigated immediately.

To address the first research objective, regression results suggest a rather ambiguous relationship between living conditions and family size. In Pasay, the structural integrity of a family's residence decreases the likelihood of a large family while it is the other way around for access to water. In Eastern Samar, access to basic utilities and the structural integrity of a house's walls increase the likelihood that a family will opt to have less than five children. In Agusan del Sur, access to electricity increases the probability of having fewer children while other indicators of living conditions have no significant relationship with family size.

The bizarre variation in the results can be seen as a vague and weak relationship between actual living conditions and family size. Perhaps, this is a manifestation of how quality of life is given little consideration in the decision-making process of parents. Given that family size seems to be at best mercurial and at worst indifferent to living conditions, there is much reason in concluding that quality of life exerts little to no influence on family size. However, one may argue that the variables used to measure the construct are mere manifestations of quality of life and may not be able to capture the precise relationship.

Poverty alleviation has been the overarching goal of most governments of developing economies. In the Philippines, to ease poverty, the state has been subsidizing the basic necessities of the poor households including health and education. For all regions concerned, the state-sponsored social provisions have been shown to increase the chances of a larger household size. Hence, the idea that increased government provision of basic services decreases the need to bear children as a substitute for social security becomes less applicable for the Philippines. In this context, government provisions seem to transfer some financial burden from the household to the state, thus freeing resources that would have been spent on basic necessities. The incentive to bear children can be attributed to two plausible sources: (1) increased purchasing power diminishes the fear of becoming financially unsustainable should an additional household member be born, and (2) the costs of bearing and rearing children also become less weighty given that expenses are partially subsidized by the state. Assuming that the decisions to bear child is contingent on a cost–benefit model, this effectively lessens the perceived monetary outlay an additional member of the family will require.

To address the second research objective, regression results suggest that higher levels of educational attainment in Pasay and Agusan del Sur indicate a decrease in the likelihood of a larger family size—results that are consistent with literature and theories on fertility. Truly, education increases the opportunity costs to childbearing and increases the likelihood and returns to meaningful employment. On the contrary, results for Eastern Samar suggest that higher educational attainment increased the likelihood of larger families. This is evidence to the argument that education is perceived as a vehicle to ascertain financial security and capacity to support a larger household. Thus, education may serve to either increase or decrease family size, depending on which motivations dominate. Should the preference for children take priority over the perceived opportunity costs to having children, the case of Easter Samar becomes a highly conceivable scenario. As such, having a larger family size is not necessarily dependent on financial return but also on other nonmonetary objectives.

To address the third research objective, regression results suggest that in Pasay and Eastern Samar, the relationship between employment and family size describes a decrease in the likelihood that a family will have less than five children. This raises questions on the motivations and preferences that underpin the decision-making process of households as far as family size is concerned. In addition, the existence of extended family members who may rear children in the absence of parents may reduce the relevance of a necessary trade-off between time spent at work and time spent at home. Meanwhile, in Agusan del Sur, it is not statistically true that employment is a disincentive to have additional children in the household.

It has been evident that the results do not fully adhere to conventional theory. Also, results derived from Pasay, Eastern Samar, and Agusan del Sur demonstrated varied impacts on the probability that a household will have at most four children. Such results convey a stark contrast between the decision-making process and priorities of the households within these areas. This can be explained by cultural nuances and differences in living standards in these areas. For instance, a highly urban area like Pasay and Agusan del Sur and a highly rural province like Eastern Samar are likely to exhibit distinct culture, philosophy, pedagogy, or mentality, which are imbibed in all facets of society including their educational system.

This suggests a need to implement rather less conventional policies, that is, population control policies should be tailor fitted to a certain area. Additionally, beyond tailor–fitting population control policies, there is also a need to calibrate policies based on relevant socioeconomic, political, and cultural nuances each area may possess. Different locations exhibit heterogeneous behavior insofar as population dynamics are concerned. It has been apparent that each surveyed province responded differently to various stimuli such as living conditions, educational attainment, employment status, and government-funded programs. Hence, it warrants the need to peer into the nuances of each region's socioeconomic context and underlying psyche. The milieu within which an individual resides may greatly influence his rational calculus and decision-making process. Specifically, the idea that education and employment are inversely related with the number of offspring has been affirmed in some cases while invalidated in others. Such inconsistencies must not be misjudged as they provide valuable insight as to how governments must vary policies in accordance to characteristics exclusive to a certain region.

On an aggregate level, it is also important that regardless of provincial location, there is a need to recalibrate government-sponsored programs because it has the tendency to incentivize free riding among poor households. It breeds dependence to the government in the deferral of their cost to childbearing. Perhaps, instead of providing these programs, conditional cash transfers (CCTs) must be given to households who are capable of maintaining a socially acceptable family size, which have yet to be determined by the government (i.e., targeting). Also, the rules and the scope of these incentives will also have to be settled by the government.

The unmistakable differences in the impacts of the variables of interest to the probability of having an optimal family size just indicate that the responsibility for slowing rapid population growth must be redirected from the national government to the local municipalities. It seems that population policies to combat rapid population growth is no longer a national plan. Moreover, consistent with the United Nation's Development Program (UNDP), to decelerate the rapid rise in population, poverty reduction and the provision of education and reproductive counseling are the necessary methods by which information about family planning can be relayed to the public. However, it also requires good governance and sound economic policies.

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2

Understanding Food Inequality in the Philippines Using Engel Curves, Lorenz Curves, and Kernel Distributions

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Alleviating poverty, characterized by income inequality and inequity, is a major developmental concern for developing economies. It is also the overarching goal of development organizations as in the United Nations' Millennium Development Goals (MDG) of 2015. In Southeast Asia, it has been tenacious that it is regarded as the basket case. In the Philippines, there is a perceptible unequal income distribution leaving Filipino households in the lower income deciles vulnerable to impoverished living conditions and depravity from basic necessities (Schelzig, 2005). These basic necessities (nonmonetary categories that define whether individuals are poor), according to the International Labor Organization (ILO) as cited by Schelzig (2005), are food, water and sanitation, health, education, and shelter. Likewise, income shocks have incapacitating effects to poor households (Albert & Ramos, 2010), compelling them to engage in risky schemes that pose negative and irreversible effects that would put them in a deeper state of poverty.

To give an overview of the state of poverty in the Philippines, according to the Philippine Statistical Authority (PSA) (formerly National Statistics

Office [NSO]) (http://psa.gov.ph), in 2014, the share of food and nonalcoholic beverages to total household expenditures is 41.2% (grew by 4.0% but showed a slowdown from its 5% growth in 2013). It can be taken that food takes a significant portion of income allocation among other priorities of consumption spending by (poor) households (Reyes, 2001).

With income inequality in the country, food inequality will also follow. This is possible through the income channel—households in the lower income deciles are most likely unable to afford decent food. Also, a decrease in real income indicates a reduced capacity of households to spend on food. Hence, households are obliged to concentrate household expenditure on food above other basic necessities—those enumerated by ILO.

The National Statistical Coordination Board (NSCB) (http://www.nscb.gov.ph) of the Philippines and PSA observes standard measures to assess the depth of poverty—poverty incidence, Gini coefficients, and income and expenditure ratios all relate to the traditional measures of welfare, which are income levels. In the Philippines, there are two official measures of poverty—poverty and food thresholds (Schelzig, 2005). In fact, according to Pedro, Candelaria, Velasco, and Barba (n.d.), estimated food threshold adjusted to the lower 30% of the income distribution, representing the poor segment of the population, is a gauge of poverty incidence through food consumption.

Establishing the link between poverty and hunger incidences, our main research questions are: (1) What are the factors that uphold this prevalence of food inequality? (2) Are the poverty reduction programs of the government effective in reducing the probability of a household experiencing hunger? To address these research questions, we have the following research objectives:

1. To understand the depth of food inequality in the Philippines by estimating Lorenz curves and Epanechnikov kernel densities at the regional and national levels;
2. To show the responsiveness of household food consumption to changes in various sources of household income by estimating Engel curves at the regional and national levels;
3. To show if the government's poverty reduction programs can address hunger incidence; and
4. To provide policy recommendations on how to reduce the incidence of hunger.

Our results can provide a framework for policymakers in improving program design and implementation. Results can also suggest alternative programs that can improve poor households' welfare and alleviate hunger incidence.

Poverty and Food Inequality

Poverty is a multifaceted concept. It is not restricted to simply being defined as the inadequacy of income. The concept evolves from the traditional definition through income as a gauge of individual welfare towards deprivation of basic capabilities (Sen, 1979) to a dynamic and complex situation capturing the idea of vulnerability and powerlessness—projected by the deprivation of access to other assets that is important for survival (Schelzig, 2005).

Albert and Molano (2009) discussed that in developing economies, poverty lines basically measure absolute poverty and are based on a fixed standard of welfare adjusted with respect to inflation. In the Philippines, the estimated poverty line is a representation of income needed to satisfy the minimal needs (food and nonfood) of a household. The food aspect is referred to as the food poverty line (FPL), which utilizes one-day menus that meet the required daily dietary needs and nominally valued at the least possible price. Alternatively, Pedro et al. (n.d.) estimated food threshold and poverty incidence using the food baskets across income groups. This is a comparative study between the estimated poverty incidence and food threshold between all income groups versus the bottom 30%. Results revealed that the food basket of the higher income group consists of food and other commodities that are more complex and expensive as compared to the lower 30%. For both studies, it can be deemed that nutritional intake and food basket composition are also relevant in defining poverty and measuring household welfare.

Poverty in the Philippines

With the recent global financial crisis in 2008, continuous severe natural calamities (i.e., Typhoon Haiyan, Bohol earthquake in 2013), and rising fuel and food prices, implementing programs aimed to reduce poverty is becoming extra challenging.

Table 1 shows that in 2012, a household with five members will need PHP 5,513.00 of monthly income to afford their minimum basic food requirements and PHP 7,890.00 monthly for their minimum basic food and nonfood requirements. This represents an increase of about 12.3% for both the food and poverty thresholds between 2009 and 2012. Such increases constitute average annual inflation of about 4.1% between 2009 and 2012. Similarly, the proportion of Filipino households in extreme poverty whose incomes are not sufficient to meet basic food needs stands at 7.5% (lower than the 7.9% and 8.8% estimates in 2009 and 2006, respectively).

Looking at poverty incidence, Table 1 shows that 19.7% of Filipino households were poor in 2012 (insignificantly lower than the 20.5% and 21.0% estimates in 2009 and 2006, respectively). Based on the figures and given the country's rapid population growth, although it can be seen that the proportion of poor households as been practically similar between 2006 and 2012, the estimated number of poor households has increased from 3.8 million in 2006 to 4.2 million in 2012.

Table 1. Full Year Thresholds, Incidences, and Magnitude of Poor

Year	2006	2009	2012
Monthly food threshold for a family of five (PHP)	3,878	4,908	5,513
Subsistence incidence (%)			
Families	8.80	7.90	7.50
Population	12.00	10.90	10.40
Magnitude of extreme (subsistence) poor (in millions)			
Families	1.60	1.55	1.61
Population	10.23	9.70	9.81
Monthly poverty threshold for a family of five (PHP)	5,566	7,030	7,890
Poverty incidence (%)			
Families	21.0	20.5	19.7
Population	26.6	26.3	25.2
Magnitude of poor (in millions)			
Families	3.81	4.04	4.21
Population	22.64	23.30	23.75

Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Other poverty measures include the *income gap* (measures the amount of income required by the poor to get out of poverty in relation to the poverty threshold itself), *poverty gap* (mean shortfall from the poverty line, expressed as a percentage of the poverty line), and *squared poverty gap* (squares the poverty gap for each household putting more emphasis on observations that fall far short of the poverty line rather than those that are closer).

From Table 2, in 2012, the income gap was estimated at 26.2%—that is, on the average, a poor household with five members needed a monthly additional income of about PHP 2,067.00 to get out of poverty. Such information is useful to determine the required budget to reduce poverty in the country. That is, suppose the state will provide cash transfer to all poor households in terms of what they would require to cross the poverty line, a total of PHP 124 billion in 2012 is needed to alleviate poverty, exclusive of targeting costs (Note: the budget allocated for conditional cash transfers [CCT] for 2012 is PHP 39.4 billion).

Table 2. Income Gap, Poverty Gap, and Severity of Poverty

Year	2003	2006	2009	2012
Income gap	27.7	27.5	26.2	26.2
Poverty gap	5.6	5.8	5.4	5.1
Severity of poverty	2.2	2.2	2.0	1.9

Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Reyes, Tabuga, Mina, Asis, and Datu (2010) pointed out that poverty in the country is characterized by the glaring income inequality as seen in Figure 1. Illustrated in Figure 1 are the thematic maps of the 2012 income gap, poverty gap, and severity of poverty where red shades show higher gaps and are therefore comparatively worse off areas than green-shaded areas. The darker the red, the worse off the situation in that area is compared to the rest, and the darker the green shade, the better off. Provinces with higher income gaps and poverty gaps are concentrated more in Mindanao than in Luzon and Visayas. There are significantly higher poverty incidences in rural areas (Eastern Visayas, Zamboanga Peninsula, and Central Mindanao) compared to the National Capital Region (NCR), Cebu, and Davao. The map highlights the reality that poverty in the country is geographical suggesting calls for more programs in alleviating poverty in regions with significantly worse conditions.

National averages do not show the staggering urban and rural differences and also the regional variations. As emphasized by Schelzig (2005), national averages also do not indicate regional and provincial disparities, which are shown in Table 3. This corroborates that there is a need to employ well-designed policies that accounts for regional and provincial profile for a strategic distribution to potential key areas promoting a more socially and economically equal society. From Table 3, the regions with the lowest poverty incidence among families in 2006, 2009, and 2012 continue to be the rural areas of the National Capital Region (NCR), Central Luzon, and CALABARZON (Cavite, Laguna, Batangas, Rizal, and Quezon). Meanwhile, rural areas like the Autonomous Region in Muslim Mindanao (ARMM), Zamboanga Region, and Caraga consistently reported the highest poverty incidence among families. While it might seem that there were no significant changes in nationwide poverty conditions from between 2003 and 2012, data show that Caraga improved its poverty incidence significantly from 46.0% in 2009 to 31.9% in 2012.

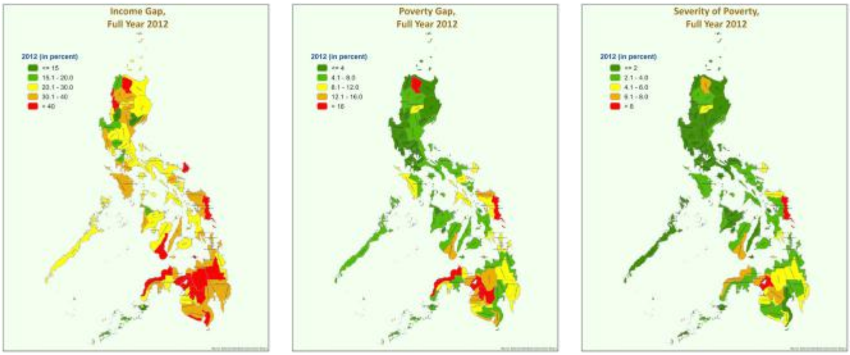


Figure 1. Thematic map of 2012 income gap, poverty gap, and severity of poverty. Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Table 3. Annual per Capita Poverty Threshold and Poverty Incidence Among Families

Region	Annual per Capita Poverty Threshold (PHP)				Estimated Poverty Incidence Among Families			
	2003	2006	2009	2012	2003	2006	2009	2012
Philippines	10,976	13,357	16,871	18,935	20.0	21.0	20.5	19.7
NCR	13,997	15,699	19,227	20,344	2.10	2.9	2.4	2.6
CAR	10,881	14,107	17,243	19,483	16.10	21.1	19.2	17.5
Ilocos	11,791	14,107	17,595	18,373	17.8	19.9	16.8	14.0
Cagayan Valley	10,350	13,944	17,330	19,125	15.2	21.7	20.2	17.0
Central Luzon	12,771	14,422	18,188	20,071	9.4	10.3	10.7	10.1
CALABARZON	12,394	13,241	17,033	19,137	9.2	7.8	8.8.	8.3
MIMAROPA	10,398	12,645	15,613	17,292	29.8	32.4	27.2	23.6
Bicol	11,476	13,240	16,888	18,257	38.0	35.4	35.3	32.3
Western Visayas	10,548	12,684	15,971	18,029	23.5	22.7	23.6	22.8
Central Visayas	11,798	13,963	16,662	18,767	32.1	30.7	26.0	25.7

Table 3 continued...

Eastern Visayas	9,850	12,520	16,278	18,076	30.2	33.7	34.5	37.4
Zamboanga Peninsula	9,642	12,743	16,260	18,054	40.5	40.0	39.5	33.7
Northern Mindanao	10,501	12,917	16,878	19,335	32.4	32.1	33.3	32.8
Davao	10,737	13,389	17,120	19,967	25.4	25.4	25.5	25.0
SOCCSKSARGEN	10,277	13,319	16,405	18,737	27.2	31.2	30.8	37.1
Caraga	10,355	14,324	18,309	19,629	37.6	41.7	46.0	31.9
ARMM	9,664	12,647	16,683	20,517	35.0	40.5	39.9	48.7

Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Root causes of poverty. Although the Philippines has been vigilant in addressing poverty, it has been lethargic compared to other Southeast Asian economies that have been effective in reducing their respective poverty incidences. Even Cambodia, Indonesia, and Vietnam, whose annual real gross domestic product (GDP) growth rate is lower than the Philippines (United Nations [UN], 2010), have outperformed the country in reducing poverty for the past twenty years. This can be attributed to the slow growth of the economy accompanied by rapid population growth; hence, the country is subjected to a slow growth in per capita income. Nonetheless, even if an economy is experiencing high growth, the quality of growth is critical as economic growth may or may not be propoor. As explained by Aldaba (2009), if the economy failed to maintain a high level of sustained growth, it cannot generate the necessary employment that will allow the poor to combat poverty further widening the poverty gap.

The rapid population growth can also be looked into. Orbeta (2002) and Schelzig (2005) emphasized that high fertility is related to the decline in human capital investments, that is, an additional member of the family means the usually insufficient income and family resources are divided further. The rapid population growth impedes economic development for two interconnected reasons as per Schelzig (2005): (1) rapid population growth lessens per capita income, since the people, especially the poor cannot sacrifice basic commodities, their savings and the resource for investment in productive capacity reduced; and (2) the country's large population that is rapidly expanding exceeds the capacity of the industry to absorb new labor—more unemployed individuals, lower quality of employment. Even with many Filipinos working overseas, unemployment rates are still high

(Aldaba, 2009). With persistent government budget deficits and increasing labor force, rapid population growth needs to be addressed (Schelzig, 2005).

According to PSA, in 2013, the share of employment in agriculture to the total employment is 31%, where most of the laborers in this sector including the industry sectors, are considered poor. The Annual Poverty Indicator Survey (APIS) of the PSA, using the bottom 40% income range as a proxy for the poor, it revealed that more than half of the poor are employed in agriculture (i.e., laborers and farmers) (Schelzig, 2005). They are poor because they are working in jobs with low income and low productivity, and little is done to transform agriculture from subsistence to commercial farming. If these sectors are improved, it creates more meaningful and quality jobs to individuals who need it most (Aldaba, 2009).

Another contributory factor to the worsening of poverty is the persistence of economic inequality (income and welfare) that shrinks the positive effects of economic growth. According to Deininger and Squire (1998), an economy's initial land distribution has an effect on its succeeding expansion and on its human development. That is, an economy with a high land inequality will likely exhibit lower income growth and slower poverty alleviation than an economy with more equitable land distribution. Other than land inequality, income inequality is also pervasive. Data from the World Bank (http://data.worldbank.org/indicator/SI.POV.GINI) reported that the Philippines' Gini coefficient in 2012 is at 43.0 (decreased from 45.8 in 2006 and 46.8 in 1991). This indicates that unequal income distribution has improved and it is better than Malaysia (46.2 in 2009) and Singapore (47.8 in 2009). However, the Philippines did not fare better than other developing economies in Southeast Asia: Cambodia (31.8 in 2011), Indonesia (38.1 in 2011), Lao PDR (36.2 in 2012), Thailand (39.4 in 2010), and Vietnam (35.6 in 2012) fared better in the distribution of income.

However, Schelzig (2005) mentioned a problem for poverty measures—they are extremely sensitive to the poverty threshold. That is, a minor adjustment in the poverty line can have sizeable adjustments to the number of individuals deemed poor.

It has been underscored earlier that poverty is also a geographical matter due to the wide disparity in the standards of living and human development among regions and provinces. From the studies of Balisacan (2003) and Aldaba (2009), intraregional inequality contributed 82 percent of overall inequality. Hence, government policies on improving income distribution should be region-specific or province-specific.

Other causes of poverty Aldaba (2009) enumerated are recurrent negative economic shocks and exposure to risks (i.e., financial crises, natural disasters, social conflicts). Social conflicts worsen poverty incidence because it hinders households from engaging in economic activities since they are displaced from their residences and sources of income. These conflicts also disrupt access to basic services, devastate transport systems, and perturb life in rural areas. Natural disasters also result to higher poverty incidences because it disturbs the poor's standard of living.

Antipoverty programs. Since the 1990s, there had been specific initiatives for poverty reduction. For instance, the Social Reform Agenda (SRA) focused on poverty alleviation and rural development for the disadvantaged economic and social groups. This set the foundation for the Social Reform and Poverty Act of 1997 (Republic Act [RA] 8425), which created the National Anti-Poverty Commission (NAPC), who acts as an advisory body in programs of social reform and poverty alleviation. It also institutionalized the basic sectors and nongovernment organizations' (NGO) participation, supports local government units in incorporating SRA, and encourages microfinance programs and institutions. One recent program launched in 2001 under the supervision of NAPC is the *Kapit-Bisig Laban sa Kahirapan* (KALAHI) program with projects including: rural projects, urban projects, social initiative projects, resettlement areas, and in conflict areas.

The issues that accompany the government's poverty reduction programs are categorized into (1) policy issues, (2) institutional issues, and (3) resource issues.

Under policy issues, every president tends to introduce new programs without regard to previous and existing programs initiated by the previous president. Even successful programs were not continued since they were part of previous presidents' programs resulting into redundancies in plans, frameworks, targets, and waste of resources. Targeting mechanisms were also diverse, inefficient, and highly politicized that lead to weak implementation. It also led to inclusion/exclusion of intended beneficiaries and significant leakages to unintended beneficiaries of the programs.

Institutional issues include transitional problems, highly politicized programs, and political appointment of agency heads. In the representation of the basic sector, political matters often succeed even from the choice of representatives for the basic sector, target beneficiaries, and the budget allocation of the budget.

For resource issues, the government response was the establishment of the Poverty Alleviation Fund (PAF) in 1998 so that funds for poverty reduction will always be a part of the national budget (Schelzig, 2005).

The State of Food Inequality in the Philippines

Root causes of food inequality. Poverty incidence and hunger are also attributed to rising global food and energy prices. As such, more poor households are being pushed further below the poverty line. Low-income households are responding to these shocks by reducing the quantity and quality of food they consume. Households belonging to lowest-income household group are the most affected as evidenced by the households' consumption structure of Cororaton and Corong (2009) using a year 2000 social accounting matrix. It was found that poor households allocate almost half of their consumption expenditure in agricultural and food products. It is interesting to note that the allocation on these commodities drops significantly if households moved to higher income deciles where consumption shifts towards services.

Food security is now also a pertinent challenge confronting developing economies. For instance, Bangladesh faces food deficit problems because of the inadequacy of its agriculture—it has to import basic food commodities. Meanwhile, Cambodia and the Philippines are confronted with food inequality. Although both economies have the resources to produce sufficient food for their population, it is distributed unequally. According to World Vision (n.d.), food inequality also arises from the unequal distribution of profits from exports to those that contributed to the production process (i.e., manual laborers).

The root causes of food inequality are similar with the root cause of poverty incidence but with emphasis on the persistent stagnation and neglect to the agricultural sector. In managing problems of food security, the sustainable approach is to increase food production by encouraging and supporting investment in agriculture to enhance food supply (Adelman & Morris, 1967). That is, developing the agricultural sector is critical in supporting national economic growth that is propoor. One approach is to increase rice productivity. Based on the rice productivity simulation results of Cororaton and Corong (2009), there is an increase in the domestic production and decrease in the importation of rice if rice productivity is improved, thus reducing prices. This is a propoor solution for food inequality since this will be beneficial to poor households in the lower income decile, who are employed in the agricultural sector. By promoting agriculture, food security will also improve since poor farmers will have an increased access to food and income and lead to households' better nutrition and higher productivity (Yu, You, & Fan, 2009).

Anti–food inequality programs. The Philippines recognizes the importance of rice productivity. In 2002, it introduced the Hybrid Rice

Commercialization Program (HRCP), which promoted the production of hybrid rice seeds and encouraged their continued use by farmers (ensured that seeds are bought at a guaranteed price, distribution of the seeds to participating farmers are offered at half the procurement price, and government provided assistance by allocating money to participating farmers to compensate additional input costs). This program also offered credit with an installment payment scheme. However, the implementation of this program was inefficient and ineffective because the appeal of hybrid rice was discouraging. Participating farmers discontinued the use of hybrid rice because it is expensive and has to be acquired every planting season (Cororaton & Corong, 2009).

The Link Between Poverty and Food Inequality in the Philippines

It has been apparent that there is a stark relationship between poverty and food inequality that runs both ways. That is, poverty inhibits households to afford sufficient and quality food consumption. The obvious disparity between poverty incidences among regions is an indication of the unequal distribution of food among regions. However, the transmission mechanisms between the two constructs vary. The relationship from poverty to food inequality is more observable than that of the complex relationship of food inequality to poverty. The explicit relationship between food and poverty is through consumption and income measures.

Llanto (1996) explored on the sensitivity of Philippine rural and agricultural households to changes in income and price. Results have shown that these households are price inelastic to staples (cereals, fruits, vegetables) since these are easily accessible. It can be seen that food inequality and poverty are linked through the agriculture sector—the primary source of income for poor households. Increasing the sectors' productivity leads to the creation of employment opportunities for the poor, accompanied by fair distribution of income and factors of production, eventually uplifting them from poverty.

The extent of research and studies conducted has been substantial and extensive, but none of which were able to discuss the notion of food inequality per se. As such, this research gap is the main agenda of this study.

Operational Framework and Methodology

Estimating the Lorenz Curve and the Epanechnikov Kernel Model

In addressing the first research objective of estimating Lorenz curves and kernel densities to understand the depth of food inequality in the Philippines on a national and regional level, the 2007 Annual Poverty Indicator Survey (APIS) on household food consumption expenditures generated by the PSA was analyzed. The APIS is a nationwide sample survey designed to gather comprehenisve information on household socioeconomic profiles. It aims for relevant information for the assessment of poverty alleviation programs and the design of policies intended to reduce poverty. It is conducted in the years when the Family Income and Expenditure Survey (FIES) is not being conducted.

The adequate sample of nationwide data contained in the APIS allows for the generation of distribution diagrams and measures of living standards in the Philippines for both the national and regional levels. These diagrams and measures aim to provide comparable and quantifiable indicators of social well-being that will facilitate interregional comparisons. However, Jao, Ng, and Vicente (2000) argued that since well-being is a multifaceted idea, the attempt to capture its definition into one encompassing indicator remains to be the major limitation of this study. Hence, we used per capita food consumption expenditure as the limited proxy measure of the construct well-being. Given the nature of the data set, only household-level data on consumption expenditure is available; the conversion of household data into per capita consumption expenditure involved some degree of arbitrariness. Although equivalence scales for such conversion are available in the literature, they are similarly limited by their inconsistency and subjectivity (Jao et al., 2000).

According to Tullao (2009), aside from household income, another major index that is commonly utilized in measuring absolute poverty is the households' food consumption. The National Food Research Council (NFRC) has measured the minimum food required to be consumed daily by a typical household. The food threshold is the lowest income needed to purchase the minimum food requirements based on the physical constitution of an ordinary Filipino, abundance of cheap alternative food, climate of the country, and other factors (see Table 1 for the actual amount). Because a major part of a household's expenditure is allocated on food, the food consumption index is a valuable measure of absolute poverty. Note that the poverty threshold based on food will be lower than the poverty threshold based on income.

To analyze personal income statistics, a Lorenz curve can be estimated. It is a diagram to show the relationship between population groups and their respective income shares. It plots the cumulative proportion of individuals in the population vis-à-vis the cumulative proportion of welfare measure, such as income or consumption expenditure, belonging to these individuals

(Kakwani, 1981; Jao et al., 2000; Todaro & Smith, 2006). Although it is not an inequality index, it is a useful graphical device used to represent and analyze the size distribution of individual welfare measures. Here, instead of using the Lorenz curve as an illustration of the incidence of unequal distribution of income, we use it to illustrate inequality in food distribution.

The cumulative proportion of individuals in the population vis-à-vis the cumulative proportion of food consumption expenditure belonging to these individuals were plotted to generate the Lorenz curve for the Philippines and its regions (see Fig. 2). The number of food recipients is plotted on the horizontal axis, not in absolute terms but in cumulative percentages. Meanwhile, the vertical axis shows the share of total food consumption received by each percentage of the population. It also is cumulative up to 100% (i.e., both axes are equally long). The entire figure is enclosed in a square, and a diagonal line, shown by line segment 0*A*, is drawn from the lower left corner of the square to the upper right corner. At every point on that diagonal line, the percentage of food received is exactly equal to the percentage of food recipients (egalitarian line or the line of equality). The egalitarian line represents perfect equality in size distribution of food wherein each percentage group of food recipients is receiving the same percentage of the total food. The Lorenz curve is shown by the curve 0*BFGA*.

We use the Lorenz curve to show the quantitative relationship between the percentage of food recipients and the percentage of the total food they consumed in a given time period. Todaro and Smith (2006) discussed that the higher the deviation of the Lorenz curve from the line of equality, the greater the degree of food inequality. The extreme case of perfect inequality—a situation in which one household receives all of the food while everybody else receives nothing—would be represented by the congruence of the Lorenz curve with the bottom horizontal and right-hand vertical axes. The greater the degree of inequality, the closer is the Lorenz curve to the bottom horizontal axis.

We also graphed kernel estimates using the Epanechnikov kernel model (or the Gaussian kernel model) (see Fig. 3). It is used to provide more information about inequality similar to Lorenz curves and is useful in locating the poverty line, which can provide insights to the proportion of the poor in a specific territory (Jao et al., 2000). From Figure 3, there is no noticeable difference between the plotted Epanechnikov density estimates and the plotted results when employing the Gaussian kernel estimator. This similarity in the results using different kernel estimators has made choosing only one of the kernel models sufficient. However, it does not follow that the choice of the kernel estimator will always have no significant dissimilarity in the results (Jao et al., 2000).

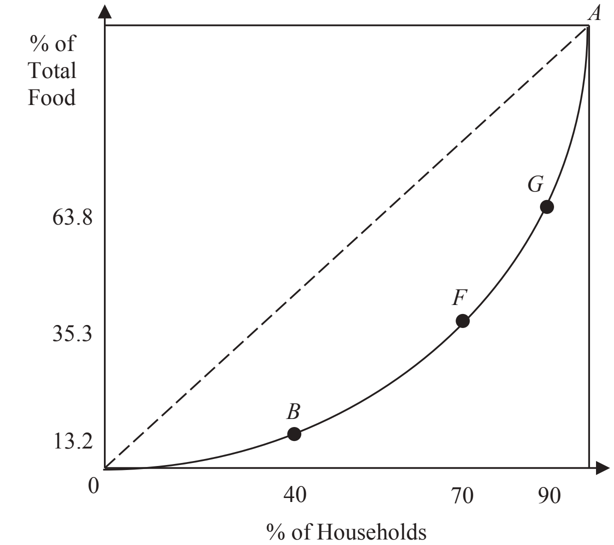


Figure 2. A hypothetical Lorenz curve.
Source: Tullao (2009).

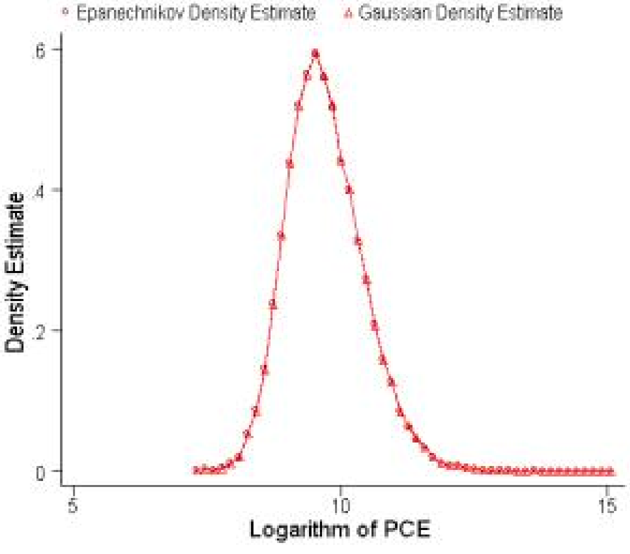


Figure 3. Kernel density estimates: Epanechnikov and Gaussian.
Source: Jao et al. (2000).

From Figure 3, the natural logarithm of the poverty line can be labelled approximately below 10. Densities that are more to the right of the poverty line indicate less poverty. Hence, according to Jao et al. (2000), as Lorenz curves are helpful in illustrating inequality, kernel densities can give an insight on the poverty incidence per area.

Estimating the Engel Curve

In addressing the second research objective of showing the responsiveness of household food consumption to changes in various sources of household income, we estimate a representative Engel curve for the Philippines. According to Besanko and Braeutigam (2002) and Chai and Moneta (2010a), an Engel curve relates the amount of a commodity purchased to the level of income, holding constant the prices of all goods. There are two varieties of Engel curves, according to Chai and Moneta (2010a): (1) the budget-share Engel curves, which describe how the proportion of household income spent on a good varies with income, and (2) those that describe how real expenditure varies with household income. Using the concept of Engel curves, we can show whether Filipino households conform to the best-known single result of Engel's law stating that the poorer a household is, the larger the budget share it has on nourishment.

We estimated the Engel curve using the 2007 APIS following the general functional form given by Equation 1:

$$FC_i = \beta_0 + \beta_1 RENT_i + \beta_2 WAGES_i + \beta_3 AGRI_i + \beta_4 INDSTRY_i + \beta_5 SRVCS_i\, \beta_6 OTHR_i + \\ \beta_7 CONAB_i + \beta_8 INTRST_i + \beta_9 DIV_i + \beta_{10} GAMB_i + \varepsilon_i \qquad (1)$$

where

FC_i is the total food consumption of household i;

$RENT_i$ is the income of household i from rental of nonagricultural lands;

$WAGES_i$ is the income of household i from salaries and wages;

$AGRI_i$ is the income of household i from agricultural activities;

$INDSTRY_i$ is the income of household i from industrial activities;

$SRVCS_i$ is the income of household i from services activities;

$OTHR_i$ are other income not elsewhere classified;

$CONAB_i$ is the cash receipts, support, etc. of household i from abroad;

$INTRST_i$ is the income of household i from interest-earning activities;

DIV_i is the income of household i from dividends;

$GAMB_i$ is the net winnings of household i from gambling; and

ε_i is the stochastic disturbance term that captures all other variables not included.

We hypothesize that the source of food inequality is income inequality. To determine the source of food inequality, the various sources of household income that influences food consumption is identified.

By a priori, all income variables must have a positive relationship with food consumption by income effect—the change in the amount of goods or services that a consumer would buy as purchasing power changes, holding all prices constant (Besanko & Braeutigam, 2002). However, the shapes of Engel curves depend on various consumer demographic characteristics. An Engel curve reflects income elasticity and indicates whether a good is normal or inferior. Empirical Engel curves are close to linear for some goods, and highly nonlinear for others. According to Besanko and Braeutigam (2002), for normal goods, the Engel curve is positively sloped (as income increases, quantity demanded increases). Most Engel curves feature saturation properties in that their slope tends to diminish at high income levels suggesting that there exists an absolute limit on how much expenditure on a goodwill rise as household income increases (Chai & Moneta, 2010b). This saturation property has been linked to slowdowns in the growth of demand for some sectors in the economy, causing major changes in an economy's sectoral composition (Pasinetti, 1981).

The Engel curve presented in Equation 2 faces the problem of endogeneity—arising as a result of measurement error, simultaneity, omitted variables, and sample selection errors (Gujarati & Porter, 2009). It is deemed that income is endogenous with respect to educational attainment as per Mincer (1974)—income distribution is related to age as well as varying amounts of education and on-the-job training among workers. To address endogeneity, there is a need to provide structural equations to explain the movement of the various sources of income. Hence, the data in Equation 2 are predicted values of a separate regression of the various sources of income against educational attainment (Mincer, 1974).

Heteroscedasticity, inherent in cross-section data, also plagues estimation of Engel curves, wherein as income increases, the difference between actual observation and the estimated expenditure level tends to increase dramatically. As such, the Engel curve and other demand function models fail to explain most of the observed variation in individual consumption behavior (Lewbel, 2006). Given this, variables other than current prices and current total expenditure must be systematically modeled if even the broad pattern of demand is to be explained in a theoretically coherent and empirically robust way (Deaton & Muellbauer, 1980).

Gujarati and Porter (2009) explained that heteroscedasticity does not cause ordinary least squares (OLS) coefficient estimates to be biased, although it can cause the variance of OLS estimates to be biased (possibly above or below the population variance). That is, in the midst of heteroscedasticity, the estimated relationships among variables are still unbiased, but standard errors are biased resulting to biased inference through hypothesis testing.

To investigate the statistical significance of the various sources of household income on food consumption, the 2007 APIS is analyzed using the generalized method of moments (GMM) estimation. This methodology is used to address heteroscedasticity, which makes use of the orthogonality conditions to allow for efficient estimation (Baum, Schaffer, and Stillman, 2003; Hansen, 1982).

The GMM method is preferred because of its robustness to differences in the specification of the data generating process (DGP), and it also automatically addresses endogeneity. According to Greene (2003), under the GMM, a sample mean or variance estimates its population counterpart regardless of the underlying process. It has flexibility from unnecessary distributional assumptions (e.g., normality) made this method appealing. However, it has accompanying costs—if more is known about the DGP (e.g., specific distribution), then the method of moments may not make use of all of the available information. Hence, the natural estimators of the parameters of the distribution based on the sample mean and variance becomes inefficient. Alternatively, the maximum likelihood estimation (MLE) can be employed, which utilizes out-of-sample information and provides more efficient estimates (Greene, 2003).

Reducing Incidence of Hunger Through Government-Sponsored Programs

In addressing the third research objective of showing if the government's poverty reduction programs are effective in addressing incidence of hunger, we assessed the impact of existing programs to the probability that a household will experience hunger. Unfortunately, the 2007 APIS cannot capture the incidence of the state of hunger—defined by the Community-Based Monitoring System (CBMS) as an indicator whether a household experienced insufficient food supplies for the past three months. We are arguing that having insufficient food supplies can be ascribed to food distribution inequality.

To determine whether the government's poverty reduction programs can reduce the probability of hunger incidence in a household, the CBMS survey data is used since it contains the variables for the constructs hunger and government programs. Specifically, we will look into the data of Pasay City (2005), Eastern Samar (2005), and Agusan del Sur (2006). For the profiles of these areas, refer to the official site of the City of Pasay (http://pasay.gov.ph), CBMS (2010a), and CBMS (2010b) for Eastern Samar and Agusan del Sur, respectively. These provinces were selected to approximate Philippine behavior with ample representatives from the major island groupings of Luzon, Visayas, and Mindanao. Equation 2 shows the logistic specification of the variables influencing the probability that the household experienced hunger. The marginal effects of Equation 2 will be estimated using MLE. For a complete discussion of the methodology, refer to Aliping, Pizarro, Reyes, and Rivera (2013).

$$\ln\left(\frac{p_i}{1-p_i}\right) = f(FSIZEi, HHINCOMEi, ESTATHHi, HEALTHi, FEEDINGi, SCHOLARi, SKILLSi, HOUSINGi, CREDITi) + \varepsilon i \qquad (2)$$

where:

p_i is the probability that a household has experienced hunger. This is an indication of irregularities in a household's access to food;

$FSIZE_i$ is the number of members in household i. This is expected to have a positive effect on p_i because more members will have to share a finite amount of food a household was able to acquire. The significance of this variable will suggest the need for a population policy to combat food inequality;

$HHINCOME_i$ measures the total household income—the sum of all sources of household income from domestic and international sources. By a priori, the higher the income of the household is, the lower is the probability of hunger;

$ESTATHH_i$ is a vector of employment status of the household head whose categories include $PERMANENT_i$ and $SEASONAL_i$—dummy variables indicating whether the household head is employed permanently or seasonally. The temporarily employed category was dropped to avoid the dummy variable trap. Categories assume a value of 1 if the household head is permanent or seasonal, 0 if otherwise. By a priori, having permanent employment reduces the probability of hunger due to the stable flow of income to finance food consumption. Meanwhile, having seasonal or temporary employment might increase the probability of hunger because of the impermanent flow of income resulting to ephemeral food consumption;

$HEALTH_i$ is a dummy variable indicating whether a household availed health assistance programs (e.g., free eye checkup, dental services) during the past 12 months. It assumes a value of 1 if the household availed this program, and 0 if otherwise;

$FEEDING_i$ is a dummy variable indicating whether a household availed supplemental feeding program for the past 12 months. It assumes a value of 1 if the household availed this program, and 0 if otherwise;

$SCHOLAR_i$ is a dummy variable indicating whether a household availed education and scholarship program for the past 12 months. It assumes a value of 1 if the household availed this program, and 0 otherwise;

$SKILLS_i$ is a dummy variable indicating whether a household availed of skills or livelihood programs for the past 12 months. It assumes a value of 1 if the household availed this program and 0 if otherwise;

$HOUSING_i$ is a dummy variable indicating whether a household availed of housing program for the past 12 months. It assumes a value of 1 if the household availed this program, and 0 if otherwise;

$CREDIT_i$ is a dummy variable indicating whether a household availed of credit program for the past 12 months. It assumes a value of 1 if the household availed this program, and 0 if otherwise. These variables represent the provision of government subsidies that will support poor households to acquire decent and sufficient amount of food. By a priori, these programs should reduce the probability of hunger because these provisions shift a portion of the burden of financing food consumption, effectively decreasing the perceived and actual costs of purchasing food. On the other hand, assuming food is a normal good, by Engel aggregation, as income increases (regardless of source), food consumption will also increase; and

ε_i is the stochastic disturbance term that captures all other variables that were not included in the equation.

To address the endogeneity of $HHINCOME_i$, we also modeled the direct relationship of education to income represented by Equation 3. Those who are able to acquire higher educational attainment are individuals who have access to higher levels of income and thus can reduce the likelihood to experience hunger. Equation 3 will be estimated using OLS. Afterwards, the predicted values of $HHINCOME_i$ will be generated and then substituted to Equation 3 to represent the income variable. That is, income is the channel of education in affecting incidence of hunger.

$$\begin{aligned} HHINCOME_i = {} & \alpha_0 + \alpha_1 ELEMGRAD_i + \alpha_2 HSUNDR_i + \alpha_3 HSGRAD_i + \alpha_4 PSUNDR_i \\ & + \alpha_5 PSGRAD_i + \alpha_6 COLUNDR_i + \alpha_7 COLGRAD_i + \alpha_8 WMSPHD_i + v_i \end{aligned} \tag{3}$$

where

$ELEMGRAD_i$, $HSUNDR_i$, $HSGRAD_i$, $PSUNDR_i$, $PSGRAD_i$, $COLUNDR_i$, $COLGRAD_i$, and $WMSPHD_i$ are dummy variables indicating whether the household head is an elementary graduate, high school undergraduate, high school graduate, postsecondary undergraduate, postsecondary graduate, college undergraduate, college graduate, and with graduate studies, respectively. The category elementary undergraduate was dropped to avoid dummy variable trap. By a priori, the higher the educational attainment of the household head, the household head will have better chances in acquiring lucrative job opportunities that will provide for food consumption; and

v_i is the stochastic disturbance term that captures all other variables that were not included in the equation.

Results and Discussion

Lorenz Curves

Figure 4 illustrates the Lorenz curve for the Philippines. It can be construed from Figure 4 that there is an apparent food inequality in the country. However, not much can be said unless the Lorenz curve is compared with another. Distinct ranking is possible only if the curves do not intersect but it is not impossible for curves to intersect because there are cases wherein the upper percentage of the population might dominate whilst there are also cases wherein the lower distribution of the population are worse off than the rest. Hence, there is selectivity in terms of ranking and no certainty of complete ranking. Meaning, it should be noted at which point in the graph is being considered (Jao et al., 2000). To identify the complete ranking of the different regions, numerical measures then should be utilized. For an in-depth discussion on interpreting Lorenz curves, refer to Todaro and Smith (2006).

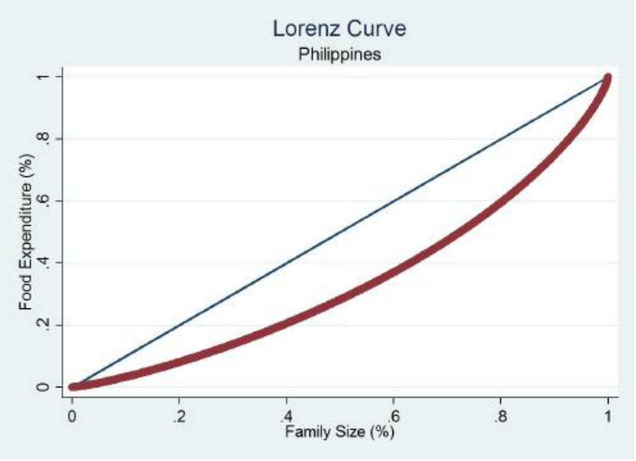


Figure 4. The Lorenz curve of the Philippines.

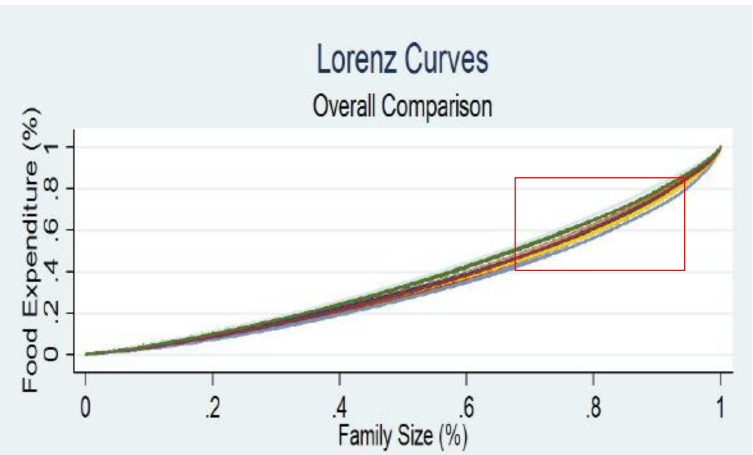
Figure 5 illustrates the Lorenz curves for each region and for the Philippines. It is evident that there are no significant distances among the curves. Region II and Region XV dominated all other regions. Region X lies farthest from the egalitarian line and does not intersect any of the regional curves including the national-level Lorenz curve. Hence, Region X has the most inequality in food distribution compared to all other regions.

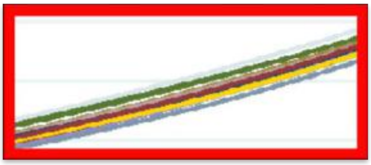
In Figure 6, the Lorenz curve for Region II dominates all regions in Luzon (same observation in Figure 5). Furthermore, majority of the Lorenz curves for the regions in Luzon dominate the national-level Lorenz curve. That is, there is less food inequality at the regional level. For the Cordillera Administrative Region (CAR), it dominates the national-level curve at first, but at 65% of the population, it intersects the Philippine curve making it the worse-off region in Luzon. As the cumulative percentage of household size increases, at 85% and beyond, there is a convergence in the curves making it hard to determine which curve dominates. Here, we must be careful in making assumptions of complete ranking.

In Figure 7, Region VI is seen to be the dominant curve—indicating egalitarianism in food distribution. For the other curves, ranking is not applicable. We should be mindful of what point in the graph is being observed due to intersections at certain points. For instance, the curve of Region VII reveals that the proportion of the family size below 75% is the worst off compared to Region VIII and the national level, but beyond that cumulative percentage, it dominates both curves. For Region VIII, it shows that in the 15% to 75% of the population, it dominates the curve of the Philippines and Region VII, but beyond 75%, it becomes the worse-off region.

In Figure 8, ARMM displayed consistent dominance as compared to the Lorenz curves of other regions in Mindanao. At 25% cumulative population, Region X deviated from the rest of the curves positioning it as the worst-off region (similar to Fig. 5). Furthermore, the complete ranking of the other regions using the Lorenz curve cannot be done due to the several intersections. Hence, there is an obvious disparity observed in Mindanao.

We also compare the Lorenz curves of the major metropolitan regions in the country (see Fig. 9). We plot the Lorenz curves of NCR (Metro Manila), Region VII (Metro Cebu), and Region XI (Metro Davao). From Figure 9, NCR is seen as the most egalitarian (since it is the center of commercial activities and exchange). However, the Lorenz curve of NCR is very close to Region XI, while Region VII is located outside the national-level Lorenz curve. Consistent with Figure 7, Region VII is also the worse-off region.





Legend:

Philippines and Caraga Region

Region I: Ilocos Region

Region IVA: CALABARZON

Region II: Cagayan Valley

Region IVB: MIMAROPA

Region III: Central Luzon

Region V: Bicol Region

Region VI: Western Visayas

Region VII: Central Visayas

Region VIII: Eastern Visayas

Region IX: Western Mindanao

Region X: Northern Mindanao

Region XI: Southern Mindanao

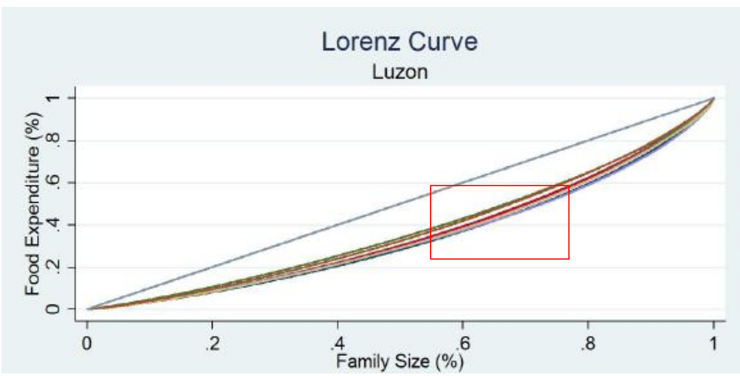
Region XII: SOCCSKSARGEN

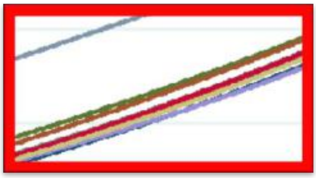
National Capital Region (NCR)

Cordillera Administrative Region (CAR)

ARMM

Figure 5. The Lorenz curve of the Philippines and its regions.





Legend:

Philippines

Region I: Ilocos

Region II: Cagayan Valley

Region III: Central Luzon

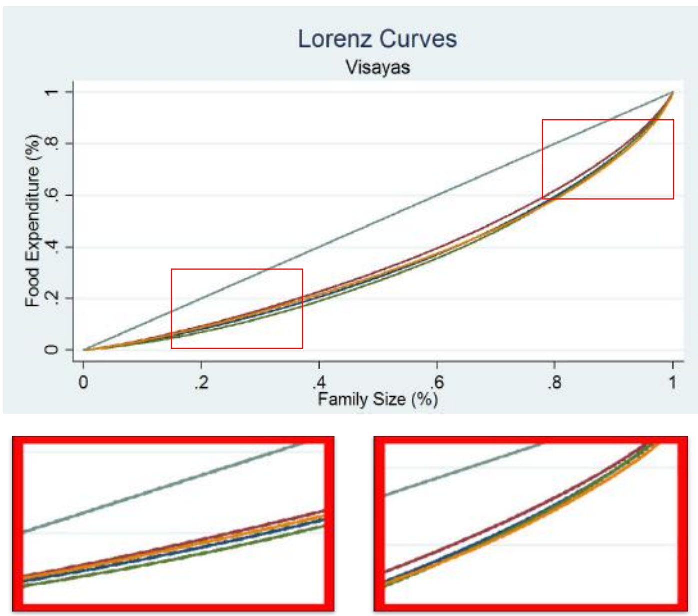
Region IV A: CALABARZON

Region IV B: MIMAROPA

National Capital Region (NCR)

Cordillera Administrative Region (CAR)

Figure 6. The Lorenz curve of the Philippines and Luzon.



Legend:

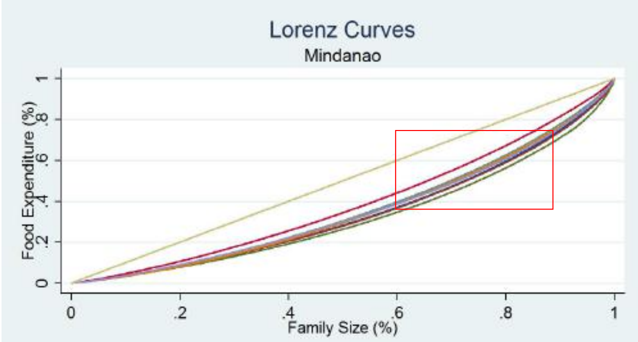
Philippines

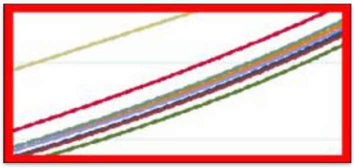
Region VI: Western Visayas

Region VII: Central Visayas

Region VIII: Eastern Visayas

Figure 7. The Lorenz curve of the Philippines and Visayas.





Legend:

Philippines

Region IX: Western Mindanao

Region X: Northern Mindanao

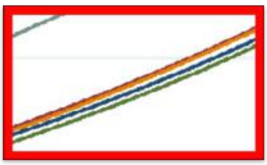
Region XI: Southern Mindanao

Region XII: SOCCSKSARGEN

ARMM

Caraga Region

Figure 8. The Lorenz curve of the Philippines and Mindanao.



Legend:

Philippines

National Capital Region (NCR)

Metro Cebu

Metro Davao

Figure 9. The Lorenz curve of the Philippines and metropolitan regions.

Epanechnikov Kernel Density

The kernel density serves as an alternative visual tool to do a comparative analysis of the food inequality among regions in the Philippines. This graphical representation depicts the distribution of the data allowing us to locate the poverty line, illustrate the incidence of food poverty, and provide an insight about the proportion of the poor in food in various areas. As a matter of caution, according to Jao et al. (2000), poverty line determination is a complex issue. We do not highlight the pros and cons of the various methods of poverty line identification; instead, the identified poverty line is used as the basis of comparison across regions.

From Figure 10, it can be seen from the kernel density (using the natural logarithm of food consumption) that the Philippine food poverty line is approximately at 10 (indicated by the tip of the distribution). To make sense of the graph, densities that are more to the right of the food poverty line indicate less food poverty. It can be seen from Figure 10 that the density is centered at 10 showing that majority of households in the sample are in close proximity to the national food poverty line.

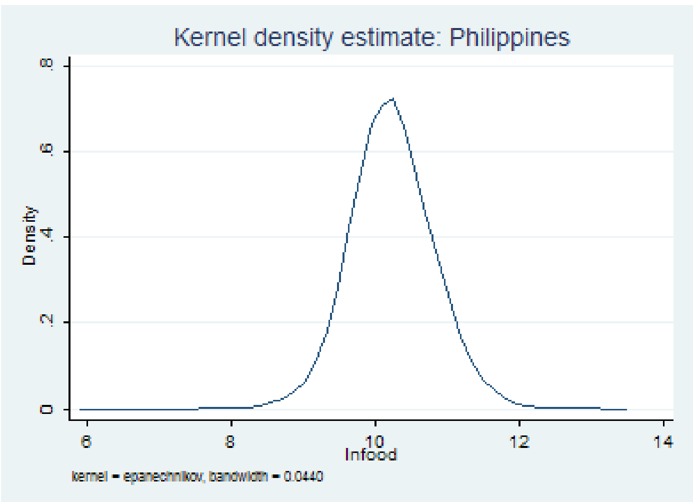


Figure 10. The Epanechnikov kernel distribution for the Philippines.

Figure 11 illustrates the food density estimates per region in Luzon. It can be seen that majority of the region's food poverty line is close to the national food poverty line (i.e., Bicol, Cagayan Valley, and Ilocos). However, MIMAROPA's (Mindoro, Marinduque, Romblon, and Palawan) food poverty line is to the left of the national average. This is the case because the main source of food production in Luzon lies on the main island where all of the regions are located except MIMAROPA. Alternatively, MIMAROPA is frequently hit by typhoons, which disrupt region-specific industrial food processes. Meanwhile, NCR, Central Luzon, and CALABARZON demonstrated food poverty lines greater than the national level because there is ease in the flow of goods distribution. These regions are also highly urban indicating a higher standard of living. Also, NCR, as the main commercial district of the country, is also the hub of overall production and distribution. Meanwhile, Central Luzon, also known as the rice granary of the country, supplies the majority of the demand for rice—a staple food in the country. Likewise, there exists special economic zones (SEZs) in the region that significantly contribute to their regional output. Lastly, CALABARZON has also evolved into an industrialized region as evidenced by the establishment of commercial districts due to its close proximity with NCR.

Figure 12 illustrates the various food density estimates in Visayas. It can be seen that Eastern Visayas's food poverty line is below the national level. However, regions in Visayas illustrated similar states of food inequality with central tendencies around the national average (but at varying kurtosis due to differences in food production and distribution). With regards to the kurtosis, from the three regions, only Central Visayas exhibited a wide span compared to the other two regions. Figure 12 shows that there are households who would just need a marginal amount of income to finance food consumption to exceed the food poverty line. This is manageable because of the nature of food production dependent on their rich marine resources.

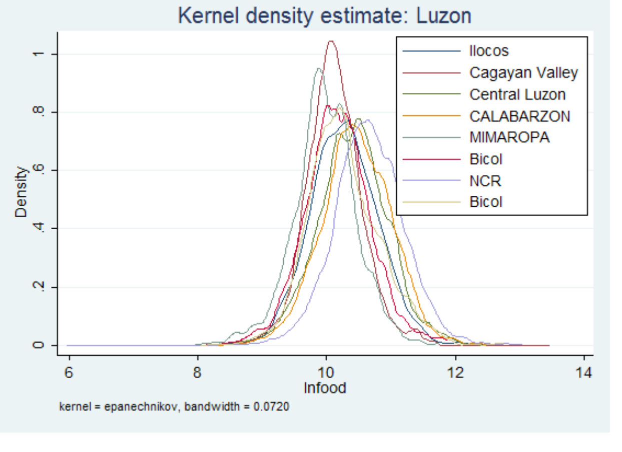


Figure 11. The Epanechnikov kernel distribution for Luzon.

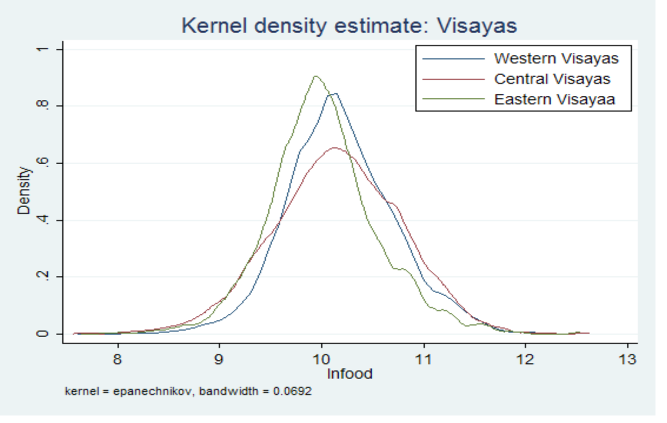


Figure 12. The Epanechnikov kernel distribution for Visayas.

Figure 13 illustrates the various food density estimates in Mindanao. It can be seen that all regions, expect Western Mindanao, have food poverty lines approximately equal with the national average. The rest of the region is experiencing similar state of food inequality vis-à-vis the national average because of the presence of food manufacturing multinational companies (MNCs) such as *Del Monte* and *DOLE*. As such, it warrants that agricultural production be designed to meet the demands of these MNCs. Moreover, the industrial and tourism sector in Mindanao is lucratively contributing to their regional output. In Southern Mindanao, majority of its people are above the national food poverty line because the region encompasses a highly urban capital, that is, Davao City, but it is also predominantly agri-based evolving into an agro-industrial region. In addition, its competitive advantage is in agri-industry, in exporting its agricultural and marine products.

Lastly, Figure 14 compares the major metropolitan areas in the country—NCR, Central Visayas, and Southern Mindanao. It can be observed that the national food poverty line of NCR exceeds Central Visayas and Southern Mindanao. Such is the case because NCR houses the main commercial and financial center indicating a high level of urbanity and standard of living. However, it can also be observed that Central Visayas and Southern Mindanao's food poverty line is relatively the same as the national level. One may infer that the inhabitants of metropolitan areas in Luzon, Visayas, and Mindanao have access to food. Looking at the kurtosis, it can be seen that metropolitan regions exhibit high concentration levels wherein residents of NCR have higher food consumption compared to the national average. Meanwhile, Central Visayas and Southern Mindanao residents' food consumption is in proximity with that of the national average. Lastly, Central Visayas has the worst state of food inequality among metropolitan regions. This may be due to the mismatch in food supplies and high population density. This increases the probability of having more people suffering from food poverty.

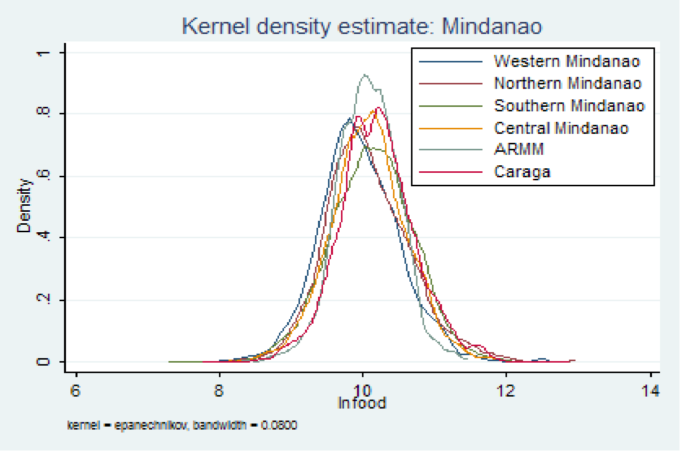


Figure 13. The Epanechnikov kernel distribution for Mindanao.

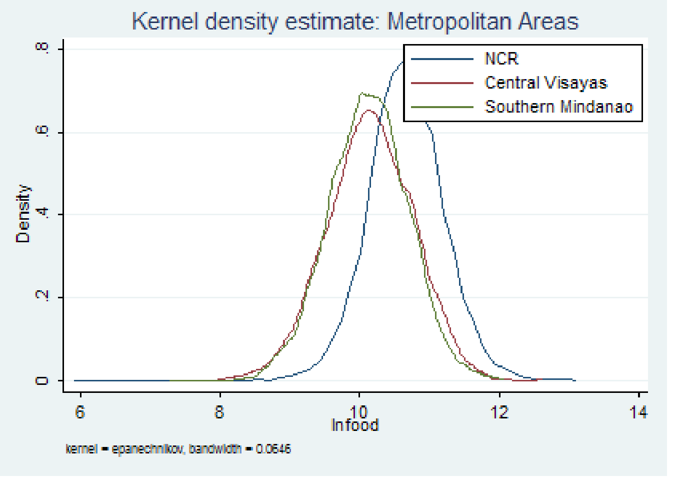


Figure 14. The Epanechnikov kernel distribution for metropolitan regions.

Engel Curves

Table 5 shows the Engel curve estimates for the Philippines using GMM. Results show that an increase in income, regardless of source, increases food expenditure. It also shows that food is a normal good, that is, by income effect, food expenditures increase given an increase in purchasing power. Among the three major business activities households engage in, an additional income from engaging in industrial activities has the largest positive marginal effect to food expenditure. An extra income from engaging in agricultural activities also has greater effect than an extra income from service activities. Households that have rental income spend more on food. Income from dividends and net winnings from gambling do not have any effect on food consumption. This can be ascribed to the few households that engage in such activities. They do not rely on these to spend for food expenditure. It is also interesting to note that from Table 6, as with any other normal good, food consumption is income inelastic.

Among the three major industries, households' food expenditure is the most sensitive to changes in income from agricultural activities. This confirms the importance of the agricultural sector in the Philippines wherein 51% of the sample engages in agricultural activities and most poor households' major source of food are from agriculture. Even though households that have rental income allocate more of their income on food expenditure, food expenditure is less sensitive to changes in rental income. This is because more than 90% of households engage in other entrepreneurial activities. Also, the additional support from abroad contributes to an increase in food expenditures although less sensitive. This is plausible because cash support from abroad is usually spent on other basic commodities—education and utilities.

Table 5. Results of the Generalized Method of Moments Regression

(Dependent Variable: Food Consumption)			
Variables	Coefficient	Standard Error	Probability Value
$RENT_i$	1.3561	0.0146	0.000
$WAGES_i$	0.4422	0.0018	0.000
$AGRI_i$	0.4886	0.0022	0.000
$INDSTRY_i$	0.6967	0.0049	0.000
$SRVCS_i$	0.2872	0.0028	0.000
$OTHR_i$	0.2415	0.0028	0.000
$INTRST_i$	0.9141	0.2609	0.000
$CONAB_i$	0.0159	0.0038	0.000

Table 5 continued...

DIV_i	0.4066	0.2136	0.057
$GAMB_i$	0.0446	0.0467	0.906
Constant	7803.8540	60.7578	0.000

Table 6. Estimated Marginal Effects

Dependent Variable: Food Consumption			
Variables	ey/ex	Standard Error	Probability Value
$RENT_i$	0.0137	0.0001	0.000
$WAGES_i$	0.2918	0.0011	0.000
$AGRI_i$	0.1760	0.0008	0.000
$INDSTRY_i$	0.0107	0.0001	0.000
$SRVCS_i$	0.0304	0.0002	0.000
$OTHR_i$	0.1026	0.0011	0.000
$INTRST_i$	0.0001	0.0000	0.000
$CONAB_i$	0.0008	0.0002	0.000
DIV_i	0.0000	0.0000	0.023
$GAMB_i$	0.0004	0.0005	0.325

Reducing Incidence of Hunger Through Government-Sponsored Programs

Table 7 reports selected descriptive statistics for Pasay, Eastern Samar, and Agusan del Sur. It shows that income at level has an abnormally high mean, standard deviation, and skewness. This can lead to poor estimates. We opted to transform income to its natural logarithmic form to contain the high variability.

Table 7. Selected Descriptive Statistics

Variables	Pasay			Eastern Samar			Agusan Del Sur		
	Mean	Standard Deviation	Skewness	Mean	Standard Deviation	Skewness	Mean	Standard Deviation	Skewness
HSIZEi	4.1980	2.0689	1.7265	4.5129	2.2613	0.6619	6.0776	2.3704	0.7116
INCOMEi	220,963	2,373,431	181.32	68,230	90,669	3.21	79,901	379,458	204.722
LNINCOMEi	11.9394	0.7743	(0.3112)	10.4874	1.1758	(0.1367)	10.7236	1.0253	(0.2522)

Table 8 shows the results of OLS regression for household income. There is a high positive and significant relationship between education and income. Furthermore, as seen in Pasay and Agusan del Sur, as educational attainment increases, its marginal effect on income also increases. Compared to Eastern Samar, college undergraduates and college graduates are the only estimates that have a significant contribution to income. This may be due to the rural status of the region wherein college attainment is deemed as the only beneficial factor in acquiring the most lucrative jobs in the locality. In addition, graduate studies in Eastern Samar does not contribute a significant increase in income since, yet again, Eastern Samar is a rural area and jobs requiring such credentials are not found in the locality and/or if ever there is a position, the compensation cannot suffice for the bargained salary. As compared to the marginal contribution of those who possess graduate studies in Pasay and Agusan del Sur, these coefficients are highly significant, therefore giving incentives to those who have graduate degrees in getting higher income.

Table 8. Ordinary Least Squares (OLS) Regression

Dependent Variable: Log of Total Income									
Variables	Pasay			Eastern Samar			Agusan del Sur		
	Coefficient	Standard Error	*p*-Value	Coefficient	Standard Error	*p*-Value	Coefficient	Standard Error	*p*-Value
ELEMGRADi	0.0884	0.0184	0.000	0.3130	0.1837	0.089	0.0380	0.0081	0.000
HSUNDRi	0.0408	0.0177	0.210	0.0236	0.0954	0.805	0.3468	0.0034	0.000
HSGRADi	0.2089	0.0153	0.000	0.3123	0.1488	0.036	0.3853	0.0067	0.000
PSUNDRi	0.3239	0.0422	0.000	—	—	—	0.7242	0.0238	0.000
PSGRADi	0.3678	0.0202	0.000	0.1823	0.8205	0.824	0.8517	0.0341	0.000
COLUNDRi	0.3999	0.0163	0.000	0.4106	0.1113	0.000	0.9219	0.0057	0.000
COLGRADi	0.6952	0.0162	0.000	0.6435	0.1307	0.000	1.4293	0.0077	0.000
WMSPHDi	0.8535	0.1625	0.000	—0.7614	0.6708	0.257	1.3659	0.1099	0.000
Constant	11.638	0.0142	0.000	10.3257	0.0572	0.000	10.5369	0.0016	0.000

Table 9 shows the marginal effects after logit. It can be seen that household size, household income, permanent employment, and seasonal employment have significant effect on the incidence of hunger in Pasay. It is also apparent that none of the government programs in Pasay have significant marginal effect on state of hunger.

Table 9. Marginal Effects After Logit

Variables	Pasay			Eastern Samar			Agusan del Sur		
	Coefficient	Standard Error	*p*-Value	Coefficient	Standard Error	*p*-Value	Coefficient	Standard Error	*p*-Value
HSIZEi	0.0015	0.0002	0.0000	0.0094	0.0049	0.0560	0.0713	0.0003	0.0000
LNINCOMEi	-0.0243	0.0024	0.0000	-0.0780	0.0530	0.1410	-1.7387	0.0026	0.0000
PERMANENTi	-0.0328	0.0053	0.0000	-0.1778	0.0349	0.0000	-0.0303	0.0025	0.0000
SEASONALi	-0.0061	0.0011	0.0000	-0.0730	0.0215	0.0010	-0.0197	0.0024	0.0000
WOMENi	0.0075	0.0035	0.0340	—	—	—	—	—	—
FEEDINGi	—	—	—	0.1693	0.1077	0.1160	0.0020	0.0033	0.5470
HEALTHi	0.0013	0.0010	0.1980	0.0228	0.0250	0.3610	0.0132	0.0016	0.0000
SCHOLARi	0.0068	0.0042	0.1020	—	—	—	0.0509	0.0075	0.0000
TRAININGi	0.0112	0.0067	0.0950	-0.0259	0.0866	0.7650	0.0167	0.0049	0.0010
HOUSINGi	0.0072	0.0069	0.2950	—	—	—	-0.0392	0.0082	0.0000
CREDITi	0.0055	0.0049	0.2610	0.0097	0.0454	0.8300	-0.0265	0.0024	0.0000

For Eastern Samar, job status is the only significant factor that affects state of hunger (see Table 9). Permanent employment has the greatest marginal effect since permanency in job assures a steady flow of income and assures accessibility to food. Again, just like in Pasay, government programs have insignificant effect on addressing hunger. This implies that program implementation may not be as effective as in urban areas. This can be due to the topography of the area, difficulty of transportation, and lack of facilities. Hence, as reported in the CBMS Status Report on MDGs for Eastern Samar in 2010, the province is still under poverty and most households are under the food threshold. Moreover, the results suggest that there is a need for sustainable living programs, provision of basic necessities, better and quality educational facilities, and technology expansion.

The results from Agusan del Sur (see Table 9) reported high significance in all variables except for the provision of feeding programs—representation of food-related programs of the government. This may be due to the strong agricultural upbringing of the region making feeding programs irrelevant because households have easy access to food supply from farming and other agricultural activities. Likewise, household size, household income, permanent employment, seasonal employment, housing programs, and credit programs are significant and consistent in reducing the probability of hunger. On the other hand, access to health programs, scholarships, and training are counter intuitive but highly significant. In this context, government provisions transfer the financial burden from the household to the state, thus freeing resources that would have been spent on basic necessities (Rivera & See, 2012). This encourages higher family size; thus, household members would get a smaller share of the food.

Conclusions

Poverty has been prevalent throughout history. Its eradication has been one of the priorities of past and present administrations. Using the APIS, we have generated the following conclusions. In addressing our first research objective, the estimated Lorenz curves for the Philippines and its regions show evidence of food inequality at varying depths. These Lorenz curves were compared with the national level and with other regions. We have seen Lorenz curves for some regions that are clustered with each other leaving no significant disparities amongst them. That is, it can be construed that food distribution in the Philippines does not favor any region. While it is evident that there are leading regions (regions that are closer to the egalitarian line), it is indicative that there are regions that have less food inequality compared to the national food distribution. Specifically, it was seen that NCR is one of the most egalitarian regions while Central Visayas has one of the worst food distribution in Visayas. Such results call for the need to help regions lagging behind in terms of food distribution.

These results have been reinforced by the estimated kernel density models. We have seen that almost all regions have approximately similar food poverty incidence, evidenced by the tightly clustered distributions. However, we have also observed differences in the peaks of the distributions indicating heterogeneity in food production and consumption among regions. Consistent with our conclusions with the Lorenz curves, it was also seen that NCR is the region with the lowest incidence of food poverty as evidenced by its kernel density whose concentration is way beyond the national average. Likewise, Central Visayas has the worst state of food inequality relative to the other two metropolitan areas in the country ascribed to its high population density. Lastly, Southern Mindanao is experiencing the least state of food poverty in Mindanao because of its rapidly expanding agri-business, which augments food production and distribution to all households.

Overall, the food poverty gap between regions in the Philippines and with respect to the national average is narrow. To augment food distribution and consumption of those under the food poverty line, the state must strengthen its food and nonfood distribution projects such as food and cash grants (see Conchada & Rivera, 2013). However, there is a need to precisely identify intended recipients to address the distribution inefficiency. Also, the state must invest in technology to enhance food production in the regions that have the potential to supply food to the entire country such as Central Luzon, Southern Mindanao, and Western Visayas. The country needs to shift from subsistence farming to commercialized farming. Engaging in research and development on how to improve the quality and quantity of rice production is also necessary. Furthermore, the state must invest in facilities that will cultivate a sustainable source of marine products through technologically advanced fish pens, factories, and marine farms.

When these technologies are in place, the country can slowly start reducing the importation of rice from Thailand and Vietnam. The country must harness again its potential in producing its own rice for national consumption and export the surplus (just like in the 1970s). Funds that are supposedly used to import rice can be reallocated for research development to further enhance food production in the country. It is essential that the country achieve sustainability in food production.

In addressing our second research objective, our estimated Engel curve for the Philippines showed that households demonstrate variation in food consumption. This heterogeneity in food consumption can be ascribed to the different levels and sources of income each household has. Moreover, the differing elasticities of various significant sources of household income against food expenditure show the sensitivity of food consumption to various sources of income. We have also seen that food consumption is most responsive to changes in salaries and wages relative to any other sources of income. Beyond this finding, it reveals the importance of addressing unemployment in the Philippines since households rely more on their salaries and wages. It has also been observed that, among the three major industrial activities, food consumption is most sensitive to income from agricultural activities, proving the significance of the agricultural sector. It can be understood that many households' food consumption may be affected if there were sudden shocks that will reduce income from agriculture. On the other hand, households' level of food consumption is least responsive to changes in (1) income from interest and (2) income from abroad. It denotes that although food consumption increases, given increases in these income channels, these incomes are usually spent on other nonfood commodities.

In addressing our third research objective, we estimated a logistic regression that will show whether government-sponsored programs in alleviating state of hunger in selected provinces are effective. Results have shown that government programs are ineffective in Pasay and Eastern Samar while only feeding program is statistically significant in Agusan del Sur. This may indicate that program implementation is not effective and does not target the intended population. This is worsened by regional topology that hinders implementation because it deters authorities in reaching those in isolated areas, who are requiring most of the assistance. For Agusan del Sur, some of the government programs positively influence hunger. This may be due to the consequence of such programs that cushion household expenditures providing them with financial flexibility to accommodate larger family size affecting food distribution within the household (see Rivera & See, 2012).

However, we do not suggest that the state stop implementing antipoverty programs. Programs addressing food shortages should be reinforced especially in areas where help from the government are very limited or close to none. However, committed programs are needed so that it reaches the most isolated households. The government can efficiently delegate tasks at the *barangay* level so that programs effectively reach small and far-flung communities. Although feeding programs are needed to instantaneously address hunger, there is a need to call for a sustainable food production and distribution in the country. It will not only change the landscape of food supply but it will also enhance work supply in the country considering the Philippines is an agricultural economy.

Another alternative undertaking is to reduce food inequality through the implementation of an enhanced food distribution projects such as conditional food and cash grants (see Conchada & Rivera, 2013). Correspondingly, a more sustainable solution to alleviate state of hunger is to provide employment. Providing a stable and meaningful employment will relieve the government the burden of continuously providing food and other transfers for the poor. Instead, resources can be devoted to other avenues of development such as agrarian reform and infrastructure development.

Addressing food poverty is a tedious task for the state. It requires political will to mitigate dependence of poor households on government transfers. The poor must harness government transfers by using them to fund household activities that will uplift them from poverty (i.e., education, entrepreneurship). Poor households should make conscious effort to climb the social ladder.

It is the obligation of the state to initiate functional frameworks aimed to address poverty at a faster pace. However, implementation is slow due to weak targeting and highly politicized intentions—programs are often designed to secure votes for the next elections. Given the political environment, legislation is required to ensure that ongoing poverty alleviation programs that are functional should be pursued regardless of who is the responsible party. Another issue to settle is financing these programs. An integrated approach will require a large sum of money since these programs will cover several issues simultaneously. Initially, programs are implemented on a national level, which requires not only financial resources but also infrastructures and manpower. This warrants serious budgetary planning and, to some extent, philanthropic actions. Microfinance for entrepreneurial ventures can also be an alternative. It has already been proven to be a scalable and sustainable tool in addressing poverty through the income channel. The increase in income will give poor households a head start to finance recurring expenditures.

In addition, microfinance institutions (MFIs) should heighten their responsibility in dealing with their clients—mostly poor and uneducated households. Educating them on how to handle the funds borrowed is complimentary. Transparency and information will give way for the efficient use of borrowed funds reducing the great deal of risks MFIs face when lending.

Once budgets are recognized and properly allocated, the state can seek help from NGOs and private groups because they are knowledgeable in addressing specific problems and are able to help advance the goals of poverty reduction. Furthermore, they can focus on smaller groups allowing them to reach out to households beyond the geographical scope of programs since they might have access to remote areas, which require most attention and help.

Health, gender, and education are equally crucial in terms of its role in poverty-reduction programs since these are mediums to enable manpower to be productive. Healthy and skilled manpower will not only make the labor market self-sufficient but also knowledgeable on handling their respective livelihoods—advancing households' respective socioeconomic status. Similarly, provisions of jobs will cater to the influx of skilled workers, facilitated by increased education. As such, those who are given scholarships and education programs will be able to use the skills imparted and reduce the incidence of free-riding.

We would like to emphasize that the government can only do so much in alleviating the hunger among impoverished households. A more sustainable way of relieving the poor from poverty must be designed instead of employing "band-aid" solutions to address hunger. If the intent of antipoverty programs is to win the votes of poor households, then they will repeatedy free-ride on government initiatives. Hence, our long-run solution is the redistribution of wealth through the provision of conditional livelihood programs. It must be implemented in such a way that the recipient must sustain the livelihood; otherwise, they will be held accountable.

It is also the obligation of poor households to strategize and to manage their resources responsibly. They should learn to be self-sufficient and should not rely solely on government support. They should complement government efforts by taking resources given to them a step further—they have a role too in poverty reduction. They should help themselves to strive independently for them to climb the social ladder.

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3

Poverty Alleviation in the Philippines: Comparing the Effects of Food and Nonfood Grants in Eastern Samar and Agusan del Sur

Mitzie Irene P. Conchada and John Paolo R. Rivera

As the Philippines moves towards a more sustainable economic growth, the battle against poverty also intensifies. Various poverty alleviation programs have been implemented, and some of them could be classified as food and nonfood grants. For instance, the Department of Social Development and Welfare (DSWD) and the Department of Education (DepEd) work hand in hand to provide feeding programs in public schools where most of the poor can be targeted. These feeding programs aim to target the poor and help them cope up with higher prices of food and other basic commodities. Moreover, feeding programs help poor children to focus on their studies and become more productive individuals. It helps address the demand-side concern of food security for the poor.

There is a huge part of the literature on food programs that point out to the fact that these programs can have a positive effect on education outcomes (Manasan & Cuenca, 2007). For instance, the Food for School Program (FSP) in 2005, though short-lived, led to increased investment in human capital through higher school attendance and increased patronage of other social services such as health (Manasan & Cuenca, 2007). On the contrary, Standing (2008) stressed several reasons why food programs may not be effective. Targeting the poor and monitoring the effectiveness of the program are seen as two of the major issues. Once this happens, the purpose is defeated and resources are wasted. This is the reason why advocates of nonfood programs are adamant in supporting such. Nonfood programs can come in the form of conditional cash grants, scholarships, or credit programs.

In an earlier study on food and nonfood programs conducted by Conchada and Rivera (2013), nonfood programs turned out to be more effective than food programs at least in Pasay City. It has contributed to an improved school participation rate as well as reduced incidence of hunger. The nonfood grant allows more flexibility on the part of the household head to invest in the education and health of family members, given that it is an investment good while the food grant is more of a consumption good.

Given such background, the study would like to extend the research of Conchada and Rivera (2013) to two other provinces in the Visayas and Mindanao regions, where the incidence of poverty is very high. Similarly, this study will focus on the following key question: Which between the food-grant and nonfood-grant programs of the government has a greater influence in raising the welfare of the poor in Eastern Samar and Agusan del Sur as per the Community-Based Monitoring System (CBMS) survey is concerned? Given this key question, the objectives of this study are as follows:

- To show that one grant is superior than the other in enhancing the welfare of the poor, theoretically and empirically; and
- To identify the facets that will contribute to increasing school participation and reducing the state of hunger of households by implementing an empirical framework incorporating the various government-sponsored programs to alleviate poverty. Hence, this study will be able to determine the significant government programs that can increase school participation and reduce state of hunger.

The results of this study will be used to complement the findings of the previous study of Conchada and Rivera (2013). Moreover, it aims to suggest policy recommendations to address hunger and absenteeism among the poor in the provinces of Eastern Samar and Agusan del Sur. In the 2012 official poverty statistics of the Philippine Statistics Authority, Eastern Samar had the highest poverty incidence (59.4%) in Region 8, while Agusan del Sur had the highest poverty incidence (38.6%) in the Caraga Region. The type of program, whether it is a food or nonfood grant or a cash grant, will matter to people who cannot afford to send their children to school or provide a well-balanced meal. Moreover, this will also help government maximize its very limited resources.

Food and Nonfood Grants in the Phippines: Food-for-School Program (FSP) and the Conditional Cash Transfer (CCT) Program

Incidence of Hunger and Malnutrition and the FSP

For most poor families, hunger is one of the problems they have to deal with on a daily basis. As defined in Conchada and Rivera (2012), hunger is the painful sensation due to inadequate and irregular food intake. If hunger is prolonged, it may lead to diseases such as malnutrition (particularly undernutrition). The latest Social Weather Station (SWS) survey (http://www.rappler.com/move-ph/issues/hunger/82144-sws-hunger-survey-2015) reported that there was a slight improvement in the fight against hunger. Self-reported hunger among households fell from 19.9% in 2012 to 18.3% in 2014, with the National Capital Region experiencing the biggest drop from 23.5% to 16%. On the other hand, severe hunger increased slightly in the past decade from 3% to 3.5% as seen in Table 1. The recent developments in the fight against hunger could be attributed to the government's efforts on improving feeding programs in public schools and the private sector's initiative, particularly nongovernmental organizations, in sponsoring similar programs.

Table 1. Incidence of Hunger in the Philippines

Severity of Hunger/ Area	2006		2006			2007	2014	
	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	
Severe hunger	2.6	3.9	4.2	3.4	4.6	3.9	4.0	3.5
Number of families	400,000	600,000	700,000	580,000	800,000	670,000	696,000	
Moderate hunger	—	—	12.7	10.1	12.3	15.1	15.0	
Number of families	—	—	2,209,000	1,757,000	2,140,000	2,597,000	2,580,000	
Total hunger incidence	15.5	16.7	16.9	13.9	16.9	19.0	19.0	18.3
National Capital Region	16.7	21.0	18.3	15.0	12.8	17.7	20.7	16.0
Luzon	18.0	13.7	14.7	10.0	14.7	17.7	18.3	19.3
Visayas	13.3	14.3	16.0	17.7	19.7	19.0	15.3	16.6
Mindanao	12.0	21.7	21.0	17.3	21.3	22.3	22.7	19.2

Source: Social Weather Stations (SWS); Department of Education (DepEd) (2007).

In the latest Philippine Nutrition Survey, as reported by Rappler.com (2014), there has not been much progress in the nutritional status of Filipino children in the past five years since 2008. It was reported that the prevalence of underweight among children ages 0 to 5 years old in 2013 was 19.8% compared to 20.7% in 2008. Moreover, the prevalence of stunting was recorded at 30.3% in 2013 compared to 32.3% five years ago (http://www.rappler.com/move-ph/issues/hunger/61824-2013-national-nutrition-survey). One of the items in the Millennium Development Goals (MDG) is to cut in half the number of children under age 5 who are malnourished. The goal is to temper it to 13.6% by the year 2015.

Moreover, estimates from the 2012 Family Income and Expenditure Survey (FIES) conducted by the National Statistics Office (NSO) revealed a 10% subsistence incidence among Filipino households in 2012. This information has not changed much since 2003, when subsistence incidence was 10.1%. In 2003, the subsistence incidence increases for households with six or more family members as seen in Table 2, which implies that a bigger family size for a poor family has a higher chance of falling below the food threshold.

Table 2. Subsistence Incidence by Household Size (2003).

Household Size	Total Number of Households (Thousands)	Subsistence Poor (Food–Poor)	
		Number of Households (Thousands)	Incidence
All households	16,480	1,671	10.1
1	689	9	1.3
2	1,636	38	2.3
3	2,651	95	3.6
4	3,320	186	5.6
5	3,018	287	9.5
6	2,163	320	14.8
7	1,397	285	20.4
8	779	197	25.3
9	428	131	30.6
>10	399	121	30.3

Source: National Statistical Coordination Board (2011); Family Income and Expenditure Survey (2003); Department of Education (2007).

As discussed by Conchada and Rivera (2012), food insecurity brought about by poverty can lead to myriad of health problems and this includes malnutrition. A child below 5 years old experiencing malnutrition is more prone to poor performance in school and high dropout rates. Long-term measures to address the problem on food insecurity or hunger include improving the supply side such as logistics and infrastructure and increasing purchasing power, but it may take time for the desired outcome to take place. Instead, the government implemented short-term programs such as the FSP (Conchada & Rivera, 2012).

Perceived Benefits of the FSP

There are a number of benefits from the Food-for-School Program. The first benefit is improved education quality and efficiency. Conchada and Rivera (2012) mentioned that investments in the nutrition and health of the child can result in improved performance and a lower dropout rate. Second, it addresses short-term hunger and improves cognition, which results in better performance in school as manifested in higher test scores. Third, it leads to higher enrollment rates, which again translates to higher probability of improved test scores. Lastly, it promotes community participation, which creates many positive externalities. The program allows communication between the teachers, parents, and school officials as they coordinate regarding the feeding program.

Conditional Cash Transfer (CCT) Program

An example of a nonfood grant is the conditional cash transfer. The program is aimed at providing assistance to extremely poor households to improve their health, nutrition, and education particularly children aged 0 to 14. For the chosen households to continue to avail the transfer, they have to comply with certain conditions: pregnant women must avail of pre- and postnatal care and be attended by a trained health professional during childbirth, parents must attend family development sessions; 0- to 5-year-old children must receive regular preventive health checkups and vaccines, 3- to 5-year-old children must attend daycare or preschool classes at least 85% of the time, 6- to 14-year-old children must enroll in elementary or high school and must attend at least 85% of the time, and 6- to 14-year-old children must receive deworming pills twice a year (Conchada & Rivera, 2012). As of September 2014, the CCT in the Philippines is implemented in 144 cities and 1,438 municipalities in 80 provinces, and a total of 4.3 million households are enrolled.

Framework of the Study and Methodology

To show which between food grants and nonfood grants are more effective in targeting beneficiaries, we appeal to the theoretical framework employed by Conchada and Rivera (2013). There is a need to show the superiority of the nonfood grant over the food grant in uplifting the welfare of the poor to rationalize the phasing out of the FSP by the government due to its ineffectiveness. Instead, the government preferred nonfood grants.

The theoretical underpinnings of Conchada and Rivera (2013) employed a baseline model that showed the welfare (i.e., measured by utility) of a representative household without any subsidy from the government. They appealed to the solution from a utility maximization problem (UMP). A Cobb–Douglas utility function and a linear budget constraint for a typical household were used to solve for the optimal basket of consumption (i.e., Marshallian demand functions).

Afterwards, the UMP would incorporate the role of an exogenous amount of food grants provided by the government. Here, Conchada and Rivera (2013) assumed that the introduction of food grants will allow the poor household to spend all household income on all other goods (i.e., good *Y*) but still allow for the consumption of the other good (i.e., good *X*) through the exogenous food grant (i.e., ω). Thus, it can be construed that since the poor household will not spend on *X* due to the exogenous ω, an increase in the consumption of *Y* will happen since the representative household can now exhaust income on *Y*. Therefore, the food grant was able to increase the utility level, from the baseline model, of the representative household since it was able to increase its consumption of *X* and *Y*, provided that $X < \omega$.

Then, Conchada and Rivera (2013) did another iteration of the UMP. This time, instead of incorporating an exogenous food grant, a nonfood grant in the form of a cash grant was included. The cash grant is equal to the price of *X* times the number of food grants that the government was supposed to provide. This technically altered the linear budget constraint.

The utility levels from the baseline model, the food grant iteration, and the cash grant iteration revealed that the utility of a representative household is higher if a nonfood grant is provided as shown below:

No Government Transfer		**Exogenous Noncash Grant (Food)**		**Nonfood Grant (Cash)**
$U^* = \left(\frac{\alpha Z}{\alpha P_1 + \beta P_1}\right)^{\alpha}\left(\frac{\beta Z}{\alpha P_2 + \beta P_2}\right)^{\beta}$	<	$U^*_{FG} = \omega^{\alpha}(Z/P_2)^{\beta}$	<	$U^*_{CG} = \left(\frac{\alpha Z + \alpha P_1 \omega}{\alpha P_1 + \beta P_1}\right)^{\alpha}\left(\frac{\beta Z + \beta P_1 \omega}{\alpha P_2 + \beta P_2}\right)^{\beta}$

Note: For the complete details of the UMP, refer to Conchada and Rivera (2013).

Meanwhile, to empirically show which between a food grant or a cash grant is more effective in enhancing the welfare of households, a functional relationship between the government-sponsored programs against poverty and target variables, namely, school participation and state of hunger, was established. The results of the regression will provide policy recommendations for improving the delivery of the transfers. The functional relationships are shown in Equation 1 and Equation 2:

$$SPR_i = f(FEEDPROG_i, HEALTH_i, SCHOLAR_i, TRAINING_i, HOUSING_i, CREDIT_i, FSIZE_i, TOTIN_i) + \varepsilon_i \tag{1}$$

$$SHG_i = f(FEEDPROG_i, HEALTH_i, SCHOLAR_i, TRAINING_i, HOUSING_i, CREDIT_i, FSIZE_i, TOTIN_i) + \varepsilon_i \tag{2}$$

To underscore the effect of educational attainment and employment status to school participation and the state of hunger, an equation capturing the contribution of educational attainment and employment status to income and then income to school participation and state of hunger was established. As a matter of technicality, Equation 3 is also necessary because income is deemed to be endogenous with educational attainment and employment status (one may argue that educational attainment is also endogenous with employment status, warranting another behavioral equation).

The reason behind Equation 3 is those who are able to acquire higher educational level are those who can have access to higher levels of income and therefore are those who can send children to school and can reduce the chances of experiencing hunger. Equation 3 will be estimated using linear generalized method of moments (GMM). Afterward, the predicted values of total income will be used as the representation of income influencing school participation and the probability of household hunger in estimating Equation 1 and Equation 2.

$$\begin{aligned} TOTIN_i = {} & \alpha_0 + \alpha_1 ELEMUNDR_i + \alpha_2 ELEMGRAD_i + \alpha_3 HSUNDR_i \\ & + \alpha_4 HSGRAD_i + \alpha_5 PSUNDR_i + \alpha_6 PSGRAD_i + \alpha_7 COLUNDR_i + \alpha_8 COLGRAD_i \\ & + \alpha_9 WMSPHD_i + \alpha_{\mathbf{0}}\ PERMANENT_i + \alpha_1\ SEASONAL_i + \alpha_{\mathbf{2}}\ TEMPORARY_i + v_i \end{aligned} \tag{3}$$

where

SPR_i is the school participation rate of household i measured by the number of children in the household with age 6 to 12 who are in grade school divided by the total number of children in the household with age 6 to 12;

SHG_i is the variable for the construct hunger. It is measured by the number of times a household consumes food. Prevalence of hunger is an outcome of poverty being addressed by the government through transfers;

$FEEDPROG_i$ is an indicator whether a household is a recipient of a feeding program sponsored by the government. It represents the food grant projects of the government such as the FSP program. It is a dummy variable assuming a value of 1 if the household availed of feeding programs and 0 otherwise. The studies of Del Rosso (1999), Moock and Leslie (1986), and Glewwe and Jacoby (1994) suggested the use of this variable for the feeding program construct; and

$HEALTH_i$, $SCHOLAR_i$, $TRAINING_i$, $HOUSING_i$, and $CREDIT_i$ are indicators whether a household is a recipient of government-sponsored programs specifically health, scholarship, training, housing, and credit programs, respectively. These represent the various nonfood grants by the government. It assumes a value of 1 if the household availed of such programs and 0 otherwise. The studies of Del Rosso (1999), Moock and Leslie (1986), and Glewwe and Jacoby (1994) suggested the use of this variable for the nonfood grant construct.

On a mathematical and statistical perspective, if the coefficient of the feeding program is less than the coefficients of the nonfood grants, then it can be deemed that the nonfood grant is superior to a food grant in enhancing welfare. Meanwhile, if the coefficients of the government-sponsored programs are positive and statistically significant in influencing school participation, then it can be interpreted that these programs are relevant in enhancing school participation. On the other hand, if the coefficients of the government-sponsored programs are negative and statistically significant in influencing state of hunger, then it can be understood that these programs are also relevant in reducing hunger.

$FSIZE_i$ is family size, which is expected to have a negative relationship with school participation rate. *Ceteris paribus*, we expect that larger households will have a lower school participation rate because they will be inclined to spend more on immediate needs like food, clothing, and shelter, and education may be ancillary. Hauser and Daymont (1977), Biblarz and Raftery (1999), Borromeo, Castillo, and Lopez (2007), and Tullao and Rivera (2009) suggested the inclusion of this variable.

$TOTIN_i$ is total household income comprised of earned family income, internal and external remittances, and other sources of income. This is suggestive of the financial competence of households in acquiring basic necessities as suggested by Borromeo, Castillo, and Lopez (2007) and Tullao and Rivera (2009). This variable is also necessary to identify households who are poor and warranting the need for transfers.

The employment status of the household head includes $PERMANENT_i$,

$SEASONAL_i$, and $TEMPORARY_i$, which are indicators whether the household head is employed permanently, seasonally, or temporarily, respectively. Note that temporary employment is the base category. By a priori, being permanently employment can increase school participation and decrease the likelihood of hunger because of the stable flow of income necessary to finance educational spending and food consumption. Lillard and Willis (1994) and Binder and Woodruff (1999) suggested the relevance of these variables.

$ELEMUNDR_i$, $ELEMGRAD_i$, $HSUNDR_i$, $HSGRAD_i$, $PSUNDR_i$, $PSGRAD_i$, $COLUNDR_i$, $COLGRAD_i$, and $WMSPHD_i$ are indicators of the highest educational attainment of the household head. It can be elementary undergraduate, elementary graduate, high school undergraduate, high school graduate, postsecondary undergraduate, postsecondary graduate, college undergraduate, college graduate, and with graduate studies, respectively. The category of no educational attainment is the base category. By a priori, a higher educational attainment of the household head implies higher chances of seizing lucrative job opportunities and acquiring meaning employment that will provide for sufficient food consumption. Likewise, as per the empirical results of Borromeo, Castillo, and Lopez (2007) and Tullao and Rivera (2009), educated parents beget educated children so the vicious cycle of poverty can be stopped.

ε_i and v_i are the stochastic disturbance terms that capture all other variables that were not included in the equations.

Methodology

The CBMS Survey for Eastern Samar (2006) and Agusan del Sur (2006) will be utilized to estimate Equation 1 and Equation 2. The CBMS is a poverty and policy-impact monitoring system using a database of household information at the local level for local planning, program implementation, and facilitation. Descriptive statistics are presented to provide an immediate picture of the extent to which government programs reach their intended households. The data set will be subjected to the linear GMM estimation to analyze the statistical significance of the government-sponsored programs in improving school participation as in Equation 1. Meanwhile, the maximum likelihood estimation (MLE) will be used to estimate the statistical significance of the exogenous variables stated in Equation 2 to the probability that a household will experience the state of hunger.

Since the data set to be used in Equation 1 is cross-sectional, heteroscedasticity is prevalent (Gujarati & Porter, 2009). According to Baum, Schaffer, and Stillman (2003), a useful approach in addressing heteroscedasticity of unknown form is to employ the GMM introduced by Hansen (1982). It makes use of the orthogonality conditions to allow for efficient estimation in the presence of heteroscedasticity of unknown form. Thus, with heteroscedasticity, the GMM estimator is more efficient than any other estimator (Baum et al., 2003). GMM estimation is also advantageous because of its robustness to differences in the specification of the data generating process (DGP) and its capacity to automatically address endogeneity. According to Greene (2003), under the GMM, a sample mean or variance estimates its population counterpart regardless of the underlying process. It provides this freedom from unnecessary distributional assumptions. However, it must be used with caution. That is, if more is known about the DGP's specific distribution and other statistical properties, the GMM may not be able to maximize the available information contained in the data. Hence, according to Greene (2003), the natural estimators of the parameters of the distribution become inefficient. Thus, the method of maximum likelihood estimation (MLE) is more appropriate because it makes use of the out-of-sample information and generates more efficient estimates.

Since the endogenous variable in Equation 2 is a binary dummy variable, it will be modeled as a standard logistic probability model. For a binary outcome data, the dependent variable takes one of two values as shown by Equation 4:

$$y = \begin{cases} 1 & \text{with probability } p \\ 0 & \text{with probability } 1 - p \end{cases} \tag{4}$$

From Equation 31, the dependent variable assumes a value of 1 if the household experiences hunger, and assumes a value of 0 if otherwise. There is no loss of generality in setting the values to 1 and 0 if all that is being modelled is p, which determines the probability of the outcome (Cameron & Trivedi, 2005). For a comprehensive discussion on the standard logistic probability model, refer to Rivera and See (2012).

The logistic specification of the variables influencing the probability that the household will experience hunger is given by Equation 5.

$$\mathrm{h}\left(\frac{p_i}{1-p_i}\right) = f(FEEDPROG_i, HEALTH_i, SCHOLAR_i, TRAINING_i, HOUSING_i, CREDIT_i, FSIZE_i, TOTIN_i) + \varepsilon \tag{5}$$

where p_i is the probability that a household experiences hunger.

Results and Discussion

Eastern Samar

Eastern Samar is one of the six provinces in the Eastern Visayas Region. The province was listed as second class based on its average income mainly coming from palay, coconut, abaca fiber, and fish production. It is considered as one of the poorest provinces in Eastern Visayas. According to NSCB (2011), it has the highest poverty incidence of population and families in the region with 54.0% and 45.8%, respectively. The statistics on subsistence incidence of population and subsistence incidence of families scored the highest in the province with 32.2% and 25.7%, respectively (NSCB, 2011). Figures on education and health depict a rather unpromising picture. Though it had the highest elementary net enrollment ratio in school year 2010–2011 in the region, its elementary cohort survival rate was the lowest with only 64.7% compared to 86.0% in Southern Leyte (NSCB, 2011). There are only 84 barangay health stations, 11 government hospitals, and 5 private hospitals despite the fact that Eastern Samar is the third largest province in terms of population in the region. As such, the prevalence of underweight children was 13.4% in 2010 (NSCB, 2011). Table 3 shows the descriptive statistics of Eastern Samar based on the CBMS data set. A total of 1,004 households were included in the survey, mostly permanently employed (499 household heads).

Few households (46%) qualified and availed of the food and nonfood programs of the government in 2006. Only 2% availed of the feeding program while health programs had the highest participation from households.

Equation 1 for Eastern Samar utilized the GMM to determine the effect of the food program, nonfood programs, income, and other demographic variables on school participation of children with age 6 to 12. The regression results are summarized in Table 4. The significant variables were nonfood programs such as scholarship, housing, and household size.

Table 3. Descriptive Statistics for Eastern Samar (2006)

Variable	Number of Households	Mean	Standard Deviation	Minimum	Maximum	Skewness
School participation rate (if the number of children between 6 to 12 years old is positive)	1,004	0.359	0.461	0	1	0.576
Total household income (for total household income ≤ 10,000,000 only)	1,000	72,398.46	108,848.5	0	1,418,000	5.496
Household size (for household size ≤ 20 only)	1,004	4.513	2.261	1	17	0.662
Number of children aged 6 to 12 who are attending elementary school	1,004	0.359	0.461	0	6	0.576
State of Hunger	1,004	—	—	—	—	—
Experienced hunger	142	—	—	—	—	—
Did not experience hunger	862	—	—	—	—	—
Received government programs (out of 1,003)						
Feeding	22	—	—	—	—	—
Health	346	—	—	—	—	—
Scholarship	22	—	—	—	—	—
Training	13	—	—	—	—	—
Housing	2	—	—	—	—	—
Credit	61	—	—	—	—	—

Table 4. GMM Linear Regression Estimates for Eastern Samar

Variable (Dependent Variable: SPR_i)	Coefficient	*p*-Value
$FEEDPROG_i$	0.0387	0.713
$HEALTH_i$	–0.0028	0.928
$SCHOLAR_i$	0.1840	0.045
$TRAINING_i$	–0.2039	0.104
$HOUSING_i$	0.3798	0.000
$CREDIT_i$	–0.0631	0.306
$TOTIN_i$	0.0000	0.612
$HSIZE_i$	0.0483	0.000
Constant	–0.5460	0.063
Number of households		1,003
$F(11, 8977)$		20.55
Prob > F		0.0000
R^2		0.0634

The food program in the Eastern Samar data set was represented by the variable *FEEDPROG*. This variable is a government or private-sector program aimed at providing supplemental feeding program to children aged 0 to 5. Results showed that this variable was not significant in contributing to a higher school participation rate.

The nonfood program variables scholar and housing were the most significant variables that affected school participation rate in Eastern Samar. Households who availed of a scholarship program will most likely enjoy an increase of 18.4% in school participation rate. In addition, if the household availed of the housing program, their school participation rate increases by 38%. These nonfood programs directly affect children between the ages of 6 to 12 avoid dropping out of school. The variable household size was also significant. As the household size increases, school participation rate increases also but only by 0.4%. This is contrary to a priori expectations since more family members would mean fewer resources divided among the family members, especially for a poor family.

Equation 2 for Eastern Samar utilized MLE to determine the effect of the food programs, nonfood programs, income, and other demographic variables on the state of hunger. Table 5 summarizes the marginal effects with the assumption that the people did not benefit from the food and nonfood programs of the government. The overall value of the dependent variable in the marginal effects after logit model implies that there is a 12.4% probability of a family experiencing hunger if there are changes in any of the independent variables. However, there are no significant variables that affect the incidence of hunger. The same is true for the marginal effects with the assumption that the people benefited from the food and nonfood programs of the government. The low turnout rate of those who availed of the food and nonfood programs in Eastern Samar could have been one of the reasons why no variable turned out to be significant. Government programs such as health programs are not availed by the majority of the population of the province because there are only 84 barangay health stations and 11 public hospitals. Moreover, lack of income from its low local government revenue collection (NSCB, 2011) and few businesses and investments contribute to higher poverty incidence. This makes it more difficult for the local government to reach out to the targeted beneficiaries due to lack of funds coupled with the large number of families experiencing poverty.

Table 5. Marginal Effects for Eastern Samar

Variable (Dependent Variable: $SHGR_i$)	*dy/dx*	*p*-Value
$FEEDPROG_i$	–0.01146	0.673
$HEALTH_i$	–0.0063	0.804
$SCHOLAR_i$	0.0650	0.573
$TRAINING_i$	0.0709	0.523
$CREDIT_i$	–0.0133	0.817
$TOTIN_i$	–0.0000	0.649
$HSIZE_i$	0.0052	0.653
Number of households		1,001
Predicted probability		0.1244

Agusan del Sur

Agusan del Sur is a province located in the Caraga Region of Mindanao. Most of the population (approximately 73%) is located in the rural area while the rest is in the urban area. The indigenous people comprise 33% of the total population. The major source of economic activity is farming. Agricultural land, which comprises 46% of total land area, is used for crops, livestock, and agro-forestry. Most of the crops produced include rice and corn and other common crops such as coconut, oil palm, and banana (CBMS, 2010). The province is considered a first-class province with a total income of PHP 729.00 million and had a total internal revenue allotment of PHP 652.00 million in 2007. However, poverty incidence in 2006 is 48.7% ("Status Report on the Millennium Development Goals Using CBMS Data," 2010). Other social indicators show that school participation rate is 74.95% in elementary and 44.14% in the secondary level for school year 2006 to 2007, higher than the previous two school years. The same is true for achievement rate in both the elementary and the secondary levels due to a lower dropout rate (CBMS, 2010). The province has 5 public hospitals, 2 private hospitals, 14 rural health units, 132 barangay health stations, and 203 day care centers (CBMS, 2010). Table 6 shows the descriptive statistics of Agusan del Sur based on the CBMS data set. A total of 301,807 households were included in the survey, mostly permanently employed (100,116 household heads).

Table 6. Descriptive Statistics for Agusan del Sur (2006)

Variable	Number of Households	Mean	Standard Deviation	Minimum	Maximum	Skewness
School participation rate (if the number of children between 6 to 12 years old is positive but less than 1)	301,807	0.569	0.210	0.143	1	-1.199
Total household income (for total household income ≤ 10,000,000 only)	549,564	77,382.97	126,818.6	0	9,054,781	13.911
Household size (for household size ≤ 20 only)	549,854	6.072	2.345	1	20	0.546
Number of children aged 6 to 12 who are attending elementary school	550,162	0.923	1.014	0	7	0.835
State of hunger	550,219	—	—	—	—	—
Experienced hunger	77,411	—	—	—	—	—
Did not experience hunger	472,808	—	—	—	—	—
Received government programs						
Feeding program	35,233	—	—	—	—	—
Health	232,002	—	—	—	—	—

Table 6 continued...

Scholarship	9,032	—	—	—	—	—
Training	13,962	—	—	—	—	—
Housing	4,048	—	—	—	—	—
Credit	52,931	—	—	—	—	—

Equation 1 for Agusan del Sur utilized the GMM to determine the effect of the food program, nonfood programs, income, and other demographic variables on school participation of children with age 6 to 12. The regression results are summarized in the Table 7. All food and nonfood programs turned out to be highly significant based on the regression result.

The high turnout rate from the number of households who availed of the food and nonfood programs to address school participation and incidence of hunger contributed to the highly significant variables. For the food program, a household that availed of the program will most likely experience a 4.3% increase in school participation rate. However, most of the nonfood programs had a counter-intuitive effect on school participation. For instance, households who availed of the scholarship program result in a decrease of 4.1% in school participation rate. The same is true for health, housing, and credit—they negatively affect school participation rate.

Table 7. GMM Linear Regression Estimates for Agusan del Sur

Variable (Dependent Variable: SPR_i)	Coefficient	*p*-Value
$FEEDPROG_i$	0.0431	0.000
$HEALTH_i$	-0.0441	0.000
$SCHOLAR_i$	-0.0412	0.000
$TRAINING_i$	0.0102	0.009
$HOUSING_i$	-0.0378	0.000
$CREDIT_i$	-0.0589	0.000
$TOTIN_i$	0.0000	0.000
$HSIZE_i$	-0.0019	0.000
Constant	0.9269	0.000
Number of households		364,280
$F(11, 8977)$		513.25
Prob > F		0.000
R^2		0.0106

One implication is that the results could reflect wrong targeting. Most of nonfood programs do not increase school participation. Agusan del Sur experienced one of the highest poverty incidence reported at 48.7% in 2006, which implies that their immediate need was to have access to the most basic necessity, which is food. In fact, 14% of the total number of households that were surveyed regarding the state of hunger answered that they experienced hunger. This is higher compared to those in Eastern Samar. Given this, the availment of a nonfood program such as credit does not necessarily lead to higher school participation because the household would have to prioritize the food requirements of the family. The only nonfood program that led to an increase in school participation was training programs. Training programs enhance the entrepreneurial skills and/or increase the employability of the individual. Having a business or being employed means that the household has more income, which implies more resources to address the basic needs such as education. This is supported by the positive relationship of the variable income to school participation rate. On the other hand, as household size increases, school participation rate decreases by 0.01%.

Equation 2 for Agusan del Sur utilized MLE to determine the effect of the food program, nonfood programs, income, and other demographic variables on the state of hunger. Results are summarized in Table 8. Only the nonfood programs appeared to be significant in affecting the incidence of hunger. The nonfood programs health, scholar, and training decrease the incidence of hunger unlike housing and credit programs. A scholarship program for instance helps decrease the incidence of hunger by 2.6%. Households with children who receive scholarship are less likely to experience hunger since the family's income could now be allotted to food and other basic necessities instead of education. The same is true for households who avail of health programs and training programs. However, housing and credit programs lead to a higher incidence of hunger. A family under a housing program would have to prioritize paying for utilities, especially electricity and water, and this usually competes with spending on food. A credit program may not lead to a lower incidence of hunger since the household could use the money for other things aside from food. Credit is usually for paying off debt (interest payment); thus, allotment for food may not be addressed.

Table 8. Marginal Effects for Agusan del Sur

Variable (Dependent Variable: $SHGR_i$)	*dy/dx*	*p*-Value
$FEEDPROG_i$	–0.0015	0.159
$HEALTH_i$	–0.0048	0.000
$SCHOLAR_i$	–0.0257	0.000

Table 8 continued...

$TRAINING_i$	–0.0114	0.000
$HOUSING_i$	0.0405	0.000
$CREDIT_i$	0.0235	0.000
$TOTIN_i$	–0.0000	0.000
$HSIZE_i$	0.0055	0.000
Number of households		364,280
Predicted Probability		0.0754

Other significant variables are income and household size. An increase in income increases the incidence of hunger but only by an infinitesimally small amount. One reason behind this could be the fact that most of the households' employment status is temporary. Household size, on the other hand, positively affects incidence of hunger.

A summary of regression results for Eastern Samar and Agusan del Sur is provided in Table 9. For Eastern Samar, the nonfood program scholarship positively affects the school participation rate among elementary-aged children. However, the scholarship program in Eastern Samar has a higher effect on school participation compared to Agusan del Sur. The very low elementary cohort survival rate in Eastern Samar explains why scholarship programs have a higher impact in increasing school participation rate. Agusan del Sur experienced a different effect on school participation.

Household size is also significant in affecting school participation rate. In Agusan del Sur, as household size increases, school participation rate decreases. On the other hand, as the number of family members increases in Eastern Samar, school participation rate also increases but only by 0.4%.

As for the incidence of hunger, only the nonfood credit program was found to affect the incidence of hunger in Agusan del Sur. No variables were found to be significant in explaining the incidence of hunger in Eastern Samar because of the very small number of people who availed of the food and nonfood programs, as explained earlier. The variables income and household intuitively affect the incidence of hunger in Agusan del Sur. A household with higher income is less likely to experience hunger. In the same way, a larger household leads to a higher incidence of hunger.

Table 9. Summary of Significant Variables for Eastern Samar and Agusan del Sur

Province	Significant Variable	*p*-Value
Eastern Samar		
GMM model (for school participation rate)	$SCHOLAR_i$	0.045
	$HOUSING_i$	0.000
	$HSIZE_i$	0.000
Probability logit (for incidence of hunger)	No significant variables	
Agusan del Sur		
GMM model (for school participation rate)	$FEEDPROG_i$	0.000
	$HEALTH_i$	0.000
	$SCHOLAR_i$	0.000
	$TRAINING_i$	0.009
	$HOUSING_i$	0.000
	$CREDIT_i$	0.000
	$HSIZE_i$	0.000
	$TOTIN_i$	0.000
Probability logit (for incidence of hunger)	$HEALTH_i$	0.000
	$SCHOLAR_i$	0.000
	$TRAINING_i$	0.000
	$HOUSING_i$	0.000
	$CREDIT_i$	0.000
	$HSIZE_i$	0.000
	$TOTIN_i$	0.000

Conclusions

Most often, developing economies support poor households with nonfood grants instead of food grants due to convenience, nature of transfers, and the obvious difference in utility derived by households. Explicitly, a food grant provides a household with consumable goods that can provisionally relieve them from hunger. That is, when the food grant is consumed, recipient households are still bounded to low levels of living. The setback with food grants is they cannot provide multiplicative returns because they are purely consumption goods, unless households sell them at a premium. On the other hand, cash transfer can incorporate all the benefits of a food grant and generate higher returns for the household in the future because it is not only a consumption tool but also an investment tool.

A recipient household can make use of the cash grant in two ways: (1) A poor household can use it to purchase consumables (i.e., food), which has exactly the same effect of a food grant. Moreover, a cash grant can also be used for utilities, education, and medical expenses, whichever is deemed of higher priority by households. (2) If the cash grant is significant in amount that the household can save and accumulate it, the money can be used to finance a small business or be spent on further education—a cash grant can be used to establish a sustainable source of income and/or find meaningful employment. However, households will not be able to experience immediate improvements in their well-being unlike those who received food grants.

To maximize the benefits of a cash grant, it must be a CCT, wherein recipient households are encouraged to make productive use of the transfer. However, a mechanism to monitor where the CCTs are spent must be in place. Oftentimes, poor households are unable to put the CCT into productive use because of the inherent need to satisfy more urgent and contemporaneous needs.

Most government programs aimed at alleviating poverty in the Philippines are prone to being unproductive due to errors of inclusion and exclusion. As for the case of food and nonfood programs in Eastern Samar and Agusan del Sur, not all addressed school participation rate and incidence of hunger as per the estimated coefficients due to its insignificant results. As per the first research objective, endeavoring to determine whether a food grant is better than a nonfood grant in addressing poverty issues and identifying the factors that may affect school participation and the incidence of hunger, based on the GMM regression result in Eastern Samar, nonfood grants proved to be better than food grants as evidenced by significant variables representing nonfood grants. Nonfood grant programs such as scholarship programs may possibly lead to an increase in school participation rate among children of ages 6 to 12 in Eastern Samar.

On the other hand, both food and nonfood programs may influence school participation in Agusan del Sur. The feeding program may possibly increase school participation unlike the other nonfood programs such as health, scholarship, housing, and credit. This implies that the food program has a significant effect in increasing school participation compared to nonfood programs, at least in those areas. Agusan del Sur experienced one of the highest poverty incidences (48.7%) in 2006, which implies that their immediate need was to have access to the most basic necessity, which is food. A feeding program is more likely to increase school participation. Results were consistent with the literature, which stipulates that health plays a vital role in a student's participation in school. One of the primary reasons why students drop out of school is because of health reasons such as malnutrition.

To provide empirical evidence in addressing the research objectives, the logistic probability regression revealed intriguing and varying results for Eastern Samar and Agusan del Sur. Specifically, no variable was significant in affecting the incidence of hunger in Eastern Samar. Only the nonfood credit program significantly affected the incidence of hunger, but the result is counter-intuitive. This could be attributed to the fact that the credit program is a monetary grant that may not necessarily address the food insecurity concerns of the household because it is usually used to pay off another debt.

Other demographic variables that turned out to significantly affect school participation and incidence of hunger were income and household size. The small but positive effect of income on school participation could be due to the fact that income is transitory for most families living below the poverty line since they do not have permanent work. Meanwhile, in Agusan del Sur, as the family size increases, school participation decreases—consistent with a priori.

The counter intuitive results of some variables may imply that there could be a mismatch in targeting. As such, program(s) should be revisited; otherwise, government resources are wasted. It is in this light that the programs should be aligned with the goals of full employment and equitable distribution of resources, as well as the MDG.

Both theoretical and empirical results have shown that nonfood programs turned out to have a greater effect in addressing school participation and incidence of hunger. It would be beneficial for the local government's allocation of resources to the poor if they implement programs aimed at providing health benefits and scholarship programs in increasing school participation rates among elementary students especially in public schools. Careful planning has to be practiced in identifying the beneficiaries of these programs in order to minimize inefficiencies and waste of resources.

In the case of incidence of hunger, credit programs do not really address the problem. The program has to be restructured to make sure that beneficiaries would experience lower incidence of hunger through improvements in income generation provided by the credit program. Long-term benefits from the credit program will only be realized if the financial support is used for income-augmenting purposes such as sustainable livelihood programs and entrepreneurial activities. The local government of Agusan del Sur may focus on increasing school participation given the very low elementary cohort survival rate by providing more scholarship programs.

Another policy implication that can be construed from the results is that programs should be made more sustainable in order for poor households to experience the benefits in the long run. One example is the generation of income. Most of the poor households in Eastern Samar and Agusan del Sur are temporarily employed, and it would be beneficial for them if the programs would assist them in maintaining a permanent source of income. Monetary compensation is one direct way of alleviating poverty. Priority should be given in generating employment opportunities, especially in the urban and rural poor areas. The current programs could be temporary measures but are not sustainable in the long run—because they breed dependency among poor households. The rapid population growth is also a hurdle as to why low school participation and incidence of hunger are prevalent in rural areas. There is a need to create more sustainable programs addressed towards the issue of rapid population growth.

The public sector must be able to allocate resources to sustainable programs in cooperation with the private sector and NGOs. An example is the *Go Negosyo* program that aims to educate and provide network for potential entrepreneurs in the country. In line with this, the promotion of micro, small, and medium enterprises will be very helpful in addressing the poverty issues. Another possibility is to tap the *Flexi Fund Program*, an SSS program for overseas Filipino workers and their family. This could provide seed capital for those who are planning to venture in a new business.

The unavailability of time series data that could provide a more in-depth analysis of how relevant the programs are needs to be addressed. Since this study only uses one time period, it focused on whether or not the food or nonfood program was significant in increasing school participation rate and decreasing the incidence of hunger. The problem of poverty is a multifaceted issue that needs to be addressed starting from the root cause. Poor school participation rate and high incidence of hunger are just some of the manifestations of poverty. Further studies could be done to verify if a similar case is present in other provinces in the Philippines where poverty is prevalent.

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4

Correlates of Hunger: Evidence from the Community-Based Monitoring System (CBMS) Data of Pasay City

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Hunger is a form of deprivation. It is one of the major problems of many countries, and reducing it is a global concern. In fact, the first of the United Nation's Millennium Development Goals (MDG) is to eradicate extreme poverty and hunger. However, attempting to reduce poverty and hunger entails the identification of the poor and those who are hungry. A lot can be said about who is poor. But who is hungry?

Thus, information is required about those who are hungry and their circumstances—who they are, where they live, what social conditions they face, how they respond to programs and projects intended for them, and so forth. With such hunger profiles, designing and implementing programs that are geared towards eradicating hunger are maximized. Despite economic growth and technological advances, food insecurity continues to be a problem. This has received increased attention because of its potential consequence—hunger.

Hunger, the consumption of a diet inadequate to sustain good health and normal activity, growth, and development (Millman & DeRose, 1998), could be experienced temporarily by people who are food secure but more likely to be experienced by those who are not. Who are they? Where do they live? What social and economic conditions do they face? Such information is vital for local government units (LGUs) when they prepare comprehensive development plans that are geared towards eradicating hunger in their communities.

The primary objective of this study is to determine correlates of hunger utilizing the Community-Based Monitoring System (CBMS) data of Pasay City. Specific objectives include: `

- To generate hunger profiles and information about the hungry households and their circumstances; and
- To generate hunger models that will identify correlates of hunger.

The hunger profiles generated can aid LGUs in their program and policy development. Coupled with the identified correlates of hunger, targeting those households who are hungry could be enhanced, allowing better utilization of their limited resources.

The CBMS data used in the study were for Pasay City for the census year 2005. It was used to compliment the poverty profiles earlier prepared for Pasay City (Arcilla, Co, & Ocampo, 2011). Besides, it was one of the most recent during the time this study was conducted, which contained the complete enumeration of all the households in its 201 barangays.

Only two hunger measures were used in the study. One of which is the measure that is based on income. The other is based on the responses of household heads as to whether they had experienced food shortage in the past three months.

Variables that are available from the CBMS data of Pasay City were considered in identifying the correlates of hunger. Recent efforts to get a detailed description of hunger, not focusing on subjective perceptions, were successful in giving an operative definition of hunger. Millman and DeRose (1998) defined it as the consumption of a diet inadequate to sustain good health and normal activity, growth, and development. Emphasis on energy as a measure of food adequacy is justified since increased dietary energy, if derived from normal staple foods, brings with it more protein and other nutrients.

Hence, an ideal indicator of hunger is one that focuses on whether people are getting enough to eat. The indicator of hunger being used officially in generating hunger statistics for the country is based on this principle. It involves the comparison between the diet actually consumed and what is required. The National Statistical Coordination Board (NSCB) does this comparison in terms of monetary values. Thus, a household will be classified as hungry if its per capita income (PCI) is lower than the food threshold, the minimum cost of the food items that will satisfy minimum nutritional requirements.

The other indicator of hunger is based on whether or not the household had experienced food shortage in the past three months. If so, the household is classified as hungry.

Literature Review

Numerous studies have been conducted that identified poverty correlates (Balisacan, 1997; Tabunda, 2000; Reyes, 2003; Albacea & Pacificador, 2003; Albert & Collado, 2004; Mina, 2008; Arcilla, Co, & Ocampo, 2011). These studies had used nationwide surveys such as the Labor Force Survey (LFS), the Family Income and Expenditure Surveys (FIES), and the Annual Poverty Indicators Survey (APIS) as well as CBMS data, employing statistical techniques such as multiple linear regression and logistic regression analyses.

Compared to poverty studies, not as many studies have identified hunger correlates that used baseline data such as the CBMS. Martin, Rogers, Cook, and Joseph (2004) explored whether social capital—a measure of trust, reciprocity, and social networks—is associated with household food security, independent of household level socioeconomic factors. Results of logistic regression showed that households with higher levels of social capital were less likely to experience hunger.

Weinreb et al. (2002, as cited by Martin et al., 2004) showed that hunger negatively impacts one's physical, mental, and emotional health. Results showed that hungry children were more likely to be chronically sick and had behavioral problems compared to children who were not hungry.

Amon and Albacea (2007) obtained hunger incidence at the municipal level using direct, the empirical best linear unbiased (EBLUP), and regression-synthetic estimation techniques with the use of the FIES and Census on Population and Housing (CPH) data. The direct and EBLUP estimates were found to be unreliable. The model obtained using the regression-based estimation procedure gave reliable estimates and had identified four predictors, namely, municipal proportion of (1) households headed by a married male who is an elementary undergraduate, (2) households with members aged between one and six years, (3) housing units with roof made of light materials, and (4) barangays with electricity.

Methodology

Data Requirements

The study utilized CBMS data collected from Pasay City during the 2005 census year. These are the most recent data, which involved a complete enumeration of 65,117 households in 201 barangays in Pasay City. However, due to some missing observations as a result of nonresponse, there were actually 65,019 responses in most of the variables in the database. This translates to a 99.8% response rate among the households included in the study. Variables included in the study were those that are available across LGUs of Pasay (Table 1). These were used in identifying the correlates of hunger.

Table 1. Variable Description

Variable	Description
Demographic Characteristics	
HSIZE	Household size
NMEM05	Number of household members 0–5 years old
NMEM611	Number of household members 6–11 years old
NMEM1215	Number of household members 12–15 years old
AGE	Age of the household head
SEX	Sex of the household head (0 = female, 1 = male)
EDUC	Highest educational attainment of the household head (0 = no grade completed, 1 = elementary undergraduate, 2 = elementary graduate, 3 = high school undergraduate, 4 = high school graduate, 5 = college undergraduate, 6 = college graduate and beyond)
OFWIND	Overseas Filipino worker (OFW) indicator (0 = absent, 1 = present)
UNIPARENT	Single-parent indicator (0 = absent, 1 = present)
THIRDSEX	Third sex indicator (0 = absent, 1 = present)
HANDICAPPED	Handicapped indicator (0 = absent, 1 = present)
BOARDIND	Boarder/bed-spacer indicator (0 = absent, 1 = present)
Economic Characteristics	
TOTIN	Total household income
JOBIND	Job/work indicator (0 = unemployed, 1 = employed)
CROPIND	Engaged in crop farming and gardening (0 = no, 1 = yes)
POULTIND	Engaged in livestock/poultry (0 = no, 1 = yes)

Table 1 continued...

FISHIND	Engaged in fishing (0 = no, 1 = yes)
FORIND	Engaged in forestry (0 = no, 1 = yes)
SALIND	Engaged in wholesale/retail (0 = no, 1 = yes)
PUBLIND	Engaged in publishing (0 = no, 1 = yes)
MANIND	Engaged in manufacturing (0 = no, 1 = yes)
MAINTIND	Engaged in maintenance services (0 = no, 1 = yes)
FOODIND	Engaged in food services (0 = no, 1 = yes)
ENTERTAIN	Engaged in entertainment services (0 = no, 1 = yes)
SERVIND	Engaged in community, social, and personal services (0 = no, 1 = yes)
COMPUTIND	Engaged in computer communication (0 = no, 1 = yes)
TRNIND	Engaged in transportation, storage, and communication (0 = no, 1 = yes)
MININD	Engaged in mining and quarrying (0 = no, 1 = yes)
CNSIND	Engaged in construction (0 = no, 1 = yes)
EOTHIND	Engaged in other activities NEC (non-elsewhere category) (0 = no, 1 = yes)
Basic Needs	
TENUR	Tenure status of house/lot (1 = owner, owner-like possession of house and lot; 2 = rent house/room including lot; 3 = own house/rent lot, 4 = own house, rent-free lot with consent of owner; 5 = own house, rent-free lot without consent of owner; 6 = rent-free house and lot with consent of owner; 7 = rent-free house and lot without consent of owner; 8 = other tenure status)
HTYPE	Building type of the housing unit (1 = single house, 2 = duplex, 3 = apartment/condominium/townhouse, 4 = commercial/industrial/agricultural, 5 = others)
WALL	Construction materials of wall (1 = strong materials, 2 = light materials, 3 = salvaged/makeshift materials, 4 = mixed but predominantly strong, 5 = mixed but predominantly light, 6 = mixed but predominantly salvaged)
ROOF	Construction materials of roof (1 = strong materials, 2 = light materials, 3 = salvaged/makeshift materials, 4 = mixed but predominantly strong, 5 = mixed but predominantly light, 6 = mixed but predominantly salvaged)
WATER	Type of water facility (1 = community water system—own; 2 = community water system—shared; 3 = deep well—own; 4 = deep well—shared; 5 = artesian well—own; 6 = artesian well—shared; 7 = dug/shallow well—own; 8 = dug/shallow well—shared; 9 = river, stream, lake, spring, bodies of water; 10 = bottled water; 11 = others)
TOIL	Type of toilet facility (1 = water-sealed flush to sewerage/septic tank—own, 2 = water-sealed flush to sewerage/septic tank—shared, 3 = closed pit, 4 = open pit, 5 = no toilet, 6 = others)
FSHORT	Experienced food shortage (0 = no, 1 = yes)

Table 1 continued...

Consumer Durables	
TV	Own TV (0 = no, 1 = yes)
VHS	Own VHS/VCD/DVD player (0 = no, 1 = yes)
COMPUTER	Own computer (0 = no, 1 = yes)
REF	Own refrigerator (0 = no, 1 = yes)
IRON	Own electric iron (0 = no, 1 = yes)
STOVE	Own LPG/gas stove/range (0 = no, 1 = yes)
WMACH	Own washing machine (0 = no, 1 = yes)
MICROW	Own microwave oven (0 = no, 1 = yes)
PHONE	Own telephone/cell phone (0 = no, 1 = yes)
AIRC	Own air-con (0 = no, 1 = yes)
CAR	Own vehicles (0 = no, 1 = yes)
Access to Government/Private Organization Programs	
SEXPROG	Received programs on gender issues (0 = no, 1 = yes)
PEACEPROG	Received programs on peace and order (0 = no, 1 = yes)
MEDHEAL	Received programs on health (0 = no, 1 = yes)
MSCHOL	Received programs on education (0 = no, 1 = yes)
MTRAININD	Received programs on livelihood training (0 = no, 1 = yes)
ASSHLOTIND	Received programs on housing (0 = no, 1 = yes)
CREDIND	Received credit programs (0 = no, 1 = yes)
CLEANPROG	Received cleanliness programs (0 = no, 1 = yes)
JOBPROG	Received employment programs (0 = no, 1 = yes)
OTHPRIND	Received other programs (0 = no, 1 = yes)

Statistical Techniques

The household's hunger status was determined using two indicators of hunger. One indicator of hunger is based on the reported income of the household. A household is classified as hungry if its PCI is below the food threshold. This indicator of hunger is the one being used officially in generating hunger statistics for the country by NSCB. The other indicator of hunger is based on whether or not the household had experienced food shortage in the past three months. A household is classified as hungry if it had experienced food shortage.

McNemar's Test

McNemar's test for matched or correlated populations was performed to determine if there is an agreement in hunger status between the PCI indicator and the food shortage indicator. This will test the null hypothesis that there is no change between the "before and after" situations versus the alternative hypothesis that there is a significant change between the "before and after" situations. The data layout for this test is as follows:

"Before"	"After"	
	+	-
+	A	B
-	C	D

The test statistic is given by $\chi^2 = \frac{(B-C)^2}{B+C}$, which has the chi-square distribution with 1 degree of freedom.

Chi-square (χ^2) Test

In generating hunger profiles, contingency analyses were performed since a household's hunger status and most of the correlates of hunger were in the nominal scale such as gender of the household head. Specifically, the χ^2 test was used to determine if hunger status is correlated with each of the categorical demographic variables, economic characteristics, basic needs, ownership of consumer durables, and access to government/private organization programs listed in Table 1.

The χ^2 test for independence of two categorical variables tests the null hypothesis that the row variable and column variable are independent versus the alternative hypothesis that they are related. The test statistic is given by, $\chi^2 = \sum \frac{(O-E)^2}{E}$, where O is the observed cell frequency and E is the expected cell frequency assuming the null hypothesis were true such that E = $\frac{\text{(row total)(column total)}}{\text{grand total}}$. This test statistic has the χ^2 distribution with degrees of freedom = (number of rows – 1)(number of columns – 1).

Multiple Logistic Regression

Multiple logistic regression analysis was used to identify the significant correlates of hunger. Since household's hunger status is a dichotomous variable, this multivariate regression technique was most appropriate, which allows the investigation of the effects of a particular correlate of hunger conditional on the levels of the other identified correlates. The initial independent variables in the logistic regression models are the variables in Table 1. The multiple logistic regression model specification is given by

$$\ln\left(\frac{p(\underset{\sim}{x})}{1-p(\underset{\sim}{x})}\right)=\beta_0+\sum_{j=1}^{k}\beta_j X_j \quad (1)$$

Or, equivalently,

$$p(\underset{\sim}{x})=\frac{e^{\beta_0+\beta_1 x_1+\ldots+\beta_k x_k}}{1+e^{\beta_0+\beta_1 x_1+\ldots+\beta_k x_k}}\text{, where } p(\underset{\sim}{x})=P(Y=1\mid \underset{\sim}{x}) \quad (2)$$

In this model, the explanatory variables $X_1, X_2, \ldots, X_k$ could be numerical or categorical and the dependent variable Y is binary, Y = 1 (event) or Y = 0 (nonevent). Nominally scaled polychotomous categorical variables were recoded using dummy variables. A stepwise selection procedure was employed to determine the best subset of the proposed explanatory variables that will comprise the final reduced model.

The odds ratio corresponding to the explanatory variable X_j with coefficient β_j in the logistic regression model is given by $\theta = e^{\beta_j}$. In case the explanatory variable X is binary (X = 1 or 0), then the odds of an event (Y = 1) for a subject who is exposed to the risk factor (X = 1) is e^{β} times the odds of the event (Y = 1) for a subject who is not exposed to the risk factor (X = 0). On the other hand, if X is continuous, then the odds of the event (Y = 1) increases multiplicatively by a factor of e^{β} for every 1 unit increase in X.

Cochran–Armitage Test for Trend

The Cochran–Armitage trend test of the odds ratios were likewise performed for the ordinal-scaled correlates of poverty. Suppose that a risk factor has K > 2 levels of exposure and the response variable is binary: Y = 1 (event) and Y = 0 (nonevent).

Outcome	Exposure Level					Total
	1	2	3	…	K	
Y = 1	a_1	a_2	a_3		a_K	n_1
Y = 0	c_1	c_2	c_3	…	c_K	n_0
Total	m_1	m_2	m_3	…	m_K	N

Choose one exposure level, say, level 1, as baseline against which to compare the other levels. The Cochran–Armitage test for trend in the resulting K – 1 odds ratios tests the null hypothesis $H_o: \theta_1 = \theta_2 = \theta_3 = \ldots = \theta_{K-1}$ versus the alternative hypotheses $H_a: \theta_1 < \theta_2 < \theta_3 < \ldots < \theta_{K-1}$ (or $\theta_1 > \theta_2 > \theta_3 > \ldots > \theta_{K-1}$) using the test statistic

$$\chi^2 = \frac{n^2(n-1)\left\{\sum_k x_k\left(a_k - e_k\right)\right\}^2}{n_1 n_0\left\{n\sum_k x_k^2 m_k - \left(\sum_k x_k m_k\right)^2\right\}} \sim \chi^2_{1df} \tag{3}$$

where x_k is the dose measure at the kth exposure level and e_ks are the expected frequencies for Y = 1. Set $x_k = k$ if the x_ks are spaced 1 unit apart.

Using the two criteria of hunger, we obtained the correlates of hunger from estimating the model. The statistical results were then used to determine which correlates were common and which ones differed.

Results and Discussion

The household's food poverty status of 65,019 households in Pasay City were determined using the PCI and the food shortage criteria. According to NSCB, 2006, the food threshold in Pasay for 2005 was PHP 11,199. The other indicator of hunger is based on whether or not the household had experienced food shortage in the past three months.

Hunger Profiles

There are 2,650 out of 65,019 households in Pasay City with PCI below food threshold (Table 2). On the other hand, only 722 of the 65,019 households reported to have experienced food shortage in the past three months. The 4.08% of households in Pasay City that were classified as food poor using the PCI criterion was significantly different from the 1.11% Pasay City hunger incidence based on the food shortage criterion. This significant disagreement in hunger incidence between the PCI and food shortage criteria is justified by the result of the McNemar's test ($p < 0.0001$).

Table 2. Hunger Incidence by PCI Versus Food Shortage

PCI Criterion	Food Shortage Criterion		Total
	+ : Hungry	- : Not Hungry	
+ : Hungry	162 (6.1%)	2,488 (93.9%)	2,650 (4.08%)
- : Not Hungry	560 (0.9%)	61,809 (99.1%)	62,369 (95.92%)
Total	722 (1.11%)	64,297 (98.89%)	*n* = 65,019

Table 3 shows that the following household characteristics had significantly higher hunger incidence under both PCI and food shortage criteria: "lower educational attainment," "without OFW," "with third sex," and "with handicapped." Households headed by males had a significantly higher hunger incidence than households headed by females based on the PCI criterion only while the following household characteristics are significant indicators of higher hunger incidence based on the food shortage criterion only: "with single parent" and "with boarder/bed spacer."

The Cochran–Armitage trend test also indicated a significantly higher hunger incidence among households whose household heads have a lower educational attainment. This phenomenon was consistent for both indicators of hunger.

Engagements in the following economic activities were found to be significant indicators of hunger incidence for both criteria: crop farming and gardening, community/social/personal services, and construction (Table 4). Household heads with no work/job and households engaged in fishing but are not engaged in food services or computer communication were indicators of higher hunger incidence using the PCI criterion alone, while households not engaged in maintenance services but are engaged in other activities were significant indicators of higher hunger incidence using the food shortage criterion alone.

Table 3. Hunger Incidence by Demographic Characteristics

Variable	Categories	*n*	PCI (Subsistence)			Food Shortage		
			% Hungry	Odds Ratio*	*p*-Value	% Hungry	Odds Ratio*	*p*-Value
SEX (sex of household head)	Female	14,179	3.3	1.3	<0.0001	1.0	1.1	0.2400
	Male	50,834	4.3			1.1		
EDUCAL (highest educational attainment of household head)	No grade completed	132	10.6	(ref**)	<0.0001	6.1	(ref**)	<0.0001

Table 3 continued...

	Elementary undergrad	3,226	9.1	0.8	<0.0001+	2.5	0.4	<0.0001+
	Elementary graduate	5,240	6.8	0.6		1.9	0.3	
	High school undergraduate	6,083	8.4	0.8		2.2	0.3	
	High school graduate	26,779	3.9	0.3		1.1	0.2	
	College undergraduate	11,205	2.6	0.2		0.6	0.1	
	College graduate and beyond	12,322	1.2	0.1		0.3	0.05	
OFWIND (OFW indicator)	Without OFW	59,577	4.3	0.3	<0.0001	1.1	0.7	0.0224
	With OFW	5,439	1.5			0.8		
	With boarder / bed spacer	1,412	3.1			2.4		
	With OFW	5,439	1.5			0.8		
UNIPARENT (single-parent indicator)	Without single parent	60,675	4.0	1.1	0.0884	1.0	2.5	<0.0001
	With single parent	4,344	4.6			2.4		
THIRDSEX (third-sex indicator)	Without third sex	64,374	4.1	1.7	0.0045	1.1	3.3	<0.0001
	With third sex	645	6.4			3.6		
HANDICAPPED (handicapped indicator)	Without handicapped	63,577	4.0	2.0	<0.0001	1.0	5.0	<0.0001
	With handicapped	1,442	7.6	0.8		4.2		
BOARDIND (boarder/bed-spacer indicator)	Without boarder/bed spacer	63,598	4.1		0.0756	1.1	2.0	<0.0001
	With boarder/bed spacer	1,412	3.1			2.4		

*Odds ratio for hunger incidence among households using row 1 as reference category.
**Reference category.
+Cochran–Armitage test for trend.

Table 4. Hunger Incidence by Economic Activities

Variable	Categories	*n*	PCI (Subsistence)			Food Shortage		
			% Hungry	Odds Ratio*	*p*-Value	% Hungry	Odds Ratio*	*p*-Value
JOBIND (job/work indicator)	Without	17,793	4.8	1.3	<0.0001	1.2	1.1	0.1127
	With	47,219	3.8			1.1		
CROPIND (engaged in crop farming and gardening)	Not engaged	64,361	4.1	2.1	0.0083	1.1	0.3	<0.0001
	Engaged	658	2.0			3.2		

Table 3 continued...

POULTIND (engaged in livestock/poultry)	Not engaged	64,874	4.1	1.5	0.5533	1.1	0.8	1.0000
	Engaged	145	2.8			1.4		
FISHIND (engaged in fishing)	Not engaged	64,951	4.1	0.4	0.0221	1.1	1.5	1.0000
	Engaged	68	10.3			0.0		
FORIND (engaged in forestry)	Not engaged	64,955	4.1	0.9	1.0000	1.1	0.7	0.5108
	Engaged	64	4.7			1.6		
SALIND (engaged in wholesale/retail)	Not engaged	54,396	4.1	1.0	0.8918	1.1	1.0	0.6460
	Engaged	10,623	4.1			1.2		
PUBLIND (engaged in publishing)	Not engaged	64,876	4.1	1.5	0.5738	1.1	1.6	1.0000
	Engaged	143	2.8			0.7		
MANIND (engaged in manufacturing)	Not engaged	64,492	4.1	1.6	0.1226	1.1	1.2	0.8832
	Engaged	527	2.7			1.0		
MAINTIND (engaged in maintenance services)	Not engaged	64,016	4.1	0.8	0.1653	1.1	5.7	0.0087
	Engaged	1,003	5.0			0.2		
FOODIND (engaged in food services)	Not engaged	64,323	4.1	1.7	0.0368	1.1	1.3	0.6577
	Engaged	695	2.5			0.9		
ENTERTAIN (engaged in entertainment services)	Not engaged	64,721	4.1	2.5	0.0510	1.1	3.3	0.2719
	Engaged	298	1.7			0.3		
SERVIND (engaged in community, social, and personal services)	Not engaged	63,682	4.0	0.7	0.0013	1.1	0.6	0.0436
	Engaged	1,337	5.8			1.7		
COMPUTIND (engaged in computer communication)	Not engaged	64,745	4.1	3.9	0.0189	1.1	3.1	0.3728
	Engaged	274	1.1			0.4		
TRNIND (engaged in transportation, storage, and communication)	Not engaged	60,686	4.1	0.9	0.3440	1.1	1.2	0.3208
	Engaged	4,333	4.4			1.0		
MININD (engaged in mining and quarrying)	Not engaged	64,931	4.1	0.9	1.0000	1.1	1.0	0.6259
	Engaged	88	4.6			1.1		
CNSIND (engaged in construction)	Not engaged	63,295	4.1	0.7	0.0028	1.1	0.5	<0.0001
	Engaged	1,724	5.5			2.2		
EOTHIND (engaged in other activities NEC)	Not engaged	64,552	4.1	0.7	0.1992	1.1	0.5	0.0185
	Engaged	467	5.4			2.4		

*Odds ratio for hunger incidence among households not engaged in economic activities versus households that are engaged in these economic activities.

Table 5 shows that for both PCI and food shortage criteria, hunger incidence is strongly associated with all the household's basic needs under consideration, namely, tenure status of house/lot, house type, construction materials of walls, construction materials of roof, type of water facility, and type of toilet facility.

Table 5. Hunger Incidence by Household's Basic Needs

Variable	Categories	*n*	PCI (Subsistence)			Food Shortage		
			% Hungry	Odds Ratio*	*p*-Value	% Hungry	Odds Ratio*	*p*-Value
TENUR (tenure status of house/lot)	Owner, owner-like... house and lot	24,048	2.6	(ref**)	<0.0001	1.1	(ref**)	<0.0001
	Rent house/room including lot	27,583	4.9	1.9		1.0	0.9	
	Own house/rent lot	1,544	4.1	1.6		1.3	1.2	
	Own house/rent-free lot with consent	3,255	4.8	1.9		1.8	1.6	
	Own house/rent-free lot without consent	1,899	7.6	2.8		2.7	2.5	
	Rent-free house and lot with consent	6,179	4.0	1.6		0.8	0.7	
	Rent-free house and lot without consent	408	8.3	3.4		0.5	0.5	
	Other	103	22.3	10.8		6.8	6.6	
HTYPE (house type)	Single house	36,320	3.8	(ref**)	<0.0001	1.2	(ref**)	<0.0001
	Duplex	12,306	4.7	1.2		1.1	0.9	
	Apartment	13,989	3.3	0.9		0.7	0.6	
	Commercial	903	3.9	1.0		1.2	1.0	
	Other	1,448	13.8	4.1		2.6	2.2	
WALL (construction materials of walls)	Strong	46,810	3.0	(ref**)	<0.0001	0.9	(ref**)	<0.0001
	Light	1,206	8.9	3.2		3.7	4.2	
	Salvaged/makeshift	1,270	9.4	3.4		1.2	1.3	
	Mixed but predominantly strong	14,472	6.1	2.1		1.2	1.3	
	Mixed but predominantly light	984	12.6	4.7		5.7	6.7	
	Mixed but predominantly light	3,667	12.0	4.4		2.9	3.3	
	Mixed but predominantly salvaged	544	12.1	4.5		3.3	3.8	

Table 5 continued...

	Community water system—own	27,973	3.7	(ref**)		0.8	(ref**)	
	Community water system—shared	10,785	7.9	2.2		2.5	3.2	
	Deep well—own	323	7.4	2.1		6.8	9.0	
	Deep well—shared	346	8.4	2.4		11.3	15.8	
	Artesian well—own	12	16.7	5.2		0.0	—	
WATER (type of water facility)	Artesian well—shared	22	9.1	2.6	<0.0001	9.1	12.4	<0.0001
	Dug/shallow well—own	9	11.1	3.2		11.1	15.5	
	Dug/shallow well—shared	7	14.3	4.3		0.0	—	
	Bottled water	24,417	2.6	0.7		0.5	0.6	
	Others	1,121	7.9	2.2		5.5	7.2	
	Water sealed—own	7,634	1.8	(ref**)		0.4	(ref**)	
	Water-sealed—shared	3,075	5.3	3.1		1.2	3.0	
TOILET (type of toilet facility)	Closed pit	39,046	3.4	1.9	<0.0001	1.0	2.5	<0.0001
	Open pit	13,494	6.0	3.5		1.4	3.5	
	No toilet	1,743	12.3	7.7		3.5	9.0	

*Odds ratio for hunger incidence among households using row 1 as reference category.
**Reference category.

Table 6 shows that ownership of household consumer durables were significant indicators of hunger. Specifically, hunger incidence was found to be significantly lower among households that own these consumer durables. The odds ratios indicated that hunger incidence among households without consumer durables was more than two up to almost four times the hunger incidence among households that own consumer durables.

Table 6. Hunger Incidence by Household's Consumer Durables

Variable	Categories	*n*	PCI (Subsistence)			Food Shortage		
			% Hungry	Odds Ratio*	*p*-Value	% Hungry	Odds Ratio*	*p*-Value
TV (own TV)	Without	8,792	7.9	2.4	<0.0001	2.2	2.4	<0.0001
	With	56,224	3.5			0.9		
VHS (own VHS/VCD/DVD player)	Without	23,409	6.9	2.9	<0.0001	2.0	3.2	<0.0001
	With	41,607	2.5			0.6		

Table 6 continued...

COMPUTER (own computer)	Without	54,703	4.6	3.7	<0.0001	1.3	4.5	<0.0001
	With	10,304	1.3			0.3		
REF (own ref)	Without	29,084	6.4	3.1	<0.0001	1.9	3.9	<0.0001
	With	35,932	2.2			0.5		
IRON (own electric iron)	Without	15,564	7.9	2.9	<0.0001	2.2	2.9	<0.0001
	With	49,452	2.9			0.8		
STOVE (own LPG/ gas stove/range)	Without	14,726	7.8	2.7	<0.0001	2.3	2.9	<0.0001
	With	50,290	3.0			0.8		
WMACH (own washing machine)	Without	35,014	5.5	2.4	<0.0001	1.6	2.9	<0.0001
	With	30,002	2.4			0.6		
MICROW (own microwave oven)	Without	54,814	4.5	2.6	<0.0001	1.2	3.0	<0.0001
	With	10,202	1.8			0.4		
PHONE (own telephone/cell phone)	Without	20,398	8.2	3.9	<0.0001	2.2	3.6	<0.0001
	With	44,611	2.2			0.6		
AIRC (own air-con)	Without	56,670	4.5	3.4	<0.0001	1.2	3.3	<0.0001
	With	8,345	1.4			0.4		
CAR (own vehicles)	Without	57,412	4.4	2.8	<0.0001	1.2	3.7	<0.0001
	With	7,601	1.6			0.3		

*Odds ratio for hunger incidence among households without consumer durables versus those that have them.

Table 7 shows that availment of the following programs were significant indicators of hunger incidence for both criteria: gender issues, peace and order, health, education, credit, and employment. Availment of other programs was also a significant indicator of hunger incidence from the PCI criterion while availment of programs on livelihood training and on housing was significant indicators of hunger incidence only for the food shortage criterion. Households that availed these programs tend to have a higher hunger incidence than households that did not receive them.

Table 7. Hunger Incidence by Household's Availment of Programs

Variable	Categories	*n*	PCI (Subsistence)			Food Shortage		
			% Hungry	Odds Ratio*	*p*-Value	% Hungry	Odds Ratio*	*p*-Value
SEXPROG (received programs on gender issues)	Did not receive	63,686	4.0	1.5	0.0007	1.1	2.7	<0.0001
	Received	1,333	5.9			2.9		

Table 7 continued...

PEACEPROG (received programs on peace and order)	Did not receive	42,886	3.9	1.2	0.0004	1.2	0.7	0.0002
	Received	22,133	4.5			0.9		
MEDHEAL (received programs on health)	Did not receive	48,642	4.0	1.1	0.0061	1.0	1.3	0.0005
	Received	16,377	4.5			1.4		
MSCHOL (received programs on education)	Did not receive	64,231	4.0	2.0	<0.0001	1.1	3.0	<0.0001
	Received	788	7.6			3.2		
MTRAININD (received programs on livelihood training)	Did not receive	64,648	4.1	0.7	0.2237	1.1	3.5	<0.0001
	Received	371	2.7			3.8		
ASSHLOTIND (received programs on housing)	Did not receive	64,722	4.1	1.1	0.9075	1.1	2.8	0.0039
	Received	297	4.4			3.0		
CREDIND (received credit programs)	Did not receive	64,644	4.1	1.7	0.0158	1.1	4.9	<0.0001
	Received	375	6.7			5.1		
CLEANPROG (received cleanliness programs)	Did not receive	47,374	4.0	1.0	0.3884	1.2	0.9	0.1422
		17,645	4.2			1.0		
	Received	5,342	5.2			1.2		
JOBPROG (received employment programs)	Did not receive	64,645	4.1	1.6	0.0303	1.1	2.7	0.0017
	Received	374	6.4			2.9		
OTHPRIND (received other programs)	Did not receive	59,677	4.0	1.3	<0.0001	1.1	1.1	0.5689
	Received	5,342	5.2			1.2		

*Odds ratio for hunger incidence among households that availed versus those that did not avail them.

Correlates of Hunger

Using logistic regression analysis, Table 8 summarizes the significant correlates of hunger based on PCI and food shortage criteria. The likelihood ratio test (LRT) for model fit shows that there is strong evidence ($p < 0.0001$) that at least one correlate has a significant effect on hunger on both the PCI and food shortage criteria. The corresponding concordance index *c*, which is a measure of the model's predictive power, is an estimate of the probability that the model predictions and the observed outcomes are concordant. Under the PCI criterion for hunger, a concordance index of 0.839 was estimated. This is the probability of correctly identifying the household that is actually experiencing between a randomly selected pair of hungry and nonhungry households. The concordance index under the food shortage criterion yielded almost the same estimated probability of 0.850.

Table 8. Significant Correlates of Hunger Incidence

Correlates	PCI (Subsistence) c = 0.839 LR Test (p < 0.0001)			Food Shortage c = 0.850 LR Test (p < 0.0001)		
	Parameter Estimate+	Odds Ratio*	p-Value	Parameter Estimate+	Odds Ratio*	p-Value
HSIZE (household size)	0.3942 (0.0092)	1.48	<0.0001	0.1894 (0.0157)	1.21	<0.0001
EDUCAL (highest educational attainment of household head)						
No grade completed	(ref**)			(ref**)		
Elementary undergraduate	-0.4635 (0.2835)	0.63	0.1021	-0.7585 (0.4042)	0.47	0.0606
Elementary graduate	-0.7180 (0.2816)	0.49	0.0108	-0.9590 (0.3995)	0.38	0.0164
High school undergraduate	-0.3983 (0.2799)	0.67	0.1548	-0.7162 (0.3963)	0.49	0.0707
High school graduate	-0.8075 (0.2776)	0.45	0.0036	-1.0600 (0.3905)	0.35	0.0066
College undergraduate	-0.9709 (0.2827)	0.38	0.0006	-1.3196 (0.4054)	0.27	0.0011
College graduate and beyond	-1.3369 (0.2895)	0.26	<0.0001	-1.5590 (0.4197)	0.21	0.0002
OFWIND (OFW indicator)	-0.6559 (0.1197)	0.52	<0.0001	n.a.		
UNIPARENT (single-parent indicator)	n.a.			0.5632 (0.1146)	1.76	<0.0001
THIRDSEX (third-sex indicator)	n.a.			0.6477 (0.2338)	1.91	0.0056
HANDICAPPED (handicapped indicator)	n.a.			0.8630 (0.1505)	2.37	<0.0001
BOARDIND (boarder/bed-spacer indicator)	n.a.			0.7835 (0.1912)	2.19	<0.0001
JOBIND (job/work indicator)	-0.5650 (0.0482)	0.57	<0.0001	n.a.		
CROPIND (engaged in crop farming and gardening)	-0.7374 (0.2993)	0.48	0.0138	1.0285 (0.2438)	2.80	<0.0001
FISHIND (engaged in fishing)	1.0242 (0.4468)	2.29	0.0219	n.a.		
SALIND (engaged in wholesale/ retail)	-0.2091 (0.0585)	0.81	0.0004	n.a.		
MAINTIND (engaged in maintenance services)	n.a.			-2.0707 (0.7161)	0.13	0.0038

Table 7 continued...

FOODIND (engaged in food services)	-0.7518 (0.2682)	0.47	0.0051	n.a.		
SERVIND (engaged in community, social, and personal services)	0.4477 (0.1311)	1.57	0.0006	n.a.		
TRNIND (engaged in transportation, storage, and communication)	-0.3467 (0.0840)	0.71	<0.0001	-0.5751 (0.1683)	0.56	0.0006
CNSIND (engaged in construction)	-0.3721 (0.1162)	0.69	0.0014	n.a.		
TENUR (tenure status of house / lot)						
Owner, owner-like…house and lot	(ref**)			(ref**)		
Rent house/room including lot	0.8947 (0.0565)	2.45	<0.0001	-0.0944 (0.0946)	0.91	0.3188
Own house/rent lot	0.2463 (0.1472)	1.28	0.0943	-0.1112 (0.2405)	0.90	0.6440
Own house/rent-free lot with consent	0.2602 (0.1009)	1.30	0.0099	0.0269 (0.1559)	1.03	0.8631
Own house/rent-free lot without consent	0.0804 (0.1212)	1.08	0.5070	-0.1428 (0.1884)	0.87	0.4485
Rent-free house and lot with consent	0.3517 (0.0847)	1.42	<0.0001	-0.6014 (0.1655)	0.55	0.0003
Rent-free house and lot without consent	0.4749 (0.2029)	1.61	0.0193	-1.6215 (0.7205)	0.20	0.0244
Other	0.9953 (0.3127)	2.71	0.0015	0.0509 (0.4974)	1.05	0.9185
HTYPE (house type)						
Single house	(ref**)					
Duplex	0.1435 (0.0586)	1.15	0.0143	n.a.		
Apartment	0.0306 (0.0605)	1.03	0.6131			
Commercial	0.1083 (0.1888)	1.11	0.5662			
Other	0.4295 (0.1106)	1.54	0.0001			

+Numbers inside parenthesis are standard error of the parameter estimate.
*Odds ratio for hunger incidence.
**Reference category.

PCI Criterion

Based on the PCI criterion, significant correlates with positive relationship to hunger status imply that households with more household members; households engaged in fishing, community, social, and personal services; and those that rent houses/rooms including lots, with rent-free houses and lots with/without consent (informal settlers), and with a duplex house type are also more likely to experience hunger.

On the other hand, an inverse relationship between hunger status implies that those households with an OFW, with job/work, and engaged in crop farming and gardening; in wholesale/retail; in food services; in transportation, storage, and communication; and in construction are less likely to experience hunger. Moreover, lower odds of experiencing hunger can be seen among household heads with a higher educational attainment.

Food-Shortage Criterion

Based on the food-shortage criterion, significant correlates that are positively related to hunger incidence imply that households with big household sizes, single-parent heads, third-sex members, handicapped members, and a boarder/bed spacer and engaged in crop farming and gardening are more likely to have experienced hunger in the past three months.

Significant correlates with an inverse relationship between hunger incidences imply that those households engaged in maintenance services and in transportation, storage, and communication and renting a free house and lot with and without consent are less likely to have experienced hunger in the past three months. Again, lower odds of hunger in the past three months can be seen among household heads with a higher educational attainment.

Conclusions and Recommendations

Results of this study will aid in enhancing the Pasay City government's ability to target those households who are hungry. The bivariate contingency and multiple logistic regression analyses showed that household size and households whose housing units/lots are not owned are positive correlates of hunger. Though Pasay City is in full support of the implementation of the *Pantawid Pamilyang Pilipino Program*, which requires the beneficiaries to attend responsible parenthood sessions, there is still a strong need for the local government unit to properly educate married couples, adults, and all residents in general on the merits of responsible parenthood. Moreover, the results showed that informal settlers, households living in dwellings with light/salvaged wall and roofing materials, without adequate water and toilet facilities, tend to have higher a hunger incidence. With over 30,000 informal-settler families, Pasay City is facing severe problems of providing housing/resettlement/relocation, and hence, there is a need for innovative ideas and programs on how to solve such problems. The city's housing program involves relocation of informal settler families affected by government priority projects or living in danger zones to off-city or in-city relocation sites. Since Pasay City with its small area is overcrowded, off-city relocation sites like Cavite are preferred. The government of Pasay City has also thought of innovative programs like the *Balik Probinsya Program*, where qualified informal-settler families who are willing to voluntarily leave their homes located in danger areas and where relocation is not possible shall be given a P25,000.00 financial assistance to help them resettle back in the province. Thus, the local government unit should directly address the issue of informal settlers and continue to implement innovative resettlement/relocation programs.

The household heads' highest educational attainment is a significant correlate of hunger incidence wherein those with a lower educational level tend to have higher odds of hunger incidence. This clearly points to the role of education in alleviating the conditions of food-poor families. A higher educational attainment of heads of families will allow them to land jobs and enable them, among other things, to own consumer durables, which are another significant correlate of hunger among households. The Pasay City government addresses the concerns in education by maintaining hundreds of day care centers where free textbooks and school supplies are provided for day care children. However, there is a further need for the local government to provide access to free education or distribute more scholarships to adults in order for them to finish college education or even short-term courses that will provide jobs or livelihoods. The Pasay City Social Welfare and Development Office has provided free education per year to thousands of day care/preschool children and scholarships to hundreds of elementary students and more than 10 high school students through the sponsorship of Petron Tulong Aral–Petron Foundation, UNICEF, and the like. Educational materials, school supplies, and feeding programs are also provided. Moreover, the Food for School program, a hunger mitigation strategy that provides 1 kilo of rice per day per child, has been successfully implemented in some schools. This program encourages mothers to send their kids to school and improve the nutritional status of the child. The programs for early education are comprehensive, but there is a need for the continuation of these programs to high school and college so that the children from food-poor households will finish college and land jobs. There is indeed a need to strengthen programs providing allowances for high school students and scholarships for college.

Availment of government/private-organization programs was found to be more prevalent among poor households who experienced food shortage. Thus, project impact studies must be conducted to evaluate the effectiveness of such programs. Moreover, Table 7 shows a low percentage of availment in these programs, and hence, local government units may consider increasing this percentage through widespread information campaigns, additional funding, and other means.

More studies are needed to look at the significant disagreement between the PCI threshold and the households' last three months' experience of food shortage as indicators of hunger. A greater understanding of the difference between the two indicators would help in explaining this "disagreement." Results of these studies may be forwarded to NSCB so as to help in revisiting its per capita income PCI threshold and/or its food shortage indicator for hunger.

Further studies may estimate the model using a municipality with a higher incidence of hunger compared to that of Pasay City to validate the results of this study. Results from such a study could be used to determine if there is a need for LGUs to differentiate hunger alleviation programs for households in urban versus rural areas, or between NCR versus non-NCR municipalities.

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A Repeated Cross-Section Analysis of Poverty Mobility Through Education in the Philippines

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Poverty has been persistent in most developing economies. In Southeast Asia, poverty is deemed as the basket case, and its eradication has been the overarching goal of governments. In the Philippines, it has posed a long-standing struggle since previous administrations have initiated programs to rapidly address the problem. Poverty in the Philippines has been characterized by unequal income distribution indicating that Filipino households in the lower income decile are vulnerable to impoverished living conditions as a consequence of depravity from basic necessities. This is even worsened by the susceptibility of poor households to income shocks that have encumbering effects driving poor households to engage in risky moneymaking schemes that have negative, irreversible consequences pushing them deeper into poverty (Albert & Ramos, 2010).

Schelzig (2005) cited the nonmonetary categories enumerated by the International Labor Organization (ILO) that define who the poor are—food, water and sanitation, health, education, and shelter. In 2014, according to the Philippine Statistical Authority (PSA, formerly National Statistics Office

[NSO]), the share of food and nonalcoholic beverages to total household expenditures is 41.2%, increased by 4% from 2013 figures. This shows that households put priority on food in consumption spending (Reyes, 2001).

The PSA and National Statistical Coordination Board (NSCB) are employing different measures to assess the depth of poverty—poverty incidence, poverty gap, Gini coefficient, headcount rations, and income and expenditure ratios. All these measures capture the traditional measure of welfare—income (Schelzig, 2005). To address the limitations of these measures, the National Academic Press (n.d.) calls for the revision of these measures to come up with more indicative measure of poverty. That is, poverty measures should have the following four characteristics:

1. Poverty thresholds should represent budget for basic necessities: food, clothing, shelter, utilities, and a small additional amount to allow for other needs such as household supplies, personal care, and non-work-related transportation.
2. Using actual consumer expenditure data that must be updated annually to reflect changes in expenditures on basic necessities over the past three years, a threshold for a reference household type can be estimated.
3. This threshold for a reference household type must also be fine-tuned to reflect the needs of various household types and to capture geographic differences in costs.
4. Household resources should be defined as the total monetary and nonmonetary income from all sources available for expenditure, minus expenses that cannot be used for consumption spending (i.e., income and payroll taxes, childcare, work-related expenses, child support transfers to another household, and out-of-pocket medical care costs).

Beyond economic factors, poverty exists because it is a consequence of displaying antidevelopment traits, values, and attitudes (i.e., refusal for improvement and resistance to change). This implies that the poor are responsible for their predicament due to their perspective of their standard of living (Abad & Eviota, 1983). Bennett (2008) reinforces this by saying that poor people continue to behave irrationally, limiting them to escape their impoverished state. Spears (2010) elaborated on this by claiming that the poor have developed a set of belief systems that is adaptive instead of responsive and that creates a broadened poverty culture. This poverty culture has the tendency to perpetuate in the succeeding years making it difficult for households to escape poverty (Abad & Eviota, 1983). Hence, it is interesting to know if Filipino culture is a propoverty culture to explain why poverty in the country is persistent.

As such, we will investigate the mobility of households in and out of the poverty threshold. This will allow us to rationalize why households move from one state to another or remain in the status quo. In this study, we are interested to know if education and demographics are vehicles by which households will move from one state to another. To address this research agenda, the following specific objectives are set:

1. To identify the probability that a household will remain in its current socioeconomic status (poor, nonpoor) or move to another state;
2. To provide a behavioral description why a household retains or shifts socioeconomic status by looking at their educational attainment; and
3. To generate recommendations on how poor households can increase the probability of moving out of poverty.

Through this study, we can determine the magnitude by which education can allow a household to escape poverty. This study is important to the government in their formulation of antipoverty initiatives through education. Meanwhile, this study is useful for households because this will emphasize the value of education in uplifting them from poverty. Results can provide a framework to policymakers to address to craft programs that can address poverty by promoting and sustaining household welfare.

Characterizing Poverty in the Philippines

The Philippines has been keen on pursuing poverty alleviation. However, initiatives aimed to address the issue has been hindered by the recent global crisis in 2008, tireless allegations of corruption (i.e., the Disbursement Acceleration Program in 2014), incessant natural calamities (i.e., Typhoon Bopha in 2012, Typhoon Haiyan in 2013, the magnitude 7.2 Bohol earthquake in 2013), and rising prices of basic commodities. The aftermaths of these recent events make it more difficult to reduce poverty incidence; instead, it has been pulling more households into poverty.

In 2012, a household with five members will need PHP 7,890.00 of monthly income to afford their minimum basic food and nonfood requirements (see Table 1). For poverty incidence, Table 1 shows that 19.7% of Filipino households were poor in 2012 (insignificantly lower than the estimates in 2009 and 2006). It can be seen that the proportion of poor households has been practically unchanged between 2006 and 2012, but the estimated number of poor households increased from 3.81 million in 2006 to 4.21 million in 2012.

Table 1. Full Year Thresholds, Incidences, and Magnitude of Poor

Year	2006	2009	2012
Monthly poverty threshold for a family of five (PHP)	5,566	7,030	7,890
Poverty incidence (%)			
Families	21.0	20.5	19.7
Population	26.6	26.3	25.2
Magnitude of poor (in millions)			
Families	3.81	4.04	4.21
Population	22.64	23.30	23.75

Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Other poverty measures worth looking at are the *income gap* (average income shortfall of the population from the poverty threshold), *poverty gap* (total income shortfall of the population from the poverty threshold), and *squared poverty gap* (squares the poverty gap for each household putting more emphasis on observations that fall far short of the poverty line rather than those that are closer).

In 2012, the income gap was estimated at 26.2% (see Table 2). Such information is useful to determine the required budget to reduce poverty in the country. That is, on the average, a poor household with five members needed a monthly additional income of about PHP 2,067.00 to get out of poverty. On a macro level, suppose the government will deliver cash transfers to all poor households needed to cross the poverty line, a total of PHP 124 billion in 2012 is needed to alleviate poverty, exclusive of targeting costs (Note: the budget allocated for conditional cash transfers [CCT] for 2012 is PHP 39.4 billion). From 2003 to 2012, all these poverty measures have all improved but insignificantly.

Table 2. Income Gap, Poverty Gap, and Severity of Poverty

Year	2003	2006	2009	2012
Income gap	27.7	27.5	26.2	26.2
Poverty gap	5.6	5.8	5.4	5.1
Squared poverty gap (severity of poverty)	2.2	2.2	2.0	1.9

Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Figure 1 illustrates the striking characteristic of poverty in the Philippines according to Reyes, Tabuga, Mina, Asis, and Datu (2010)—income inequality across regions. Illustrated in Figure 1 are the thematic maps of the 2012 income gap, poverty gap, and squared poverty gap. Red shades indicate comparatively worse off areas than green shaded areas. Provinces that are worst off are situated in Visayas and Mindanao.

Eastern Samar has consistently displayed one of the worst values of income gap, poverty gap, and severity of poverty. Likewise, these poverty measures have been unswervingly high in provinces within the Caraga, Zamboanga Peninsula, and Central Mindanao regions. Note that these areas have been highly rural. These maps also highlight the veracity that poverty is a geographical issue that calls for antipoverty programs that prioritize regions with significantly worse conditions.

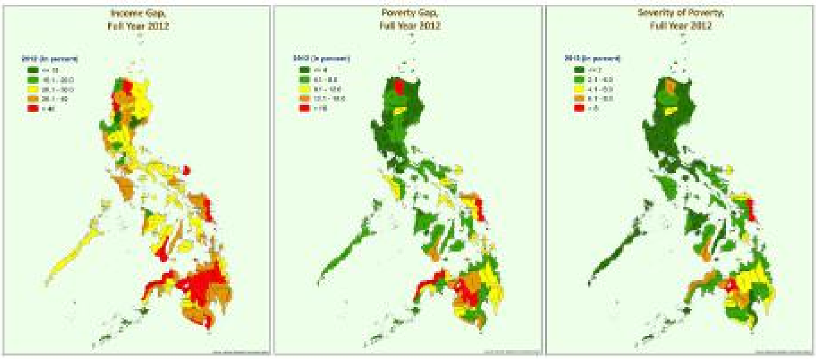

Figure 1. Thematic map of 2012 income gap, poverty gap, and severity of poverty. Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

National averages are not indicative of the astounding regional, provincial, rural, and urban variations as seen from Table 3 (Schelzig, 2005). This validates the need for policies that accounts for regional and provincial profiles to create a strategic distribution mechanism to potential key areas. This can build a more socioeconomically equal society. The regions with the lowest poverty incidence among families in 2006, 2009, and 2012 continue to be the rural areas of the National Capital Region (NCR), Central Luzon, and CALABARZON (Cavite, Laguna, Batangas, Rizal, and Quezon). Meanwhile, rural areas like the Autonomous Region in Muslim Mindanao (ARMM), Zamboanga Region, and Caraga consistently registered the highest poverty incidence among households.

Table 3. Annual per Capita Poverty Threshold and Poverty Incidence Among Families

Region	Annual per Capita Poverty Threshold (PHP)				Estimated Poverty Incidence Among Families			
	2003	2006	2009	2012	2003	2006	2009	2012
Philippines	10,976	13,357	16,871	18,935	20.0	21.0	20.5	19.7
NCR	13,997	15,699	19,227	20,344	2.10	2.9	2.4	2.6
CAR	10,881	14,107	17,243	19,483	16.10	21.1	19.2	17.5
Ilocos	11,791	14,107	17,595	18,373	17.8	19.9	16.8	14.0
Cagayan Valley	10,350	13,944	17,330	19,125	15.2	21.7	20.2	17.0
Central Luzon	12,771	14,422	18,188	20,071	9.4	10.3	10.7	10.1
CALABARZON	12,394	13,241	17,033	19,137	9.2	7.8	8.8.	8.3
MIMAROPA	10,398	12,645	15,613	17,292	29.8	32.4	27.2	23.6
Bicol	11,476	13,240	16,888	18,257	38.0	35.4	35.3	32.3
Western Visayas	10,548	12,684	15,971	18,029	23.5	22.7	23.6	22.8
Central Visayas	11,798	13,963	16,662	18,767	32.1	30.7	26.0	25.7
Eastern Visayas	9,850	12,520	16,278	18,076	30.2	33.7	34.5	37.4
Zamboanga Peninsula	9,642	12,743	16,260	18,054	40.5	40.0	39.5	33.7
Northern Mindanao	10,501	12,917	16,878	19,335	32.4	32.1	33.3	32.8
Davao	10,737	13,389	17,120	19,967	25.4	25.4	25.5	25.0
SOCCSKSARGEN	10,277	13,319	16,405	18,737	27.2	31.2	30.8	37.1
Caraga	10,355	14,324	18,309	19,629	37.6	41.7	46.0	31.9
ARMM	9,664	12,647	16,683	20,517	35.0	40.5	39.9	48.7

Source: 2012 Full Year Official Poverty Statistics, National Statistical Coordination Board.

Root Causes of Poverty

Developing economies like the Philippines have been heedful to eradicate poverty. However, the rate at which poverty incidence is being lessened has been slow compared to other neighboring economies like Cambodia, Indonesia, Malaysia, and Vietnam, whose annual real gross domestic product (GDP) growth rate is lower than the Philippines. These economies, according to the UNDP, have outperformed the Philippines in reducing poverty for the past 20 years because of the incapacity of economic growth to trickle down to the poor. Although the economy is experiencing growth, it is not propoor. It can be implied that the economy is not creating the necessary employment resulting to insufficient income for the poor that further reduces their opportunity to fight poverty (Aldaba, 2009).

Rapid Population Growth

Rapid population growth also contributes to poverty (Rivera & See, 2012). That is, the larger the family size is, the greater is the household's likelihood of being poor (Schelzig, 2009) because an additional family member means an additional mouth to feed making the allocation of a usually meager income lesser (Schelzig, 2005). Also, high fertility is associated with the decline in human capital investments (Orbeta, 2002).

Rapid population growth hampers economic development for two interrelated reasons. First, it reduces per capita income, since the people, especially the poor, cannot sacrifice basic commodities; their savings and resources for investment in productive capacity are reduced. This will sequentially decrease overall economic growth and increase poverty (Schelzig, 2005). Second, rapid population growth will eventually exceed the rate at which industries can absorb new labor—the outcome will be more unemployed individuals negatively affecting the development of the economy. In a decade, the country's labor force would have increased by more than 50% and even the total labor force participation would have increased due to the higher participation of women in the labor force. Even with Filipinos choosing to work abroad, unemployment rates are still high (Aldaba, 2009). With the increasing number of poor households in the country together with persistent government budget deficits and increasing labor force, rapid population growth is a problem that must be addressed to combat poverty (Schelzig, 2005).

Underdeveloped Agricultural Sector

According to PSA, in 2013, the share of employment in agriculture to the total employment is 31%, where most of the laborers are considered poor. The Annual Poverty Indicator Survey (APIS) of the PSA, using the bottom 40% income range as a proxy for the poor, revealed that more than 50% the poor are employed in agriculture (i.e., laborers and farmers) (Schelzig, 2005). Poverty arises because they are working in jobs with low income and low productivity. If these sectors are improved (i.e., transform agriculture from subsistence to commercial farming), it will create more meaningful and quality jobs to individuals who need it most (Aldaba, 2009).

In relation to agriculture, the existence of inequitable land distribution compounds the problem of poverty (Deininger & Squire, 1998). That is, an economy troubled with high inequitable land distribution will likely exhibit lower income growth in the long run and a slower rate of poverty reduction than an economy with more equitable land distribution initially. Apparently, inequitable land distribution has been the Philippines' problem for many decades.

External Economic Shocks

Economic shocks from the external economy may also contribute to difficulties in poverty alleviation. One of which is a financial crisis. For the case of the Philippines, the recent financial crisis (in 1997 and 2008) contributed to the slow pace of poverty reduction. The Philippine economy may have recovered from these crises, but it has greatly affected the trade and manufacturing sectors of the economy—the lifeblood of developing economies. Poverty incidence was also exacerbated by high inflation rates brought about by the crisis (Aldaba, 2009). Consequently, the poor faces rising prices of food commodities succumbing them to worse living standards as they reallocate income on food by diverting household resources from education and health care (Son, 2008).

Income Inequality

The Philippines is also addressing income inequality. Data from the World Bank (http://data.worldbank.org/indicator/SI.POV.GINI) reported that the economy's Gini coefficient in 2012 is at 43.0 (decrease from 45.8 in 2006 and 46.8 in 1991). This indicates that unequal income distribution has improved, and it is better than Malaysia (46.2 in 2009) and Singapore (47.8 in 2009). However, the Philippines underperformed compared to other developing economies in Southeast Asia: Cambodia (31.8 in 2011), Indonesia (38.1 in 2011), Lao PDR (36.2 in 2012), Thailand (39.4 in 2010), and Viet Nam (35.6 in 2012). However, these figures may be misleading because one major shortcoming of poverty measures, according to Schelzig (2005), is its extreme sensitiveness to the poverty threshold due to the large number of individuals in the initial deciles. That is, slight adjustments to the poverty line can result to sizable adjustments to the number of individuals defined as poor.

From Figure 1, it was construed that poverty is a geographical issue evidenced by the wide disparity in the standards of living and human development across regions. According to Balisacan (2003) and Aldaba (2009), intraregional inequality contributes 82% of overall inequality. Hence, antipoverty policies must improve distribution at the regional level instead of the national level.

Natural Calamities and Social Conflicts

Social conflicts worsen poverty incidence since these hinder households from doing economic activities, disrupt access to basic services, and devastate transport systems and life in general as households are displaced from their residences and income sources. These conflicts also result to disablement, deaths, and loss of household heads, thereby increasing a household's dependency burden. Concisely, it affects households' access to all forms of capital—physical, natural, social, financial, and human (Schelzig, 2005). Similarly, natural calamities also result to higher poverty incidences because its occurrence affects mostly standard of living of the poor. They experience more losses since their sources of income and health is most likely reliant on the environment (Aldaba, 2009).

Behavioral Factors

Other than economic factors, it is also critical to look at behavioral and social factors in explaining why poverty is persistent. In an empowerment study in Chile by Guzman, Irarrazaval, and de los Rios (2014), personal initiative and responsible work were relevant factors for an individual's economic success. Also, laziness and lack of initiative are also contributing factors to poverty incidence. Hine, Montiel, Cooksey, and Lewko (2005) affirmed this finding when they also considered laziness and the lack of effort as causal factors of poverty. Laziness can be ascribed to the lack of drive and the reliance of the poor to uplift their economic situation. Moreover, Montecillo (2015) also stated that instant gratification (i.e., happiness derived from impulsive decisions) is one of the traits most Filipinos possess. This might explain why most Filipinos habitually execute any task the quickest and easiest way possible. Instant gratification is also supported by the collective notion that most Filipinos are also impatient. As cited by Spears (2010), a lower level of income will likely entail a higher tendency of impatience, *ceteris paribus.* This behavior has been observed to be the source of the tendency for Filipinos to blame others for the lack of progress and development they are experiencing in their personal lives. It follows that the Filipinos, mostly the poor, blame the government for their condition. Similarly, Bennett (2008) stated that as the state aids the poor more, the latter are less likely to work for themselves– to fend for themselves. Thus, Sebastian (2014) argued that those who live in impoverished areas have developed dependency on the government and entitlement mentality. Most of the poor strongly believe they are entitled to receive government benefits and privileges instead of being solely responsible for their own lives.

Chronic and Transitory Poverty

In every economy, there exists a significant amount of individuals who endure low socioeconomic status. There are households who have been obstinately chained to poverty for a long period of time. They are categorized under chronic poverty. Often, chronic poverty is extensive in low-income economies. On the other hand, there are households who are classified as poor for a time period and then move in and out of poverty. They are categorized under transitory poverty. For both cases, poverty is a distinct phenomenon associated with low asset holdings, low income-generating activities, and disadvantageous demographic characteristics (McKay & Lawson, 2003).

Regardless of the category, there is a need to alleviate them from poverty and reduce the chances that they will return to their impoverished state. To do this, there is a need to understand why households remain or move in and out of this predicament. In understanding such, policymakers can design policies on how they can permanently stay out of poverty. Ribas and Machado (2007) organized the understanding of chronic and transient poverty in the literature through three angles. The first category focuses on the duration of being poor. A household is deemed to be chronic poor if the levels of their per capita income or per capita consumption are constantly below the poverty line. It is considered transient if the levels fluctuate above and under the poverty line (Gaiha & Deolalikar, 1993). The second category highlights the components of income or consumption. The constant component is the determinant of chronic poverty while the fluctuating component reflects transient poverty (Jalan & Ravallion, 1998). The third category focuses on the variability of current income that will imply a household's vulnerability to poverty (Pritchett, Suryahadi, & Sumarto, 2000).

According to McKay and Lawson (2002), chronic poverty is characterized as the unfavorable condition of households in terms of their human capital, demographic composition, geographical location, physical assets, and occupational category. For human capital development, acquiring higher education has been continuously being evaluated to reduce the likelihood of households being subjected to chronic poverty. The geographic location of households also plays a role in determining chronic poverty due to the lack of available opportunities, supply of health, and education in certain locations (McKay & Lawson, 2002). A large household size and lack of physical assets also make it difficult for households to get out of poverty (Rivera & See, 2012).

Meanwhile, such characterization for chronic poverty may also hold true for transient poverty; however, the analysis would differ because of its impermanence. The analysis can include the role of government transfers, inherent seasonality of economic activities, and adverse price movements. According to McKay and Lawson (2002), empirical evidences suggest that transient poverty is due to households' failure to insure themselves sufficiently against fluctuations in their income sources and changes in living conditions (e.g., additional member of the household, death of an income-earning member).

Looking at the case of a developed economy like the United States of America (USA), low human capital, minority status, and geographic locations (i.e., rural south) are their poverty determinants (Mills & Mykerezi, n.d.). For developing economies in Latin America, it has been observed that there are cohorts that are likely to be poor relative to others. Those cohorts were identified to be of African descent (minority affiliation) and other indigenous population, whose household sizes are large with members who have little schooling—categorical indications of households under poverty (World Bank, 2003). Specifically, in Brazil, low educational attainment is the likely cause of poverty (Ribas & Machado, 2007).

Distinguishing between chronic and transitory poverty allows us to understand how households match their income generation capabilities with their spending requirements. This will suggest antipoverty programs taking into consideration the type of problem being addressed. Addressing the encompassing concept of poverty on a macro level results to interventions being futile.

Poverty Mobility

Balisacan and Fuwa (2004) scrutinized the geographical concentration of chronic and transient poor in the Philippines. Results showed that chronic and transient poor are high in Mindanao. It was then concluded that the welfare of the poor tends to be lower in areas with political dynasties relative to areas with political competition. Poverty was also assessed through the profile of household heads. Results showed that chronic poverty has been evident in households with male-headed households who are high school graduates and are involved in the agricultural sector. This calls for policies to advance the agricultural sector to foster broad–based growth.

Panganiban (2010) decomposed poverty using the Cebu Longitudinal Health and Nutrition Survey. Poverty was examined by relating socio-economic status to household head characteristics. Significant correlation has been established between poverty, settlement factors, household dependency burden, mother's age, and work in the farming sector. Analysis has shown that chronic poverty exists in the agricultural sector especially among those who are contractual and wage earners. The time dimension of poverty was also considered—children inheriting their parents' impoverished living conditions. If parents can readily borrow and support human capital investments for their children, then the vicious cycle of poverty could be stopped.

Reyes, Tabuga, Mina, and Asis (2011) studied the movement of Filipino households in and out of poverty by examining per capita income and its movement along the poverty threshold. Findings showed that from 2003 to

2006, there were numerous poor households that were subjugated further under the poverty threshold due to significant reductions in income. It is important to emphasize that income is one of the most notable and quantitative measure of households' capacity to meet daily needs. Descriptive statistics revealed that income from entrepreneurial activities, especially from agriculture, is the major component of total income of the chronic poor while income from nonagricultural sources significantly comprises the income of the nonpoor.

The Food Aspect of Poverty

Economic poverty has been defined as the inability to afford food, clothing, shelter, education, and health services—all of which are used to measure poverty. The differences among poverty incidences among regions, provinces, and municipalities explain the unequal distribution of income and resources among these areas and among its population. Llanto (1996) analyzed the price and income elasticity of Philippine households (i.e., rural and agricultural households). Findings show that households in the lower strata are more affected when there are shocks affecting commodity prices and level of income. The factors that cause food prices to increase have negative effects on poor households. It shares the view that poor households have huge expenditures on food. Any rise in food prices will hurt them more than the nonpoor households. The price and income elasticity of households at the regional level, income class, and geographical location were also analyzed. Results revealed that rural and agricultural households are price inelastic to staples since these are easily accessible and have no close substitutes. If the productivity of the agricultural sector will be developed, the industry will grow and will create more meaningful employment opportunities for the poor that will eventually get them out of poverty. Initiatives to distribute agricultural profits fairly are also called for.

The concept of poverty is not just deprivation of access to assets that are essential to live decently. Schelzig (2005) recognized that poverty is also a dynamic and complex phenomenon describing vulnerability and powerlessness. That is, the definitions and measures of poverty are not stagnant. It evolves accordingly from the traditional measure of income, as the gauge of welfare, towards to deprivation of basic needs (i.e., food) and capabilities (Sen, 1979).

In developing economies, Albert and Molano (2009) discussed that poverty lines represent absolute poverty lines, which are based on a fixed standard of welfare adjusted whenever price changes. In the Philippines, the estimated poverty line represents the required income needed to afford the minimal needs of a household, both food and nonfood. The food aspect is referred to as the food poverty line (FPL)—which employs one-day menus that are nominally valued at the minimum price, expected to meet required daily dietary needs.

Meanwhile, Pedro, Candelaria, Velasco, and Barba (n.d.) estimated food threshold and poverty incidence using the food baskets across income groups. Results showed that the food basket of the upper 70% of the income decile consists of food and other commodities that are more complex and expensive as compared to the lower 30%.

It is apparent that the studies of Albert and Molano (2009) and Pedro, Candelaria, Velasco, and Barba (n.d.) looked beyond the traditional definition of poverty using income levels of households. In their study, nutritional intake and food basket composition are also appropriate measures to define poverty and quantify welfare.

Antipoverty Programs

Since the 1990s, specific projects for poverty reduction have already been in place. For instance, the Social Reform Agenda (SRA) focused on poverty alleviation and rural development for the disadvantaged economic and social groups. It set the foundation for the Social Reform and Poverty Act of 1997 (Republic Act [RA] 8425), which created the National Anti-Poverty Commission (NAPC), which serves as the coordinating and advisory body of programs concerning social reforms and poverty reduction. It also institutionalized the participation of local government units (LGUs) and nongovernment organizations (NGOs) in incorporating the SRA and at the same time managing microfinance programs and institutions. In 2001, under the supervision of NAPC, the *Kapit-Bisig Laban sa Kahirapan* (KALAHI) program was launched. KALAHI was involved in the implementation of: rural projects, urban projects, social initiative projects, and resettlement in conflict areas.

However, government-sponsored programs to reduce poverty always have accompanying issues—categorized into (1) policy issues, (2) institutional issues, and (3) resource issues. For policy issues, every president is compelled to introduce new antipoverty programs regardless if there are ongoing initiatives set by the previous president. There may be instances that even successful programs were discontinued since the value proposition of the previous is not aligned with the current president. This results to redundancies in plans, frameworks, and targets—waste of resources. Likewise, antipoverty programs suffer from inappropriate targeting that are diverse, inefficient, and highly politicized resulting to inadequate implementation. It also results to inclusion/exclusion of intended beneficiaries and significant leakages to unintended beneficiaries. For institutional issues, it includes transitional problems (disjoint priorities of leaders), highly politicized programs (biased selection of beneficiaries), and political appointment of agency heads (nepotism and cronyism). For the resource issue, the scarcity of funds compelled the government to establish the Poverty Alleviation Fund (PAF) in 1998. It states that funds for poverty reduction should always be part of the national budget (Schelzig, 2005).

Operational Framework and Methodology

Data Requirements

To quantitatively determine the likelihood why households will remain or move in and out of poverty, the 2000, 2003, 2006, and 2009 Family Income and Expenditure Surveys (FIES) will be used. The FIES provides data on family income and expenditure, which includes consumption levels by item of expenditure and sources of income. It captures levels of living and disparities in income and spending patterns of households belonging to different income groups and geographical locations in the Philippines. It also includes related information such as household size, employment status, demographics, and educational attainment of household head. It is released by the PSA on a triennial basis.

The sufficient sample of nationwide data contained in the FIES allows for the generation of distribution diagrams and measures of living standards in the Philippines for both national and regional levels. These measures aim to provide comparable and quantifiable indicators of social welfare that will facilitate interregional comparisons. However, as argued by Jao, Ng, and Vicente (2000), since welfare is a multifaceted idea, the attempt to capture its definition into one encompassing indicator remains to be the major limitation of this study.

Repeated Cross-Section and Pseudo-Panels

Panel data is the ideal method to measure income mobility, but due to data limitation, we used an approach that is different but will yield results expected from panel data estimation. It will also offer insightful inferences on poverty mobility and its related dynamics. It is important to note that the estimates are bounds of the fraction of mobility (upper and lower) and not actual point estimates. This alternative approach was used by Dang, Lanjouw, Luoto, and McKenzie (2011), which employed repeated cross-sections. This method will allow the creation of pseudo panels to assess bounds of mobility in and out of poverty.

The procedure will only make use of the 2003 and 2006 FIES. We are dropping the 2000 and 2009 FIES because it is conditional that the measure of welfare (income or consumption) will be the same for both periods. The 2003 and 2006 FIES utilized the same interview procedure and have the same set of survey questions (Ericta & Fabian, 2009), which make them viable for this procedure.

Another issue to consider when using surveys is attrition. There is little probability that a specific household can be traced from 2000 to 2003 to 2006 to 2009. As such, this procedure will make use of pseudo panels at the cohort level. Hence, both data sets are restricted to households with heads having an age of 25 to 60. This restriction will rationalize problematic and less indicative nature of households with heads aged younger than 25 and older than 60, for trivial reasons.

In estimating the upper bound (or the unobserved first period consumption), the procedure will begin with ordinary least squares (OLS), shown in Equation 1:

$$y_{i1}^{1} = \beta_{i1}' x_{i1}^{1} + \varepsilon_{i1} \tag{1}$$

where

y_{i1}^{1} is consumption for round 1, and

x_{i1}^{1} is a vector of household characteristics which are observed in round 1.

We then predict the residuals from Equation 1 and take a random draw with replacement from the distribution. Together with the estimated *betas* and the observed values of household characteristics in round 2, Equation 2 shows the estimated first round consumption:

$$\hat{y}_{i1}^{2} = \hat{\beta}_{i1}' x_{i1}^{2} + \hat{\varepsilon}_{i1}^{2} \tag{2}$$

where

$\hat{y}_{i1}^{2}$ is the unobserved first period consumption,

x_{i1}^{2} observed household characteristics from round 2, and

$\hat{\varepsilon}_{i1}^{2}$ randomly drawn betas (with replacement) from (1).

Using the estimated first-round consumption, the degree of mobility to and from poverty will be computed as in Equation 3:

$$Pr(\hat{y}_{i1}^{2} < p \middle| y_{i2}^{2} > p) \tag{3}$$

where p is the poverty line. The study will use the poverty threshold released by the Philippine National Statistical Coordination Board (NSCB) in 2006, which is PHP 75,285.00 (http://www.nscb.gov.ph/pressreleases/2008/PR-200803-SS2-02_pov.asp; see Table 1 for more recent figures).

In estimating the lower bounds of mobility, the same procedure will be employed. However, instead of the residuals derived from Equation 1 that will be imputed in Equation 2, another OLS will be estimated, shown in Equation 4, and this will replace $\hat{\varepsilon}_{i1}^{2}$ in Equation 2.

$$Pr(\hat{y}_{i1}^{2} < p \middle| y_{i2}^{2} > p) y_{i2}^{2} = \beta_{i2}' x_{i2}^{2} + \varepsilon_{i2}^{2} \tag{4}$$

where

y_{i2}^{2} is consumption for round 2, and

x_{i2}^{2} is a vector of household characteristics which are observed in round 2.

The residuals in Equation 4 will serve as the prediction error in Equation 2, which will then provide a way to estimate the lower bound. Once a series of y_{i2}^{2} is estimated, movements into and out of poverty of interest will be computed, which is the same as the representation in Equation 3.

Discrete Models

Once the bounds of mobility are estimated, it is also imperative to observe the physical characteristics of households and its effect on household mobility to and from poverty. Abufhele and Puentes (2011) employed this approach in examining poverty mobility in Chile.

The methodology will utilize the probit and multinomial probit in assessing the factors of transition through maximum likelihood estimation (MLE). To emphasize the role of education on poverty mobility, we included the following factors in our probit specification: household demographics (age, sex, and marital status of household head) and educational attainment of the household head. From Equation 5 and Equation 6, the dependent variables in each will take the values of

$$y_{entered\ t1,t2} \begin{cases} 1\ if\ household\ is\ Nonpoor\ in\ t_1\ and\ Poor\ in\ t_2 \\ 0\ if\ household\ is\ Nonpoor\ in\ t_1\ and\ Nonpoor\ in\ t_2 \end{cases} \quad (5)$$

$$y_{exit\ t1,t2} \begin{cases} 1\ if\ household\ is\ Poor\ in\ t_1\ and\ Nonpoor\ in\ t_2 \\ 0\ if\ household\ is\ Poor\ in\ t_1\ and\ Poor\ in\ t_2 \end{cases} \quad (6)$$

To quantify the dependent variables, we defined the poor households and the nonpoor households using the poverty threshold of NSCB by creating dummy variables (1 = poor; 0 otherwise). These dependent variables will also be used in the multinomial probit models, but there will be two additional dependent variables that will correspond to households that did not change states in between 2003 and 2006. The regression will utilize both household characteristics observed in 2003 and 2006 in order to trace whether factors affecting transition is the same all throughout. Regression results will suggest to policy makers which aspect of the physical characteristics of households will cause detrimental and/or beneficial effects on poverty mobility.

Results and Discussions

Bounds of Mobility

Due to the difficulty of constructing household panel data for the Philippines, we employed the approach of Dang, Lanjouw, Luoto, and McKenzie (2011)—repeated cross-sections of the household data in estimating the dynamics of poverty by transforming these into a pseudo- panel. Although it cannot show mobility point estimates in the presence of measurement error, it can estimate upper bounds and lower bounds of poverty mobility.

Table 5 shows the computed upper and lower bounds using repeated cross-section analysis. Using the upper bound estimates, assuming no autocorrelation between the 2003 and 2006 error terms, the probability that nonpoor households in 2006 were nonpoor in 2003 is 85.32%, and for those poor in 2006, the probability that these households were nonpoor households in 2003 is 44.34%. However, the width of the lower and upper bounds is 19.21% for the nonpoor households in 2006 and 44.34% for the poor households in 2006. These wide gaps of the upper and lower bound estimates may be very limiting. The most important inference that can be derived from Table 5 is movements between states are less often relative to households staying in the same state from 2003 to 2006.

We are emphasizing that these numbers are estimated using household demographics (age, sex, and marital status of household head) and educational attainment of the household head as the variables explaining logged consumption levels. For further research, adding more exogenous variables would minimize the measurement errors thus narrowing the gap of the bounds (Dang, Lanjouw, Luoto, & McKenzie, 2011). Subsequently, the range of mobility will be reduced to create more significant implications.

Table 5. Bounds of Mobility

State of the World	Lower Bound	Upper Bound
Nonpoor in 2006; nonpoor in 2003	0.6611	0.8532
Nonpoor in 2006; poor in 2003	0.1468	0.3389
Poor in 2006; nonpoor in 2003	—	0.4434
Poor in 2006; poor in 2003	0.5566	1.0000

Probit Estimations

Table 6 summarizes the marginal effects after probit estimations. Notice that the endogenous variable was estimated twice, each considering the household characteristic observed in the 2003 and 2006 FIES. This is due to the fact that both FIES are not panels representing the same set of households. Nonetheless, results will still provide inference on the characteristics of the surveyed households and its relation to poverty mobility.

Nonpoor to Nonpoor

Both survey periods showed the same marginal effects to the probability of remaining out of poverty. Indeed, educational attainment served as a key factor in sustaining household security. Furthermore, civil status (i.e., being married) contributes positively to the likelihood of being nonpoor. With the spouse working, it will provide additional source of income to finance household expenditures. Age also contributes positively to the chances that a household will remain out of poverty. This is due to the fact that most household heads who are considered nonpoor in the first period are less likely to retire and stop working in the second period.

Poor to Poor

Both survey periods show the same results when it comes to its response in staying poor. Similar with the nonpoor-to-nonpoor results, education decreases the chance of staying poor. This is also the case in being married and having a spouse who is employed. It decreases the chances of being poor since more income from employment will provide sustenance to the household.

Nonpoor to Poor

The results for the 2003 and 2006 FIES differ in terms of signs. The 2003 FIES provided counterintuitive but significant marginal effects. This might be due to the fact that the observed poor households are in 2006 while the nonpoor households are in 2003. This causes the response to different period household characteristics to contrast.

It can also be construed that the actual movement to the new state happened in 2006 and not in 2003 wherein the new state, which is being poor, responded accordingly to a priori expectations. Observing the figures, the results from 2006 are more intuitive—the educational attainment of household head diminishes the probability of being poor.

Poor to Nonpoor

Here, the logic is the same with the nonpoor-to-poor results. However, it has been established that educational attainment still plays a critical role in combating poverty. Thus, poor households who have readily acquired skills and training are more likely to become nonpoor in the future. Additionally, the civil status and employment of the household head's spouse will also increase the chances of moving out of poverty since it can provide more channels of income for the household.

Table 6. Marginal Effects After Probit Estimates

Endogenous Variables	Nonpoor to Poor		Poor to Nonpoor		Poor to Poor		Nonpoor to Nonpoor	
Exogenous Variables	2003	2006	2003	2006	2003	2006	2003	2006
Age	0.002633	-0.00223	-0.0052	0.00	-0.00238	-0.00441	0.005793	0.007583
Male household head	-0.039	0.039814	0.076223	-0.04062	0.024949	0.031403	-0.04726	-0.03131
College graduate	0.253236	-0.20326	-0.27024	0.341975	-0.13097	-0.14528	0.512482	0.416125
College undergraduate	0.23922	-0.18097	-0.23743	0.314101	-0.11223	-0.12712	0.460946	0.378754
High school graduate	0.176801	-0.1717	-0.21051	0.259444	-0.10077	-0.122	0.388629	0.338183

Table 6 continued...

High school undergraduate	0.128949	-0.11958	-0.13881	0.203128	-0.06627	-0.07681	0.297921	0.261113
Grade school graduate	0.090875	-0.08498	-0.09706	0.134611	-0.05116	-0.05481	0.224418	0.196181
Grade school undergraduate	0.029589	-0.04308	-0.03749	0.074923	-0.02501	-0.02769	0.099492	0.102318
Married	0.035853	-0.07994	-0.09059	0.050539	-0.02601	-0.04552	0.045842	0.060968
Spouse is employed	0.033089	-0.03362	-0.06266	0.032239	-0.03309	-0.02902	0.064	0.03287

Conclusions

With the depth of poverty in the Philippines posing a threat towards economic growth and development, one may argue that poverty alleviation may also be addressed by appealing to the capacity of households to improve their economic position. The condition in which a household remains impoverished can be ascribed not only to the ineffectiveness of antipoverty programs but also to the income-earning capacity and spending behavior of households. In this study, instead of evaluating the efficiency of government programs in alleviating poverty, we looked at the household educational and demographic variables explaining why households move in and out of poverty.

In addressing the first research objective, we estimated the probabilistic relationship of the poverty mobility and selected sociodemographic factors. We employed repeated cross-section analysis that will allow us to create pseudo-panels that will compute the upper and lower bounds of mobility to and from poverty. Findings encourage the importance of human capital investment and having an employed spouse to escape and remain out of poverty. In general, those who have acquired skills training are more equipped to sustain their families given a larger income. This enables them to be prepared for economic shocks such as financial crises, natural disasters, social conflicts, and environmental property.

In addressing the second research objective of explaining why households retain or shift socioeconomic status, we have seen from the results that for developing economies, like the Philippines, engulfed by income inequality, inequitable distribution of income, the economy's population needs a total overhaul on its human resource development. As evidenced by the marginal effects after probit, households headed by educated individuals are more equipped to deal with unexpected shocks that disrupt income flow. As such, securing a stable and meaningful employment presents itself as the primary objective. Moreover, the poor must be made aware that it is never too late to continue education with the availability of technical and vocational courses offered by the Technical Education and Skills Development Authority (TESDA). Instead of providing the most basic skills offered by basic education, TESDA's courses provide workers with a skill set more suited for specific jobs.

It has been apparent that the lack of education negatively affects the spending patterns of households. They have the tendency to inefficiently allocate resources for long-run benefits. With the lack of education, the poor may develop a mentality that collectively points to laziness and overdependence—they do not see the need to take action to solve their own problems because they believe that the state and NGOs will eventually provide aid incessantly.

In addressing the third research objective, we have explored other perspectives why households find it difficult to move out of poverty. This will lead to the creation of policy options. For instance, rapid population growth undermines both macro- and micro-level poverty alleviation efforts. This is due to the misguided notion that more children translate to greater income and to greater chances of escaping poverty. Chances are households tend to discount the initial spending necessary before these expectations are achieved. As such, the failure to provide every member of the household with a minimum level of education and health worsens the household's condition. Additionally, rapid population growth accelerates labor force expansions leading to higher unemployment rates and poverty persistence across generations. This is even exacerbated in areas where basic education is not available to all.

Accordingly, government intervention in human resource development is critical to poverty reduction in the Philippines. The government has adopted two key strategies in accomplishing this goal: (1) the Responsible Parenthood and Reproductive Health Act of 2012 (RA 10354), which promotes limiting family size through family planning, and (2) the K-to-12 program, which expands and strengthens the country's basic education system. In addition to these initiatives, however, the government must also provide opportunities for every Filipino to enroll in technical-vocational courses by improving on the current process and utilization of information and communication technology.

We have been examining why the Philippines is susceptible to poverty. Other than poverty alleviation, there is also a need to stop the vicious cycle so that poverty is not passed across generations. As such, sustained human resource development promotes inclusive growth—a pathway towards significant poverty reduction. However, this is dependent on the commitment of the government to reduce poverty, regardless of the ruling administration. Temporary solutions (e.g., dole outs, housing), while valued, only address current needs and may not be sustainable. The Philippines should do away with responses to poverty that are short-term reactive and should rather resort to long-term preplanned initiatives. Effective government programs must strike a balance between meeting immediate needs and addressing root causes of poverty.

As a matter of policy, we recommend that in order to reduce poverty, the current system can take the following forms: (1) eliminating redundancies and inefficiencies by seeking the commitment of the present and incoming administrations in continuing the implementation of beneficial poverty reduction programs, (2) designing programs that work on the empirically verified responsiveness of poor households to changes in salaries and wages (strategies that guarantee access to sustainable employment would, thus, relieve the government from the need to offer grants and subsidies that consume significant shares of the national budget), and (3) improving the business environment by lowering corporate taxes for new firms, eliminating red tape, developing infrastructures (e.g., roads and transportation), and promoting a more efficient system and broader scope of financial activities. Favorable business environments attract investments, which create much needed jobs.

Finally, we believe that the most important response to poverty is the attitude an individual takes, the approach undertaken, the organization and institutions working, and, most importantly, the commitment made to fight poverty, as if it were a battle.

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6

The Dilemma of the Filipino Child—To Study or to Work: A Joint Estimation of the Different Schooling-Work Choices[1]

Cesar C. Rufino

The Joint Estimation of the Filipino Child's Participation in Schooling and Employment and New Stylized Facts on the Philippine Child Labor Situation

Child labor, because of its tremendous welfare implications, has developed into an issue of grave concern among economists, sociologists, politicians, international agencies, NGOs, and the general public. Vivid imageries of children engaged in at times back-breaking human labor are often seen in the internet and media of wide circulation, escalating the awareness of the general public on mostly third-world children's plight. This public interest seems to be motivated by a concern about child labor as a human rights issue and its implication for long-term growth and development through its interaction with education (Edmonds, 2007). The most common policy response of governments and multilateral agencies to the problem is legislation and/or labor conventions, protocols, and roadmaps that would effectively enforce a ban on child labor. The public meanwhile employs certain forms of consumer boycott of products produced by child laborers.

However, since it is well-recognized that the multifaceted phenomenon of child labor is intricately rooted from, and interwoven with, the equally multidimensional problem of poverty, most of these interventions are often ineffective—mainly due to vested interests and hidden protectionism (Basu, 1998, 1999), resulting in further aggravation of child labor, poverty, or both.

Concurrent with this rise in public awareness is a proliferation of theoretical and empirical literature on why children who are supposed to be engaged in full-time schooling are instead working. Outstanding theoretical publications such as Basu and Van (1998), Baland and Robinson (2000), and Ravallion and Wodon (2000) have spurred such a large number of empirical studies tackling the different dimensions of child labor across time and settings.

The need for a formal and objective inquiry into the causes and consequences of child labor has driven the economics profession far afield to study this issue. As a result, over the last two decades, there has been an upsurge of studies on the economics of child labor, both theoretical and empirical. A good number of these studies feature the Philippines as a case in point (e.g., Gunn & Ostos, 1992; Sakellariou, 2000; Sakellariou & Ashish, 2000; Del Rosario & Bonga, 2000; Lim, 2002; Alonzo & Edillon, 2002; Esguerra, 2002; Edralin, 2002; Villamil, 2002; Aldaba, Alzona, & Tamangan, 2004; Bacolod & Ranjan, 2008; and Dacuycuy & Dacuycuy, 2013). Most of these researches focus on the empirical determination of the relevant factors that explain why Filipino children are engaged in at times dehumanizing employment in various settings.

Although child labor is undesirable, there is a wide disagreement among researchers on how to address the problem. But in the pursuit of solutions, almost everyone agrees on the need to identify the factors that contribute to the continued existence of the problem and focus on monitoring these factors through periodic sample surveys in order to craft policies that can effectively curb the phenomenon.

This research aims to use the most recently available public use raw data file of the Annual Poverty Indicator Survey (APIS-2011) in a simultaneous microeconometric estimation of the different schooling and employment outcomes (or choices) of (or for) Filipino children. The objective of the study is to provide new insights on the child labor situation of the country and to offer new evidence on the continued empirical relevance of the findings of extant literature, in addition to supplying additional empirics on the linkage of child labor to poverty, the child's demographics, community, and guardians' characteristics and other socioeconomic indicators of child labor.

Literature Review and Methodology

The recent applied and theoretical literature on child labor has different strands. Models differ not only in their initial assumptions but also in the variables that are deemed to be of importance in explaining the phenomenon. A great majority of these studies supply empirical evidence on the role of poverty in the proliferation of child labor. Many of these works are based on what Basu and Van (1998) called the luxury axiom, i.e., a family will send a child to work only if the family's non–child-labor income drops below some threshold. Children's age, gender and marital status are also expected to affect their work and schooling choices. Beyond a certain age, the older the child, the more likely he or she works (Connelly, DeGraff, & Levison, 1996). Girls differ from boys as they are expected to substitute time at school for time doing household chores or child care activities, especially if the child has marital responsibilities (Levison, Moe, & Knaul, 2001). Manacorda (2006) on the other hand, finds that children are less likely to work when they have older siblings and vice versa, that is, more likely to work if they have younger siblings to support (Villamil, 2002).

Some economists stress the importance of the interaction between adults' labor market conditions and child labor (Basu & Van, 1998; Basu, 1999; Rosenzweig & Evenson, 1977) while other theoretical works include social norms and household preferences in the analysis (Birdsall, 1991; López-Calva, 1999). Dynamic models have also shown the use of child labor as a consumption smoothing device (Jacobi & Skoufias, 1997). Still others feature the involvement of the credit market in explaining the phenomenon (Ranjan, 2001; Dehejia & Gatti, 2002). Some studies document a positive correlation between family size and child labor (Patrinos & Psacharopoulos, 1997; Togunde & Richardson, 2006), and this is generally viewed as suggestive of resource and credit constraints on child time allocation as noted by Laitner (1997), Parsons and Goldin (1989), Jacoby and Skoufias (1997), Knodel and Wongsith (1991), Patrinos and Psacharopoulos (1997), and Dacuycuy and Dacuycuy, (2013). Works by Parikh and Sadoulet (2005) and Edmonds and Turk (2004) pointed out that children work more in households with more self-employment activities, with higher correlation noted between child works and family's self-employment as the household gets involved more on microcredit programs (Wydick, 1999).

The insights from the above studies will provide the basis in choosing the variables in APIS 2011 to be used as regressors of the causal model to be implemented in the present study. These variables will give the metrics that may capture the empirical validity of the ideas of these authors.

There are two main econometric models used in the empirical literature to identify the extent of the covariation of the aforementioned factors with child labor. Which model to use depends on the underlying process followed by the decision maker. Decision making may be sequential; that is, the household head first decides whether to send the child to school, and after a choice is made, the head decides whether to send him/her to work. On the other hand, the head may choose among the four categorical school/work options that a child may engage in (i.e., school and no work, work and school, no work and no school, work and no school). Multinomial logit and multinomial probit models are well-suited for the latter case (e.g., Liu, 1998; Deb & Rosati, 2001), whereas ordered logit or sequential probit models are appropriate for the former case (see Sakellariou & Ashish, 2000, and Villamil, 2002). Also in the later case, it is assumed that there is a natural ordering of the options available to the child on the basis of his or her welfare. Other studies collapse the four outcomes into binary outcomes (study or no study, work or no work) and proceed to use either the binary logit or probit models (e.g., Patrinos & Psacharopoulos, 1997; Ray, 1998; Aldaba, Alzona, & Tamangan, 2004).

Empirical Strategy

This study is concerned with the determination of the explanatory factors on the decision of the children (or the decision of their parents/guardians) in entering the different study–work states available to them. It is posited that these choices are determined by three global attributes: the child's demographic characteristics, the household's socioeconomic circumstances including age-specific household composition and household head demographics, and locational attributes of the household.

Notationally, we can use the following vectors to denote these global attributes:

X = vector of demographic characteristics of the child
Υ = vector of household's socioeconomic characteristics
Z = vector of locational characteristics of the household

Generally speaking, two major decisions are to be made by or for the child: whether or not he or she attends school and/or works. If we let W^* be the net benefit attained by the family in sending the child to work and S^* be the latent variable which corresponds to the net benefit the family gained in sending the child to school, we can formulate the following latent variable models for the schooling/work outcomes for the child:

$$W_i^* = \delta_1 + X_{1i}\beta_1 + \Upsilon_{1i}\lambda_1 + Z_{1i}\varphi_1 + u_{1i} \quad (1)$$
$$S_i^* = \delta_2 + X_{2i}\beta_2 + \Upsilon_{2i}\lambda_2 + Z_{2i}\varphi_2 + u_{2i} \quad (2)$$

The latent variables W_i^* and S_i^* together with the random errors u_{1i} and u_{2i} are unobserved, with the error assumed independently and identically distributed (iid) with mean 0 and variance 1. What we actually observe are the following dummy variables:

$W_i = 1$ if the ith child works (W_i^* >0), 0 otherwise (3)
$S_i = 1$ if the ith child studies (S_i^* >0), 0 otherwise (4)

Setting up (1) and (2) for joint estimation, the following latent variable model in matrix notation emerges:

$$Y_i^* = C_i\theta + u_i \quad (5)$$

where

$$Y_i^* = \begin{bmatrix} W_i^* \\ S_i^* \end{bmatrix} \quad C_i = \begin{bmatrix} 1\,X_{1i} & \Upsilon_{1i} & Z_{1i} & 0 \\ 0\;\;1 & X_{2i} & \Upsilon_{2i} & Z_{2i} \end{bmatrix} \quad \theta' = \begin{bmatrix} \delta_1\,\beta_1 & \lambda_1 & \varphi_1 & 0 \\ 0\;\delta_2 & \beta_2 & \lambda_2 & \varphi_2 \end{bmatrix} \text{ and } u_i = \begin{bmatrix} u_{1i} \\ u_{2i} \end{bmatrix}$$

The latent variable model (5) can be estimated in the context of a *multinomial logit model* (see Greene, 2012, pp. 763–766) when (5) is converted into an observable form using the dummy variables (3) and (4) and the probabilities of the four mutually exclusive and exhaustive states:

$W_i^* \le 0, S_i^* > 0$ (child does not work ($W_i = 0$), attends school ($S_i = 1$)) (6)

$W_i^* > 0, S_i^* > 0$ (child works ($W_i = 1$), attends school ($S_i = 1$)) (7)

$W_i^* \le 0, S_i^* \le 0$ (child neither works ($W_i = 0$) nor attends school ($S_i = 0$)) (8)

$W_i^* > 0, S_i^* \le 0$ (child works ($W_i = 1$), does not attend school ($S_i = 0$)) (9)

By letting $Y_i = j$ ($j = 0$ for state [6], $j = 1$ for state [7], $j = 2$ for state [8], and $j = 3$ for state [9] for the *i*th child) and using the *Gumbel* cdf as the link function, the following probabilities can be derived:

$$\Pr[Y_i = j] = \frac{\exp(C_i \theta_{(j)})}{1 + \exp(C_i \theta_{(j)})} \text{ for j = 1, 2, 3} \tag{10}$$

$$\Pr[Y_i = 0] = \frac{1}{1 + \exp(C_i \theta_{(j)})} \tag{11}$$

The vector of regression coefficients $\theta_{(j)}$ corresponds to the choice outcome j, whose elements are estimated using maximum likelihood procedure and who will provide the set of probabilities for the different school–work outcomes chosen by or for the child, given the specific global attributes of the child. These probabilities should sum up to unity as we assume that the outcomes are mutually exclusive and exhaustive; hence, only three multinomial logit equations for three of the choices will be estimated, while the other one will serve as the reference choice category. In this study, the outcome j = 0 (child exclusively attends school) is the reference or base outcome.

Interpreting the estimated coefficients of the resulting equations may be daunting due to the nonlinear nature of the model, but when we take the ratio of (10) and (11), we can come up with an intuitively appealing composite ratio called the *relative risk ratio* (RRR) of the *j*th choice relative to the reference outcome (*j* = 0)

$$RRR_j = \frac{\Pr[Y_i = j]}{\Pr[Y_i = 0]} = \exp(C_i \theta_{(j)}) \tag{12}$$

which is interpreted, in "ceteris paribus" context per explanatory variable, as the risk of staying in category *j* relative to (or rather than moving to) the reference category, for one unit change in the corresponding variable. If the coefficient is negative, the RRR is a positive fraction, since it is the antilogarithm of the coefficient. Alternatively, since the exponentiated coefficient of the relevant explanatory variable ("ceteris paribus") is the RRR, it may be interpreted as the impact of a unit increase in the relevant regressor on the "odds ratio" of the *j*th state with reference to the base state (that's why RRR is sometimes referred to as OR or odds ratio). For example, if the RRR for the "family size" variable in outcome I = 3 (work only) is significant with a magnitude of 4.0, it may be interpreted as the risk for the child to remain a full-time worker (rather than a full-time student) is 4 times (i.e., 4 times as likely), per additional family member, "ceteris paribus." If the regressor is a dummy variable, for example, the gender dummy (sex = 1 for boys, 0 otherwise), an RRR of 2 for the same equation may be read as the odds for boys to be working full-time instead of studying full-time is twice larger than that of girls, "ceteris paribus" (Hosmer & Lemeshow, 2000). Such interpretations are valid under the assumption of *independence from irrelevant alternatives* (IIA).

The deterministic model (12) can be converted into an empirically testable econometric model, each for choices j = 1, 2, and 3 augmented respectively by a stochastic disturbance term u_{ij} with well-defined statistical properties. These models are the following multinomial logit equations, each of which is associated with the log odds ratio of the three schooling-work outcomes (study and work, no work and no study, and work only) respectively as the dependent variables, with j = 0 (study only) as the base outcome, i.e.,

$$\log\left[\frac{p_{ij}}{p_{i0}}\right] = C_i\theta_{(j)} + u_{ij} \tag{13}$$

with $p_{ij} = \Pr[Y_i = j]$, which is the conditional probability of child i to choose option (or outcome) j = 1, 2, 3, given the global attributes in vector C_i associated with child i.

Incorporating the Sampling Design of the Survey: Let's Do It Right!

It has been one of the goals of this study to compute descriptive statistics and parameter estimates of the models as well as the stylized facts of the target population with full consideration of the complex design of the survey. This is made clear at the onset since the proponent would like to distinguish this study from most statistical investigations that employ large-scale survey data. More often than not, statistical inferences in most of these researches are done with the assumption that the data collection is undertaken using simple random sampling (SRS) without replacement, with the elements of the target population having equal chances of being included in the sample. Although computationally convenient, this procedure is theoretically flawed when complex design was used in the survey (Deaton, 1997; Korn & Graubard, 1999).

The Annual Poverty Indicator Survey (APIS) in particular, being a nationwide survey, employs a multistaged stratified random sampling design aimed at economizing on the sample size (and cost of survey operation) without sacrificing the precision of the sample representation. As a consequence, each population element has different probabilities of inclusion in the sample. As such, there is a need to take into consideration the use of sampling weights (sometimes called raising factors) which represent the inverse of the selection probabilities for each sample element (Cochran, 1977).

These sampling weights are needed to correct for differential representation and the effect of the sampling design on the estimates and their respective standard errors (Deaton, 1997; Rufino, 2013). This will ensure the unbiasedness and consistency of the estimates, resulting in better inference, in addition to the mitigation of the effects of heteroscedasticity.

Data and Descriptive Statistics

The primary basis of establishing poverty statistics for the country is the Family Income and Expenditure Survey (FIES). This nationwide survey is conducted by the National Statistics Office once every three years involving about 42,000 households all over the Philippines. During times when the FIES is not conducted, the Annual Poverty Indicator Survey (APIS) is carried out to provide readily available nonincome indicators of poverty which can be used as inputs to the development of an integrated poverty indicator and monitoring system in the country (Ericta & Jeremias, 2009). It presents a socioeconomic profile of Filipino families and other information relating to their living conditions.

Survey items incorporated in any APIS round are agreed upon by a working group consisting of all stakeholders in poverty research and poverty monitoring in a series of consultative meetings. The final questionnaire is subsequently finalized and pretested in the field. The APIS 2011 round, conducted in July 2011, involved a total of 43,833 households of which 42,063 were successfully interviewed. This translated to a response rate of 96% at the national level. The sampling design used ensures reliability of estimates to at least the regional level. The database of the present study is the merged file of the households and individual persons files which resulted in an overall total of 193,097 observations, of which only 59,079 observations belong to the 5- to 17-years-old age group, which will be the focus of analysis. Design-based inference, both descriptive analysis and econometric modeling, will be implemented using this nationwide sample of children.

Design-Consistent Sample Descriptives

As presented in the empirical strategy section, the different explanatory variables of child labor/schooling decisions are divided into three global characteristic vectors (X, Υ, and Z). The relevant variables included in the APIS 2011 are grouped into these vectors with descriptive statistics presented in Table 1. The statistics shown are computed using design-consistent estimation formulas via the sampling weights of each of the 59,079 observations. The weighted means of the dummy variables, in effect are the estimates of the population proportions (or probabilities) associated with these attributes; for example, the table shows that the proportion of Filipino children who are boys is estimated at 50.80%, with 95% confidence interval of 50.38% to 51.22% inclusive; 79.97% of Filipino children are sons or daughters of the household heads, with 95% confidence interval of 79.63% to 80.31% inclusive. For the quantitative variables like age, family size, per capita income, per capita expenditure, etc., the means may be considered as the design-consistent estimates of the population means for these variables. Hence we can say, without loss of generality, that the typical Filipino child is about 11.13 years old, belongs to a household with about 6.15 members and whose head is about 46.5 years old, etc. Hence, using Table 1, we can in effect construct a profile of a typical Filipino child in a valid inferential manner.

Table 1. Design-Consistent Stylized Facts, Children 5 to 17 Years Old, Philippines 2011

No.	Variable	Variable Label	Mean	Standard Deviation	95% Confidence Interval	
					Lower Limit	Upper Limit
Vector X—Child's Characteristics						
1	age	Age of the child	11.1278	0.0156	11.0972	11.1584
2	age2	Age squared	137.0965	0.3487	136.4130	137.7800
3	sex	Gender (1 = boy, 0 = girl)	0.5080	0.0021	0.5038	0.5122
4	study	Dummy (1 = child studies, 0 = otherwise)	0.8016	0.0017	0.7982	0.8050
5	work	Dummy (1 = child works, 0 = otherwise)	0.0697	0.0011	0.0676	0.0718
6	child_hhh	Dummy (1 = child of household head, 0 = otherwise)	0.7997	0.0017	0.7963	0.8031
7	child_married	Dummy (1 = child is married, 0 = otherwise)	0.0037	0.0003	0.0032	0.0042
Vector Y—Household's Characteristics						
8	fsize	Family size	6.1482	0.0094	6.1298	6.1666
9	chld_6_12	Dummy (1 = household has 6- to 12-year-old child, 0 = otherwise)	0.8258	0.0016	0.8226	0.8290
10	chld_6_11	Dummy (1 = household has 6- to 11-year-old child, 0 = otherwise)	0.7712	0.0018	0.7677	0.7747

Table 1 continued...

11	chld_13_16	Dummy (1 = household has 13- to 16-year-old child, 0 = otherwise)	0.6281	0.0021	0.6240	0.6322
12	chld_12_15	Dummy (1 = household has 12- to 15-year-old child, 0 = otherwise)	0.6499	0.0020	0.6458	0.6539
13	chld_18_up	Dummy (1 = household has 18-year-old or older child, 0 = otherwise)	0.9991	0.0001	0.9988	0.9993
14	educ_6_12	Dummy (1 = household has 6- to 12-year-old studying, 0 = otherwise)	0.7339	0.0019	0.7302	0.7377
15	educ_6_11	Dummy (1 = household has 6- to 11-year-old studying, 0 = otherwise)	0.7029	0.0020	0.6990	0.7067
16	educ_13_16	Dummy (1 = household has 13- to 16-year-old studying, 0 = otherwise)	0.4243	0.0021	0.4201	0.4284
17	educ_12_15	Dummy (1 = household has 12- to 15-year-old studying, 0 = otherwise)	0.4220	0.0021	0.4179	0.4262
18	totexpc	Household expenditure per capita	17,761	101	17,563	17,960
19	totincpc	Household income per capita	16,279	86	16,110	16,448
20	hhmsch	Number of household members studying	2.4657	0.0065	2.4531	2.4784
21	hhmelem	Number of household members studying in elementary	1.4324	0.0049	1.4227	1.4420
22	hhmhs	Number of household members studying in high school	0.6918	0.0035	0.6849	0.6987
23	hhmcol	Number of household members studying in college	0.1199	0.0017	0.1167	0.1231
24	hhh_sex	Dummy (1 = household head is male, 0 = household head is female)	0.8372	0.0016	0.8341	0.8404
25	hhh_age	Age of household head	46.5008	0.0501	46.4026	46.5991
26	hhh_single	Dummy (1 = household head is single, 0 = otherwise)	0.0120	0.0005	0.0111	0.0130

Table 1 continued...

27	hhh_married	Dummy (1 = household head is married, 0 = otherwise)	0.8601	0.0015	0.8571	0.8630
28	hhh_loweduc	Dummy (1 = household head graduated elementary or lower, 0 = otherwise)	0.4319	0.0021	0.4277	0.4360
29	hhh_higheduc	Dummy (1 = household head is at least high school graduate, 0 = otherwise)	0.1844	0.0017	0.1812	0.1877
30	hhh_selfempl	Dummy (1 = household head is self-employed, 0 = otherwise)	0.3481	0.0020	0.3442	0.3521
31	electricity	Dummy (1 = household has electricity, 0 = otherwise)	0.8425	0.0015	0.8396	0.8455
32	avail_loan	Dummy (1 = household has availed of loan within 3 months, 0 = otherwise)	0.3096	0.0020	0.3057	0.3135
33	poor	Dummy (1 = household belongs to 1st quintile of pc income, 0 = otherwise)	0.3396	0.0020	0.3357	0.3435
Study–Work Outcomes						
34	child studies only	Dummy (1 = child studies only, 0 = otherwise)	0.7726	0.0018	0.7691	0.7761
35	child studies and works	Dummy (1 = child studies and works, 0 =otherwise)	0.0290	0.0007	0.0277	0.0303
36	child does not study, neither works	Dummy (1 = child does not study or work, 0 = otherwise)	0.1577	0.0016	0.1546	0.1608
37	child works only	(1 = child works only, 0 = otherwise)	0.0407	0.0008	0.0391	0.0423
Vector Z—Locational Variables						
38	urban	Dummy (1 = household is situated in urban area, 0 = otherwise)	0.4479	0.0021	0.4436	0.4521
39	Ilocos	Dummy (1 = household is situated in Ilocos Region, 0 = otherwise)	0.0528	0.0010	0.0509	0.0547
40	Cagayan Valley	Dummy (1 = household is situated in Cagayan Valley Region, 0 = otherwise)	0.0357	0.0007	0.0343	0.0370
41	Central Luzon	Dummy (1 = household is situated in Central Luzon Region, 0 = otherwise)	0.1028	0.0015	0.1000	0.1057

Table 1 continued...

42	Bicol	Dummy (1 = household is situated in Bicol Region, 0 = otherwise)	0.0672	0.0010	0.0652	0.0693
43	Western Visayas	Dummy (1 = household is situated in Western Region, 0 = otherwise)	0.0833	0.0013	0.0808	0.0858
44	Central Visayas	Dummy (1 = household is situated in Central Visayas Region, 0 = otherwise)	0.0740	0.0012	0.0717	0.0763
45	Eastern Visayas	Dummy (1 = household is situated in Eastern Visayas Region, 0 = otherwise)	0.0523	0.0009	0.0506	0.0540
46	Zamboanga Peninsula	Dummy (1 = household is situated in Zamboanga Region, 0 = otherwise)	0.0426	0.0008	0.0410	0.0442
47	Northern Mindanao	Dummy (1 = household is situated in North Mindanao Region, 0 = otherwise)	0.0458	0.0009	0.0440	0.0475
48	Davao	Dummy (1 = household is situated in Davao Region, 0 = otherwise)	0.0439	0.0008	0.0424	0.0454
49	Soccsksargen	Dummy (1=household is situated in Soccsksargen Region, 0 = otherwise)	0.0471	0.0008	0.0455	0.0487
50	Metro Manila	Dummy (1 = household is situated in Metro Manila, 0 = otherwise)	0.1036	0.0014	0.1010	0.1063
51	CAR	Dummy (1 = household is situated in CAR, 0 = otherwise)	0.0182	0.0004	0.0174	0.0189
52	ARMM	Dummy (1 = household is situated in ARMM, 0 = otherwise)	0.0458	0.0007	0.0444	0.0473
53	CARAGA	Dummy (1 = household is situated in CARAGA, 0 = otherwise)	0.0292	0.0006	0.0281	0.0303
54	CALABARZON	Dummy (1 = household is situated in Calabarzon, 0 = otherwise)	0.1178	0.0015	0.1148	0.1208
55	MIMAROPA	Dummy (1 = household is situated in MIMAROPA, 0 = otherwise)	0.0379	0.0007	0.0365	0.0393

Also from Table 1, we can infer the estimated proportions (or probabilities) of Filipino children being in any of the four mutually exclusive and exhaustive study–work outcomes: 77.36% full-time students (study only), 2.90% part-time workers (study and work), 15.77% idle (no study, no work), and 4.07% full-time workers (work only). Gender differences of these estimates are pictorially shown in Figure 5.

Design-Consistent Estimates of Totals and Percentages

As earlier mentioned, the sampling design of APIS 2011 ensures reliable regional estimates of the parameters of the different variables. Presented in the following tables (Tables 2 and 3) are the regional estimates of the total and percentage of children who opted for the different study–work outcomes. Table 2 shows the regional totals, and Table 3 presents the regional percentages. It can be seen in Table 2 that the estimated total number of children belonging to the 5- to 17-years age bracket is 29,513,512, which is lower than the author-estimated figure of 29,568,043 using the 2008 APIS. In Table 3, it can be seen that the top 3 regions with children in this age group in 2011 are Calabarzon (11.78%), Metro Manila (10.36%), and Central Luzon (10.28%).

With respect to the age structure of the children, as well as their poverty status, vis-à-vis their study–work choices, design-consistent estimates are also generated and presented in Table 4 and Table 5, respectively. The existence of an inverted U curve for the age of children when plotted against the study-only option and a monotonically increasing geometric curve for the work-only option are suggested by Table 4. A lot of insights can be gleaned when the figures presented in Table 4 are graphed per study–work outcome (or options). These insights are obvious in Figures 1 to 4. Figure 5 highlights the gender difference among the study–work options taken by Filipino children. It shows that male children are more likely to take options that involve working (study and work, and work only), whereas female children tend to specialize in full-time study. Figure 6 represents the different options by urbanity variable, which shows that more rural children are exclusively working while more urban children are idle (no school, no work) by more than a 2:1 ratio. Meantime, more rural children than urban study exclusively (79.08% vs. 75.02%).

Table 2. Total Number of Children by Region and by Study–Work Outcomes, 2011 Design-Consistent Estimates

Region	Outcome				Totals
	Study Only	Study and Work	No study and No work	Work Only	
Ilocos	1,264,647	13,355	226,098	54,480	1,558,580
Cagayan Valley	787,380	62,373	136,217	66,315	1,052,286
Central Luzon	2,302,288	17,407	635,441	79,882	3,035,018
Bicol	1,615,129	72,567	198,560	97,740	1,983,996
Western Visayas	1,930,465	85,506	336,925	105,042	2,457,938
Central Visayas	1,652,147	97,805	330,300	103,684	2,183,935
Eastern Visayas	1,259,752	51,146	141,082	91,130	1,543,110
Zamboanga Peninsula	1,032,265	36,350	113,589	75,280	1,257,484
Northern Mindanao	985,611	132,462	148,795	83,552	1,350,420
Davao	1,014,177	27,261	196,307	58,287	1,296,032
Soccsksargen	1,053,123	64,169	193,328	79,811	1,390,431
Metro Manila	2,319,129	10,573	696,890	31,552	3,058,143
CAR	392,853	23,862	95,995	23,243	535,953
ARMM	1,041,613	20,835	240,105	49,866	1,352,420
CARAGA	643,875	68,330	94,785	54,872	861,861
CALABARZON	2,601,668	26,290	765,384	84,143	3,477,484
MIMAROPA	905,644	45,638	105,312	61,908	1,118,501
Philippines	22,801,764	855,928	4,655,113	1,200,787	29,513,592

Table 3. Weighted Percentage of Children by Region and by Study–Work Outcomes, Philippines 2011

Region	Outcome				Totals
	Study Only	Study and Work	No study and No work	Work Only	
Ilocos	81.14	0.86	14.51	3.50	5.28
Cagayan Valley	74.83	5.93	12.94	6.30	3.57
Central Luzon	75.86	0.57	20.94	2.63	10.28
Bicol	81.41	3.66	10.01	4.93	6.72

Table 3 continued...

Western Visayas	78.54	3.48	13.71	4.27	8.33
Central Visayas	75.65	4.48	15.12	4.75	7.4
Eastern Visayas	81.64	3.31	9.14	5.91	5.23
Zamboanga Peninsula	82.09	2.89	9.03	5.99	4.26
Northern Mindanao	72.99	9.81	11.02	6.19	4.58
Davao	78.25	2.10	15.15	4.50	4.39
Soccsksargen	75.74	4.62	13.90	5.74	4.71
Metro Manila	75.83	0.35	22.79	1.03	10.36
CAR	73.30	4.45	17.91	4.34	1.82
ARMM	77.02	1.54	17.75	3.69	4.58
CARAGA	74.71	7.93	11.00	6.37	2.92
CALABARZON	74.81	0.76	22.01	2.42	11.78
MIMAROPA	80.97	4.08	9.42	5.53	3.79
Philippines	77.26	2.90	15.77	4.07	100.00%

Table 4. Design-Consistent Total and Percentage of Children by Outcome and by Age of Child, Philippines, 2011

Age of Child	Study/Work Outcome				Total
	Study Only	Study and Work	Neither Study Nor Work	Work Only	
5	1,458,564	2,621	461,814	725	1,923,725
	75.82	0.14	24.01	0.04	100.00
6	1,710,055	5,201	303,942	384	2,019,583
	84.67	0.26	15.05	0.02	100.00
7	1,977,849	12,065	205,702	1,607	2,197,223
	90.02	0.55	9.36	0.07	100.00
8	2,070,317	24,962	185,402	886	2,281,567
	90.74	1.09	8.13	0.04	100.00
9	2,043,821	33,948	170,878	1,466	2,250,113
	90.83	1.51	7.59	0.07	100.00
10	2,203,194	45,617	191,568	2,477	2,442,857
	90.19	1.87	7.84	0.10	100.00
11	2,216,539	57,193	204,307	6,389	2,484,427
	89.22	2.30	8.22	0.26	100.00

Table 4 continued...

12	1,954,143	73,344	266,845	19,001	2,313,333
	84.47	3.17	11.54	0.82	100.00
13	1,949,935	98,581	368,785	45,840	2,463,141
	79.16	4.00	14.97	1.86	100.00
14	1,775,279	110,565	409,058	87,678	2,382,580
	74.51	4.64	17.17	3.68	100.00
15	1,581,938	150,297	416,244	173,852	2,322,331
	68.12	6.47	17.92	7.49	100.00
16	1,128,323	135,188	655,946	365,028	2,284,485
	49.39	5.92	28.71	15.98	100.00
17	731,807	106,346	814,622	495,454	2,148,229
	34.07	4.95	37.92	23.06	100.00
Total	22,801,764	855,928	4,655,113	1,200,787	29,513,592
	77.26	2.90	15.77	4.07	100.00

Table 5. Design Consistent Total and Percentage of Children by Outcome and by Age of Child, Philippines, 2008

Age of Child	Study/Work Outcome				Total
	Study Only	Study and Work	Neither Study Nor Work	Work Only	
5	1,330,206	1,733	690,505	1,018	2,023,463
	65.74	0.09	34.12	0.05	100.00
6	1,759,824	5,023	297,362	1,376	2,063,585
	85.28	0.24	14.41	0.07	100.00
7	2,113,828	13,933	99,932	2,572	2,230,265
	94.78	0.62	4.48	0.12	100.00
8	2,306,511	27,114	64,859	4,613	2,403,096
	95.98	1.13	2.70	0.19	100.00
9	2,148,975	33,715	47,617	6,851	2,237,158
	96.06	1.51	2.13	0.31	100.00
10	2,370,466	55,514	57,172	8,328	2,491,480
	95.14	2.23	2.29	0.33	100.00
11	2,163,517	64,225	55,672	11,846	2,295,260
	94.26	2.80	2.43	0.52	100.00
12	2,225,858	81,459	87,305	22,324	2,416,946

Table 5 continued...

	92.09	3.37	3.61	0.92	100.00
13	2,066,409	124,112	115,532	65,961	2,372,015
	87.12	5.23	4.87	2.78	100.00
14	1,877,235	108,012	169,707	116,839	2,271,794
	82.63	4.75	7.47	5.14	100.00
15	1,748,837	168,074	185,641	215,246	2,317,797
	75.45	7.25	8.01	9.29	100.00
16	1,411,891	155,659	339,078	353,331	2,259,959
	62.47	6.89	15.00	15.63	100.00
17	1,086,660	135,715	451,392	511,458	2,185,225
	49.73	6.21	20.66	23.41	100.00
Total	24,610,217	974,286	2,661,776	1,321,764	29,568,043
	83.23	3.30	9.00	4.47	100.00

To provide baseline statistics for the 2011 results to compare with, the author used the merged individual and household files of the 2008 public use raw data of APIS to come up with Table 5. When compared with Table 4, a rather alarming development was noted: the percentage of children attending school on a full-time basis dropped from 83.23% in 2008 to only 77.26% in 2011, and the percentage of idle children (not working and not attending school) increased, from 9.0% in 2008 to 15.77% in 2011. However, child labor, measured by the percentage of children engaged in the labor market full-time declined from 4.47% in 2008 to 4.07% in 2011. More distressing results provided by both APIS rounds may be seen in the two tables, and this concerns the plight of our 16- and 17-year-old children. In 2008, 15.63% of 16-year-old kids and 23.41% of our 17-year-old children are full-time workers. In 2011, the corresponding figures are almost the same—15.98% of 16-year-olds and 23.06% of the 17-year-olds are exclusively working. These figures imply that almost 4 out of every 10 Filipino full-time child laborers are either 16 or 17 years old.

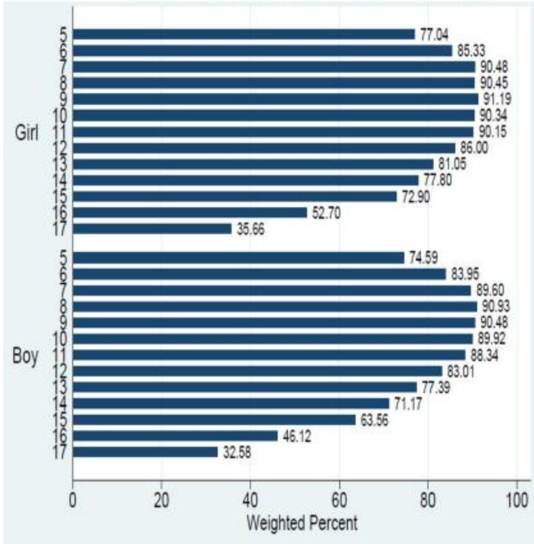

Figure 1. Outcome: Study Only, by Gender and Age

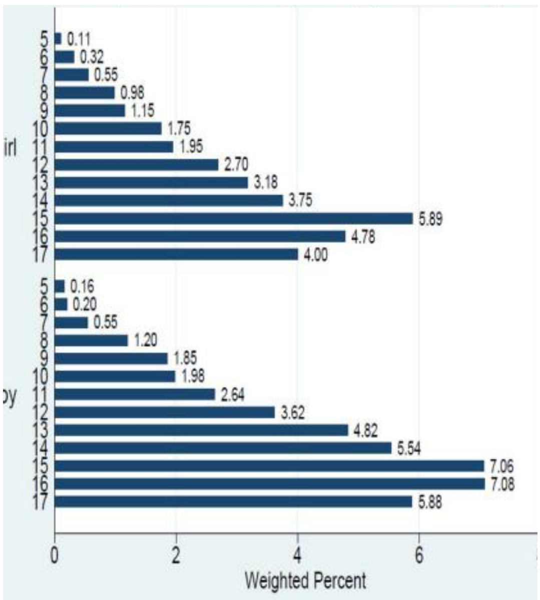

Figure 2. Outcome: Study and Work, by Gender and Age

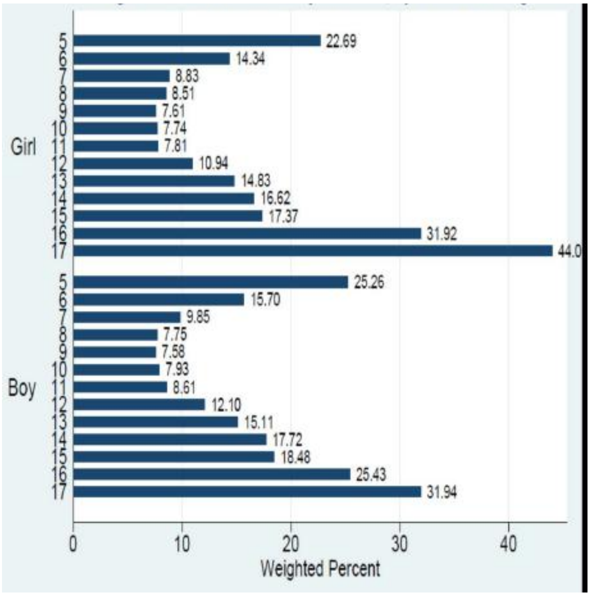

Figure 3. Outcome: No Study No Work, by Gender and Age

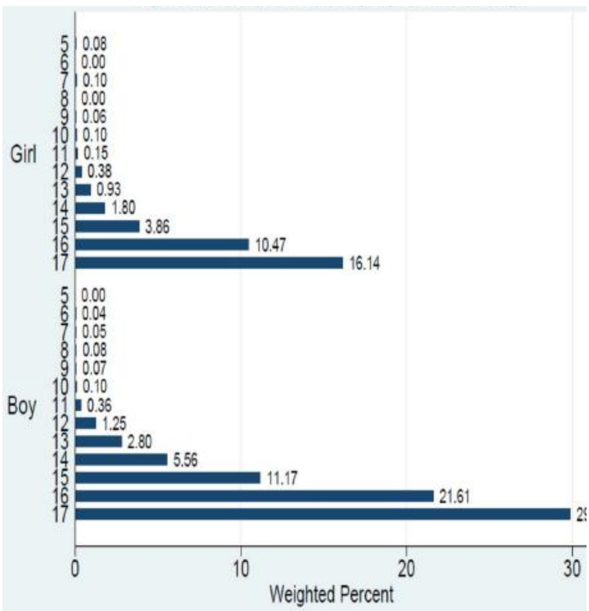

Figure 4. Outcome: Work Only, by Gender and Age

Results of the Multinomial Logit Model Estimation

When the empirical strategy presented in section 3 is implemented using the merged files of households and individual children, new insights can be gleaned about the continued relevance of the different correlates of child labor and child schooling. The results of the sampling-design-consistent implementation of maximum likelihood estimation of the multinomial logit model discussed in section 3 are summarized in Table 6 below.

The tabulated summary of the estimated model presents three equations. Both the estimated coefficients and relative risk ratios (RRR) together with their standard errors are presented in the table. For all equations, most of the explanatory variables are deemed significant at the highest conventional level ($\alpha = 0.001$). It is important to note that the *p*-values for the coefficients and the RRRs are identical inasmuch as the RRR is just the exponentiated value of the coefficient (i.e., RRR = exp [coefficient]). These estimates will give us valuable insights on the latest state of child labor and its correlates in the Philippines.

Table 6. Joint Estimation of the Schooling–Work Outcomes of Filipino Children Using Sampling-Design-Based Implementation of the Multinomial Logit Model

SVY: Multinomial Logit Regression	Population size = 29,513,592	Number of Jobs = 59,276
Age Group: 5–17 Years Old		
Base Outcome: Study Only (*j* = 0)	F(117, 59159) = 116.43 (p < 0.000000)	

Study and Work (*j* = 1)	Coefficient	Standard Error	RRR	Standard Error	*t*-Value	*p*-Value
Age of HHH***	0.315263	0.067222	1.370620	0.092136	4.69	0.0000
Age squared	0.001022	0.002768	1.001022	0.002771	0.37	0.7120
Child's sex***	0.452000	0.053275	1.571451	0.083719	8.48	0.0000
Child of HHH	0.142475	0.101935	1.153124	0.117544	1.40	0.1620
Child is married	-0.445428	0.816465	0.640550	0.522987	-0.55	0.5850
Family size	-0.024644	0.019824	0.975658	0.019341	-1.24	0.2140
Child is 6 to 12 years old	0.142085	0.147237	1.152674	0.169716	0.97	0.3350
No. of 6- to 12-year-olds in school*	-0.311966	0.149252	0.732007	0.109254	-2.09	0.0370
Total household expenditure per capita	-0.000003	0.000005	0.999997	0.000005	-0.55	0.5830
No. of household members in school*	-0.106914	0.049892	0.898603	0.044833	-2.14	0.0320

Table 6 continued...

No. of household members in elementary***	0.223865	0.055325	1.250902	0.069207	4.05	0.0000
No. of household members in high school***	0.230444	0.054683	1.259159	0.068854	4.21	0.0000
Sex of HHH	-0.153018	0.111516	0.858115	0.095693	-1.37	0.1700
Age of HHH	-0.002137	0.003258	0.997865	0.003251	-0.66	0.5120
HHH is married	-0.096492	0.112332	0.908017	0.101999	-0.86	0.3900
HHH has low education***	0.249571	0.061716	1.283475	0.079211	4.04	0.0000
HHH has high education***	-0.486382	0.117101	0.614847	0.071999	-4.15	0.0000
HHH is working***	1.034382	0.169316	2.813367	0.476348	6.11	0.0000
HHH is self-employed***	0.606808	0.056325	1.834567	0.103331	10.77	0.0000
Household has electricity***	-0.543846	0.062812	0.580511	0.036463	-8.66	0.0000
Poor household***	0.252910	0.066694	1.287768	0.085886	3.79	0.0000
Urban household***	-0.729406	0.076666	0.482195	0.036968	-9.51	0.0000
Ilocos***	-1.061134	0.226528	0.346063	0.078393	-4.68	0.0000
Cagayan Valley ***	0.956311	0.142059	2.602081	0.369649	6.73	0.0000
Central Luzon ***	-1.212582	0.228909	0.297428	0.068084	-5.30	0.0000
Bicol	-0.054362	0.142294	0.947089	0.134765	-0.38	0.7020
Western Visayas	0.116358	0.139640	1.123398	0.156871	0.83	0.4050
Central Visayas***	0.413002	0.136186	1.511348	0.205824	3.03	0.0020
Eastern Visayas	-0.182832	0.146665	0.832908	0.122158	-1.25	0.2130
Zamboanga Peninsula*	-0.332948	0.158758	0.716808	0.113799	-2.10	0.0360
Northern Mindanao***	1.313838	0.131659	3.720426	0.489829	9.98	0.0000
Davao**	-0.460014	0.172239	0.631275	0.108730	-2.67	0.0080
Soccsksargen*	0.345660	0.139885	1.412922	0.197646	2.47	0.0130
Metro Manila***	-1.113229	0.255431	0.328496	0.083908	-4.36	0.0000
CAR***	0.357838	0.149313	1.430234	0.213552	2.40	0.0170
ARMM***	-1.315171	0.181112	0.268428	0.048616	-7.26	0.0000
CARAGA***	0.994434	0.132994	2.703193	0.359509	7.48	0.0000
CALABARZON***	-0.977812	0.191973	0.376133	0.072207	-5.09	0.0000
_cons***	-8.136198	0.492218	0.000293	0.000144	-16.53	0.0000

Note. HHH = household head. *$p < 0.05$, **$p < 0.01$, ***$p < 0.005$.

Table 6 continued...

SVY: Multinomial Logit Regression	Population size = 29,513,592	
Age Group: 5–17 Years Old		
Base Outcome: Study Only (j = 0)	F(117, 59159) = 116.43 (p < 0.000000)	

Outcome: No Study, No Work (j = 2)	Coefficient	Standard Error	RRR	Standard Error	*t*-Value	*p*-Value
Age of HHH***	-1.607708	0.039043	0.200346	0.007822	-41.18	0.0000
Age squared***	0.084520	0.001776	1.088195	0.001933	47.58	0.0000
Child's sex***	0.100376	0.033669	1.105586	0.037224	2.98	0.0030
Child of hhh***	0.331861	0.054071	1.393559	0.075351	6.14	0.0000
Child is married***	2.406629	0.428397	11.096490	4.753702	5.62	0.0000
Family size***	0.434005	0.010181	1.543426	0.015714	42.63	0.0000
Child is 6 to 12 years old***	2.809570	0.065333	16.602770	1.084716	43.00	0.0000
No. of 6- to 12-year-olds in school***	-2.601705	0.069288	0.074147	0.005138	-37.55	0.0000
Total household expenditure per cap***	0.000016	0.000002	1.000016	0.000002	7.89	0.0000
No. of household members in school***	-2.280845	0.056540	0.102198	0.005778	-40.34	0.0000
No. of household members in elementary***	1.337682	0.059417	3.810201	0.226392	22.51	0.0000
No. of household members in high school	-0.000620	0.063368	0.999380	0.063329	-0.01	0.9920
Sex of HHH***	-0.342527	0.060322	0.709974	0.042827	-5.68	0.0000
Age of HHH***	-0.014632	0.001857	0.985474	0.001830	-7.88	0.0000
HHH is married	-0.026740	0.066107	0.973615	0.064363	-0.40	0.6860
HHH has low education*	-0.105432	0.043193	0.899936	0.038871	-2.44	0.0150
HHH has high education***	0.327792	0.050476	1.387901	0.070055	6.49	0.0000
HHH is working	-0.076541	0.056842	0.926315	0.052653	-1.35	0.1780
HHH is self-employed	0.005878	0.039917	1.005895	0.040152	0.15	0.8830
Household has electricity	-0.104270	0.054482	0.900982	0.049088	-1.91	0.0560
Poor household***	0.426049	0.047823	1.531196	0.073226	8.91	0.0000
Urban household***	0.160856	0.040425	1.174515	0.047480	3.98	0.0000
Ilocos	-0.044462	0.112314	0.956512	0.107430	-0.40	0.6920
Cagayan Valley	-0.039116	0.116745	0.961640	0.112267	-0.34	0.7380
Central Luzon	0.072877	0.100606	1.075598	0.108211	0.72	0.4690
Bicol	-0.140043	0.112468	0.869321	0.097770	-1.25	0.2130

Table 6 continued...

Western Visayas	0.076156	0.107076	1.079131	0.115549	0.71	0.4770
Central Visayas	-0.012508	0.105765	0.987570	0.104450	-0.12	0.9060
Eastern Visayas	-0.182233	0.116347	0.833407	0.096964	-1.57	0.1170
Zamboanga Peninsula	-0.157652	0.120052	0.854147	0.102542	-1.31	0.1890
Northern Mindanao *	-0.257440	0.120113	0.773028	0.092851	-2.14	0.0320
Davao	-0.096962	0.107784	0.907590	0.097824	-0.90	0.3680
Soccsksargen	0.015995	0.110170	1.016124	0.111946	0.15	0.8850
Metro Manila	-0.184017	0.103116	0.831922	0.085785	-1.78	0.0740
CAR	0.083078	0.116943	1.086626	0.127074	0.71	0.4770
ARMM***	0.659260	0.104568	1.933362	0.202168	6.30	0.0000
CARAGA	-0.031768	0.118689	0.968731	0.114977	-0.27	0.7890
CALABARZON	0.127175	0.099963	1.135615	0.113520	1.27	0.2030
_cons***	4.353495	0.235863	77.749730	18.338260	18.46	0.0000

Note. *$p < 0.05$, **$p < 0.01$, ***$p < 0.005$.

Outcome: Work Only (j = 3)	Coefficient	Standard Error	RRR	Standard Error	*t*-Value	*p*-Value
Age of HHH	0.343117	0.264249	1.409333	0.372415	1.30	0.1940
Age squared***	0.030099	0.009123	1.030556	0.009402	3.30	0.0010
Child's sex***	1.062317	0.060155	2.893065	0.174033	17.66	0.0000
Child of HHH***	0.270569	0.092614	1.310711	0.121390	2.92	0.0030
Child is married***	1.787166	0.440802	5.972503	2.632693	4.05	0.0000
Family size***	0.400063	0.015838	1.491919	0.023628	25.26	0.0000
Child is 6 to 12 Years Old***	2.306882	0.127497	10.043070	1.280463	18.09	0.0000
No. of 6- to 12-year-olds in school***	-1.648150	0.134073	0.192406	0.025796	-12.29	0.0000
Total household expenditure per cap***	-0.000038	0.000006	0.999962	0.000006	-6.45	0.0000
No. of household members in school***	-1.882495	0.068489	0.152210	0.010425	-27.49	0.0000
No. of household members in elementary***	1.009127	0.074544	2.743205	0.204488	13.54	0.0000
No. of household members in high school ***	-0.536073	0.077635	0.585041	0.045419	-6.91	0.0000
Sex of HHH	-0.108590	0.113032	0.897098	0.101401	-0.96	0.3370
Age of HHH***	-0.026475	0.003129	0.973872	0.003047	-8.46	0.0000
HHH is married***	-0.441800	0.108349	0.642878	0.069655	-4.08	0.0000

Table 6 continued...

HHH has low education***	0.467608	0.068405	1.596171	0.109187	6.84	0.0000
HHH has high education***	-0.530461	0.123529	0.588334	0.072677	-4.29	0.0000
HHH is working***	0.469855	0.124671	1.599763	0.199444	3.77	0.0000
HHH is self-employed***	0.224487	0.061247	1.251680	0.076661	3.67	0.0000
Household has electricity***	-0.508426	0.072619	0.601442	0.043676	-7.00	0.0000
Poor household***	0.283822	0.072471	1.328196	0.096255	3.92	0.0000
Urban household***	-0.387191	0.068078	0.678962	0.046223	-5.69	0.0000
Ilocos	-0.218612	0.170786	0.803634	0.137249	-1.28	0.2010
Cagayan Valley	0.315270	0.164225	1.370629	0.225092	1.92	0.0550
Central Luzon ***	-0.605047	0.160599	0.546049	0.087695	-3.77	0.0000
Bicol	-0.287287	0.157632	0.750296	0.118271	-1.82	0.0680
Western Visayas	-0.179192	0.155233	0.835946	0.129766	-1.15	0.2480
Central Visayas	-0.208629	0.153461	0.811696	0.124564	-1.36	0.1740
Eastern Visayas	-0.155381	0.156018	0.856089	0.133565	-1.00	0.3190
Zamboanga Peninsula	-0.077622	0.164698	0.925314	0.152397	-0.47	0.6370
Northern Mindanao	0.231486	0.166106	1.260471	0.209371	1.39	0.1630
Davao	-0.583221	0.163504	0.558098	0.091252	-3.57	0.0000
Soccsksargen	-0.093220	0.152389	0.910993	0.138826	-0.61	0.5410
Metro Manila***	0.916630	0.213433	0.399864	0.085344	-4.29	0.0000
CAR	0.010190	0.181169	1.010242	0.183025	0.06	0.9550
ARMM***	-0.554154	0.157087	0.574558	0.090256	-3.53	0.0000
CARAGA	0.277619	0.160937	1.319984	0.212434	1.73	0.0850
CALABARZON***	-0.493274	0.160086	0.610624	0.097752	-3.08	0.0020
Constant***	-12.468450	1.906302	0.000004	0.000007	-6.54	0.0000

Note. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.005$.

The following are some of the interesting results implied by the estimated equations. All statements are "ceteris paribus" and with reference to the base option of studying full time ($j = 0$). In all equations, the coefficients of the gender dummy is significantly positive implying that boys are more likely than girls to specialize in working full-time, combine work with study, or be idle (neither working nor studying). But among these outcomes, boys are highly more likely than girls to be working full-time, as evidenced by the odds ratio or RRR of 2.8931 (which means boys are almost 3 times more likely than girls to choose the work only option over the study only option, "ceteris paribus").

Older children are more likely to combine schooling with work than younger children, whereas younger children are more likely to take the option of being idle (neither studying[2] nor working). Married children are highly likely to be either full-time workers or be idle. Married children are about 6 times more likely to be a full-time worker than unmarried children and are about 11 times more likely to be idle (just at home) than unmarried children. The former is intuitively appealing in the case of male children and the latter in the case of female children, as males support while females care for their children.

When family size increases by one additional member, the odds of children working full-time and those who are just staying at home increase. For those combining school and work, family size does not matter. Marginal increase in per capita household expenditure tends to decrease the likelihood of children to become full-time workers (j = 3) but increases the odds of becoming idle children (j = 2).

The presence of young children (6 to 12 years old) in the households appears to be a very important factor for idle children (with RRR = 16.6) not to study full-time or for those working full-time to remain in that state (with RRR = 10.04) than studying full-time. This result validates the "taking care of younger sibling" (Mancorda, 2006) and the "supporting younger sibling" (Villamil, 2002) suggestions, respectively. Complementary to these findings are the highly significant and positive coefficients and greater-than-1 RRRs in all equations for the "number of household members in elementary school" variable.

The estimated coefficients and odds ratios (RRRs) for the basic demographics of the household head (age, sex, and marital status) in all equations are not supportive of the "strong authority" expectation for Filipino household heads with regard to the education and labor market entry of their children. However, household heads' educational attainment appears to have strong bearing on these decisions. Lower educated heads are more likely to exert parental/guardian authority on children working full-time to continue working full-time, while higher educated heads of idle (no work, no study) children are more likely to persuade their wards to remain idle, rather than study full-time, perhaps to take care of younger siblings or help in the family enterprise.

Adequate supply of electricity in the household discourages children to work either full-time (j = 3) or part-time (j = 1). This result is intuitive since electricity connection is a signal of the family's capability to send children to school. The linkage of poverty and child labor (as it interacts with education) is adequately supported by the results of the study. All coefficients of the dummy variable "poor" in all equations are positive and extremely significant

($p < 0.001$) with odds ratios higher than unity in all study–work outcomes. This implies that children of poor households tend to specialize more on any of the three study–work outcomes than be full-time students "ceteris paribus," in a way validating the Basu and Van (1998) luxury axiom.

Household's engagement in self-employment activities may render children to be highly likely to combine work with study, The odds ratio of 1.8346 implies that these children are 1.8346 times more likely to be working part-time than children of households which are not engaged in self-employment enterprises. For equation $j = 2$ (idle children), the odds ratio is significant at RRR = 1.2517. These results are in support of the Edmonds and Turk (2004) findings.

Urbanization increases the likelihood of children become idle ($j = 2$) but decreases the probability of combining work with study ($j = 1$), with RRR of 1.1745 and 0.4822, respectively. Urbanity of the place of residence of the child however has nothing to do in his/her choice of working full-time ($j = 3$).

The equations reveal the presence of significant regional effect on the likelihood of children to be in the different study–work outcomes. But this locational effect appears to be stronger in the study-and-work outcome ($j = 1$) with 13 regional coefficients significant, than the work-only outcome ($j = 3$), which has 5 significant coefficients, and the no-work–no-study outcome ($j = 2$) with only 2 significant regional dummy variable coefficients.

Summary and Conclusions

Education has always been viewed as a pillar in national development and a primary basis for social and economic mobility. The constitution guarantees the right to education of every Filipino, and landmark legislations (R.A. 6655 and R.A. 9155) have been implemented to provide Filipino children, in particular, free and compulsory education in the elementary and high school levels. Yet, despite these actions of the state, not to mention the long list of policy interventions to see to it that all Filipino children are studying full-time, the phenomenon of child labor remains to be an enduring social malady over the years.

This study is an attempt to contribute to the effort of providing policy makers with timely and relevant insights and descriptive information that would help in crafting action plans or legislations that would effectively curb, if not minimize, the problem of child labor in the country. It employs the latest available public-use raw data files of the recently available Annual Poverty Indicator Survey (2011 round) to simultaneously model the behavior of Filipino children with respect to their decisions on choosing any of the four permutations of studying or working (study only, study and work, no study and no work, and work only), which represent the mutually exclusive and exhaustive options open for every Filipino child.

A value-added feature of this study is the use of survey-design-consistent estimation procedures, which are implemented on the descriptives and the primary model itself to obviate the possibility of biased and inconsistent inferential results if equal weighing of observations (as in SRS) is used. This adjustment is also seen as a move to mitigate the expected onset of heteroscedasticity that may compromise inference.

The primary result of the study is somewhat revealing particularly the stylized facts generated by design-consistent estimation. The estimated proportion of children who are full-time students of 0.7726 in 2011 is a lot smaller than the figure of 0.8323 in 2008. The proportion of idle children in 2011 was estimated at 0.1577, which was only 0.0900 in 2008. This set of figures is indicative of the presence of a problem serious enough to be a target for policy intervention. The study also uncovered the plight of the 16- and 17-year-old Filipinos: that despite the guarantee by the state for free and compulsory elementary and high school education, only 49.39% of the 16-year-olds and 34.07% of the 17-year-olds are studying full-time, whereas 15.98% of the 16-year-olds and 23.06% of the 17-year-olds are full-time workers, putting the incidence of child labor among the 16- to 17-year-old age group at 39.04% in 2011.

The likelihood of Filipino children in choosing the various categorical study–work options available to them truly varies with the elements of the vectors of global attributes we posited. The confrontation of the survey data and the *multinomial logit model* we constructed adequately supplied the empirical content to these theoretical covariations. Among the most significant and intuitively appealing covariates uncovered by this study are the following: *age of the child, gender of the child, the child being married, family size, per capita household expenditure, the presence of younger children (6 to 12 years old) in the household, the number of younger children (6 to 12 years old) studying, household head's educational attainment, provision for electricity to the household, household's engagement in self-employment activities, urbanization, regional location, and most importantly the poverty status of the household*.

Contrary to the predictions of certain strands in the literature regarding the influence of the basic demographics of household head (age, sex, and marital status) on the child's schooling–work choices, the study found no significant influence of such factors.

Notes

[1] The funding support of the Angelo King Institute (AKI) of DLSU School of Economics is greatly appreciated

[2] The reasons for the child not being in school are available in the survey but not analyzed to avoid complications.

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7

The Pattern of Consumption for Food Away From Home (FAFH) of Modern Filipino Households

Cesar C. Rufino

Food has traditionally been the top priority item in any household's consumption basket. Whether consumed at home or outside the home, households usually apportion about half of their total budget on food. In the modern times however, because of the shifting consumer preferences and dramatic growth in income, especially in the cities, there has been a remarkable change in household's food consumption patterns. In the Philippines, the proliferation of vast arrays of food service facilities such as conventional full-service and fast-food restaurants, coffee shops, food courts, roadside stalls, canteens, delicatessens, etc., together with improved purchasing power, growing time constraints among household members and incessant bombardment of promotional ads across various media collectively create a strong impetus among Filipinos to "eat out." The result may be a steady convergence of the proportion of food eaten at home (FAH) and the proportion of food eaten away from home (FAFH).

The issue of the increasing importance of FAFH has not been a priority area among local researchers and policy makers as there is an obvious dearth of research studies, executive and legislative concerns related to it.

This apparent oversight induced the researcher to propose a study that will empirically and analytically examine available nationwide household survey data (Family Income and Expenditure Survey [FIES]) undertaken during the period 2003–2012, in search for the answer to the following research question:

> "To what extent has the emergence of the modern Filipino society brought about significant changes in the household consumption patterns on food particularly in their behavior in spending on food away from home?"

In pursuit of the above research agenda, the study aims to achieve the following specific objectives:

1. To determine through appropriate descriptive methods whether there really is a growing convergence between FAH and FAFH over time;
2. To establish survey-design-consistent stylized facts on important household consumption indicators and statistics with regards to FAH and FAFH;
3. To analytically determine the different factors (socio-demographic, locational and economic) that shape household decision in allocating budget for FAFH;
4. To examine the continued relevance (or statistical regularity) of the theoretical predictions of Engel's law on FAFH during the modern era; and,
5. To establish statistically and econometrically adequate estimates of FAFH elasticity relevant to policy making among the following stakeholders: *food industry experts/analysts, entrepreneurs, marketing managers, agribusiness analysts, fitness and health experts, academicians, legislators, fiscal planners*, *medical professionals*, etc.

Review of Literature

Empirical research on consumption of food away from home (FAFH) is widely developed in the international economic literature. Various angles of the phenomenon (e.g., behavioral patterns, fitness and nutrition, visit frequency, role of time constraint, food security, commercialization, type of meals and facilities, etc.) have been scrutinized in different country settings with wide-ranging policy implications. These studies are mostly concerned with the determination of the various social, demographic, and economic factors that promote dining out that boost away-from-home food spending (in the United States: e.g., Byrne et al., 1998; Binkley, 2008; McCraken & Brandt, 1987; Guthrie et al., 2002; in Malaysia: e.g., Tey et al., 2009; Radam et al., 2006; in China: e.g., Ma et al., 2005; Min et al., 2004; and Fang & Beghin, 2002; in Spain: e.g., Molina, 1994, and Manrique & Jensen, 1998).

Almost all of the published works on FAFH employ large-scale household survey data; however, the researcher did not find any study in the literature searched that employed survey-design-consistent estimation techniques, as well as the existence of any study that features the Philippines.

Much of the early literature on FAFH has been descriptive in nature, e.g., LeBovit (1967), Manchester (1977), Van Dress (1980). Succeeding researchers recognized the importance of rigorous economic foundation to the analysis of eating out behavior of households. Most of these authors cite the work of Becker (1965) and Prochaska and Schrimper (1973) in justifying their inclusion of the different factors that shape households demand for FAFH. In particular, the framework proposed by Becker stresses the allocation of household time between market and nonmarket activities, making the inclusion of those variables that put value on household time important (see McCracken & Brandt, 1987; Kinsey, 1980; Capps, Jr., et al., 1985; Prochaska & Schrimper, 1973; Redman, 1980).

Using causal research designs, studies on the FAFH almost exclusively employed OLS estimation prior to the study of McCracken and Brandt (1987), who saw the importance of the heavy censoring needed for observations with zero consumption incidence on FAFH (which are rather numerous in varied settings). Insisting on the use of least-squares methods will render results to be both biased and inconsistent as shown in other applications and the theoretical literature. Succeeding researchers on FAFH took heed, by using either the Tobit or the Heckman models to address selectivity bias or other techniques like count and duration models when frequency of FAFH incidence during the reference period is being modeled (e.g., Dong et al., 2000). When zero FAFH consumption is seen to be due to purchase infrequency, especially when reference period is as short as weekly, the Box–Cox double hurdle model is applied (e.g., Yen, 1993; Shonkwiler & Yen, 1999). However, estimation biases may still linger when the complexity of the sampling design of the underlying survey is ignored (Deaton, 1997; Heeringa et al., 2010; Haughton & Haughton, 2011) in studies that employ large-scale survey data.

Evidence on the applicability of the Engel's law on FAFH consumption has also been investigated in the literature, particularly in the United States (see Byrne et al., 1996; Yen, 1993; McCracken & Brandt, 1987; Holcomb et al., 1995) by showing that FAFH is a necessity, through the estimated magnitudes of the expenditure elasticities using various functional specifications of Engel curves. Most of the studies on Engel curves of FAFH use the Working–Leser form, estimated through the Heckman two-stage procedure (selection stage and consumption stage) to address selectivity issues in consuming FAFH (see Heien & Wessells, 1990; Tey et al., 2009).

Gaps in the Literature

The proposed study is expected to fill yawning gaps in the literature revealed by our brief survey, which are the following:

1. The lack of empirical study on Filipino households' consumption pattern of FAFH, and
2. The dearth of empirical works that employ survey-design-consistent methodologies in inference vis-à-vis FAFH.

Methodology

Incorporating the Sampling Design of the Survey in Inference

It has been one of the goals of this study to compute parameter estimates of the models together with the necessary descriptive measures and standard errors with full consideration of the complex design of the survey. This is made clear at the onset since the proponent would like to distinguish this study from most statistical investigations that employ survey data. More often than not, statistical inferences in most of these researches are done with the assumption that the data collection is undertaken using simple random sampling (SRS) without replacement (Heeringa et al., 2010, pp. 18), with the elements of the target population having equal chance of being included in the sample. Although computationally convenient and conforming with the i.i.d. requirement of most econometric softwares, this procedure is theoretically flawed when complex design was used in the survey (Deaton, 1997).

The main data source of the study, the FIES in particular employs a multistaged stratified sampling design aimed at economizing on the sample size without sacrificing the precision of the sample representation. As a consequence, each population element has different probabilities of inclusion in the sample. As such, there is a need to take into consideration the use of sampling weights (sometimes called raising factors), which represent the inverse of the selection probabilities for each sample element (Cochran, 1977).

These sampling weights are needed to correct for differential representation and the effect of the sampling design on the estimates and their respective standard errors (Deaton, 1997; Haughton & Haughton, 2011). This will ensure the unbiasedness and consistency of the estimates, resulting in better inference.

Theoretical Framework

According to the household production theory proposed by Becker (1965), purchases of certain items being consumed by households are influenced by traditional factors like prices, income, demographic characteristics of the household, and nontraditional influences like life stages and time constraints faced by household members. This extension of the traditional demand theory can be adopted in the analysis of FAFH by representing the associated demand function (either amount consumed or budget share) of FAFH as a function of the usual demand determinants plus other factors in the context of Becker (1965) and Prochaska and Schrimper (1973), emphasizing the value of household time in the preparation of home-consumed food items and those related to the opportunity cost of household member's time or foregone earnings. Such demand function/s is/are supposed to be the steady-state solution to the first order condition of the household's budget and time-constrained utility maximization problem. The arguments concerning the existence of such solution was articulated and convincingly demonstrated by Becker (1965) and the resulting theoretical demand function has been empirically adopted in numerous consumer demand studies on FAFH (e.g., Kinsey, 1980; Capps, Jr., et al., 1985; Prochaska & Schrimper, 1973; Redman, 1980; McCracken & Brandt, 1987).

Empirical Strategy

In this study, two alternative empirical modeling frameworks are to be implemented to operationalize the household production theory in the context of household demand for FAFH. The first model (Tobit model) presumes the household as a utility maximizing entity subject to both budget and time limitations and makes a one-time decision of simultaneously deciding to consume FAFH and determining the amount to be consumed, with the Tobin (1958) maximum likelihood procedure as the basis of parameter estimation. The second is anchored on the framework originally proposed by Cragg (1971) that consumption of items with less than perfect consumption incidence like FAFH is a double-hurdle process of deciding to consume and how much to consume. The framework of Tobin attributed zero consumption to consumers' attributes alone, not on the infrequency of purchases, which may be due to other reasons (e.g., abstention, budget restriction, under reporting). When considered as a double-hurdle process, the Tobit model presupposes the same set of explanatory factors in both the decisions to consume (the first hurdle) and how much to consume (the second hurdle). In the case of the double-hurdle process of Cragg, the sets of explanatory variables for the first and the second hurdles are not constrained to be the same (Cameron & Trivedi, 1998). In order to observe positive consumption, both hurdles must be surmounted. When one assumes that the two hurdle processes are dependent, the original model of Cragg (1971) may not be appropriate for use in the present study, but instead, the framework proposed by Heckman (1979), which also treats censoring as a sample selection issue addressed by the double-hurdle process, may be. Also, instead of estimating the FAFH demand equation in the second hurdle, the FAFH Engel curve under the Working–Leser specification is estimated.

Under the Heckman procedure (Heckman, 1979), the first hurdle (participation stage) uses the Probit model to determine the probability of the household to decide consuming FAFH, while the second hurdle (consumption stage) models the actual budget formation process through the Working–Leser specification of the FAFH Engel curve, augmented by a sample selection adjustment term generated in the participation stage. The Tobit and Heckman models differently address the sample selectivity issues surrounding the consumption of FAFH that may bias inferences to be made.

The Tobit Model (Tobin, 1958)

Prior to McCraken and Brandt (1987), studies involving empirical analyses of FAFH almost exclusively used single equation *ordinary least squares (OLS)* regression, which has been proven to be both *biased and inconsistent* because of the large number of households not consuming FAFH. The use of the Tobit model (also known as censored regression model) in FAFH analysis was pioneered by McCracken and Brandt (1987) to preclude this concern on OLS. The empirical form of the model is the usual regression specification (whose population regression function is supposedly a solution to the first order condition of the household's utility maximization problem subject to budget and time constraints, anchored on the theory of household production, outlined by Becker [1965]).

$$FAFH_h = \kappa_1 + \kappa_2 ' D_{1h} + \kappa_3 ' L_{1h} + \kappa_4 ' E_{1h} + u_h \quad (1)$$

where the household h^{th} *FAFH* consumption is left censored at zero for households who do not “eat out” as determined by vectors D_1 (*household’s* *sociodemographic characteristics vector*), L_1 (*household's geographical location vector*), and E_1 (*household's economic attributes vector*). The subscript of the attribute vectors pertain to the single-hurdle nature of the Tobit model. To account for this censoring, the Tobin (1958) maximum likelihood procedure (whose likelihood function is based on the censored normal distribution) is used in the parameter estimation.

The Heckman Model (Heckman, 1979)

In this model, it is presumed that consumption of FAFH is characterized by a two-stage decision process. The first stage is deciding whether or not to consume FAFH, called the participation stage. The next decision stage is in determining the budget share (or the proportion of income allocated) for the consumption of FAFH—the consumption stage. The Heckman model is employed in this study to implement the estimation of the FAFH Engel curve.

Stage 1. This is the so-called *participation stage*: Let $Y_h = 1$ if household *h* decides to consume FAFH, 0 if otherwise. The conditional probability

$$P(Y_h = 1 \mid \mathrm{D}_{ph}, \mathrm{L}_{ph}, \mathrm{E}_{ph}) = \Phi(\alpha + \lambda'\mathrm{D}_{ph} + \gamma'\mathrm{L}_{ph} + \delta'\mathrm{E}_{ph}) \qquad (2)$$

is the participation probability of the household *h* given its demographic, locational, and economic attributes. The Probit model is used to estimate the intercept α and the parameter vectors λ, γ, and δ via MLE with $\phi(.)$ and $\Phi(.)$ are the *pdf* (probability density function) and *CDF* (cumulative distribution function), respectively, of the standard normal curve. The inverse Mills ratio

$$MR_h = \phi(\hat{z}_h)\, \widehat{\Phi}_h^{-1}(\hat{z}_h) \qquad (3)$$

with $\hat{z}_h = \hat{\alpha} + \hat{\lambda}' D_{ph} + \hat{\gamma}' L_{ph} + \hat{\delta}' E_{ph}$ (the estimated Probit index function value) is generated for each household to correct for the sample selectivity bias in the expenditure stage. The additional subscript *p* of the attribute vectors pertains to the "participation" stage.

Stage 2. This is the so-called *consumption stage*. Estimate the model

$$FAFHShare_h = \kappa_1 + \kappa_2' D_{ch} + \kappa_3' L_{ch} + \kappa_4' E_{ch} + \beta MR_h + u_h \qquad (4)$$

using GLS for all uncensored observations to come up with the estimated FAFH Engel curve equation using the Working–Leser functional specification. This stage features the augmentation of the Engel curve equation by the inverse Mill's ratio MR_h as an additional regressor to correct for the sample selectivity bias. The additional subscript c of the attribute vectors pertains to the "consumption" stage.

The Working–Leser Engel Curve Model

The traditional approach in estimating Engel curves using cross-section data is based on full-system parametric models that simultaneously consider the income expansion paths of all items in the consumption basket. The most common specifications are the Almost Ideal Demand System (Deaton & Muellbauer, 1980) and the linear expenditure system (Stone, 1954)—favored by researchers because of their representative agent and exact aggregation properties; the main drawback of these models however has been the recurrent problem of model misspecification (see Deaton & Muellbauer, 1980; Molina, 1994). Working (1943) proposed a log-linear budget share specification, which eventually became known as the Working–Leser model, since Leser (1963) found that this functional form fits better than most full-system and single-equation alternatives. The popularity of the Working–Leser model among modern consumer demand researchers is its nonlinear form and its more direct basis of classifying consumption items as either necessity or luxury to supply the empirical content to the predictions of Engel's law.

The basic Working–Leser Engel curve presents the budget share of j^{th} consumption item as a semi logarithmic function of household's income:

$$S_{hj} = \alpha_j + \zeta \log(Y_h) + u_{hj} \tag{5}$$

where S_{hj} is the budget share of the j^{th} item for the h^{th} household and Y_h is the income of the h^{th} household.

The relationship being represented by an Engel curve is that of consumption (budget allocation) and income. However, households' consumption patterns also respond to sociodemographic and geographic location (both regional and urbanization) of the households, hence specification (5) can be augmented as

$$S_{hj} = \alpha_j + \zeta \log(Y_{hj}) + \gamma_j^{'} X_{hj} + u_{hj} \tag{6}$$

with X_{hj} as the composite vector of sociodemographic, economic, and locational characteristics of the h^{th} household influencing the budget share for the j^{th} consumption item, with corresponding parameter column vector γ_j. The Working–Leser curve (6) is the specification implemented in Stage 2 of the Heckman procedure.

Working–Leser Elasticity Estimation

The income elasticity of FAFH consumption is the economic relationship coefficient of interest in this study. Using specification (6), this elasticity can be shown to be represented by the formula (see Rufino, 2013)

$$\hat{\varepsilon}_{S_{j|Y}} = \frac{\partial S_{hj}}{\partial Y_h} \frac{Y_h}{S_{hj}} = 1 + \frac{\hat{\zeta}}{\bar{\bar{S}}_j} \tag{7}$$

The algebraic sign, as well as the magnitude of the income elasticity estimates, will be the basis of ascertaining whether FAFH consumption by modern Filipinos may show evidence of subscribing to the predictions of Engel's law.

Data

The public use file of the FIES 2012, which is the survey's latest available round from the National Statistics Office (NSO), is considered as the primary database of the study as it deems to represent the modern period. The raw data files of earlier rounds of FIES (2009, 2006, 2003) are also used to account for the dynamic nature of FAH and FAFH consumption. Sampling-design-consistent stylized facts on the different eras are generated to give policy makers unbiased and consistent descriptive scenarios on how the pattern of food consumption away from home among Filipinos evolves over time. Design-consistent estimates of all analytical models in the study are likewise generated.

Empirical Results

Descriptive Statistics

Based on the 2012 FIES survey round, 89.61% of Filipino households consumed FAFH (from a figure of just 75.43% during the previous round of

2009). This pattern of consumption is noted to be monotonically increasing (67.03% in 2003 and 71.66% in 2006), which unmistakably represents an interesting behavioral shift in the manner modern Filipino families are consuming food. Using survey-design-consistent estimation, the evolution of this behavioral pattern is summarized graphically in Figure 1, showing the budget shares of the household total expenditures devoted to food consumption, food consumption at home (FAH), and food consumption away from home (FAFH).

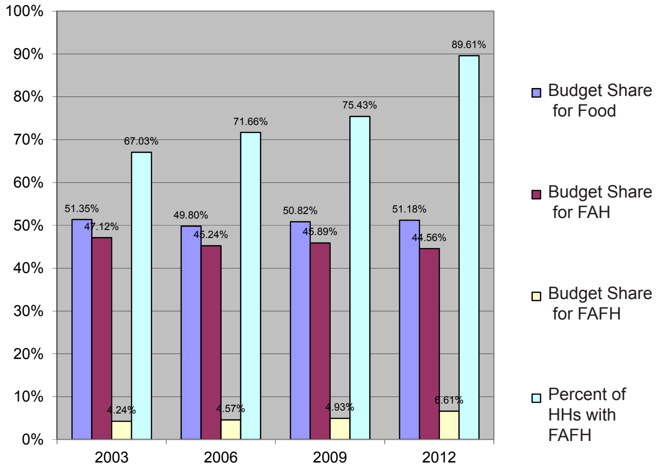

Figure 1. Evolution of budget shares of FOOD, FAH, FAFH, and proportion of households with FAFH, Philippines: 2003, 2006, 2009, and 2012.

The bar graphs of Figure 1 show the relatively slow convergence of the shares FAH and FAFH of the household budget during the earlier FIES survey rounds, with FAH going down and FAFH going up: 40.96% in 2009, 40.67% in 2006, and 42.88% in 2003 for FAH; and 4.93%, 4.57%, and 4.24%, respectively, for 2009, 2006, and 2003. In 2012, however, the percent gap of these food consumption categories reached its narrowest at 37.95%. This narrowing difference in the propensities of families to consume FAH and FAFH is replicated in most regions of the country, particularly those with highly urbanized locales, namely, Region 13 (Metro Manila), Region 41 (CALABARZON), and Region 3 (Central Luzon).

The statistics presented in Figure 1 are extracted from Table 1, which features along with the budget shares design-consistent statistics on the per capita total household expenditure, total food expenditure, FAH, and FAFH, as well as the per-household average expenditures on food, FAH, and FAFH. These statistics for the different FIES rounds are pictorially presented in Figure 2. Based on the data presented in Table 2, FAFH *per capita* registered the highest continuously compounded[1*] annual growth at **9.19%** over the period 2003–2012, followed by FAFH *per household* at **8.59%** per year. FAH per household is growing at the slowest pace at 4.20% per year, followed by FAH per capita at 4.41% per annum. The remarkable growth in FAFH consumption and the slower rate of increase in FAH consumption by Filipino households suggest convergence in the consumption incidence of these food categories.

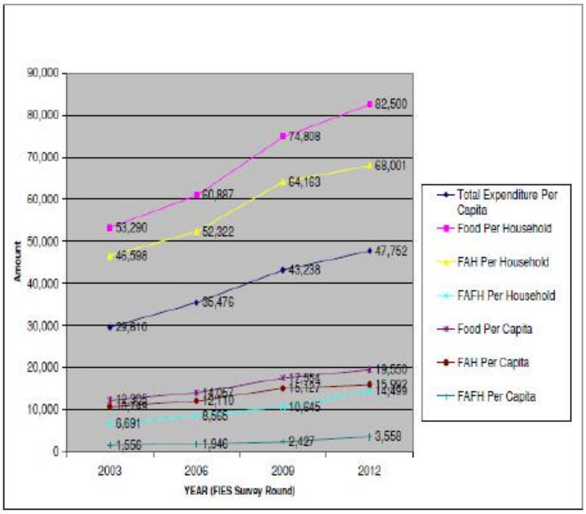

Figure 2. Weighted mean estimates of the food, FAH, and FAFH expenditures per household and per capita figures on total, food, FAH, and FAFH Expenditures, Philippines: 2003, 2006, 2009, and 2012.

The regional weighted mean and median consumption of FAFH per household are presented graphically for the years 2003, 2006, 2009, and 2012 by Figures 3 to 6. These graphs highlight the importance of the differences in regional location of the households in explaining the variations in FAFH consumption; the more progressive and urbanized the region, the higher the expenditure of FAFH by the households. This phenomenon is heavily supported in the literature (e.g., Ma et al., 2006; McCracker & Brandt, 1987; Nayga & Capps, Jr., 1992).

Table 1. Design-Consistent Mean Estimates of Food, FAH, and FAFH Consumption, 2003 to 2012

2003	Mean	Linearized Standard Error	95% Confidence Interval		2006	Mean	Linearized Standard Error	95% Confidence Interval	
Totex PC	29,610.19	186.51	29,244.64	29,975.75	Totex PC	35,475.63	372.92	34,744.16	36,207.09
Food	53,289.58	187.78	52,921.52	53,657.64	Food	60,887.04	350.43	60,199.69	61,574.39
FAH	46,598.46	146.78	46,310.75	46,886.16	FAH	52,321.92	283.77	51,765.33	52,878.51
FAFH	6,691.12	65.87	6,562.02	6,820.23	FAFH	8,565.12	113.14	8,343.20	8,787.04
Food PC	12,304.94	44.71	12,217.30	12,392.58	Food PC	14,056.59	85.67	13,888.55	14,224.64
FAH PC	10,748.53	34.18	10,681.53	10,815.53	FAH PC	12,110.39	66.63	11,979.69	12,241.09
FAFH PC	1,556.41	18.29	1,520.56	1,592.26	FAFH PC	1,946.21	30.70	1,885.98	2,006.43
Food Share	51.35%	0.07%	51.21%	51.49%	Food Share	49.80%	0.13%	49.55%	50.06%
FAH Share	47.12%	0.08%	46.96%	47.27%	FAH Share	45.24%	0.14%	44.97%	45.50%
FAFH Share	4.24%	0.03%	4.18%	4.30%	FAFH Share	4.57%	0.04%	4.48%	4.65%
With FAFH	67.03%	0.23%	66.57%	67.49%	With FAFH	71.66%	0.37%	70.94%	72.37%
2009	Mean	Linearized Standard Error	95% Confidence Interval		2012	Mean	Linearized Standard Error	95% Confidence Interval	
Totex PC	43,237.54	645.44	41,971.96	44,503.13	Totex PC	47,751.64	708.89	46,361.70	49,141.58
Food	74,808.35	608.71	73,614.80	76,001.90	Food	82,499.84	677.96	81,170.56	83,829.12
FAH	64,163.01	428.64	63,322.53	65,003.49	FAH	68,000.98	441.50	67,135.32	68,866.63
FAFH	10,645.34	228.89	10,196.54	11,094.14	FAFH	14,498.86	297.31	13,915.92	15,081.81
Food PC	17,554.29	151.26	17,257.68	17,850.89	Food PC	19,549.65	165.72	19,224.73	19,874.58
FAH PC	15,127.46	107.40	14,916.86	15,338.05	FAH PC	15,991.84	106.15	15,783.70	16,199.98
FAFH PC	2,426.83	56.38	2,316.27	2,537.39	FAFH PC	3,557.81	76.32	3,408.17	3,707.45
Food Share	50.82%	0.18%	50.47%	51.16%	Food Share	51.18%	0.18%	50.81%	51.54%
FAH Share	45.89%	0.22%	45.46%	46.31%	FAH Share	44.56%	0.23%	44.11%	45.01%
FAFH Share	4.93%	0.07%	4.79%	5.07%	FAFH Share	6.61%	0.08%	6.45%	6.78%
With FAFH	75.43%	0.47%	74.51%	76.36%	With FAFH	89.61%	0.33%	88.96%	90.25%

Table 2.Weighted Mean Consumption per Household and per Capita of Total Food, FAH, FAFH, and Incidence of FAFH, by Survey Rounds 2003–2012

Weighted Mean	2003	2006	2009	2012
Total expenditure per capita	29,610.19	35,475.63	43,237.54	47,751.64
Food consumption per household	53,289.58	60,887.04	74,808.35	82,499.84
FAH consumption per household	46,598.46	52,321.92	64,163.01	68,000.98
FAFH consumption per household	6,691.12	8,565.12	10,645.34	14,498.86
Food consumption per capita	12,304.94	14,056.59	17,554.29	19,549.65
FAH consumption per capita	10,748.53	12,110.39	15,127.46	15,991.84
FAFH consumption per capita	1,556.41	1,946.21	2,426.83	3,557.81
Budget share for food	51.35%	49.80%	50.82%	51.18%
Budget share for FAH	47.12%	45.24%	45.89%	44.56%
Budget share for FAFH	4.24%	4.57%	4.93%	6.61%
Percent of households with FAFH	67.03%	71.66%	75.43%	89.61%

Table 3. Annual Growth Rates (per Capita and per Household) of Total Expenditure and Food (Total and Consumed at Home and Away From Home)

Period	Totex per Capita	Food per Capita	FAH per Capita	FAFH per Capita	Food per Household	FAH per Household	FAFH per Household
2003	29,610	12,305	10,749	1,556	53,290	46,598	6,691
2012	47,752	19,550	15,992	3,558	82,500	68,001	14,499
Annual growth	5.31%	5.14%	4.41%	9.19%	4.86%	4.20%	8.59%

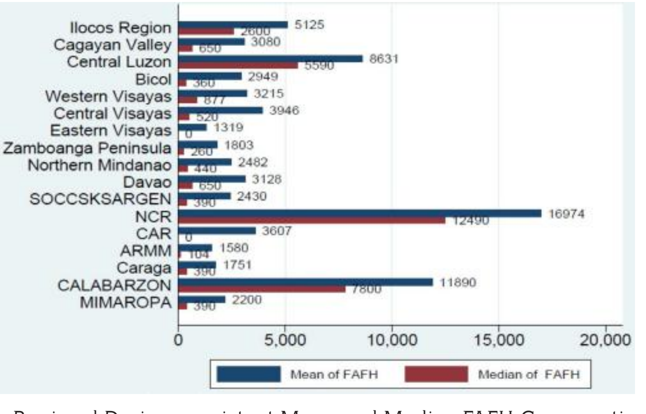

Figure 3. Regional Design-consistent Mean and Median FAFH Consumption, 2003.

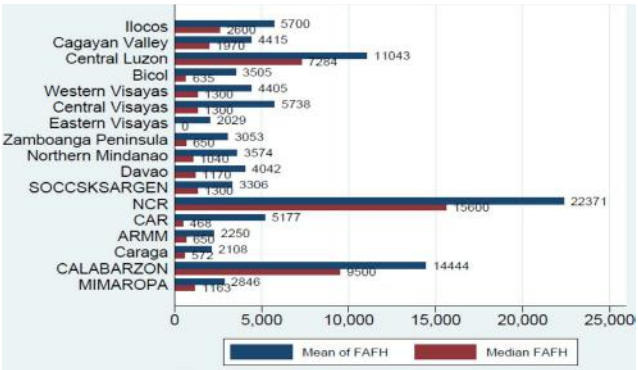

Figure 4. Regional Design-consistent Mean and Median FAFH Consumption, 2006.

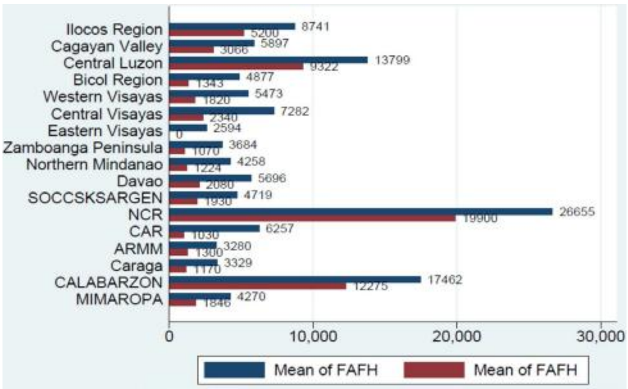

Figure 5. Regional Design-consistent Mean and Median FAFH Consumption, 2009.

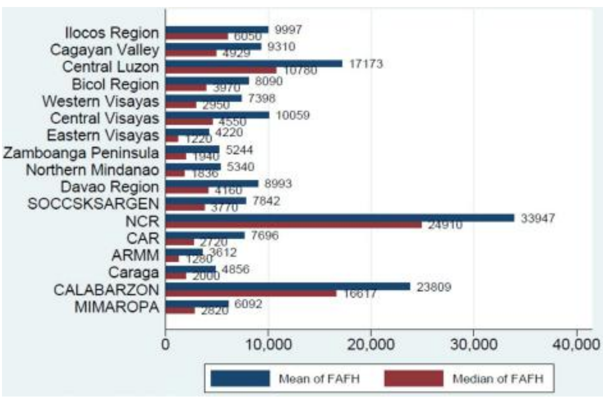

Figure 6. Regional Design-consistent Mean and Median FAFH Consumption, 2012.

Results of Tobit Modeling

Survey design-consistent estimates of the Tobit models for FAFH using the raw data files of the four rounds of FIES yielded four censored regression equations presented in Tables 4 to 7. The same sets of regressors are applied in each model to assess the dynamic impact of the variables on households' consumption of FAFH. The stylized facts on these variables are presented in Tables 8 and 9. These descriptive statistics are design-consistent and hence can be considered as unbiased and consistent estimates of their counterparts in the population. Interesting insights can be gleaned from these figures; for example, household purchasing power (income per household) is ever increasing over time by **5.13%** per year across survey rounds, reaching its peak at P234,615 per household in 2012 from P147,888 in 2003. Also worthwhile to note is the aging profile of household heads—from 46.2 years average in 2003 to 50.82 years in 2012, for an aging rate of about **1.06%** per year. Other stylized facts appear to be almost stationary over the time span of 2003–2012, with subtle dynamic variations.

Looking at Table 4, which presents the estimated Tobit model of FAFH consumption using the most recently available FIES raw data, the estimated demand equation for FAFH for the modern Filipino households takes shape. Some interesting significant covariations can be noted, other than those provided by the usual demand determinants like the household's income level and size of the family. For one, locational attributes of the households appear to be the most significant predictors. The dummy variables for the highly urbanized regions of Metro Manila, CALABARZON, and Central Luzon were deemed to provide the highest explanatory contribution to the level of FAFH consumption of the average Filipino household with respective marginal contributions of P21,029, P15,169, and P9,087 (all at $p < 0.0001$). When interpreted, FAFH consumption by the typical Metro Manila household is on the average P21,029 higher than that of Eastern Visayas (the benchmark region). Remarkably, some household demographics failed to produce significant explanatory impact, for instance, gender ($p > 0.90$) and age ($p > 0.35$) of the household head.

Table 4. Design-Consistent Tobit Censored Regression of FAFH Consumption, 2012

FAFH	Coefficient	Linearized Standard Error	*t*-Value	*p*-Value	95% Confidence Interval	
					Lower Limit	Upper Limit
Total income	0.0370	0.0033	11.2400	0.0000	0.0305	0.0434
Family size	1,265.2300	153.7054	8.2300	0.0000	963.8571	1,566.6020
Sex (male = 1)	32.3844	417.1206	0.0800	0.9380	-785.4701	850.2389

Table 4 continued...

Age of household head	-42.5935	45.6556	-0.9300	0.3510	-132.1111	46.9241
Age squared	-0.4479	0.4486	-1.0000	0.3180	-1.3275	0.4316
Single household head	1,094.5960	570.0172	1.9200	0.0550	-23.0454	2,212.2370
Married household head	-1,910.1060	479.5258	-3.9800	0.0000	-2,850.3190	-969.8925
College grad household head	2,228.2270	363.2000	6.1300	0.0000	1,516.0960	2,940.3590
Employed members	992.1206	146.1351	6.7900	0.0000	705.5915	1,278.6500
Wife is employed	866.0623	299.2714	2.8900	0.0040	279.2764	1,452.8480
Middle-income household	4,472.1590	652.3210	6.8600	0.0000	3,193.1440	5,751.1740
One-member household	1,366.7040	502.9226	2.7200	0.0070	380.6166	2,352.7920
Number of children	384.0957	121.2075	3.1700	0.0020	146.4424	621.7489
Ilocos Region	4,047.2410	689.3270	5.8700	0.0000	2,695.6680	5,398.8150
Cagayan Valley	2,561.7050	764.7166	3.3500	0.0010	1,062.3130	4,061.0960
Central Luzon	9,087.1060	756.2521	12.0200	0.0000	7,604.3110	10,569.9000
Bicol Region	5,253.5790	659.5368	7.9700	0.0000	3,960.4160	6,546.7430
Western Visayas	900.1818	786.0743	1.1500	0.2520	-641.0856	2,441.4490
Central Visayas	4,522.1290	718.9115	6.2900	0.0000	3,112.5480	5,931.7090
Zamboanga Peninsula	905.0703	668.1206	1.3500	0.1760	-404.9236	2,215.0640
Northern Mindanao	-117.6918	665.2091	-0.1800	0.8600	-1,421.9770	1,186.5940
Davao Region	3,517.7100	759.5009	4.6300	0.0000	2,028.5450	5,006.8740
Soccsksargen	4,247.9510	662.4926	6.4100	0.0000	2,948.9920	5,546.9100
Metro Manila	21,028.5600	847.9085	24.8000	0.0000	19,366.0500	22,691.0600
CAR	-2,300.3100	901.9050	-2.5500	0.0110	-4,068.6880	-531.9316
ARMM	-2,957.9820	1,229.5960	-2.4100	0.0160	-5,368.8680	-547.0950
Caraga	-1,003.1770	694.4416	-1.4400	0.1490	-2,364.7790	358.4248
CALABARZON	15,169.2400	762.1959	19.9000	0.0000	13,674.8000	16,663.6900
MIMAROPA	684.0354	625.6325	1.0900	0.2740	-542.6515	1,910.7220
_Intercept	-10,843.0100	1,407.3950	-7.7000	0.0000	-13,602.5100	-8,083.5140
/sigma	18,100.4100	535.3381	33.8100	0.0000	17,050.7700	19,150.0600

Table 5. Design-Consistent Tobit Censored Regression of FAFH Consumption, 2009

FAFH	Coefficient	Linearized Standard Error	*t*-Value	*p*-Value	95% Confidence Interval	
					Lower Limit	Upper Limit
Total income	0.0147	0.0007	20.7900	0.0000	0.0133	0.0161
Family size	2,170.7560	66.7960	32.5000	0.0000	2,039.7820	2,301.7300
Sex (male = 1)	490.3256	348.7996	1.4100	0.1600	-193.6028	1,174.2540
Age of household head	216.8734	46.2744	4.6900	0.0000	126.1382	307.6085
Age squared	-3.3308	0.4539	-7.3400	0.0000	-4.2207	-2.4409
Middle income	8,854.0470	239.8894	36.9100	0.0000	8,383.6700	9,324.4240
Single household head	-709.6474	621.1895	-1.1400	0.2530	-1,927.6800	508.3849
Married household head	-952.3312	370.9527	-2.5700	0.0100	-1,679.6980	-224.9648
College grad household head	9,256.1340	626.2624	14.7800	0.0000	8,028.1550	10,484.1100
Employed members	1,971.3450	177.0048	11.1400	0.0000	1,624.2730	2,318.4170
Wife is employed	-359.1273	251.8386	-1.4300	0.1540	-852.9339	134.6794
Ilocos Region	12,583.0300	1,157.5200	10.8700	0.0000	10,313.3500	14,852.7000
Cagayan Valley	8,384.3710	794.8501	10.5500	0.0000	6,825.8240	9,942.9180
Central Luzon	17,985.5000	802.9460	22.4000	0.0000	16,411.0700	19,559.9200
Bicol Region	6,127.4400	823.8880	7.4400	0.0000	4,511.9550	7,742.9250
Western Visayas	7,403.4990	806.1959	9.1800	0.0000	5,822.7050	8,984.2930
Central Visayas	9,093.5490	937.3606	9.7000	0.0000	7,255.5670	10,931.5300
Zamboanga Peninsula	5,680.1310	850.3557	6.6800	0.0000	4,012.7490	7,347.5140
Northern Mindanao	5,096.7270	862.4139	5.9100	0.0000	3,405.7010	6,787.7540
Davao Region	8,180.7130	844.4261	9.6900	0.0000	6,524.9570	9,836.4690
Soccsksargen	7,875.7430	784.6761	10.0400	0.0000	6,337.1450	9,414.3410
Metro Manila	29,585.1000	886.6207	33.3700	0.0000	27,846.6100	31,323.5900
CAR	4,468.2750	1,144.0230	3.9100	0.0000	2,225.0670	6,711.4840
ARMM	4,974.4040	961.1409	5.1800	0.0000	3,089.7930	6,859.0150
Caraga	4,700.3190	830.9683	5.6600	0.0000	3,070.9510	6,329.6870
CALABARZON	21,600.6100	818.4214	26.3900	0.0000	19,995.8500	23,205.3800
MIMAROPA	7,193.7350	812.5204	8.8500	0.0000	5,600.5400	8,786.9300
One-member household	-4,656.8960	637.5808	-7.3000	0.0000	-5,907.0680	-3,406.7240
Constant	-30,086.6300	1,447.4520	-20.7900	0.0000	-32,924.8100	-27,248.4600
/sigma	15,095.7500	458.3317	32.9400	0.0000	14,197.0500	15,994.4500

Table 6. Design-Consistent Tobit Censored Regression of FAFH Consumption, 2006

FAFH	Coefficient	Linearized Standard Error	*t*-Value	*p*-Value	95% Confidence Interval	
					Lower Limit	Upper Limit
Total income	0.0377	0.0036	10.4400	0.0000	0.0306	0.0448
Family size	1,256.7120	94.4159	13.3100	0.0000	1,071.5200	1,441.9040
Sex (male = 1)	716.7801	339.3820	2.1100	0.0350	51.1001	1,382.4600
Age of household head	272.0120	39.8864	6.8200	0.0000	193.7769	350.2471
Age squared	-4.0501	0.4051	-10.0000	0.0000	-4.8446	-3.2555
Middle income	4,078.8160	544.7310	7.4900	0.0000	3,010.3550	5,147.2780
Single household head	1,656.2360	595.2642	2.7800	0.0050	488.6563	2,823.8160
Married household head	-1,963.6020	385.2618	-5.1000	0.0000	-2,719.2730	-1,207.9310
College grad household head	2,684.7780	708.8483	3.7900	0.0000	1,294.4090	4,075.1470
Employed members	1,594.0190	126.3876	12.6100	0.0000	1,346.1160	1,841.9210
Wife is employed	-115.7145	204.3318	-0.5700	0.5710	-516.5006	285.0717
Ilocos Region	8,854.6530	689.1431	12.8500	0.0000	7,502.9350	10,206.3700
Cagayan Valley	6,468.1080	674.5849	9.5900	0.0000	5,144.9450	7,791.2710
Central Luzon	13,311.0900	655.3280	20.3100	0.0000	12,025.7000	14,596.4800
Bicol Region	4,787.2480	626.0253	7.6500	0.0000	3,559.3320	6,015.1640
Western Visayas	6,664.0280	645.1342	10.3300	0.0000	5,398.6310	7,929.4250
Central Visayas	7,922.9290	655.4177	12.0900	0.0000	6,637.3620	9,208.4970
Zamboanga Peninsula	4,980.4350	660.8816	7.5400	0.0000	3,684.1510	6,276.7200
Northern Mindanao	5,259.7980	633.1314	8.3100	0.0000	4,017.9440	6,501.6520
Davao Region	6,485.0660	618.5762	10.4800	0.0000	5,271.7610	7,698.3710
Soccsksargen	6,463.6590	667.1696	9.6900	0.0000	5,155.0410	7,772.2770
Metro Manila	20,970.9500	897.0803	23.3800	0.0000	19,211.3800	22,730.5300
CAR	2,970.0090	891.3031	3.3300	0.0010	1,221.7650	4,718.2540
ARMM	4,885.7640	788.3954	6.2000	0.0000	3,339.3680	6,432.1600
Caraga	3,943.2980	699.5532	5.6400	0.0000	2,571.1610	5,315.4350
CALABARZON	16,816.5300	668.5940	25.1500	0.0000	15,505.1200	18,127.9400
MIMAROPA	5,568.7020	638.3848	8.7200	0.0000	4,316.5430	6,820.8600
One-member household	-4,373.5720	577.0646	-7.5800	0.0000	-5,505.4540	-3,241.6900
Constant	-24,872.7600	1,277.3400	-19.4700	0.0000	-27,378.2000	-22,367.3300
/sigma	13,274.4800	354.0208	37.5000	0.0000	12,580.0800	13,968.8700

Table 7. Design-Consistent Tobit Censored Regression of FAFH Consumption, 2003

FAFH	Coefficient	Linearized Standard Error	*t*-Value	*p*-Value	95% Confidence Interval	
					Lower Limit	Upper Limit
Total income	0.0097	0.0041	2.3300	0.0200	0.0015	0.0178
Family size	1,543.8690	99.0877	15.5800	0.0000	1,349.6550	1,738.0830
Sex (male = 1)	86.9262	310.4721	0.2800	0.7790	-521.6054	695.4579
Age of household head	331.9857	34.1507	9.7200	0.0000	265.0496	398.9219
Age squared	-4.1184	0.3432	-12.0000	0.0000	-4.7911	-3.4457
Middle income	7,356.2580	572.7653	12.8400	0.0000	6,233.6270	8,478.8900
Single household head	1,885.7930	480.4296	3.9300	0.0000	944.1416	2,827.4450
Married household head	-1,414.5950	356.2326	-3.9700	0.0000	-2,112.8180	-716.3718
College grad household head	6,133.3570	868.8031	7.0600	0.0000	4,430.4850	7,836.2290
Employed members	1,347.2270	117.4668	11.4700	0.0000	1,116.9890	1,577.4640
Wife is employed	529.0588	190.6077	2.7800	0.0060	155.4639	902.6538
Ilocos Region	9,561.3910	411.0761	23.2600	0.0000	8,755.6740	10,367.1100
Cagayan Valley	5,050.8740	400.3563	12.6200	0.0000	4,266.1680	5,835.5810
Central Luzon	13,294.8500	484.7701	27.4300	0.0000	12,344.6900	14,245.0000
Bicol Region	4,552.3660	356.5618	12.7700	0.0000	3,853.4980	5,251.2350
Western Visayas	6,086.7290	360.9182	16.8600	0.0000	5,379.3220	6,794.1360
Central Visayas	6,023.5710	366.3830	16.4400	0.0000	5,305.4530	6,741.6890
Zamboanga Peninsula	3,590.2810	378.5854	9.4800	0.0000	2,848.2460	4,332.3160
Northern Mindanao	4,226.1280	355.9308	11.8700	0.0000	3,528.4970	4,923.7600
Davao Region	5,534.5600	379.4328	14.5900	0.0000	4,790.8640	6,278.2560
Soccsksargen	4,242.8490	363.4062	11.6800	0.0000	3,530.5650	4,955.1330
Metro Manila	21,629.5500	855.4234	25.2900	0.0000	19,952.9000	23,306.2000
CAR	4,081.9860	481.4697	8.4800	0.0000	3,138.2960	5,025.6770
ARMM	3,272.1200	384.6084	8.5100	0.0000	2,518.2800	4,025.9600

Caraga	4,245.0100	349.7451	12.1400	0.0000	3,559.5030	4,930.5180
CALABARZON	17,101.8200	578.3005	29.5700	0.0000	15,968.3400	18,235.3000
MIMAROPA	4,133.5290	371.0969	11.1400	0.0000	3,406.1710	4,860.8860
One-member household	-2,407.8310	495.3801	-4.8600	0.0000	-3,378.7860	-1,436.8760
Constant	-27,726.5900	1,325.0580	-20.9200	0.0000	-30,323.7300	-25,129.4500
/sigma	11,488.1600	425.9931	26.9700	0.0000	10653.21	12323.12

Table 8. Design-Consistent Means of the Variables Used in Tobit Censored Regressions, 2003–2012

2003	Mean	Linearized Standard Error	95% Confidence Interval		2006	Mean	Linearized Standard Error	95% Confidence Interval	
FAFH	6,691.12	65.87	6,562.02	6,820.23	FAFH	8,565.12	113.14	8,343.20	8,787.04
Total income	147,887.80	1,360.92	145,220.40	150,555.30	Total income	172,730.00	1,716.99	169,362.30	176,097.80
Family size	4.82	0.01	4.79	4.84	Family size	4.82	0.01	4.79	4.85
Age of household head	46.20	0.07	46.06	46.35	Age of household head	48.44	0.09	48.26	48.61
Age squared	2,337.56	7.42	2,323.01	2,352.10	Age squared	2,543.00	9.28	2,524.79	2,561.21
Sex (male = 1)	0.8329	0.0020	0.8290	0.8367	Sex (male = 1)	0.8133	0.0022	0.8090	0.8175
Single household head	0.0404	0.0010	0.0383	0.0424	Single household head	0.0394	0.0012	0.0372	0.0417
Married household head	0.8130	0.0020	0.8090	0.8170	Married household head	0.8004	0.0023	0.7958	0.8049
Wife is employed	0.3645	0.0025	0.3596	0.3694	Wife is employed	0.4001	0.0031	0.3939	0.4063
Middle income	0.6000	0.0025	0.5950	0.6050	Middle income	0.6000	0.0039	0.5924	0.6076
College-educated household head	0.0995	0.0016	0.0964	0.1025	College-educated household head	0.1049	0.0024	0.1002	0.1095
Employed members	1.7148	0.0053	1.7045	1.7252	Employed members	1.7732	0.0069	1.7596	1.7867
Ilocos Region	0.0532	0.0011	0.0511	0.0552	Ilocos Region	0.0544	0.0010	0.0525	0.0563
Cagayan Valley	0.0356	0.0008	0.0341	0.0371	Cagayan Valley	0.0356	0.0007	0.0343	0.0369
Central Luzon	0.1099	0.0018	0.1064	0.1133	Central Luzon	0.1097	0.0017	0.1063	0.1131
Bicol Region	0.0574	0.0011	0.0552	0.0596	Bicol Region	0.0580	0.0012	0.0557	0.0603
Western Visayas	0.0768	0.0014	0.0742	0.0795	Western Visayas	0.0787	0.0013	0.0763	0.0812

Table 8 continued...

Central Visayas	0.0738	0.0013	0.0712	0.0764	Central Visayas	0.0743	0.0016	0.0711	0.0776
Eastern Visayas	0.0458	0.0009	0.0439	0.0476	Eastern Visayas	0.0468	0.0011	0.0447	0.0489
Zamboanga Peninsula	0.0356	0.0008	0.0340	0.0373	Zamboanga Peninsula	0.0358	0.0008	0.0343	0.0373
Northern Mindanao	0.0449	0.0010	0.0429	0.0468	Northern Mindanao	0.0453	0.0013	0.0427	0.0479
Davao Region	0.0492	0.0010	0.0472	0.0513	Davao Region	0.0483	0.0013	0.0458	0.0509
Soccsksargen	0.0430	0.0009	0.0412	0.0448	Soccsksargen	0.0430	0.0013	0.0405	0.0455
Metro Manila	0.1391	0.0021	0.1349	0.1434	Metro Manila	0.1357	0.0038	0.1283	0.1432
CAR	0.0170	0.0004	0.0161	0.0178	CAR	0.0174	0.0005	0.0163	0.0184
ARMM	0.0306	0.0007	0.0292	0.0321	ARMM	0.0307	0.0010	0.0287	0.0326
Caraga	0.0252	0.0006	0.0241	0.0264	Caraga	0.0255	0.0007	0.0241	0.0269
CALABARZON	0.1326	0.0019	0.1289	0.1363	CALABARZON	0.1293	0.0019	0.1256	0.1330
MIMAROPA	0.0303	0.0007	0.0290	0.0317	MIMAROPA	0.0313	0.0009	0.0296	0.0331
One-member household	0.0424	0.0010	0.0403	0.0444	One-member household	0.0466	0.0012	0.0443	0.0489

Table 9. Design-Consistent Means of the Variables Used in Tobit Censored Regressions, 2003–2012 (cont.)

2009	Mean	Linearized Standard Error	95% Confidence Interval		2012	Mean	Linearized Standard Error.	95% Confidence Interval	
FAFH	10,932.19	236.97	10,467.53	11,396.84	FAFH	14,498.86	297.31	13,915.92	15,081.81
Total Income	207,506.20	3,128.70	201,371.40	213,641.00	Total Income	234,614.90	3,525.22	227,703.00	241,526.90
Family Size	4.84	0.01	4.82	4.87	Family Size	4.69	0.01	4.66	4.71
Age of HHH	49.36	0.09	49.17	49.54	Age of HHH	50.82	0.10	50.62	51.01
Age Squared	2,614.67	9.68	2,595.69	2,633.66	Age Squared	2,781.19	10.49	2,760.62	2,801.75
Sex (Male=1)	0.8046	0.0026	0.7995	0.8097	Sex (Male=1)	0.7729	0.0027	0.7676	0.7782
Single HHH	0.0371	0.0011	0.0349	0.0393	Single HHH	0.0463	0.0013	0.0438	0.0488
Married HHH	0.7943	0.0024	0.7896	0.7989	Married HHH	0.7554	0.0026	0.7503	0.7605
Wife Employed	0.4197	0.0034	0.4130	0.4264	Wife Employed	0.4145	0.0032	0.4082	0.4207
Middle Income	0.5902	0.0050	0.5803	0.6000	Middle Income	0.6000	0.0058	0.5887	0.6113
College Educ HHH	0.1109	0.0028	0.1055	0.1164	College Educ HHH	0.1262	0.0012	0.1239	0.1286
Employed Members	1.8899	0.0067	1.8768	1.9031	Employed Members	1.9802	0.0087	1.9631	1.9973
Ilocos Region	0.0526	0.0043	0.0441	0.0611	Ilocos Region	0.0516	0.0043	0.0432	0.0599

Table 9 continued...

Cagayan Valley	0.0354	0.0031	0.0293	0.0415	Cagayan Valley	0.0360	0.0032	0.0296	0.0423
Central Luzon	0.1079	0.0069	0.0944	0.1215	Central Luzon	0.1114	0.0071	0.0973	0.1254
Bicol Region	0.0583	0.0047	0.0491	0.0674	Bicol Region	0.0544	0.0044	0.0457	0.0631
Western Visayas	0.0783	0.0058	0.0671	0.0896	Western Visayas	0.0749	0.0055	0.0640	0.0857
Central Visayas	0.0748	0.0056	0.0638	0.0858	Central Visayas	0.0736	0.0056	0.0626	0.0847
Eastern Visayas	0.0469	0.0040	0.0389	0.0548	Eastern Visayas	0.0421	0.0036	0.0350	0.0492
Zamboanga Peninsula	0.0369	0.0033	0.0304	0.0433	Zamboanga Peninsula	0.0360	0.0031	0.0298	0.0422
Northern Mindanao	0.0462	0.0040	0.0383	0.0541	Northern Mindanao	0.0456	0.0039	0.0379	0.0533
Davao Region	0.0484	0.0042	0.0401	0.0566	Davao Region	0.0503	0.0041	0.0422	0.0584
Soccsksargen	0.0440	0.0040	0.0361	0.0518	Soccsksargen	0.0461	0.0041	0.0381	0.0541
Metro Manila	0.1327	0.0085	0.1161	0.1493	Metro Manila	0.1362	0.0070	0.1224	0.1499
CAR	0.0171	0.0017	0.0138	0.0204	CAR	0.0175	0.0017	0.0141	0.0209
ARMM	0.0322	0.0031	0.0261	0.0384	ARMM	0.0260	0.0026	0.0208	0.0312
Caraga	0.0256	0.0024	0.0209	0.0303	Caraga	0.0248	0.0023	0.0202	0.0294
CALABARZON	0.1301	0.0077	0.1150	0.1453	CALABARZON	0.1439	0.0083	0.1276	0.1602
MIMAROPA	0.0326	0.0030	0.0268	0.0385	MIMAROPA	0.0298	0.0028	0.0243	0.0353
One Member HH	0.0378	0.0011	0.0356	0.0399	One Member HH	0.0569	0.0014	0.0543	0.0596
					Number of Children	1.3736	0.0096	1.3548	1.3924

The two categories of marital status registered contrasting effects on FAFH consumption. Coefficient for the married dummy variable ($p < 0.0001$) is negative while that of being single ($p < 0.10$) is positive. This result is echoed in other FIES rounds except in 2009 (Table 4), when the single status dummy is insignificant ($p > 0.25$). All other postulated demand determinants are highly significant with correct a priori algebraic signs. Most of these results are replicated in the estimated equations in other FIES rounds (see Tables 5–7). The most important feature of the main FAFH demand equation (Table 4) is the apparent empirical validity of the household production and consumption theory (Becker, 1965; Prochaska & Schrimper, 1973) adopted in the study. The variables that proxy for the value of household members time posted highly significant coefficient estimates: wife is employed ($p < 0.005$), number of employed members ($p < 0.0001$), and one-member household dummy ($p < 0.01$).

Results of the Heckman Estimation of Working–Leser Engel Curves

Because of the inherent sample selection problem surrounding the specification of the FAFH Engel curve, which may not be present in FAH, the systems approach in simultaneously estimating both the FAH and the FAFH Engel curves using the Heckman procedure is precluded in the analysis. Instead, the single-equation approach is used and only for FAFH. As a result, four Working–Leser Engel curves are estimated independently for each FIES survey round. These estimated equations are presented in Tables 10 to 13. The focus of attention is on the FAFH Engel curve presented in Table 10, representing the most contemporary FAFH budget formation process of Filipino households.

The upper panel of Table 10 presents the outcome of the second (consumption) stage of the Heckman procedure, while the lower panel shows the result of the first (participation) stage. The participation stage is implemented through probit estimation of the conditional probability that the household will consume FAFH given its attributes, while the consumption stage features the estimated Engel curve for FAFH corrected for selectivity bias through the inclusion of the inverse Mills ratio derived from the results of the participation stage as additional regressor (Heckman, 1979). The fit of the models in both stages appear to be excellent with nearly all coefficients estimated with extreme statistical significance and conforming to theoretical a priori expectations, except for a few variables which are insignificant.

Table 10. Weighted Heckman Estimation of Working–Leser FAFH Engel Curve, 2012.

Engel Curve	Coefficient	Standard Error	*t*-Value	*p*-Value	95% Lower Limit	95% Upper Limit
Log(total income)	-0.00246	0.00085	-2.90000	0.00400	-0.00413	-0.00080
Family size	0.00012	0.00024	0.51000	0.61000	-0.00034	0.00059
Age of household head	-0.00070	0.00022	-3.13000	0.00200	-0.00114	-0.00026
Age squared	0.00000	0.00000	1.85000	0.06400	0.00000	0.00001
Sex (male = 1)	0.00626	0.00147	4.27000	0.00000	0.00339	0.00913
Single household head	0.01474	0.00302	4.89000	0.00000	0.00883	0.02065
Married household head	-0.01880	0.00165	-11.40000	0.00000	-0.02203	-0.01557
Wife is employed	0.00434	0.00094	4.60000	0.00000	0.00249	0.00619
College undergrad household head	0.00276	0.00104	2.65000	0.00800	0.00071	0.00480
College grad household head	0.00132	0.00318	0.41000	0.67800	-0.00492	0.00755
Number of employed members	0.00207	0.00045	4.59000	0.00000	0.00118	0.00295
Ilocos Region	0.03792	0.00293	12.95000	0.00000	0.03218	0.04366

Table 10 continued...

Cagayan Valley	0.04238	0.00299	14.15000	0.00000	0.03651	0.04826
Central Luzon	0.05319	0.00269	19.77000	0.00000	0.04791	0.05846
Bicol Region	0.02674	0.00324	8.25000	0.00000	0.02038	0.03310
Western Visayas	0.01947	0.00284	6.87000	0.00000	0.01391	0.02503
Central Visayas	0.03185	0.00314	10.14000	0.00000	0.02570	0.03801
Zamboanga Peninsula	0.01044	0.00269	3.87000	0.00000	0.00516	0.01573
Northern Mindanao	0.00479	0.00242	1.98000	0.04800	0.00005	0.00953
Davao Region	0.02723	0.00326	8.36000	0.00000	0.02084	0.03361
SOCCSKSARGEN	0.01992	0.00269	7.40000	0.00000	0.01464	0.02520
Metro Manila	0.07899	0.00272	29.09000	0.00000	0.07367	0.08432
CAR	0.00667	0.00265	2.52000	0.01200	0.00148	0.01186
ARMM	0.01333	0.00331	4.02000	0.00000	0.00683	0.01982
Caraga	0.00590	0.00246	2.40000	0.01600	0.00108	0.01073
CALABARZON	0.06917	0.00259	26.72000	0.00000	0.06409	0.07425
MIMAROPA	0.01377	0.00262	5.25000	0.00000	0.00863	0.01891
_cons	0.08730	0.01180	7.40000	0.00000	0.06418	0.11043
Probit Stage	Coefficient	Standard Error	*t*-Value	*p*-Value	95% Lower Limit	95% Upper Limit
Log(total income)	0.48277	0.02261	21.35000	0.00000	0.43844	0.52710
Family size	0.08500	0.00983	8.65000	0.00000	0.06573	0.10427
Age of household head	-0.00834	0.00444	-1.88000	0.06000	-0.01704	0.00035
Age squared	-0.00001	0.00004	-0.30000	0.76300	-0.00009	0.00007
Sex (male = 1)	-0.04021	0.03528	-1.14000	0.25400	-0.10937	0.02896
Single household head	-0.07750	0.05326	-1.46000	0.14600	-0.18192	0.02692
Married household head	-0.26221	0.03765	-6.96000	0.00000	-0.33603	-0.18838
Wife is employed	0.17178	0.02690	6.39000	0.00000	0.11903	0.22453
College undergrad household head	0.10246	0.02830	3.62000	0.00000	0.04697	0.15794
College grad household head	0.21200	0.06892	3.08000	0.00200	0.07687	0.34713
Number of employed members	-0.06910	0.01288	-5.36000	0.00000	-0.09436	-0.04384
Metro Manila	0.56027	0.04786	11.71000	0.00000	0.46643	0.65411
_cons	-4.43544	0.26299	-16.87000	0.00000	-4.95108	-3.91979
/athrho	-0.05071	0.01812	-2.80000	0.00500	-0.08623	-0.01518
/lnsigma	-2.71105	0.01260	-215.20000	0.00000	-2.73575	-2.68634
rho	-0.05066	0.01807			-0.08602	-0.01518
sigma	0.06647	0.00084			0.06485	0.06813
lambda	-0.00337	0.00120			-0.00571	-0.00102

Table 11. Weighted Heckman Estimation of Working–Leser FAFH Engle Curve, 2009

Engel Curve	Coefficient	Standard Error	*t-Value*	*p-Value*	95% Lower Limit	95% Upper Limit
Log(total income)	0.00270	0.00067	4.02000	0.00000	0.00138	0.00402
Family size	-0.00038	0.00021	-1.81000	0.07000	-0.00079	0.00003
Age of household head	0.00023	0.00019	1.23000	0.21900	-0.00014	0.00060
Age squared	-0.00001	0.00000	-3.29000	0.00100	-0.00001	0.00000
Sex (male = 1)	0.00626	0.00127	4.92000	0.00000	0.00376	0.00875
Single household head	0.00798	0.00310	2.57000	0.01000	0.00189	0.01406
Married household head	-0.00994	0.00156	-6.36000	0.00000	-0.01300	-0.00688
Wife is employed	-0.00323	0.00080	-4.02000	0.00000	-0.00481	-0.00165
College undergrad household head	0.00162	0.00082	1.96000	0.05000	0.00000	0.00323
College grad household head	-0.00635	0.00106	-6.00000	0.00000	-0.00842	-0.00427
Number of employed members	0.00701	0.00047	14.85000	0.00000	0.00608	0.00793
Ilocos Region	0.03615	0.00303	11.92000	0.00000	0.03020	0.04210
Cagayan Valley	0.02013	0.00272	7.39000	0.00000	0.01479	0.02547
Central Luzon	0.04776	0.00274	17.45000	0.00000	0.04239	0.05313
Bicol Region	0.01460	0.00293	4.99000	0.00000	0.00886	0.02034
Western Visayas	0.01523	0.00269	5.66000	0.00000	0.00996	0.02050
Central Visayas	0.02062	0.00298	6.92000	0.00000	0.01477	0.02646
Zamboanga Peninsula	0.00486	0.00288	1.69000	0.09200	-0.00079	0.01050
Northern Mindanao	0.00386	0.00275	1.40000	0.16000	-0.00153	0.00925
Davao Region	0.01311	0.00293	4.47000	0.00000	0.00737	0.01886
Soccsksargen	0.00537	0.00264	2.03000	0.04200	0.00019	0.01054
Metro Manila	0.05775	0.00253	22.83000	0.00000	0.05279	0.06272
CAR	0.01129	0.00342	3.30000	0.00100	0.00458	0.01800
ARMM	0.01288	0.00307	4.20000	0.00000	0.00686	0.01890
Caraga	0.00037	0.00263	0.14000	0.88700	-0.00479	0.00554
CALABARZON	0.05435	0.00263	20.68000	0.00000	0.04920	0.05950
MIMAROPA	0.00858	0.00279	3.07000	0.00200	0.00311	0.01405
_cons	-0.00006	0.00861	-0.01000	0.99400	-0.01694	0.01681
Probit Stage	Coefficient	Standard Error	*t*-Value	*p*-Value	95% Lower Limit	95% Upper Limit
Log(total income)	0.65364	0.02145	30.48000	0.00000	0.61159	0.69569
Family size	0.12569	0.00671	18.75000	0.00000	0.11255	0.13884
Age of household head	0.01432	0.00418	3.43000	0.00100	0.00613	0.02252
Age squared	-0.00029	0.00004	-7.46000	0.00000	-0.00037	-0.00022

Table 11 continued...

Sex (male = 1)	-0.03168	0.03140	-1.01000	0.31300	-0.09325	0.02988
Single household head	-0.26855	0.04928	-5.45000	0.00000	-0.36519	-0.17192
Married household head	-0.19624	0.03425	-5.73000	0.00000	-0.26340	-0.12907
Wife is employed	0.12307	0.02296	5.36000	0.00000	0.07804	0.16809
College undergrad household head	0.15058	0.02249	6.70000	0.00000	0.10649	0.19467
College grad household head	-0.09385	0.03814	-2.46000	0.01400	-0.16864	-0.01907
Number of employed members	-0.04739	0.01248	-3.80000	0.00000	-0.07186	-0.02293
Metro Manila	0.33371	0.03341	9.99000	0.00000	0.26821	0.39921
_cons	-7.39795	0.25057	-29.52000	0.00000	-7.88927	-6.90664
/athrho	-0.12641	0.01626	-7.77000	0.00000	-0.15830	-0.09452
/lnsigma	-3.00323	0.01312	-228.91000	0.00000	-3.02896	-2.97751
rho	-0.12574	0.01601			-0.15699	-0.09424
sigma	0.04963	0.00065			0.04837	0.05092
lambda	-0.00624	0.00077			-0.00775	-0.00473

Table 12. Weighted Heckman Estimation of Working–Leser FAFH Engle Curve, 2006.

Engel Curve	Coefficient	Standard Error	*t-Value*	*p-Value*	95% Lower Limit	95% Upper Limit
Log(total income)	0.00153	0.00065	2.37000	0.01800	0.00026	0.00280
Family size	-0.00080	0.00021	-3.73000	0.00000	-0.00122	-0.00038
Age of household head	0.00088	0.00018	4.95000	0.00000	0.00053	0.00123
Age squared	-0.00001	0.00000	-6.34000	0.00000	-0.00001	-0.00001
Sex (male = 1)	0.00680	0.00130	5.21000	0.00000	0.00424	0.00935
Single household head	0.02024	0.00327	6.19000	0.00000	0.01383	0.02665
Married household head	-0.01004	0.00154	-6.50000	0.00000	-0.01307	-0.00701
Wife is employed	-0.00354	0.00086	-4.11000	0.00000	-0.00524	-0.00185
College undergrad household head	0.00032	0.00092	0.34000	0.73000	-0.00148	0.00212
College grad household head	-0.00468	0.00120	-3.92000	0.00000	-0.00703	-0.00234
Number of employed members	0.00751	0.00048	15.81000	0.00000	0.00658	0.00844
Ilocos Region	0.02740	0.00298	9.18000	0.00000	0.02155	0.03325
Cagayan Valley	0.01590	0.00259	6.13000	0.00000	0.01082	0.02099
Central Luzon	0.04114	0.00248	16.60000	0.00000	0.03628	0.04600

Table 12 continued...

Bicol Region	0.01197	0.00250	4.78000	0.00000	0.00706	0.01687
Western Visayas	0.01689	0.00239	7.07000	0.00000	0.01221	0.02158
Central Visayas	0.02307	0.00291	7.92000	0.00000	0.01736	0.02878
Zamboanga Peninsula	0.00419	0.00268	1.57000	0.11800	-0.00106	0.00944
Northern Mindanao	0.00794	0.00238	3.34000	0.00100	0.00328	0.01260
Davao Region	0.01019	0.00233	4.37000	0.00000	0.00562	0.01476
Soccsksargen	0.01082	0.00246	4.40000	0.00000	0.00600	0.01565
Metro Manila	0.06337	0.00245	25.86000	0.00000	0.05856	0.06817
CAR	0.01399	0.00263	5.31000	0.00000	0.00882	0.01915
ARMM	0.01082	0.00299	3.62000	0.00000	0.00496	0.01668
Caraga	-0.00261	0.00223	-1.17000	0.24200	-0.00699	0.00177
CALABARZON	0.05077	0.00235	21.60000	0.00000	0.04616	0.05538
MIMAROPA	0.00953	0.00232	4.11000	0.00000	0.00498	0.01408
_cons	-0.00500	0.00820	-0.61000	0.54200	-0.02110	0.01109
Probit Stage	Coefficient	Standard Error	*t*-Value	*p*-Value	95% Lower Limit	95% Upper Limit
Log(total income)	0.63823	0.01743	36.62000	0.00000	0.60405	0.67242
Family size	0.10963	0.00571	19.21000	0.00000	0.09844	0.12083
Age of household head	0.01381	0.00359	3.85000	0.00000	0.00677	0.02086
Age squared	-0.00028	0.00003	-8.26000	0.00000	-0.00035	-0.00022
Sex (male = 1)	-0.00617	0.02961	-0.21000	0.83500	-0.06424	0.05191
Single household head	-0.13867	0.04630	-2.99000	0.00300	-0.22949	-0.04785
Married household head	-0.21913	0.03207	-6.83000	0.00000	-0.28204	-0.15623
Wife is employed	0.14169	0.02171	6.53000	0.00000	0.09911	0.18428
College undergrad household head	0.11279	0.02045	5.52000	0.00000	0.07268	0.15291
College grad household head	-0.12158	0.03656	-3.33000	0.00100	-0.19329	-0.04987
Number of employed members	-0.00321	0.01168	-0.27000	0.78400	-0.02612	0.01970
Metro Manila	-0.23836	0.02930	-8.13000	0.00000	-0.29583	-0.18089
_cons	-6.76617	0.22427	-30.17000	0.00000	-7.20607	-6.32628
/athrho	-0.10260	0.01626	-6.31000	0.00000	-0.13448	-0.07071
/lnsigma	-2.95918	0.01247	-237.33000	0.00000	-2.98363	-2.93472
rho	-0.10224	0.01609			-0.13367	0.07059
sigma	0.05186	0.00065			0.05061	0.05315
lambda	-0.00530	0.00082			-0.00691	-0.00369

Table 13. Weighted Heckman Estimation of Working–Leser FAFH Engle Curve, 2003.

Engel Curve	Coefficient	Standard Error	*t*-Value	*p*-Value	95% Lower Limit	95% Upper Limit
Log(total income)	0.00079	0.00063	1.25000	0.21100	-0.00045	0.00202
Family size	-0.00152	0.00021	-7.36000	0.00000	-0.00193	-0.00112
Age of household head	0.00056	0.00018	3.11000	0.00200	0.00021	0.00091
Age squared	-0.00001	0.00000	-4.69000	0.00000	-0.00001	0.00000
Sex (male = 1)	0.00797	0.00151	5.28000	0.00000	0.00501	0.01093
Single household head	0.01851	0.00325	5.69000	0.00000	0.01213	0.02488
Married household head	-0.01354	0.00175	-7.74000	0.00000	-0.01698	-0.01011
Wife is employed	-0.00327	0.00084	-3.88000	0.00000	-0.00492	-0.00162
College undergrad household head	0.00012	0.00091	0.14000	0.89200	-0.00165	0.00190
College grad household head	-0.00686	0.00116	-5.93000	0.00000	-0.00912	-0.00459
Number of employed Members	0.00734	0.00046	15.84000	0.00000	0.00643	0.00825
Ilocos Region	0.03434	0.00195	17.57000	0.00000	0.03051	0.03817
Cagayan Valley	0.01928	0.00191	10.12000	0.00000	0.01555	0.02302
Central Luzon	0.04545	0.00180	25.26000	0.00000	0.04192	0.04897
Bicol Region	0.02187	0.00204	10.74000	0.00000	0.01788	0.02586
Western Visayas	0.01446	0.00175	8.24000	0.00000	0.01102	0.01790
Central Visayas	0.02514	0.00191	13.16000	0.00000	0.02140	0.02888
Zamboanga Peninsula	0.00322	0.00179	1.80000	0.07200	-0.00029	0.00674
Northern Mindanao	0.00818	0.00182	4.50000	0.00000	0.00462	0.01174
Davao Region	0.01277	0.00188	6.80000	0.00000	0.00909	0.01645
Soccsksargen	0.01293	0.00198	6.53000	0.00000	0.00905	0.01681
Metro Manila	0.05613	0.00177	31.75000	0.00000	0.05267	0.05960
CAR	0.01390	0.00224	6.20000	0.00000	0.00951	0.01829
ARMM	0.00835	0.00177	4.73000	0.00000	0.00489	0.01182
Caraga	0.00224	0.00173	1.30000	0.19500	-0.00115	0.00563
CALABARZON	0.05374	0.00170	31.66000	0.00000	0.05041	0.05707
MIMAROPA	0.00829	0.00184	4.50000	0.00000	0.00468	0.01190
_cons	0.01618	0.00770	2.10000	0.03500	0.00110	0.03127
Probit Stage	**Coefficient**	**Standard Error**	***t*-Value**	***p*-Value**	**95% Lower Limit**	**95% Upper Limit**
Log(total income)	0.71693	0.01346	53.25000	0.00000	0.69055	0.74332
Family size	0.08446	0.00435	19.41000	0.00000	0.07593	0.09299
Age of household head	0.02725	0.00324	8.42000	0.00000	0.02091	0.03359
Age squared	-0.00039	0.00003	-12.06000	0.00000	-0.00046	-0.00033
Sex (male = 1)	-0.01028	0.03062	-0.34000	0.73700	-0.07029	0.04974

Table 12 continued...

Single household head	-0.04067	0.04447	-0.91000	0.36000	-0.12783	0.04650
Married household head	-0.22096	0.03329	-6.64000	0.00000	-0.28622	-0.15571
Wife employed	0.10936	0.01785	6.13000	0.00000	0.07438	0.14434
College undergrad household head	0.14757	0.01764	8.37000	0.00000	0.11301	0.18214
College grad household head	-0.13138	0.03237	-4.06000	0.00000	-0.19483	-0.06793
Number of employed members	0.00172	0.00973	0.18000	0.86000	-0.01735	0.02078
Metro Manila	0.49082	0.03222	15.23000	0.00000	0.42767	0.55397
_cons	-8.41598	0.15940	-52.80000	0.00000	-8.72842	-8.10355
/athrho	-0.11121	0.01351	-8.23000	0.00000	-0.13769	-0.08473
/lnsigma	-2.95669	0.01142	-258.980	0.00000	-2.97907	-2.93431
rho	-0.11075	0.01334			-0.13682	-0.08453
sigma	0.05199	0.00059			0.05084	0.05317
lambda	-0.00576	0.00068			-0.00710	-0.00442

One of the most interesting results noted in Table 10 is the apparent validity of the Engel's law on the budget setting process for FAFH using the 2012 FIES survey data. This assertion is demonstrated by the highly significant and negative coefficient estimate of the income variable, which when interpreted would mean that poorer households devote higher share of income to FAFH than richer families. Furthermore, income elasticities are computed (using equation [7]) for the various FIES rounds results and exhibited in Table 14.

Table 14. Estimated Working–Leser Elasticities of FAFH

FIES Survey Round	Average FAFH Share	Engel Curve Coefficient of ln(Income)	Working–Leser Income Elasticity	Commodity Classification of FAFH
2003	0.036308	0.00079	1.02176	Luxury
2006	0.041559	0.00153	1.03682	Luxury
2009	0.044584	0.00270	1.06056	Luxury
2012	0.059527	-0.00246	0.95867	Necessity

By classifying FAFH as a necessity consumption item, even households situated in the lower rung of income distribution are compelled to consume FAFH during the modern era. This phenomenon is not seen in the earlier survey rounds as FAFH had been consistently categorized as luxury item.

The highly significant and positive coefficient estimates for the variables related to the value of time of household members justify these variables as the nontraditional budget shares predictors, echoing the results noted in the Tobit estimated FAFH demand equation. This result implies the validity of the household production theory (Becker, 1965; Prochaska & Schrimper, 1973) in specifying Engel curves of FAFH.

Concluding Remarks

Consumption incidence of FAFH among Filipino households has been increasing monotonically over the years, reaching an all-time high of 89.61% of all households in 2012. Per capita consumption of FAFH is also on the uptrend at an annual clip of 9.91%, compared to the increase of just 4.41% per year on per capita expenditure of food consumed at home (FAH). These statistics are testament to the phenomenon of changing consumer preferences resulting in a remarkable shift in food consumption patterns, particularly in the cities and highly urbanized locales. Despite the economic and commercial importance of food consumption away from home, very limited effort has been made to investigate the evolution and economics of this type of food consumption among Filipinos over time. This study attempts to bridge this gap in the literature by doing a comprehensive analysis of this emerging consumption trend using the four most recent public use files of the FIES, aiming to establish the stylized facts and the significant drivers of this phenomenon. A value-added feature of the study is the use of survey-design-compliant procedures in all estimation and inferences conducted to avoid misleading inferences.

The outcomes of the study confirm the significant covariation of FAFH consumption in the most recent period (2012) with the traditional food demand determinants like household income, family size, age composition, and the household head's demographics like education and marital status. Usual demand predictors, however, like age and gender are insignificant determinants. Interestingly, nontraditional factors like the employment status of the homemaker (wife), single-member status of the household, and number of employed members contribute significant explanatory influence on FAFH consumption. This empirical result confirms the validity of the household production and consumption theory due to Becker (1965). Overall, the most powerful drivers of the phenomenon proved to be the locational characteristics of the household captured by the regional dummy variables, with the indicator variables for Metro Manila, Calabarzon, and Central Luzon appear to be the strongest drivers.

The empirical verification by the study that FAFH is a necessity item in the food basket of modern Filipino household also confirms the validity of the Engel's law to FAFH, with an income elasticity of **0.9587**. The results of the study may be used as the basis of predicting the increasing role of FAFH in shaping the consumption behavior of the modern Filipino families, thus offering important insights with valuable commercial and economic implications shift in food consumption.

Note

*Annual growth is determined by the formula.

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8

Engel Curve Modeling: Analysis of the Consumption Pattern of the Poor Households in Metro Manila

Cesar C. Rufino

The National Capital Region (NCR), better known as the Metropolitan Manila Area or Metro Manila, is the country's premier region. Not only is Metro Manila the most progressive among the regions of the country, it is also the most densely populated. Metro Manila, which is composed of 17 highly urbanized cities that are geographically segmented into four contiguous districts, has traditionally been regarded as the country's center of commercial, political, educational, and economic activities. Not to mention its being the seat of the national leadership. Its generally affluent inhabitants, who according to the 2007 population census reached close to 11.6 million people (living in an area of 636 km^2 for a very high population density of 18,157 persons per square kilometer), are enjoying the highest purchasing power and standard of living among the different regions of the country.

However, despite the general affluence of Metro Manila inhabitants, like all regions of the country, it also has its share of the urban poor or those who barely meet the basic necessities of life. It is in Metro Manila that the contrast between the rich and the poor is exceptionally glaring. This study attempts to uncover the consumption pattern of the urban poor in Metro

Manila through econometric modeling of the budget households allocate to the different consumption items necessary to meet living standards, in relation to their spending capability, household composition, location in the metropolis, and other demographic characteristics. The public use file of the 2009 Family Income and Expenditure Survey (FIES) for Metro Manila constitutes the database of the study, focusing on sample households belonging to the lowest 20% of the regional income distribution, which in this study is presumed to constitute the poor segment of the population.

Problem Statement/Policy Issue and Its Importance

The central issue in this study is the conduct of an in-depth descriptive and econometric analysis of the consumption pattern of Metro Manila urban poor across household composition, demographic, social, and locational categories of households, to provide policy makers with invaluable inputs in establishing poverty outline and other descriptive measures that may help local and national authorities in profiling the poor situated within these classifications for focused intervention targeting. An important value-added characteristic of this research is the incorporation of the complex survey design features of the FIES to improve estimates of parameters and standard errors that will be used in the descriptive analysis and econometric modeling to be done. Explicitly, the main problem addressed in this research is, “How do the urban poor of Metro Manila allocate their meager resources to meet basic human requirements in light of their demographic and other attributes?”

Theoretical and Operational Framework

The most important microeconomic concept used in empirical modeling of household budgets is that of Engel curves. This concept was named after Ernst Engel, a 19th-century Prussian statistician who conducted one of the earliest studies of household expenditure patterns. In a series of budget studies, he theorized that food expenditures take a steadily declining share of income as income of the family becomes larger. He also posited that clothing and housing take a constant share of the income regardless of its size, while education, health, transportation, recreation, and saving take larger percentage allocation as income of the family increases (Engel, 1857). These empirical regularities came to be known in the literature as the classical Engel’s Law, and the mathematical equation linking income (or spending) to the budget share of a good is called Engel curve of the good. In a family budget, there are as many Engel curves as there are goods in the family's market basket.

Engel curves are a systematic way of summarizing and describing the development of household budgets as material resources increase (Deaton & Case, 1987). In the microeconomic theory of consumer behavior, an Engel curve pertains to the income or expenditure expansion path of demand for a particular consumer good under constant prices (Varian, 2005). In its most basic form, an Engel curve represents a mathematical relationship of the proportion of the budget allocated for a good (budget share) as a function of the household income (or by the total expenditure under the nonsatiety assumption of the theory).

It is however simplistic to assume that variation in budget allocation for the different consumption items is explained solely by variation in household income (or expenditure). The presence of children in the household will definitely affect budget allocation for certain items children are heavy users of (e.g., education, clothing, and footwear). Gender of the household head and so with the age and other demographic characteristics of the household may also impact the budget allocation process.

In this study, it is postulated that the data provided by the Metro Manila sample belonging to the first two regional income deciles (households whose total income is at the bottom 20% of all Metro Manila households, which constitute the "Poor" segment) contain the necessary information that may reveal their budget allocation process—hence their consumption pattern. The choice of using the first and the second regional income deciles to identify the poor is due to the 2009 poverty incidence of 20.9% for the Philippines (Virola, 2011) which is closely approximated by the 20% figure. The empirical model that subscribes to the theoretical tenets of microeconomics is formulated accordingly this way: letting $\varpi_i =$ the budget share of the ith consumption category in the consumption basket, and M = total household expenditure (proxy for disposable income) or total household income.

The Basic Engel Curve

The basic form of the Engel curve for the ith consumption items takes the following empirical form popular in the literature as the Working–Leser Engel curve (Working, 1943; Leser, 1963):

$$\varpi_i = \alpha_i + \beta_i \ln(M) + u_i \text{ for } i = 1, 2, ..., k \qquad (1)$$

where k is the total number of mutually exclusive consumption categories in the household's budget, α_i and β_i are parameters to be estimated, and u_i is a random disturbance term that is assumed to have zero mean and constant variance, generally independent across sample households and not related to M.

In order for this function to be empirically plausible, the adding-up restriction must be met in the parameter estimation, that is,

$$\sum_{i=1}^{k} \varpi_i = 1 \text{ that is possible only when } \sum_{i=1}^{k} \alpha_i = 1 \text{ and } \sum_{i=1}^{k} \beta_i = 0 \qquad (2)$$

Note that the above restrictions can be satisfied when ordinary least squares (OLS) estimation of the model's parameters is implemented independently on an equation-by-equation basis. Hence, under the basic Working–Leser Engel curve model, adding up is not a cross-equation restriction that usually messes up the parameter estimation. In this study, separate Engel curves will be constructed and analyzed for M = total household expenditure and M = total household income. When total household expenditure is used, budget shares are the proportion of the total expenditure accounted for by the *i*th consumption item, while budget shares are deemed to be the proportion of the total household income allocated for the various items M is income. Additionally, in the income Engel curves, household savings is assumed to be a distinct consumption category.

Augmented Engel Curves with Demographic and Locational Dummies

The basic form of the model can easily be adjudged to be overly simple, bordering on being a crude approximation of reality. Since different household characteristics are posited earlier to influence budget decisions of households, we can modify the basic model by augmenting it with household composition as well as demographic and locational dummy variables. In this way, we can empirically determine and assess the significance of the differential impact of these supposedly relevant factors on the budget shares of the various consumption categories.

The form of the Engel curves that will serve as our means of testing our a priori expectations and theoretical predictions take the following form (known as the Augmented Working–Leser Engel curves):

$$\varpi_i = \alpha_i + \beta_i \ln(M) + \sum_{j=1}^{a} \gamma_{ij} \eta_j + \sum_{j=1}^{b} \psi_{ij} DEM_j + \sum_{j=1}^{c} \phi_{ij} DISTRICT_j + u_i \quad (3)$$

where $\varpi_i, \alpha_i, \beta_i, M$, and u_i are the same as before,

a = number of age-specific household composition variables
b = number of demographic characteristics dummy variables
c = number of Metro Manila district dummy variables
$\eta_j =$ number of household members belonging to the jth age category
$DEM_j = 1$ if sample household belongs to the jth demographic category, 0 if otherwise
$DISTRICT_j = 1$ if sample household belongs to the jth Metro Manila district, 0 if otherwise

To make model (3) subscribe to the adding-up requirement of the theory, it is necessary for the following to be met in the parameter estimates:

$$\sum_{i=1}^{k}\alpha_i = 1 \qquad \sum_{i=1}^{k}\beta_i = 0 \qquad \sum_{i=1}^{k}\gamma_{ij} = 0 \qquad \sum_{i=1}^{k}\psi_{ij} = 0 \quad \text{and} \quad \sum_{i=1}^{k}\varphi_{ij} = 0 \tag{4}$$

It is to be noted however that when OLS estimation is applied for each equation in isolation, there is no way we can incorporate the above constraints; hence, it is imperative that we employ simultaneous equation system estimation, with facility to handle cross-equations a priori restrictions. In this study, the Full Information Maximum Likelihood (FIML) estimation is seen to provide the best results under the adding-up constraints (4). As an alternative, the Iterative SURE, by virtue of its being an asymptotic FIML, can likewise be used, provided that the solution converges.

Incorporating the Sampling Design of the Survey in Inference

It has been one of the goals of this study to compute parameter estimates of the models together with the necessary descriptive measures and standard errors with full consideration of the complex design of the survey. This is made clear at the onset since the proponent would like to distinguish this study from most statistical investigations that employ survey data. More often than not, statistical inferences in most of these researches are done with the assumption that the data collection is undertaken using simple random sampling (SRS) without replacement, with the elements of the target population having equal chance of being included in the sample. Although computationally convenient, this procedure is theoretically flawed when complex design was used in the survey (Deaton, 1997; Korn & Graubard, 1999).

The FIES in particular employs a multistage stratified sampling design aimed at economizing on the sample size without sacrificing the precision of the sample representation. As a consequence, each population element has different probabilities of inclusion in the sample. As such, there is a need to take into consideration the use of sampling weights (sometimes called raising factors), which represent the inverse of the selection probabilities for each sample element (Cochran, 1977). These sampling weights are needed to correct for differential representation and the effect of the sampling design on the estimates and their respective standard errors (Deaton, 1997). This will ensure the unbiasedness and consistency of the estimates, resulting in better inference.

An important by-product of the adjustment process called the design effect (Deff) is generated for each design-consistent estimate. This statistic represents the ratio of the variance of the estimate (using the complex design) and the variance under a hypothetical survey conducted under the SRS sampling without replacement and with the same number of elements as in the complex survey (Kish, 1965). Stratification tends to reduce Deff below 1.0 while clustering tends to increase it above 1.0 (Deaton, 1997; Kish, 1995). A design effect above 1.0 may seem to be pointing to the relative undesirable of the complex design vis-à-vis SRS on the basis of efficiency; however, survey designers have to take into consideration various factors in designing surveys (e.g., costs and timeliness of the results). All things being equal, a simple random sample gives the most efficiency per observation collected. Oftentimes however, important considerations dictate that samples not be taken strictly at random (Wolter, 2007).

The adjustment process to incorporate the complex design of the 2009 FIES in all of the estimation and statistical inferences procedures implemented in the study is automated using the STATA Ver. 11 software through the various commands and macros known collectively as "svy commands." Such a suite of commands is well suited for all researchers who use survey data in their analyses and wanted to "do it right," that is, to avoid the consequences of using SRS-based estimation and inference procedures that may lead to misleading results.

Identifying the Poor Households

Due to the multifaceted nature of poverty, identifying the individuals who are in such a state has become a matter of conjecture. In the Philippines, there are a number of estimates for an indicator known as the "poverty line" or "poverty threshold"—an income cutoff point that represents the "minimum acceptable standard of welfare that separates the poor from the non-poor" (ADB, 2009). The government, multilateral organizations, and private entities employ different poverty lines, which vary significantly in any given reference period. During the year 2009, the official poverty threshold using the approved poverty estimation methodology announced by NSCB is

P16,841 per capita income, which when used for the entire Philippines puts the poverty incidence at 20.9% (Virola, 2011). For international comparison, multilateral organizations either use the $1-a-day or the $1.25-a-day standards as the threshold. The Social Weather Stations (SWS) employs the "self-rated poverty indicator," which in the second quarter of 2009 stood at 50% (ADB, 2009). The methodology of the Annual Poverty Indicator Survey (APIS) identifies the poor as those belonging to lower 40% of the income distribution (NSO, 2009). Balisacan (2003) on the other hand, proposed a spatially consistent poverty threshold that varies across time and space, which at the moment has no updated figure for NCR available yet.

In the present study, the official poverty incidence of 20.9% in 2009 is used to identify the poor, which roughly corresponds to the bottom 20% (lowest quintile) of the regional income distribution of the NCR. When the P16,841-per-capita threshold is to be used, only 57 of the Metro Manila 2009 FIES sample of 4,285 will be classified as poor, defeating the purpose of the study. Hence, due to the asymptotic nature of the econometric estimation methodology to be employed as well as to come up with a more robust descriptive estimates, it is deemed necessary to use the more "realistic" system of identifying the poor as those households belonging to the first two regional income deciles resulting in a working sample of 854 households.

Conceptual Framework

The classical microeconomic theory of consumer demand behavior has it that the basic determinant of the budget share formation of consumers is the total income available at their disposal (Varian, 2005). It is to be expected that the higher the income of the consumer, the higher would be the allocation proportion that they would assign to those items they can do without when they are poorer. Moreover, during situations of relative poverty, families tend to put higher priorities to items that are considered to be of basic importance to their survival, like food, utilities, clothing, and shelter.

It is however simplistic to assume that consumption varies exclusively with income of the household. Some other characteristics could decidedly impact on the budget allocation process. For one, the presence of school-aged members could influence the budget shares for education, food, clothing and footwear, and transportation and communication, among other consumption items. Having nonrelatives, particularly family friends and household helps, could create a dent on the household budget in terms of allocation to household operations, nondurables, and other related items. In short, household composition should be taken into consideration in the modeling process.

Households also vary extensively in their demographic characteristics. Consequently, such variation can be manifested in the manner they form their household budget. We can postulate that variables such as, gender, age, educational attainment and employment status of the household head, and the type of family may be considered as logical determinants of consumption behavior of the family. Location of the household in the metropolis may also play a role in family budgeting.

Presented in Figure 1 is the conceptual framework paradigm of the study. It simply shows the interrelationships of the various components—database, models, inference techniques, estimation procedures, basic outcomes, and the possible policy implications of the results.

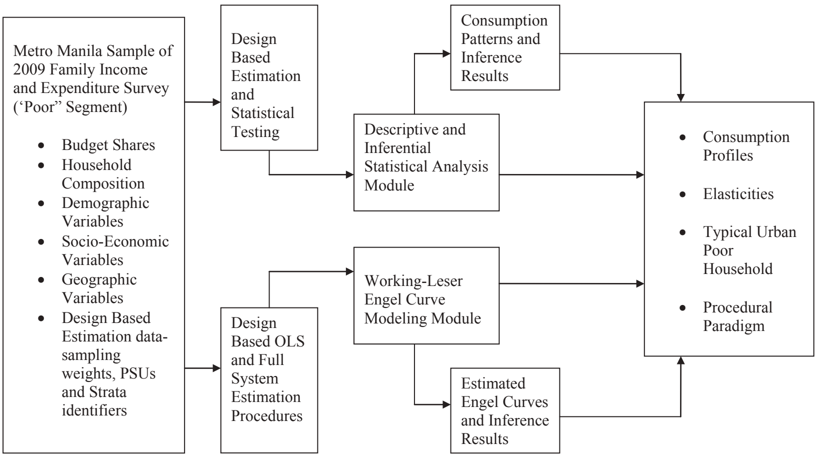

Figure 1. Conceptual Fframework diagram

The Variables and How They are Prepared for Analysis

The main concern of the analysis are the budget shares for the different consumption categories that are used and conceptually presented in the operational definitions of the 2009 FIES. Two different kinds of budget shares are generated: the shares of total household expenditures and the shares of total household income devoted to each of the 19 consumption items. For the income budget share, an additional category of budget is used, which is that of household savings. For each of these sets of budget shares for each household, the total is 1 by construction. It has to be emphasized that in this study, the average share of each item pertains to the sample average for the item, that is, for the ith consumption item: $\varpi_i = \frac{\sum_j w_j \omega_i}{\sum_j w_j}$, with w_j is the weight of the sample household, in contrast to the aggregate budget share concept (Deaton & Case, 1997), which the NSO has adopted in its published figures. The formula for this concept is $\bar{w}_i = \frac{\sum_j w_j c_{ij} / \sum_j w_j}{\sum_i \sum_j c_{ij}}$, with j across sample households.

Income and Expenditure Elasticities

Among the most important parameters of economic relationships essential in research is the concept of elasticity. In this study, both the income and expenditure elasticities of consumption of each of the various consumption categories. In budget studies like Engel curve analysis, income or expenditure elasticities may be used as a basis of categorizing the various items of consumption into necessity, luxury, or inferior. Obtaining estimates for these coefficients in the present study may reveal important insight into how the urban poor of the Metropolis consider the various items.

Using the Basic Working–Leser Engel curve model (1), a general elasticity formula can be derived by considering that the budget share ϖ_i may be represented as the ratio of the unit price times the quantity of the commodity consumed by the household and the total consumption or total income.

Given the model $\varpi_i = \frac{p_i q_i}{M} = \alpha_i + \beta_i \ln(M)$, the income/expenditure elasticity for the ith consumption item which is denoted by ε_i can be derived as

$$\varepsilon_i = \frac{\partial \ln q_i}{\partial \ln M} = 1 + \frac{\beta_i}{\varpi_i} \tag{5}$$

Evaluation of the elasticities is undertaken at the mean budget share $\overline{\varpi}_i$ using the empirically determined parameter $\hat{\beta}_i$ (the coefficient of the natural logarithm of income or natural logarithm of expenditure).

In this study, both the income and expenditure elasticities of the different consumption items are estimated. In estimating the income elasticities, household savings is considered as one of the items families allocate budget for. Hence, a design-based estimate for savings elasticity of household income will be one of the distinct outputs of the study.

Review of Related Literature

The earliest account in the literature of empirical modeling of complete system of demand equation was the contribution of Leser (1941) using family budget data of a cross-section of Australian households. Prior to Leser, the early history of empirical demand analysis is characterized by the extensive use of single-equation methodology centered on measurement of elasticities (e.g., Schultz, 1938). After Leser, it took a decade for another researcher to come up with another application of the complete system approach. This happened when Stone (1954) published an empirical implementation of the linear expenditure system (LES) to British consumption data. This publication marked the beginning of a slow but steady flow of research concerning the application of the theory of consumer demand behavior in multicommodity markets using both cross-section and time series data.

The publication by Houthaker (1960) of a theoretical landmark about additive preferences marked the end of the infant stage of the systems approach (Barten, 1977). Since then, there has been an almost continuous flow of journal articles and published materials, theoretical and applied, delving mainly on systems of consumer demand equations. The primary concern of the modern strand of the literature on demand systems is the specification of the mathematical form of the complete system model. The trust along this area in microeconomics is in the formulation of the model or models with the most desirable properties (Barten, 1977). Over the years, many models have been proposed, but perhaps the most outstanding among these complete demand models are the Rotterdam model, due to Theil (1965) and Barten (1966), and the Almost Ideal Demand System (AIDS) by Deaton and Muellbauer (1980). These two models are considered excellent alternatives to the LES, which remained to be the model of choice by many researchers since the time of Stone (1954).

What made these three models extremely popular to consumer demand analysts and other economists is their demonstrated empirical validity as well as the fact that these models are the leading representative functional forms of the three approaches used in generating systems of consumer demand equations. No other models registered a better loyal following among demand researchers than these three theoretically sound and mathematically rigorous models. These demand systems can also be used to model budget shares of the consumption items on household's income (or spending). When taken in this form, the model becomes a system of Engel curves.

The type of Engel curve initially used in empirical studies was the single-equation model of budget shares and per capita disposable income for each commodity item in the consumption basket. Empirical estimation can be performed in many ways. The review works of Prais and Houthakker (1971) and Brown and Deaton (1972) offered a glimpse of the various techniques used in estimating single-equation Engel curves. The common consensus in the reviews was that the double logarithmic and semi-logarithmic forms produced better goodness-of-fit performance than the other commonly used forms.

A major concern in the estimation of Engel curves is for the algebraic form of the model used should be consistent with observed consumer behavior and at the same time fall within the theoretical requirements of consumer demand theory. One important theoretical condition called the "adding-up" restriction is usually violated by single-equation models. Adding up requires that consumers do not spend more than what they earn. One functional form that satisfies this restriction and can represent closely demand behavior of consumers was originally proposed by Working (1943) and elaborated by Leser (1963), which came to become the most popular single-equation modeling technique for Engel curves under the name *Working–Leser model*. It allows for luxuries, necessities and inferior goods, and elasticities to vary with income. Finally, the form is linear in the logarithm of expenditure (under the nonsatiety assumption) and is easily estimated by OLS equation by equation.

More recent studies gravitate towards the use of full system models of Engel curves. The main reason for such a shift was the implausibility of some of the requirements of consumer demand theory when more explanatory variables are used in the single-equation forms. Under this scenario, the theoretical developments in the literature of the full system consumer demand equations converged with that of the full system Engel curve modeling as both are deemed to be theoretically similar in many respects. Current issues that are being resolved in the literature concern the appropriateness of using nonlinear budget shares and elasticities (e.g., Bhalotra & Attfield, 1998; Gong et al., 2005; Kedir & Girma, 2007) and the concern about the maximum dimension of the function space contained by the Engel curve (e.g., Yu, Hertel, Preckel, & Eales, 2004; Cranfield et al., 2003).

Philippines Demand and Engel Curves System Studies

In the Philippines, most of the complete system studies were about consumer demand analysis using cross-section data. Bouis (1990) estimated food demand elasticities for the Philippines' urban and rural populations on seven food categories and one nonfood category using a food characteristic demand model. He noted more pronounced tendencies for rural populations to have higher estimated income elasticities for more expensive foods. In using the model to simulate consumption, he noted that the model correctly anticipated urban and rural consumption of certain food items using observed price and income data in out-of-sample simulation.

Balisacan (1994) employed a two-stage budgeting framework in estimating the coefficients of an AIDS implementation of another food demand system. Instead of using the original Deaton and Muellbauer (1980) specification of AIDS, he followed the suggestion of Blundell (1988) of incorporating quadratic real income term and some household demographic variables. Using data from the 1985 to 1992 FIES, he estimated the model for six consumption categories and uncovered different patterns of consumption of various demographic groups across survey periods.

The structure used by Balisacan (1994) gave Llanto (1996) a theoretical and procedural basis for a separate study aimed at determining the consumption response of agricultural households to changes in income and prices. Llanto posited that poor households are more vulnerable to adverse price movements, particularly that of food, due to inappropriate government policies mostly intended to protect producers but are detrimental to consumers (e.g., tariffs and price supports). Following the same procedure used by Balisacan, Llanto reported theoretically plausible and statistically adequate results. In this study, Llanto cited the study of Orbeta (1994), whose finding is consistent with his.

Orbeta and Alba (1998) employed the regional data files of the 1991 FIES to analyze the impact of macroeconomic policy changes on the nutritional status of Filipino households. To do this, they used an eight-equation food demand system with a modified AIDS specification for the purpose of estimating uncompensated price elasticities and expenditure elasticities. These elasticity estimates were then used as inputs to a multimarket model developed by Quisumbing (1988) that calculates the changes in nutrient consumption resulting from changes in prices and income. This allowed simulation exercises to be done through the APEX General Equilibrium Model (Cororaton, 1996) to examine the impact of the Tariff Reform Program implementation between 1988 and 1992 on micronutrient availability to the household sector.

The most interesting innovation of Orbeta and Alba (1998) is in the computation of price elasticities using cross-section data. In circumventing the price invariance of survey data, they exploited the fact that price variation occurs across provincial boundaries (spatial price variation). By grouping the nationwide sample into income quintiles and applying the contemporaneous provincial price indices of the various consumption categories on the households in each income grouping, they were able to generate expenditure and price elasticities. The study was able to show progressive impact of policy changes on nutrition as compared to the impact on income.

An analytical study (Alba, 1999) on the consumption pattern of urban poor households was conducted using full system Engel curve models using a modified Working–Lesser model. The model was implemented using primary data collected by two NGOs—HASIK and PHLSSA—in five consumption categories (food, transport, clothing, utilities, and others). Estimation was carried out by the full information maximum likelihood (FIML) method, with cross-equation adding-up restrictions imposed to make the estimates satisfy consumer demand theory. The estimated model however produced very few significant parameter estimates, particularly in the transport and utility equations with no significant coefficients. Differential effects can not be sorted out even in Engel curve equations with significant coefficients. To figure out the net influences of the significant variables, Alba resorted to the use of counter-factual simulations implemented on households with hypothetical characteristics. The most robust among the findings uncovered was that urban poor families are (probably) less able to adjust to increases in prices of food and utilities than to similar changes in transport and clothing.

Presentation and Analysis of Results

After implementing the different descriptive and analytical procedures outlined in the methodology section, we are now ready to present the results. The presentation is divided into two main sections: the first is the outcome of the descriptive analysis of the stylized facts about Metro Manila urban poor; the second is a discussion of the results of the analytical models employed in the study particularly the Working–Leser Engel curves of the various consumption items. A total of 38 statistical tables were constructed summarizing the information extracted from the Metro Manila sample of FIES 2009.

Stylized Facts on the Demographics and Consumption Pattern of Metro Manila Urban Poor

Using the estimation procedure suggested by the survey design of FIES 2009, it is estimated that the total number of urban poor households in Metro Manila in 2009 stands at 492,392 families. Presented in Table 1 and Table 1A are the different demographic and locational characteristics of this segment of Metro Manila households. The average age of household heads is 45.63 years with a mean family size of 3.6 persons. The highest number of age-specific household members is under the working-age segment—the 25- to

59-year-old bracket—with 1.5 persons on the average, while nonrelative members and infants (aged less than 1 year old) have the least number with less than 0.1 average members. Adolescents (7 to 14 years old) average 0.8 members; toddlers (1 to 6 years old) average 0.6 members, while young adults (15 to 24 years old) are estimated at a little less than 0.5 average.

Three out of four (75.1%) households are headed by males, 7 out of 10 (70.1%) have married heads, and about 6 in 10 (56.6%) have high-school–educated heads. Nine out of ten (89.3%) households belong to the nuclear single-family type. The unemployment rate of the household heads stands at 21.95%, of which married unemployed are 12.4% of household heads, male unemployed are 12.1%, and heads who are older than 45 years and jobless are estimated at 17.4%. Unemployment rate in the poorest decile is estimated at 13.6%.

In those households with unemployed heads, 59,577 (12.1% of all households) are male, 61,145 (12.4%) are married, 85,950 (13.6%) are at least 45 years old, and 6,592 (1.3%) are college graduates.

Among Metro Manila's four contiguous districts, the largest number of poor households at 180,499 is located in District 2 (Eastern Metro Manila composed of Mandaluyong, Marikina, Pasig, Quezon City, and San Juan). District 3 (CAMANAVA District—Caloocan, Malabon, Navotas, and Valenzuela) houses 132,949 households, while District 4 (Southern Metro Manila—Las Piñas, Makati, Muntinlupa, Parañaque, Pasay, Pateros, and Taguig) has 124,952 poor households. The district comprising the City of Manila has the least number of poor households at 53,991. Judging the severity of poverty across districts may not be appropriate because of scale effects; the number of poor households in districts with bigger geographical area is expectedly higher than smaller districts. Looking at the per capita income of poor households in the four districts, the CAMANAVA District, with per capita income of P43,170, proved to have the poorest of the poor while the City of Manila with per capita income of P45,584 has poor with the highest purchasing power. Estimates of the average income, expenditures, per capita income, and per capita expenditure of the poor in the different districts are presented in Table 1B.

Sampling design-consistent estimation of the average income and expenditure of the poor in Metro Manila resulted in the figures of P117,087 and P115,433, respectively, in current (2009) peso, with per capita figures of P44,008 and P42,521. These numbers are less than half of Metro Manila's FIES results (P356,000 income and P309,000 expenditure) reported by NSO for the year 2009 but better than those estimated for ARMM (P113,000 income and P98,000 expenditure) during the same year (NSO Press l Release Number: 2011-07). Despite their meager purchasing power, the urban poor of the capital region managed to generate an estimated P1,654 average savings (compared to Metro Manila savings of P47,000). As expected, food accounts for the lion share of both income and expenditure of the households, with budget shares of 49.94% of income and 50.41% of expenditure. House rent (17.46% of income and 17.74% of expenditure) and utilities (9.37% of income and 9.48% of expenditure) are the two other major consumption items. These three categories, together with household operations and personal care and effects, registered 100% consumption incidence (or items consumed by all sample households) during the reference period.

As gleaned from Tables 2, 6, and 7, expenditure items receiving the least budget shares are purchases of nondurable furnishings (0.10% of income and 0.11% of expenditure), house repair and maintenance (0.16% of income and 0.17% of expenditure), recreation (0.22% of income and 0.22% of expenditure), and education (0.7% of income and 0.69% of expenditure). These items also registered the least consumption incidence although not in the same order. Interestingly, 28.36% of the big cities' poor paid taxes, 59.37% were able to save part of their income, 68.46% turned in positive expenditure on gifts and contributions to others, and more than half (51.59%) consumed alcoholic beverages.

Nonpoor Versus Poor Income Disposition

Looking at the other segment of the population of households in Metro Manila we labeled "Nonpoor," which basically consist of households belonging to the top 8 regional income deciles, a glaring contrast in consumption patterns may be noted. Table 7A presents the disposition of household income and consumption incidence by the nonpoor households of all consumption items. Also exhibited in the table are the average income and expenditure per household as well as the per capita income and expenditure figures. To highlight the contrast in consumption patterns and purchasing power between nonpoor and poor households, Table 7B is constructed from information in Table 7 and Table 7A.

The validity of the Engel's Law that richer families tend to have lower proportion of their income devoted to food is apparent in Table 7B as only 36.38% of the nonpoor's income is consigned to food while the figure is 49.94% for the poor. In all other expenditure items, the disposition of their income essentially differ, but the ranking in their importance is basically the same, especially in the top two items—food and housing—which account for the bulk of their income. For the nonpoor, savings occupy the third highest allocation proportion, while utilities are the third highest for the poor. The difference in their savings rate is an awe-inspiring ratio of more than 10:1 (9.89% for the nonpoor versus 0.91% for the poor). Two other items exhibit glaring contrasts: tax payments (2.33% versus 0.36%) and education expenditures (3.18% versus 0.70%). These figures suggest an extreme disparity in well being enjoyed by the nonpoor over the poor.

With regards to consumption incidence (percentage of the total households consuming positive amount) of the various items, the two segments registered 100% incidence of almost the same items except for savings, where only 59.37%% of the poor was able to save while the nonpoor posted 100%. Among the other noteworthy differences in consumption incidence are in education, recreation, durable, and nondurable furnishings, special occasions of the family, gifts and contribution to others, house repairs and maintenance, and tax payments. When one looks at the hard figures of average household and average per capita income and expenditure, the picture of contrast will be complete—for the nonpoor vis-à-vis the poor, total income (almost fourfold), total expenditure (threefold), per capita income (2.4-fold), and per capita expenditure (double).

Design-Consistent vis-à-vis Simple Random Sampling (SRS) Estimates

One of the value-added features of the study is the survey design-consistent estimation procedure employed in all of the descriptive and analytical methodologies implemented. The 2009 FIES is a complex survey with clustering and stratification features of the different stages of sample selection; hence, treating the raw data as elements of a simple random sample when used in data analysis will produce biased and inconsistent results (Deaton, 1997). To make a comparative analysis of the difference between the design-consistent and SRS estimates, Tables 2, 3, and 4 will be of help.

Presented in Tables 2 and 3 are the design-consistent and SRS estimates of the mean household consumption by expenditure categories, respectively. Table 4 exhibits the two estimates side by side to highlight their difference. It is to be emphasized that the SRS estimates disregard the true survey design of FIES and hence are fictitious and are generated only for comparative analysis. One may note the glaring difference between the two sets of estimates, with the design consistent estimates being generally higher than SRS estimates and having larger standard errors. Out of 23 items estimated, only six SRS estimates are higher than the design consistent estimates and only seven produced higher standard errors.

In all of the tables showing design consistent estimates, an indicator of the relative efficiency of SRS estimates over that of design-based figures, called the Deff, is included for reference. A Deff figure of 1.5000 can be interpreted to mean that SRS without replacement is 50% more efficient (lesser variance) than a complex design should SRS be the actual sample selection procedure used. However, as mentioned in the Methodology section, SRS estimates are biased and inconsistent (hence misleading) if the true survey design involves clustering and stratification.

Estimated Income and Expenditure Elasticities

Further insights can be gathered beyond a descriptive analysis of the budget allocation process of Metro Manila poor households when we can quantify the manner they consume the various consumption items in response to their changing disposable income. We call this measure income elasticity of demand. Sometimes we use the alternative measure called expenditure elasticity when we equate disposable income to the total expenditure. Such an assumption is usually made in analytical studies and is necessary to allow the adding-up restriction of consumer demand theory to be relevant. In this study, both the income and expenditure elasticities are computed as we allow savings to be endogenized and treated as an additional consumption category in the computation of income elasticities.

One of the most useful applications of the estimated elasticities is in the classification of the consumption items as necessity or luxury goods. Identifying which of the different expenditure categories are considered necessity for the urban poor may provide important insights into the type of assistance suitable for this segment of the population. The following summary, taken from Tables 7 and 8, gives the results of the computation of both the income and the expenditure elasticities for the different budget items.

Consumption Item	Income Elasticity	Classification	Expenditure Elasticity	Classification
Food	0.8734	Necessity	0.9558	Necessity
Alcoholic beverages	ns ($p > 0.567$)	Independent	ns ($p > 0.942$)	Independent
Tobacco	0.5292	Necessity	ns ($p > 0.143$)	Independent
Fuel, light, and water	0.8066	Necessity	0.8812	Necessity
Transportation and communication	1.5703	Luxury	1.6581	Luxury
Household operations	ns ($p > 0.125$)	Independent	ns ($p > 0.396$)	Independent
Personal care and effects	ns ($p > 0.666$)	Independent	1.1105	Luxury
Clothing and footwear	ns ($p > 0.262$)	Independent	1.1683	Luxury
Education	2.1169	Luxury	2.1429	Luxury

continued...

Recreation	1.7832	Luxury	1.8915	Luxury
Medical care	ns (p > 0.828)	Independent	ns (p > 0.665)	Independent
Nondurable furnishings	ns (p > 0.164)	Independent	1.4787	Luxury
Durable furnishings	3.0067	Luxury	2.8230	Luxury
Taxes paid	3.0396	Luxury	3.0175	Luxury
House rent/rental value	0.5355	Necessity	0.6407	Necessity
House maintenance/ repairs	ns (p > 0.766)	Independent	ns (p > 0.648)	Independent
Special occasions	1.3740	Luxury	1.3993	Luxury
Gifts and contributions	1.5900	Luxury	1.7579	Luxury
Other expenditures	2.3792	Luxury	2.3876	Luxury
Savings	9.3401	Luxury		

Note. ns—not significant (with *p*-value > 0.05).

As seen in the above summary, five (5) items are categorized as necessity while the rest are either luxury or independent (with insignificant income/expenditure coefficients in the basic Working–Leser Engel curves) goods. Both income and expenditure elasticities agree with their classification (except for three items—tobacco, personal care and effects, and clothing, footwear and other wears). Foremost among the list of necessary consumption items are food, utilities (fuel, light, and water), and house rent, which a priori are items the poor cannot do without. The other four necessities (alcoholic beverages, tobacco, medical care, and household operations) are not really expected a priori. However, when one analyzes the nature of these items, one can justify their classification as necessary goods for the poor.

For the expenditure items classified as luxury by either income or expenditure elasticities, sound economic sense can be gleaned from their inclusion. Transportation and communication; personal care and effects; clothing, footwear, and other wear; education; recreation; durable and nondurable furnishings; special occasions of the family; gifts and contributions; house maintenance and repairs; tax payments; and household savings may be expected to fall at the lower priority end of the budget formation of the financially challenged segment of the population. The items having the highest income elasticities—savings (9.34), tax payment (3.04), durable furnishings (3.01), and education (2.12)—indicate the aspirations of the poor to consume more of these items when their purchasing power improves.

Results of Engel Curve Modeling

The income and expenditure elasticities presented in the previous section are estimated using the basic (linear-logarithmic) Working–Leser Engel curves (1) estimated for each item using the elasticity formula (5). When the objective is to model how the budget allocation process of Metro Manila poor is influenced by the household's socioeconomic and demographic characteristics, the basic model has to be augmented to form model (3) called the augmented Working–Leser Engel curves (Working, 1943, and Leser, 1963).

The model given by specification (5) represents a system of Engel curves of the various consumption items which are seen to be linked through their stochastic disturbance terms, thus forming a system of seemingly unrelated regression equations (SURE) to be estimated simultaneously via the joint generalized least squares (JGLS) estimation, which is asymptotic FIML. Twenty (20) statistical tables are constructed (Tables 10 to 30) to exhibit the results of SURE estimation of both the income and the expenditure Engel curves. Tables 31 and 32 show the correlation matrix of the residuals of the expenditure and income Engel curves, respectively, together with the results of the Breusch–Pagan tests of independence of the residuals to empirically validate the assumption underlying the SURE estimation of the Engel curves that there exist cross-equations linkage via their error terms. The test for both expenditure and income Engel curves turned in highly significant results ($p < 0.0001$), hence validating the propriety of using the seemingly unrelated regression framework, instead of doing equation-by-equation estimation via OLS. Tables 33A and 33B present the goodness-of-fit measures for the two Engel curve SURE systems. From these tables, all equations with the exception of repairs and maintenance and durable furnishings have excellent goodness of fit.

The most important item in the consumption basket of the urban poor in Metro Manila is food, which accounts for a little over 50% of the family's income or expenditure. From Table 10, household consumption of food as revealed by its augmented Engel curves is strongly influenced by logarithm of income or total expenditure and the different household composition variables. Additional memberships in all age-specific categories are highly significantly positive except for the eldest category of 60 years old and over. The working age class of 25 to 59 years old appears to have the highest relative increase in food consumption as their membership grows by an additional person (3.72% per person), followed by the two younger groups with almost identical incremental relative consumption of 3.5% increase per additional member. Food consumption by households with high-school-educated heads and those 45 years and ever registered significantly negative food consumption change per household. Households situated in Districts 2 and 4 and those under the single-family-type group turned in significantly higher percentage increase.

Alcohol and beverage consumption relative change per household is significantly higher for male-headed households, ceteris paribus, while those in the poorest decile and with elder heads have significantly lower relative consumption. Heavy users of alcohol and beverages per capita are inferred to be those belonging to the working-age population while those in other age groups except the toddlers and eldest members (with insignificant coefficients) have significantly negative semielasticities. Locational and other demographic variables, as seen in Table 11, have insignificant percentage change in alcohol and beverage consumption. As reflected in Table 12, the Engel curve for cigarette and tobacco also suggests that male-headed households are heavy users of this consumption item, while those whose heads are married and those belonging to the elder category of heads have negative coefficients. On a per-person basis, working-age members have positive incremental change in percentage consumption of cigarettes and tobacco. The three district dummies, on the other hand, have significantly lower percentage change in cigarette and beverage consumption over the base Metro Manila district of the City of Manila.

The Engel curves for utilities show that all age-specific household membership of poor households have significantly positive semielasticities for electricity, gas, and water, particularly the eldest age group and the adolescents. Households with married heads also registered positive and significant semielasticity as well as all of the Metro Manila district dummies, signifying the increased utilities consumption of the poor with these attributes. With regards to transportation and communication, a pronounced disparity of the results of income and expenditure Engel curves was noted. In particular, consumption does not depend on income for the income curve while expenditure curve depends heavily on income. Both curves however have significant coefficients for the above-60-years-age group (negative), the above-45-years-old group (negative), college graduate heads (positive), and Metro Manila District 4 (positive). These bits of information from Table 14 indicate the diminished need of elder poor and increased need of highly educated poor for transport and communications.

Consumption on household operations does not depend on either income or total expenditure by the household as reflected in Table 15. Households with highly educated heads and those situated in the CAMANAVA District as well as those in the poorest income decile have significantly positive coefficients; other variables have insignificant coefficients. For personal care and effects (Table 16), all age-specific household membership variables turned in significant positive semielasticities with the sole exception of the senior citizens, who have significantly negative figures for both curves. Married households and those in the CAMANAVA District and fourth district of Metro Manila also have positively significant coefficients. Negatively significant coefficients are noted for male-headed households

Recreation's budget share of income and total expenditure varies significantly negative with regards to young adults and working-age adults as well as the household being of the single nuclear type. Total income, total expenditure, and other variables do not significantly affect the poor's budget formation for recreation (Table 17).

For medical care as a consumption item (Table 18), both income and expenditure Engel curves indicate the important factors that show the consumption pattern of the poor. Consumption varies negatively with income or expenditure; infants and the oldest age group receive the most positive semielasticities; working adults (25 to 59 years old) have negative semielasticities—suggesting the poor's priority in allocating their income to medical needs of the household members—infants and eldest first at the expense of the working adults. Other explanatory variables have insignificant roles in the budget formation for medical care.

Augmented Working–Leser Engel curves for nondurable and durable furnishings (Tables 19 and 20) produced insignificant semielasticities in all explanatory variables, even the logarithm of total income and total expenditures as well as their locational circumstances. This empirical result suggests that budget allocation for any types of furnishing is not systematically related to any of their household attributes; they can make do with whatever furnishings they have or come to acquire over time.

Even the poor segment of Metro Manila population considers education important as indicated by both the income and expenditures Engel curves for this consumption item. Table 21 reveals that the proportion of income/expenditure allocated to education by the poor significantly vary (positively) with the number of household members who are of school age. Interestingly, even the number of young working-age adults has significant influence on the budget formation for education, which may be interpreted to mean that urban poor working population tend to acquire education even later than normal.

In a society where the regime of socialized taxation is the norm, as in the Philippines, the poor are supposed to enjoy the benefit of being subsidized by the upper income segments of the population, especially when it comes to paying income taxes. This norm however does not exempt them from paying other types of taxes that are imposed by consuming something or by enjoying certain services. Hence, tax payment is also a distinct budget item even for the poor. Although only 28.26% of our sample households paid tax in 2009, the determinants of budget share for taxes can still be assessed using Engel curves. Table 22 presents the income and expenditure Engel curves for tax payments. Some of the most significant predictors are the single status of household head and the completion of a college degree, both of which have significantly positive coefficients. The negative predictors of tax payments among the poor are the presence of children in the household (toddlers and adolescents), the household head being older than 45 years old, and the household being at the bottom 10% of Metro Manila families in terms of income. With respect to locational attributes of the poor, those situated in Metro Manila District 4 (Southern MM District) have significantly positive semielasticity.

Among the estimated Engel curves in this study, minor repairs and maintenance income and expenditure Engel curves exhibit a poor fit as evidenced by the lack of significant determinants of this budget item. Table 23 shows the estimated model generated by the iterative seemingly unrelated regression estimation (SURE) procedure. Like that of the nondurable and durable furnishings curves, budget formation for repairs and maintenance does not depend on any specific demographic and other socioeconomic attributes of the urban poor households of Metro Manila.

Clothing, footwear, and other wear budget share depends on some age-specific household memberships (see Table 24). The presence of adolescents—7 to 14 years old—has shown to positively influence budget formation for this consumption item, while working-age adults (25- to 59-year-olds) and seniors (60 years old and over) negatively affect it. Surprisingly, household members who are nonrelatives (e.g., friends, household helps) exhibit strong explanatory influence on the share of clothing and footwear in the family's budget. This phenomenon may be due to the payment in kind arrangement poor families adopt in asking nonrelatives to stay and help in household chores.

The second most important item in the budget of Metro Manila poor households is house rental. It accounts for a little less than 20% of the household's income or total expenses. It is also among the items in the consumption basket of the poor with 100% consumption incidence. Consequently, it is expected that budget allocation for this item may have numerous predictors. As seen in Table 25, both the income and the expenditure Engel curves for house rentals are significantly influenced by most household composition variables, except the infants, seniors, and nonrelatives. Interestingly, every relative increase in household composition (toddlers, adolescents, young adults, and working adults) decreases the proportion of house rentals out of the income or expenditure of the household. This may seem to be counter-intuitive at first, but for poor families, balancing the budget when household members increase involves a trade-off among the major consumption items—food and house rentals. But since the share of food cannot be compromised, house rental's share decreases.

Urban poor from Metro Manila form their budget allocation for special occasions of the family on the basis of its income with positive coefficient. A relative increase in their income results in an increase on the budget allocation proportion to expenses on special occasions. The other positive predictor for this consumption item is the high school education of the household heads. Factors that contribute negatively are the jobless status of the household head, the household being of the single-family type, and the presence of adolescents.

With respect to gifts and contributions made by the household, a good number of predictors are noted in the Engel curves for this category of consumption by the poor (Table 27). Other than categorizing this item as a luxury, budget allocation for this item positively responds to income of the family but negatively related to all household composition variables, with the working-age group having the highest negative semielasticity. Other negative predictors are the age of the household head and the type of household, while the only positive factor other than income is the married status of the household head. The rest of the explanatory variables are insignificant. The insight that can be inferred from these results is that due to the limited financial capability of poor families, the needs of the family members come first before giving away part of their meager income as gifts and contributions. However, as their income grows, they tend to engage more in charitable giving.

Savings is a feature of only the income Engel curve as we deliberately consider it as an item in the budget list of the family. As can be seen in Table 28, the income Engel curve reveals a lot of insights into how the poor households in Metro Manila form their budget allocation for savings. Realistically, the budget share of savings correlates positively with the income of the family as evidenced by the highly significant semielasticity of 0.14097, which when interpreted means that for every percent increase in the income of the family, they tend to increase the amount they set aside for future use by an additional budget allocation of 14.1% ceteris paribus. Adolescents (7 to 14 years old) and young adults (15 to 24 years old) exert significantly negative influence in the family's saving behavior. This observed phenomenon may be due to education, medical care, and other needs of these age groups that impinge on the family's desire to save. The presence of nonrelative members of the household and, understandably, the jobless status of the head also dampen the savings propensity of the poor.

Interestingly, households with lesser educated heads are more prone to savings than households with more educated heads. The same observation was noted for single-headed households vis-à-vis households with married heads. Poor households also present locational variation in savings budget allocation with District 2 (East Metro Manila) and District 4 (South Metro Manila) with significantly negative differential savings propensity than the benchmark district, the City of Manila. The CAMANAVA District has insignificant differential intercept, hence having the same propensity as the benchmark district.

Consumption Profile of the Urban Poor in Metro Manila

The main objective of the study is to generate the consumption profile of the poor households in Metro Manila area using survey design-consistent analysis of the most recently available FIES data. The foregoing stylized facts and results of a systems-wide modeling of Engel curves of the various consumption items comprising the market basket of the poor provide us with the necessary information to meet this objective. Since all of the descriptive statistics and Engel curves presented pertain to the average household, an attempt will be made to create a portrait of a typical Metro Manila poor household in a nontechnical and intuitive manner.

Based on the results of the analytical procedures implemented, the typical urban poor family in Metro Manila is composed of four members headed by a 46-year-old high-school-educated father, living in District 2 (Eastern Metro Manila) of Metro Manila with his wife and two children—an adolescent and a toddler. They live as a single-family household whose family income in 2009 amounted to P117,087 and have a total expenditure of P115,433, making them on the average better off than families living in the Autonomous Region of Muslim Mindanao but more than twice worse off than the average Metro Manila families. The typical poor family finds it difficult to allocate their income to their various consumption requirements as they need to spend two-thirds of it for food (49.9%) and house rent (17.5%), leaving the remaining third to other expenditure items, especially those needed by their children like education, medical care, and apparel. Despite their meager income, the family managed to make both ends meet and is able to pay tax and save a modest P1,654 for the year.

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Appendix: Tables

Table 1. Design Consistent Means of Demographic Characteristics of Metro Manila Poor Households, 2009

Household Demographics	Mean	Standard Error	95% Confidence Interval		Design Effect
			Lower Limit	Upper Limit	
Age of household head	45.62916	0.52725	44.59107	46.66726	1.0967
Family size	3.58901	0.06710	3.45691	3.72112	1.0929
Members of household younger than 1 year	0.06969	0.00989	0.05022	0.08915	1.2461
Members of household who are 1 to 6 years old	0.56111	0.02884	0.50433	0.61789	0.9663
Members of household who are 7 to 14 years old	0.76892	0.03627	0.69750	0.84033	1.0224
Members of household who are 15 to 24 years old	0.43399	0.02829	0.37829	0.48968	1.1257
Members of household who are 25 to 59 years old	1.50160	0.02936	1.44379	1.55940	1.2815
Members of household who are 60 years and older	0.27787	0.02125	0.23603	0.31972	1.2060
Number of nonrelative members of household	0.02697	0.00920	0.00885	0.04508	1.0934
Male household head (dummy)	0.75091	0.01606	0.71928	0.78253	1.1766
Female household head (dummy)	0.24909	0.01606	0.21747	0.28072	1.1766
Household head is jobless (dummy)	0.21952	0.01510	0.18978	0.24926	1.1358
Household head is 45 years old and older (dummy)	0.46172	0.01756	0.42714	0.49629	1.0585
Single household head (dummy)	0.09838	0.01184	0.07507	0.12168	1.3471
Married household head (dummy)	0.70070	0.01618	0.66885	0.73255	1.0644
Widowed household head (dummy)	0.13624	0.01223	0.11216	0.16032	1.0843
Separated or divorced household head (dummy)	0.06468	0.00813	0.04867	0.08069	0.9322
At most elementary graduate (dummy)	0.30770	0.01804	0.27217	0.34323	1.3038
High school undergraduate or graduate (dummy)	0.56456	0.01515	0.53473	0.59440	0.7966

Table 1 continued...

With some college education (dummy)	0.09319	0.01054	0.07243	0.11395	1.1221
At least college graduate (dummy)	0.03455	0.00635	0.02205	0.04704	1.0304
Single type of household (dummy)	0.89289	0.01115	0.87095	0.91484	1.1084
Household in the poorest decile (dummy)	0.50025	0.01878	0.46327	0.53724	1.2040
Household in the City of Manila (dummy)	0.10965	0.01410	0.08188	0.13742	1.7380
Household in Metro Manila District 2 (dummy)	0.36658	0.03429	0.29905	0.43410	4.3205
Household in Metro Manila District 3 (dummy)	0.27001	0.02599	0.21884	0.32117	2.9223
Household in Metro Manila District 4 (dummy)	0.25377	0.02701	0.20058	0.30695	3.2864
Household head is married and jobless (interaction)	0.12418	0.01153	0.10148	0.14688	1.0425
Household head is a college graduate and jobless (interaction)	0.01339	0.00411	0.00529	0.02148	1.0916
Household head is 45 years old and older and jobless (interaction)	0.17456	0.01277	0.14942	0.19969	0.9648
Household head is male and jobless (interaction)	0.12100	0.01154	0.09828	0.14371	1.0676
Household head is jobless and in poorest decile (interaction)	0.13622	0.01235	0.11191	0.16052	1.1051

Table 1A. Design-Consistent Estimates of Total Number of Metro Manila Poor Households by Demographic and Locational Characteristics

Poor Households Demographic or Locational Characteristics	Estimated Number of Households	Linearized Standard Error	95% Confidence Interval		Design Effect
			Lower Limit	Upper Limit	
Male headed	369,740	26,399	317,763	421,717	13.1088
Household head is jobless	108,090	9,089	90,194	125,986	1.6964
Household head is 45 years old and older	227,346	15,804	196,229	258,463	3.5358
Household head is single	48,440	6,724	35,200	61,679	1.7935

Table 1A continued...

Household head is married	345,021	25,477	294,859	395,183	10.8892
Household head is widowed	67,084	6,633	54,025	80,144	1.3153
Household head is separated	31,847	4,113	23,750	39,944	0.9836
Household head has elementary education	151,508	15,649	120,698	182,319	4.0446
Household head has high school education	277,987	18,014	242,521	313,454	4.6440
Household head is college undergraduate	45,886	5,311	35,430	56,342	1.1741
Household head is college graduate	17,010	3,079	10,948	23,073	1.0001
Single-type household	439,653	28,458	383,623	495,684	29.7929
Household is in City of Manila	53,991	6,787	40,629	67,353	1.6598
Household is in Metro Manila District 2	180,499	23,550	134,131	226,868	8.4036
Household is in Metro Manila District 3	132,949	13,934	105,514	160,384	3.4658
Household is in Metro Manila District 4	124,953	15,025	95,371	154,534	4.1939
Household head is male and jobless	59,577	6,695	46,395	72,760	1.4829
Household head is married and jobless	61,145	6,842	47,674	74,617	1.5144
Household is in bottom regional income decile and with jobless head	67,072	6,906	53,474	80,670	1.4262
Household head is college graduate but jobless	6,592	2,027	2,601	10,582	1.0943
Household head is at least 45 years old and jobless	85,950	7,814	70,565	101,334	1.4908

Table 1B. Design Consistent Estimates of the Mean Household Income and Expenditure, Per Capita Household Income and Expenditure, Metro Manila Poor by District, 2009

Metro Manila District	Mean	Standard Error	95% Confidence Interval		Design Effect
			Lower Limit	Upper Limit	
Total income					
City of Manila	118,970	3,021	113,022	124,919	1.38664
Eastern Metro Manila	116,018	1,576	112,914	119,121	1.03770
CAMANAVA	113,131	2,213	108,774	117,488	1.29669
Southern Metro Manila	122,027	1,823	118,437	125,617	1.10880
Metro Manila	117,087	1,056	115,007	119,167	1.26440
Total expenditure					
City of Manila	112,962	3,132	106,796	119,128	1.27085
Eastern Metro Manila	116,262	1,732	112,852	119,671	0.75605
CAMANAVA	108,867	2,285	104,367	113,366	1.16868
Southern Metro Manila	122,289	2,347	117,668	126,911	1.40513
Metro Manila	115,433	1,197	113,076	117,790	1.16270
Per capita income					
City of Manila	45,584	3,997	37,714	53,453	1.32498
Eastern Metro Manila	43,644	1,631	40,432	46,856	1.03828
CAMANAVA	43,170	1,877	39,475	46,865	0.84477
Southern Metro Manila	44,745	2,549	39,727	49,763	1.63119
Metro Manila	44,008	1,106	41,830	46,187	1.16540
Per capita expenditure					
City of Manila	42,991	3,994	35,127	50,854	1.49731
Eastern Metro Manila	42,521	1,497	39,574	45,468	1.06060
CAMANAVA	40,930	1,847	37,295	44,566	0.94781
Southern Metro Manila	44,010	2,372	39,341	48,679	1.69783
Metro Manila	42,521	1,049	40,455	44,587	1.23810

Table 2. Design Consistent Mean Household Consumption per Consumption Items, Metro Manila Poor Households, 2009

Consumption Items	Estimate (Mean)	Standard Error	95% Confidence Interval		Design Effect
			Lower Limit	Upper Limit	
Food	57,936.69	834.21	56,294.22	59,579.16	1.5405
Alcoholic beverages	1,050.02	72.01	908.24	1,191.81	1.0761
Tobacco	1,076.27	72.62	933.29	1,219.25	1.4984
Fuel, light, and water	10,813.77	186.39	10,446.79	11,180.76	1.2532
Transport and communication	6,037.71	235.03	5,574.97	6,500.45	1.5905
Household operations	1,751.18	61.40	1,630.28	1,872.08	1.1243
Personal care and effects	5,154.23	118.92	4,920.09	5,388.36	1.6050
Clothing, footwear, and other wear	2,359.85	89.46	2,183.71	2,536.00	2.0079
Education	876.90	104.06	672.02	1,081.78	0.9366
Recreation	270.11	46.59	178.38	361.84	1.1330
Medical care	1,799.57	177.24	1,450.60	2,148.54	1.2798
Nondurable furnishings	124.28	13.45	97.81	150.75	1.8355
Durable furnishings	1,531.20	515.88	515.49	2,546.90	2.5056
Taxes paid	490.61	103.00	287.80	693.41	1.4011
Rental value of dwelling unit	19,828.47	495.60	18,852.68	20,804.26	1.5732
House maintenance and minor repairs	188.04	37.45	114.31	261.78	1.1008
Special occasions of the family	1,254.55	95.82	1,065.88	1,443.21	1.5998
Gifts and contributions to others	1,845.09	204.53	1,442.40	2,247.78	1.0759
Other expenditures	1,044.25	81.03	884.72	1,203.78	1.2777
Total income	117,086.90	1,056.36	115,007.10	119,166.80	1.2644
Total expenditure	115,432.80	1,197.19	113,075.60	117,789.90	1.1627
Total savings	1,654.14	729.57	217.70	3,090.58	1.1147
Per capita income	44,008.03	1,106.456	41,829.54	46,186.52	1.1654
Per capita expenditure	42,520.93	1,049.151	40,455.27	44,586.59	1.2381

Table 3. SRS Estimates of the Mean Household Consumption by Consumption Items of Metro Manila Poor Households, 2009

Consumption Items	SRS Estimates	Standard Error	95% Confidence Interval	
			Lower Limit	Upper Limit
Food	57,970.14	674.83	56,645.62	59,294.66
Alcoholic beverages	1,034.89	70.69	896.15	1,173.63
Tobacco	1,065.17	58.80	949.76	1,180.59
Fuel, light, and water	10,787.73	169.50	10,455.04	11,120.41
Transport and communication	5,940.51	186.90	5,573.67	6,307.34
Household operations	1,741.31	58.50	1,626.49	1,856.14
Personal care and effects	5,161.93	63.34	4,978.47	5,345.40
Clothing, footwear, and other wear	2,374.77	111.35	2,250.37	2,499.17
Education	861.56	39.46	643.02	1,080.11
Recreation	254.41	156.00	176.96	331.85
Medical care	1,749.81	10.03	1,443.63	2,055.99
Nondurable furnishings	123.95	237.69	104.26	143.64
Durable furnishings	1,152.78	77.51	686.26	1,619.30
Taxes paid	470.23	392.77	318.10	622.35
Rental value of dwelling unit	19,917.95	34.23	19,147.03	20,688.86
House maintenance and minor repairs	178.38	198.25	111.19	245.57
Special occasions of the family	1,232.39	73.71	1,087.71	1,377.07
Gifts and contributions to others	1,817.93	72.62	1,428.81	2,207.05
Other expenditures	1,037.49	1,083.96	894.96	1,180.03
Total expenditure	104,873.30	72.62	112,745.80	177,000.90
Total income	116,572.70	945.16	114,717.60	118,427.90
Per capita income	44,310.61	1,041.55	42,266.32	46,354.91
Per capita expenditure	42,831.19	958.90	40,949.12	44,713.26

Table 4. Comparative Table of the SRS and Design Consistent Estimates of Mean Consumption of Metro Manila Poor Households by Consumption Items, 2009

Consumption Items	Design Consistent Estimate	Standard Error	95% Confidence Interval		SRS Estimate	Standard Error	95% Confidence Interval		% Difference of SRS
			Lower Limit	Upper Limit			Lower Limit	Upper Limit	
Food	57,936.69	706.22	56,550.55	59,322.83	57,970.14	674.83	56,645.62	59,294.66	0.06
Alcoholic beverages	1,050.02	70.94	910.79	1,189.26	1,034.89	70.69	896.15	1,173.63	–1.44
Tobacco	1,076.27	62.73	953.14	1,199.40	1,065.17	58.80	949.76	1,180.59	–1.03
Fuel, light, and water	10,813.77	168.10	10,483.83	11,143.72	10,787.73	169.50	10,455.04	11,120.41	–0.24
Transport and communication	6,037.71	191.66	5,661.53	6,413.88	5,940.51	186.90	5,573.67	6,307.34	–1.61
Household operations	1,751.18	59.05	1,635.28	1,867.08	1,741.31	58.50	1,626.49	1,856.14	–0.56
Personal care and effects	5,154.23	98.26	4,961.36	5,347.09	5,161.93	63.34	4,978.47	5,345.40	0.15
Clothing, footwear, and other wear	2,359.85	66.24	2,229.84	2,489.86	2,374.77	111.35	2,250.37	2,499.17	0.63
Education	876.90	107.84	665.25	1,088.56	861.56	39.46	643.02	1,080.11	–1.75
Recreation	270.11	49.15	173.65	366.57	254.41	156.00	176.96	331.85	–5.81
Medical care	1,799.57	163.62	1,478.44	2,120.71	1,749.81	10.03	1,443.63	2,055.99	–2.77
Nondurable furnishings	124.28	10.11	104.43	144.13	123.95	237.69	104.26	143.64	–0.27
Durable furnishings	1,531.20	536.98	477.24	2,585.15	1,152.78	77.51	686.26	1,619.30	–24.71
Taxes paid	490.61	100.81	292.74	688.47	470.23	392.77	318.10	622.35	–4.15
Rental value of dwelling unit	19,828.47	425.15	18,994.00	20,662.94	19,917.95	34.23	19,147.03	20,688.86	0.45
House maintenance and minor repairs	188.04	38.95	111.59	264.50	178.38	198.25	111.19	245.57	–5.14
Special occasions of the family	1,254.55	82.23	1,093.14	1,415.95	1,232.39	73.71	1,087.71	1,377.07	–1.77
Gifts and contributions to others	1,845.09	205.11	1,442.52	2,247.67	1,817.93	72.62	1,428.81	2,207.05	–1.47
Other expenditures	1,044.25	73.03	900.91	1,187.58	1,037.49	1,083.96	894.96	1,180.03	–0.65
Total expenditure	115,432.80	1,258.88	112,961.90	117,903.60	104,873.30	72.62	112,745.80	177,000.90	–9.15
Total income	117,086.90	980.60	115,162.30	119,011.60	116,572.70	945.16	114,717.60	118,427.90	–0.44
Per capita income	44,008.03	1,106.456	41,829.54	46,186.52	44,310.61	1,041.55	42,266.32	46,354.91	–0.69
Per capita expenditure	42,520.93	1,049.1	40,455.27	44,586.59	42,831.19	958.90	40,949.12	44,713.26	–0.73

Table 5. Design-Consistent Estimates of Total Number of Metro Manila Poor Households by Demographic and Locational Characteristics

Poor Households' Demographic or Locational Characteristics	Estimated Number of Households	Linearized Standard Error	95% Confidence Interval		Design Effect
			Lower Limit	Upper Limit	
Male headed	369,740	26,399	317,763	421,717	13.1088
Household head is jobless	108,090	9,089	90,194	125,986	1.6964
Household head is 45 years old and older	227,346	15,804	196,229	258,463	3.5358
Household head is single	48,440	6,724	35,200	61,679	1.7935
Household head is married	345,021	25,477	294,859	395,183	10.8892
Household head is widowed	67,084	6,633	54,025	80,144	1.3153
Household head is separated	31,847	4,113	23,750	39,944	0.9836
Household head has elementary education	151,508	15,649	120,698	182,319	4.0446
Household head has high school education	277,987	18,014	242,521	313,454	4.6440
Household head is college undergraduate	45,886	5,311	35,430	56,342	1.1741
Household head is college graduate	17,010	3,079	10,948	23,073	1.0001
Single-type household	439,653	28,458	383,623	495,684	29.7929
Household is in City of Manila	53,991	6,787	40,629	67,353	1.6598
Household is in Metro Manila District 2	180,499	23,550	134,131	226,868	8.4036
Household is in Metro Manila District 3	132,949	13,934	105,514	160,384	3.4658
Household is in Metro Manila District 4	124,953	15,025	95,371	154,534	4.1939
Household head is male and jobless	59,577	6,695	46,395	72,760	1.4829
Household head is married and jobless	61,145	6,842	47,674	74,617	1.5144
Household is in bottom regional income decile and with jobless head	67,072	6,906	53,474	80,670	1.4262
Household head is college graduate but jobless	6,592	2,027	2,601	10,582	1.0943
Household head is at least 45 years old and jobless	85,950	7,814	70,565	101,334	1.4908

Table 6. Budget Shares of Total Expenditure of Metro Manila Poor Households by Consumption Items, 2009

Consumption Items	Estimated Share of Expenditure	Standard Error	95% Confidence Interval		Design Effect	Consumption Incidence
			Lower Limit	Upper Limit		
Food	50.41%	0.48%	49.46%	51.35%	1.8098	100.00%
Alcoholic beverages	0.91%	0.06%	0.79%	1.04%	1.0159	51.59%
Tobacco	0.99%	0.07%	0.85%	1.13%	1.5990	49.09%
Fuel, light, and water	9.48%	0.14%	9.21%	9.75%	1.2339	100.00%
Transport and communication	4.97%	0.18%	4.62%	5.31%	1.6503	96.10%
Household operations	1.54%	0.05%	1.44%	1.64%	1.1038	100.00%
Personal care and effects	4.44%	0.09%	4.26%	4.62%	1.8540	100.00%
Clothing, footwear, other wear	2.02%	0.08%	1.87%	2.17%	2.2550	97.27%
Education	0.69%	0.08%	0.53%	0.85%	0.9985	57.91%
Recreation	0.22%	0.04%	0.15%	0.30%	1.1345	46.68%
Medical care	1.54%	0.13%	1.29%	1.79%	1.1468	97.96%
Nondurable furnishings	0.11%	0.01%	0.08%	0.13%	1.7734	31.85%
Durable furnishings	0.92%	0.21%	0.50%	1.33%	2.3240	22.77%
Taxes paid	0.37%	0.07%	0.23%	0.51%	1.3731	28.36%
Rental value of dwelling unit	17.74%	0.39%	16.98%	18.51%	1.4380	100.00%
House maintenance and minor repairs	0.17%	0.04%	0.10%	0.24%	1.1258	8.31%
Special occasions of the family	1.06%	0.08%	0.90%	1.22%	1.7661	65.10%
Gifts and contributions to others	1.61%	0.17%	1.27%	1.96%	1.0931	68.46%
Other expenditures	0.83%	0.06%	0.70%	0.95%	1.2617	31.33%
Total expenditure	115,433	1,197	113,076	117,790	1.1627	
Total income	117,087	1,056	115,007	119,167	1.2644	
Per capita income	44,008	1,106	41,830	46,187	1.1654	
Per capita expenditure	42,521	1,049	40,455	44,587	1.2381	

Table 7. Budget Shares of Total Income of Metro Manila Poor Households by Consumption Items, 2009

Consumption Items	Estimated Share of Income	Standard Error	95% Confidence Interval		Design Effect	Consumption Incidence
			Lower Limit	Upper Limit		
Food	49.94%	0.60%	48.76%	51.12%	1.7107	100.00%
Alcoholic beverages	0.90%	0.06%	0.77%	1.02%	1.0517	51.59%
Tobacco	0.95%	0.07%	0.82%	1.09%	1.5654	49.09%
Fuel, light, and water	9.37%	0.14%	9.08%	9.65%	1.2121	100.00%
Transport and communication	4.96%	0.18%	4.60%	5.33%	1.6220	96.10%
Household operations	1.52%	0.05%	1.42%	1.62%	1.0416	100.00%
Personal care and effects	4.40%	0.09%	4.21%	4.58%	1.6743	100.00%
Clothing, footwear, and other wear	2.00%	0.08%	1.85%	2.15%	2.2033	97.27%
Education	0.70%	0.08%	0.54%	0.85%	0.9697	57.91%
Recreation	0.22%	0.03%	0.15%	0.29%	1.1201	46.68%
Medical care	1.55%	0.14%	1.27%	1.82%	1.1837	97.96%
Nondurable furnishings	0.10%	0.01%	0.08%	0.13%	1.8068	31.85%
Durable furnishings	1.13%	0.36%	0.43%	1.83%	2.5182	22.77%
Taxes paid	0.36%	0.07%	0.22%	0.51%	1.3888	28.36%
Rental value of dwelling unit	17.46%	0.39%	16.69%	18.23%	1.4184	100.00%
House repairs and maintenance	0.16%	0.03%	0.09%	0.23%	1.1388	8.31%
Special occasions of the family	1.05%	0.08%	0.88%	1.21%	1.5896	65.10%
Gifts and contributions to others	1.52%	0.17%	1.18%	1.86%	1.0656	68.46%
Other expenditures	0.81%	0.06%	0.69%	0.93%	1.2756	31.33%
Savings	0.91%	0.64%	‹0.35%	2.17%	1.1426	59.37%
Average income	117,087	1,056	115,007	119,167	117,087	
Average expenditure	115,433	1,197	113,076	117,790	115,433	
Per capita income	44,008	1,106	41,830	46,187	44,008	
Per capita expenditure	42,521	1,049	40,455	44,587	42,521	

Table 7A. Budget Shares of Total Income of Nonpoor of Metro Manila Households by Consumption Items, 2009

Consumption Items	Estimated Share of Income	Standard Error	95% Confidence Interval		Design Effect	Consumption Incidence
			Lower Limit	Upper Limit		
Food	36.38%	0.40%	35.58%	37.17%	3.35353	100.00%
Alcoholic beverages	0.58%	0.02%	0.53%	0.62%	1.99837	59.60%
Tobacco	0.59%	0.03%	0.53%	0.64%	2.41444	52.82%
Fuel, light, and water	7.53%	0.08%	7.37%	7.69%	2.22034	100.00%
Transport and communication	7.47%	0.13%	7.23%	7.72%	1.92315	99.86%
Household operations	1.86%	0.06%	1.74%	1.99%	2.18020	100.00%
Personal care and effects	3.49%	0.05%	3.38%	3.59%	3.18696	100.00%
Clothing, footwear, and other wear	1.92%	0.04%	1.84%	2.01%	4.02608	99.23%
Education	3.18%	0.12%	2.95%	3.41%	1.64224	78.65%
Recreation	0.39%	0.02%	0.35%	0.43%	2.52066	69.59%
Medical care	1.64%	0.08%	1.49%	1.79%	1.24062	99.39%
Nondurable furnishings	0.13%	0.01%	0.12%	0.15%	2.38343	45.70%
Durable furnishings	1.75%	0.18%	1.40%	2.10%	1.40642	40.36%
Taxes paid	2.33%	0.12%	2.10%	2.57%	3.04146	65.25%
Rental value of dwelling unit	15.47%	0.30%	14.87%	16.06%	3.71157	100.00%
House repairs and maintenance	0.26%	0.03%	0.21%	0.32%	1.58358	14.14%
Special occasions of the family	1.58%	0.07%	1.45%	1.70%	2.23376	85.25%
Gifts and contributions to others	1.63%	0.08%	1.48%	1.78%	1.92449	70.57%
Other expenditures	1.94%	0.05%	1.84%	2.03%	1.63887	77.13%
Savings	9.89%	0.43%	9.04%	10.73%	1.87639	100.00%
Average Income	416,002	16,024	384,487	447,517	5.73872	
Average Expenditure	357,387	10,761	336,223	378,551	5.18452	
Per Capita Income	105,362	5,573	94,402	116,322	5.80070	
Per Capita Expenditure	90,020	3,807	82,532	97,507	5.25078	

Table 7B. Disposition of Total Income and Consumption Incidence of Poor vis-à-vis Non poor Metro Manila Households, 2009

Consumption Items	Estimated Share of Income		Consumption Incidence	
	Nonpoor	Poor	Nonpoor	Poor
Food	36.38%	49.94%	100.00%	100.00%
Alcoholic beverages	0.58%	0.90%	59.60%	51.59%
Tobacco	0.59%	0.95%	52.82%	49.09%
Fuel, light, and water	7.53%	9.37%	100.00%	100.00%
Transport and communication	7.47%	4.96%	99.86%	96.10%
Household operations	1.86%	1.52%	100.00%	100.00%
Personal care and effects	3.49%	4.40%	100.00%	100.00%
Clothing, footwear, and other wear	1.92%	2.00%	99.23%	97.27%
Education	3.18%	0.70%	78.65%	57.91%
Recreation	0.39%	0.22%	69.59%	46.68%
Medical care	1.64%	1.55%	99.39%	97.96%
Nondurable furnishings	0.13%	0.10%	45.70%	31.85%
Durable furnishings	1.75%	1.13%	40.36%	22.77%
Taxes paid	2.33%	0.36%	65.25%	28.36%
Rental value of dwelling unit	15.47%	17.46%	100.00%	100.00%
House repairs and maintenance	0.26%	0.16%	14.14%	8.31%
Special occasions of the family	1.58%	1.05%	85.25%	65.10%
Gifts and contributions to others	1.63%	1.52%	70.57%	68.46%
Other expenditures	1.94%	0.81%	77.13%	31.33%
Savings	9.89%	0.91%	100.00%	59.37%
Average household income	416,002	115,433		
Average household expenditure	357,387	117,087		
Per capita income	105,362	44,008		
Per capita expenditure	90,020	42,521		

Table 8. Basic Working–Leser Engel Curves and Estimated Expenditure Elasticities of Metro Manila Poor Households, 2009

Consumption Items	Constant	Standard Error	*t* Value	*p* Value	Log of Expenditure	Standard Error	*t* Value	*p* Value	Expenditure Elasticity
Food	0.76319	0.14770	5.17	0.000	−0.02227	0.01286	−1.73	0.084	0.9558
Alcoholic beverages	0.01260	0.04757	0.26	0.791	−0.00030	0.00408	−0.07	0.942	0.9671
Tobacco	0.05202	0.02892	1.80	0.073	−0.00362	0.00247	−1.47	0.143	0.6343
Fuel, light, and water	0.22582	0.05144	4.39	0.000	−0.01126	0.00441	−2.55	0.011	0.8812
Transport and communication	−0.33086	0.05188	−6.38	0.000	0.03271	0.00447	7.32	0.000	1.6581
Household operations	0.03121	0.01859	1.68	0.094	−0.00136	0.00160	−0.85	0.396	0.9118
Personal care and effects	−0.01272	0.02689	−0.47	0.636	0.00491	0.00233	2.10	0.036	1.1105
Clothing, footwear, and other wear	−0.01935	0.02163	−0.89	0.372	0.00340	0.00185	1.83	0.068	1.1683
Education	−0.08487	0.01943	−4.37	0.000	0.00789	0.00173	4.57	0.000	2.1429
Recreation	−0.02058	0.01192	−1.73	0.085	0.00196	0.00105	1.87	0.063	1.8915
Medical care	0.03263	0.03966	0.82	0.411	−0.00148	0.00342	−0.43	0.665	0.9038
Nondurable furnishings	−0.00506	0.00274	−1.85	0.065	0.00053	0.00024	2.21	0.028	1.4787
Durable furnishings	−0.18599	0.07336	−2.54	0.012	0.01677	0.00648	2.59	0.010	2.8230
Taxes paid	-0.08319	0.02258	-3.68	0.000	0.00746	0.00200	3.74	0.000	3.0175
Rental value of dwelling unit	0.91900	0.13748	6.68	0.000	-0.06374	0.01186	−5.37	0.000	0.6407
House maintenance and minor repairs	−0.00361	0.01169	−0.31	0.758	0.00045	0.00099	0.46	0.648	1.2674
Special occasions of the family	−0.03866	0.02285	−1.69	0.092	0.00423	0.00196	2.16	0.032	1.3993
Gifts and contributions to others	−0.12584	0.05537	−2.27	0.024	0.01220	0.00479	2.55	0.011	1.7579
Other expenditures	−0.12575	0.01994	−6.31	0.000	0.01152	0.00173	6.66	0.000	2.3876

Table 9. Basic Working–Leser Engel Curves and Estimated Income Elasticities of Metro Manila Poor Households, 2009

Consumption Items	Constant	Standard Error	*t* Value	*p* Value	Log of Income	Standard Error	*t* Value	*p* Value	Income Elasticity
Food	1.23479	0.20840	5.93	0.000	-0.06321	0.01790	-3.53	0.000	0.8734
Alcoholic beverages	0.02735	0.04400	0.62	0.535	-0.00158	0.00377	-0.42	0.676	0.8245
Tobacco	0.06182	0.02712	2.28	0.023	-0.00449	0.00231	-1.94	0.053	0.5292
Fuel, light, and water	0.30448	0.06043	5.04	0.000	-0.01812	0.00517	-3.50	0.001	0.8066
Transport and communication	-0.27968	0.05954	-4.70	0.000	0.02830	0.00513	5.51	0.000	1.5703
Household operations	0.04192	0.01737	2.41	0.016	-0.00230	0.00149	-1.54	0.125	0.8482
Personal care and effects	0.02992	0.03268	0.92	0.361	0.00121	0.00280	0.43	0.666	1.0275
Clothing, footwear, and other wear	-0.00544	0.02272	-0.24	0.811	0.00219	0.00195	1.13	0.262	1.1093
Education	-0.08355	0.01955	-4.27	0.000	0.00778	0.00173	4.49	0.000	2.1169
Recreation	-0.01777	0.01020	-1.74	0.083	0.00172	0.00090	1.91	0.057	1.7832
Medical care	0.02512	0.04380	0.57	0.567	-0.00083	0.00380	-0.22	0.828	0.9466
Nondurable furnishings	-0.00290	0.00280	-1.04	0.301	0.00034	0.00024	1.40	0.164	1.3262
Durable furnishings	-0.25233	0.12484	-2.02	0.044	0.02266	0.01103	2.06	0.041	3.0067
Taxes paid	-0.08260	0.02316	-3.57	0.000	0.00741	0.00205	3.62	0.000	3.0396
Rental value of dwelling unit	1.11802	0.15705	7.12	0.000	-0.08109	0.01351	-6.00	0.000	0.5355
House maintenance and minor repairs	-0.00160	0.01092	-0.15	0.883	0.00028	0.00093	0.30	0.766	1.1719
Special occasions of the family	-0.03504	0.02405	-1.46	0.146	0.00391	0.00206	1.90	0.059	1.3740
Gifts and contributions to others	-0.08904	0.06008	-1.48	0.140	0.00896	0.00515	1.74	0.083	1.5900
Other expenditures	-0.12175	0.01988	-6.12	0.000	0.01116	0.00172	6.47	0.000	2.3792
Savings	-0.87172	0.33553	-2.60	0.010	0.07570	0.02871	2.64	0.009	9.3401

Table 10. Augmented Working–Leser Food Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	*z* Value	*p* Value	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	−0.14893	0.01898	−7.850	0.000	−0.07421	0.01301	−5.700	0.000
Members of household younger than 1 year	0.01731	0.01449	1.190	0.232	0.01723	0.01141	1.510	0.131
Members of household who are 1 to 6 years old	0.02730	0.00496	5.500	0.000	0.02789	0.00391	7.140	0.000
Members of household who are 7 to 14 years old	0.03501	0.00386	9.080	0.000	0.02708	0.00305	8.870	0.000
Members of household who are 15 to 24 years old	0.03519	0.00513	6.860	0.000	0.02847	0.00405	7.030	0.000
Members of household who are 25 to 59 years old	0.03718	0.00663	5.600	0.000	0.03770	0.00518	7.270	0.000
Members of household who are 60 years and over	−0.00405	0.00926	−0.440	0.662	0.00270	0.00725	0.370	0.710
Number of nonrelative members of household	0.01691	0.01434	1.180	0.238	−0.00134	0.01130	−0.120	0.906
Male household head (dummy)	−0.01221	0.01100	−1.110	0.267	−0.00805	0.00865	−0.930	0.352
Household head is jobless (dummy)	0.00076	0.00993	0.080	0.939	−0.01451	0.00781	−1.860	0.063
Household head is 45 years old and older (dummy)	−0.02119	0.00958	−2.210	0.027	−.00706	0.00757	−0.930	0.351
Single household head (dummy)	−0.02874	0.01869	−1.540	0.124	−0.01438	0.01471	−0.980	0.328

Table 10 continued...

Married household head (dummy)	0.02687	0.01640	1.640	0.101	0.00208	0.01293	0.160	0.872
Widowed household head (dummy)	0.02004	0.01748	1.150	0.252	0.01196	0.01375	0.870	0.384
At most elementary graduate (dummy)	−0.01008	0.00926	−1.090	0.276	0.01108	0.00733	1.510	0.131
At most high school graduate (dummy)	−0.04351	0.01152	−3.780	0.000	−0.01826	0.00911	−2.010	0.045
With some college education (dummy)	−0.00995	0.01339	−0.740	0.457	−0.01518	0.01054	−1.440	0.150
At least college graduate (dummy)	0.02176	0.02080	1.050	0.295	0.00217	0.01639	0.130	0.895
Single type of household (dummy)	0.04208	0.01372	3.070	0.002	0.03464	0.01081	3.200	0.001
Household in the poorest decile (dummy)	0.00467	0.01029	0.450	0.650	0.00708	0.00725	0.980	0.329
Household in Metro Manila District 2 (dummy)	0.02718	0.01221	2.230	0.026	0.00510	0.00962	0.530	0.596
Household in Metro Manila District 3 (dummy)	−0.00117	0.01254	−0.090	0.925	−0.00341	0.00987	−0.350	0.730
Household in Metro Manila District 4 (dummy)	0.02900	0.01274	2.280	0.023	−0.00066	0.01006	−0.070	0.947
_Intercept	2.07219	0.22333	9.280	0.000	1.23582	0.15205	8.130	0.000

Table 11. Augmented Working–Leser Alcoholic Beverages Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	*z* Value	*p* Value	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	–0.00684	0.00318	–2.150	0.031	–0.00425	0.00285	–1.490	0.136
Members of household younger than 1 year	–0.00093	0.00243	–0.380	0.701	–0.00097	0.00250	–0.390	0.697
Members of household who are 1 to 6 years old	–0.00162	0.00083	–1.950	0.051	–0.00164	0.00086	–1.910	0.056
Members of household who are 7 to 14 years old	–0.00157	0.00065	–2.440	0.015	–0.00170	0.00067	–2.530	0.011
Members of household who are 15 to 24 years old	–0.00143	0.00086	–1.660	0.097	–0.00153	0.00089	–1.730	0.084
Members of household who are 25 to 59 years old	0.00263	0.00111	2.360	0.018	0.00238	0.00114	2.100	0.036
Members of household who are 60 years and older	–0.00138	0.00155	–0.890	0.373	–0.00164	0.00159	–1.030	0.302
Number of nonrelative members of household	–0.00027	0.00240	–0.110	0.911	–0.00049	0.00248	–0.200	0.842
Male household head (dummy)	0.00728	0.00184	3.950	0.000	0.00786	0.00190	4.140	0.000
Household head is jobless (dummy)	0.00122	0.00166	0.730	0.464	0.00096	0.00171	0.560	0.577
Household head is 45 years old and older (dummy)	–0.00325	0.00160	–2.030	0.043	–0.00313	0.00166	–1.890	0.059
Single household head (dummy)	–0.00126	0.00313	–0.400	0.687	–0.00089	0.00322	–0.270	0.784

Table 11 continued...

Married household head (dummy)	−0.00278	0.00275	−1.010	0.311	−0.00343	0.00284	−1.210	0.226
Widowed household head (dummy)	0.00197	0.00293	0.670	0.501	0.00247	0.00301	0.820	0.413
At most elementary graduate (dummy)	0.00078	0.00155	0.510	0.613	0.00123	0.00161	0.760	0.444
At most high school graduate (dummy)	0.00306	0.00193	1.580	0.113	0.00337	0.00200	1.690	0.092
With some college education (dummy)	−0.00152	0.00224	−0.680	0.498	−0.00206	0.00231	−0.890	0.373
At least college graduate (dummy)	0.00089	0.00348	0.260	0.797	−0.00111	0.00359	−0.310	0.758
Single type of household (dummy)	0.00020	0.00230	0.090	0.931	−0.00017	0.00237	−0.070	0.943
Household in the poorest decile (dummy)	−0.00411	0.00172	−2.390	0.017	−0.00406	0.00159	−2.550	0.011
Household in Metro Manila District 2 (dummy)	−0.00190	0.00204	−0.930	0.353	−0.00249	0.00211	−1.180	0.237
Household in Metro Manila District 3 (dummy)	−0.00215	0.00210	−1.020	0.307	−0.00249	0.00216	−1.150	0.250
Household in Metro Manila District 4 (dummy)	−0.00279	0.00213	−1.310	0.191	−0.00369	0.00221	−1.670	0.095
_Intercept	0.08866	0.03739	2.370	0.018	0.05986	0.03334	1.800	0.073

Table 12. Augmented Working–Leser Cigarette and Tobacco Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	*z* Value	*p* Value	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	-0.00551	0.00268	-2.060	0.040	-0.00734	0.00240	-3.060	0.002
Members of household younger than 1 year	0.00018	0.00204	0.090	0.931	-0.00012	0.00210	-0.060	0.953
Members of household who are 1 to 6 years old	-0.00040	0.00070	-0.570	0.570	-0.00030	0.00072	-0.410	0.681
Members of household who are 7 to 14 years old	-0.00113	0.00054	-2.080	0.037	-0.00107	0.00056	-1.900	0.058
Members of household who are 15 to 24 years old	0.00089	0.00072	1.230	0.221	0.00100	0.00075	1.350	0.178
Members of household who are 25 to 59 years old	0.00197	0.00094	2.100	0.035	0.00207	0.00095	2.170	0.030
Members of household who are 60 years and older	0.00013	0.00131	0.100	0.922	0.00041	0.00134	0.310	0.759
Number of nonrelative members of household	-0.00033	0.00202	-0.160	0.869	-0.00034	0.00208	-0.160	0.870
Male household head (dummy)	0.00639	0.00155	4.120	0.000	0.00667	0.00159	4.190	0.000
Household head is jobless (dummy)	-0.00029	0.00140	-0.210	0.836	-0.00059	0.00144	-0.410	0.682
Household head is 45 years old and older (dummy)	-0.00306	0.00135	-2.260	0.024	-0.00330	0.00139	-2.360	0.018
Single household head (dummy)	-0.00286	0.00264	-1.080	0.278	-0.00200	0.00271	-0.740	0.460

Table 12 continued...

Married household head (dummy)	-0.00407	0.00231	-1.760	0.078	-0.00390	0.00238	-1.640	0.101
Widowed household head (dummy)	-0.00226	0.00247	-0.920	0.359	-0.00201	0.00253	-0.790	0.428
At most elementary graduate (dummy)	0.00152	0.00131	1.170	0.243	0.00183	0.00135	1.350	0.176
At most high school graduate (dummy)	0.00093	0.00163	0.570	0.567	0.00111	0.00168	0.660	0.508
With some college education (dummy)	-0.00119	0.00189	-0.630	0.529	-0.00118	0.00194	-0.610	0.545
At least college graduate (dummy)	-0.00139	0.00293	-0.470	0.636	-0.00245	0.00302	-0.810	0.417
Single type of household (dummy)	0.00039	0.00194	0.200	0.839	0.00037	0.00199	0.190	0.852
Household in the poorest decile (dummy)	0.00122	0.00145	0.840	0.402	0.00024	0.00134	0.180	0.860
Household in Metro Manila District 2 (dummy)	-0.00313	0.00172	-1.820	0.069	-0.00368	0.00177	-2.080	0.038
Household in Metro Manila District 3 (dummy)	-0.00293	0.00177	-1.660	0.098	-0.00337	0.00182	-1.850	0.064
Household in Metro Manila District 4 (dummy)	-0.00464	0.00180	-2.580	0.010	-0.00537	0.00185	-2.900	0.004
_Intercept	0.07316	0.03150	2.320	0.020	0.09491	0.02801	3.390	0.001

Table 13. Augmented Working–Leser Fuel, Light, and Water Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	*z* Value	*p* Value	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	-0.01782	0.00656	-2.720	0.007	-0.00726	0.00551	-1.320	0.187
Members of household younger than 1 year	-0.00850	0.00501	-1.700	0.090	-0.00794	0.00483	-1.640	0.100
Members of household who are 1 to 6 years old	0.00170	0.00171	0.990	0.322	0.00130	0.00165	0.780	0.433
Members of household who are 7 to 14 years old	0.00347	0.00133	2.600	0.009	0.00195	0.00129	1.510	0.132
Members of household who are 15 to 24 years old	0.00337	0.00177	1.900	0.057	0.00181	0.00171	1.050	0.292
Members of household who are 25 to 59 years old	0.00428	0.00229	1.860	0.062	0.00481	0.00219	2.190	0.028
Members of household who are 60 years and older	0.01039	0.00320	3.250	0.001	0.01242	0.00307	4.050	0.000
Number of nonrelative members of household	0.00958	0.00496	1.930	0.053	0.00588	0.00478	1.230	0.219
Male household head (dummy)	-0.00437	0.00380	-1.150	0.250	-0.00502	0.00366	-1.370	0.170
Household head is jobless (dummy)	0.00257	0.00343	0.750	0.454	-0.00028	0.00331	-0.080	0.933
Household head is 45 years old and older (dummy)	0.00772	0.00331	2.330	0.020	0.01040	0.00320	3.250	0.001
Single household head (dummy)	0.00409	0.00646	0.630	0.527	0.00892	0.00622	1.430	0.152

Table 13 continued...

Married household head (dummy)	0.01735	0.00567	3.060	0.002	0.01356	0.00547	2.480	0.013
Widowed household head (dummy)	0.00354	0.00604	0.590	0.558	0.00154	0.00582	0.270	0.791
At most elementary graduate (dummy)	-0.00694	0.00320	-2.170	0.030	-0.00283	0.00310	-0.910	0.362
At most high school graduate (dummy)	-0.00546	0.00398	-1.370	0.171	-0.00105	0.00386	-0.270	0.785
With some college education (dummy)	0.00323	0.00463	0.700	0.486	0.00292	0.00446	0.650	0.513
At least college graduate (dummy)	0.00761	0.00719	1.060	0.290	0.00200	0.00694	0.290	0.773
Single type of household (dummy)	-0.00221	0.00474	-0.470	0.642	-0.00284	0.00458	-0.620	0.534
Household in the poorest decile (dummy)	0.00772	0.00356	2.170	0.030	0.00674	0.00307	2.200	0.028
Household in Metro Manila District 2 (dummy)	0.01400	0.00422	3.320	0.001	0.01059	0.00407	2.600	0.009
Household in Metro Manila District 3 (dummy)	0.01161	0.00433	2.680	0.007	0.01125	0.00418	2.690	0.007
Household in Metro Manila District 4 (dummy)	0.01766	0.00440	4.010	0.000	0.01262	0.00426	2.960	0.003
_Intercept	0.26087	0.07718	3.380	0.001	0.14413	0.06436	2.240	0.025

Table 14. Augmented Working–Leser Transportation and Communication Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Stdandard Error	*z* Value	*p* Value	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	0.01049	0.00717	1.460	0.144	0.02010	0.00591	3.400	0.001
Members of household younger than 1 year	0.00000	0.00548	0.000	0.999	0.00003	0.00518	0.010	0.995
Members of household who are 1 to 6 years old	-0.00089	0.00188	-0.470	0.637	-0.00093	0.00177	-0.530	0.599
Members of household who are 7 to 14 years old	0.00114	0.00146	0.780	0.434	-0.00052	0.00139	-0.380	0.707
Members of household who are 15 to 24 years old	0.00180	0.00194	0.930	0.354	0.00038	0.00184	0.200	0.838
Members of household who are 25 to 59 years old	-0.00027	0.00251	-0.110	0.916	-0.00087	0.00235	-0.370	0.712
Members of household who are 60 years and older	-0.00668	0.00350	-1.910	0.056	-0.00567	0.00329	-1.720	0.085
Number of nonrelative members of household	0.00659	0.00542	1.220	0.224	0.00447	0.00513	0.870	0.384
Male household head (dummy)	-0.00573	0.00416	-1.380	0.168	-0.00427	0.00393	-1.090	0.277
Household head is jobless (dummy)	-0.00058	0.00375	-0.150	0.877	-0.00282	0.00355	-0.800	0.426
Household head is 45 years old and older (dummy)	-0.00835	0.00362	-2.310	0.021	-0.00625	0.00344	-1.820	0.069
Single household head (dummy)	-0.00696	0.00706	-0.990	0.324	-0.00393	0.00668	-0.590	0.557

Table 14 continued...

Married household head (dummy)	0.00607	0.00620	0.980	0.327	0.00326	0.00587	0.550	0.579
Widowed household head (dummy)	-0.00919	0.00661	-1.390	0.164	-0.01005	0.00624	-1.610	0.108
At most elementary graduate (dummy)	-0.00054	0.00350	-0.160	0.876	0.00228	0.00333	0.680	0.493
At most high school graduate (dummy)	-0.00582	0.00435	-1.340	0.181	-0.00165	0.00414	-0.400	0.690
With some college education (dummy)	-0.00012	0.00506	-0.020	0.981	-0.00025	0.00479	-0.050	0.959
At least college graduate (dummy)	0.01815	0.00786	2.310	0.021	0.01598	0.00744	2.150	0.032
Single type of household (dummy)	0.00129	0.00519	0.250	0.803	-0.00133	0.00491	-0.270	0.786
Household in the poorest decile (dummy)	-0.00154	0.00389	-0.400	0.693	-0.00163	0.00329	-0.490	0.622
Household in Metro Manila District 2 (dummy)	0.00415	0.00462	0.900	0.368	0.00158	0.00437	0.360	0.717
Household in Metro Manila District 3 (dummy)	-0.00016	0.00474	-0.030	0.973	-0.00129	0.00448	-0.290	0.773
Household in Metro Manila District 4 (dummy)	0.01794	0.00481	3.730	0.000	0.01296	0.00457	2.840	0.005
_Intercept	-0.07204	0.08441	-0.850	0.393	-0.17702	0.06905	-2.560	0.010

Table 15. Augmented Working–Leser Household Operations Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	*z* Value	*p* Value	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	0.00297	0.00256	1.160	0.247	0.00311	0.00213	1.460	0.145
Members of household younger than 1 year	-0.00075	0.00196	-0.380	0.701	-0.00072	0.00187	-0.390	0.700
Members of household who are 1 to 6 years old	-0.00065	0.00067	-0.970	0.330	-0.00062	0.00064	-0.960	0.335
Members of household who are 7 to 14 years old	0.00008	0.00052	0.140	0.885	-0.00018	0.00050	-0.350	0.725
Members of household who are 15 to 24 years old	-0.00039	0.00069	-0.560	0.577	-0.00058	0.00066	-0.870	0.384
Members of household who are 25 to 59 years old	0.00088	0.00090	0.980	0.325	0.00068	0.00085	0.810	0.421
Members of household who are 60 years and older	0.00160	0.00125	1.280	0.200	0.00195	0.00119	1.640	0.100
Number of nonrelative members of household	0.00347	0.00194	1.790	0.073	0.00256	0.00185	1.380	0.166
Male household head (dummy)	0.00025	0.00148	0.170	0.867	0.00038	0.00142	0.270	0.790
Household head is jobless (dummy)	0.00026	0.00134	0.190	0.848	-0.00059	0.00128	-0.460	0.643
Household head is 45 years old and older (dummy)	-0.00082	0.00129	-0.640	0.525	-0.00018	0.00124	-0.140	0.886
Single household head (dummy)	0.00231	0.00252	0.910	0.360	0.00320	0.00241	1.330	0.184
Married household head (dummy)	-0.00014	0.00221	-0.060	0.950	-0.00067	0.00212	-0.320	0.751

Table 15 continued...

Widowed household head (dummy)	0.00098	0.00236	0.410	0.678	0.00083	0.00225	0.370	0.713
At most elementary graduate (dummy)	0.00014	0.00125	0.110	0.911	0.00044	0.00120	0.370	0.714
At most high school graduate (dummy)	-0.00120	0.00156	-0.770	0.440	-0.00049	0.00149	-0.330	0.742
With some college education (dummy)	0.00142	0.00181	0.780	0.434	0.00109	0.00173	0.630	0.528
At least college graduate (dummy)	0.00773	0.00281	2.750	0.006	0.00528	0.00268	1.970	0.049
Single type of household (dummy)	0.00235	0.00185	1.270	0.205	0.00206	0.00177	1.160	0.244
Household in the poorest decile (dummy)	0.00347	0.00139	2.500	0.012	0.00229	0.00119	1.930	0.054
Household in Metro Manila District 2 (dummy)	0.00218	0.00165	1.320	0.186	0.00146	0.00157	0.930	0.352
Household in Metro Manila District 3 (dummy)	0.00433	0.00169	2.550	0.011	0.00411	0.00162	2.540	0.011
Household in Metro Manila District 4 (dummy)	0.00078	0.00172	0.460	0.649	-0.00035	0.00165	-0.210	0.832
_Intercept	-0.02717	0.03015	-0.900	0.368	-0.02655	0.02489	-1.070	0.286

Table 16. Augmented Working–Leser Personal Care and Effects Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	*z* Value	*p* Value	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	-0.00274	0.00341	-0.800	0.423	-0.00074	0.00282	-0.260	0.794
Members of household younger than 1 year	0.01189	0.00261	4.560	0.000	0.01168	0.00248	4.720	0.000
Members of household who are 1 to 6 years old	0.00298	0.00089	3.330	0.001	0.00315	0.00085	3.710	0.000
Members of household who are 7 to 14 years old	-0.00014	0.00069	-0.200	0.842	-0.00086	0.00066	-1.290	0.196
Members of household who are 15 to 24 years old	0.00267	0.00092	2.890	0.004	0.00210	0.00088	2.390	0.017
Members of household who are 25 to 59 years old	0.00282	0.00119	2.360	0.018	0.00287	0.00113	2.550	0.011
Members of household who are 60 years and older	-0.00430	0.00167	-2.580	0.010	-0.00351	0.00157	-2.230	0.026
Number of nonrelative members of household	0.01073	0.00258	4.160	0.000	0.00976	0.00245	3.980	0.000
Male household head (dummy)	-0.00986	0.00198	-4.990	0.000	-0.01035	0.00188	-5.510	0.000
Household head is jobless (dummy)	0.00260	0.00179	1.460	0.145	0.00085	0.00170	0.500	0.616
Household head is 45 years old and older (dummy)	-0.00301	0.00172	-1.740	0.081	-0.00164	0.00164	-1.000	0.319
Single household head (dummy)	-0.00153	0.00336	-0.450	0.650	-0.00013	0.00319	-0.040	0.969

Table 16 continued...

Married household head (dummy)	0.00871	0.00295	2.950	0.003	0.00696	0.00281	2.480	0.013
Widowed household head (dummy)	0.00389	0.00314	1.240	0.216	0.00227	0.00298	0.760	0.447
At most elementary graduate (dummy)	-0.00301	0.00167	-1.810	0.071	-0.00115	0.00159	-0.720	0.470
At most high school graduate (dummy)	-0.00239	0.00207	-1.150	0.250	0.00005	0.00198	0.030	0.979
With some college education (dummy)	0.00114	0.00241	0.470	0.636	0.00102	0.00229	0.450	0.656
At least college graduate (dummy)	0.00350	0.00374	0.930	0.350	0.00009	0.00356	0.020	0.981
Single type of household (dummy)	-0.00065	0.00247	-0.260	0.793	-0.00163	0.00235	-0.700	0.486
Household in the poorest decile (dummy)	0.00416	0.00185	2.250	0.025	0.00231	0.00157	1.470	0.143
Household in Metro Manila District 2 (dummy)	0.00354	0.00220	1.610	0.107	0.00079	0.00209	0.380	0.703
Household in Metro Manila District 3 (dummy)	0.00513	0.00226	2.270	0.023	0.00444	0.00214	2.070	0.038
Household in Metro Manila District 4 (dummy)	0.00762	0.00229	3.320	0.001	0.00446	0.00218	2.040	0.041
_Intercept	0.06563	0.04018	1.630	0.102	0.04766	0.03301	1.440	0.149

Table 17. Augmented Working–Leser Recreation Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	z Value	p Value	Coefficient	Standard Error	z Value	p Value
Log of income/expenditure	0.00226	0.00152	1.490	0.136	0.00209	0.00143	1.460	0.145
Members of household younger than 1 year	-0.00078	0.00116	-0.680	0.499	-0.00078	0.00126	-0.620	0.535
Members of household who are 1 to 6 years old	-0.00009	0.00040	-0.220	0.827	-0.00008	0.00043	-0.180	0.858
Members of household who are 7 to 14 years old	-0.00017	0.00031	-0.540	0.589	-0.00024	0.00034	-0.710	0.476
Members of household who are 15 to 24 years old	-0.00124	0.00041	-3.030	0.002	-0.00134	0.00045	-3.010	0.003
Members of household who are 25 to 59 years old	-0.00107	0.00053	-2.030	0.043	-0.00105	0.00057	-1.840	0.066
Members of household who are 60 years and older	-0.00091	0.00074	-1.240	0.217	-0.00088	0.00080	-1.100	0.273
Number of nonrelative members of household	-0.00034	0.00114	-0.300	0.764	-0.00056	0.00124	-0.450	0.655
Male household head (dummy)	0.00027	0.00088	0.310	0.756	0.00028	0.00095	0.290	0.772
Household head is jobless (dummy)	-0.00126	0.00079	-1.590	0.113	-0.00146	0.00086	-1.700	0.089
Household head is 45 years old and older (dummy)	-0.00041	0.00076	-0.540	0.591	-0.00034	0.00083	-0.400	0.688
Single household head (dummy)	-0.00062	0.00149	-0.420	0.677	-0.00061	0.00162	-0.380	0.706
Married household head (dummy)	0.00021	0.00131	0.160	0.875	-0.00007	0.00142	-0.050	0.963
Widowed household head (dummy)	0.00186	0.00140	1.340	0.182	0.00175	0.00151	1.150	0.248
At most elementary graduate (dummy)	-0.00047	0.00074	-0.640	0.523	-0.00015	0.00081	-0.190	0.852
At most high school graduate (dummy)	-0.00082	0.00092	-0.890	0.371	-0.00051	0.00100	-0.510	0.610
With some college education (dummy)	-0.00008	0.00107	-0.080	0.937	-0.00021	0.00116	-0.180	0.857
At least college graduate (dummy)	-0.00081	0.00166	-0.490	0.626	-0.00062	0.00181	-0.340	0.731
Single type of household (dummy)	-0.00465	0.00110	-4.240	0.000	-0.00496	0.00119	-4.170	0.000
Household in the poorest decile (dummy)	-0.00004	0.00082	-0.050	0.962	-0.00044	0.00080	-0.550	0.584
Household in Metro Manila District 2 (dummy)	-0.00121	0.00097	-1.240	0.215	-0.00114	0.00106	-1.080	0.281
Household in Metro Manila District 3 (dummy)	-0.00165	0.00100	-1.650	0.100	-0.00150	0.00109	-1.380	0.167
Household in Metro Manila District 4 (dummy)	-0.00183	0.00102	-1.800	0.071	-0.00187	0.00111	-1.690	0.091
_Intercept	-0.01582	0.01783	-0.890	0.375	-0.01319	0.01675	-0.790	0.431

Table 18. Augmented Working–Leser Medical Care Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	*z* Value	*p* Value	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	0.01366	0.00645	2.120	0.034	0.01496	0.00521	2.870	0.004
Members of household younger than 1 year	0.01537	0.00492	3.120	0.002	0.01594	0.00456	3.490	0.000
Members of household who are 1 to 6 years old	-0.00122	0.00168	-0.730	0.468	-0.00071	0.00156	-0.450	0.649
Members of household who are 7 to 14 years old	-0.00088	0.00131	-0.670	0.504	-0.00117	0.00122	-0.960	0.339
Members of household who are 15 to 24 years old	-0.00235	0.00174	-1.350	0.177	-0.00241	0.00162	-1.490	0.137
Members of household who are 25 to 59 years old	-0.00717	0.00225	-3.180	0.001	-0.00796	0.00207	-3.840	0.000
Members of household who are 60 years and older	0.00594	0.00315	1.890	0.059	0.00619	0.00290	2.130	0.033
Number of nonrelative members of household	-0.00259	0.00487	-0.530	0.595	-0.00413	0.00452	-0.910	0.361
Male household head (dummy)	-0.00143	0.00373	-0.380	0.702	-0.00155	0.00346	-0.450	0.653
Household head is jobless (dummy)	0.00271	0.00337	0.800	0.422	0.00203	0.00313	0.650	0.516
Household head is 45 years old and older (dummy)	0.00528	0.00325	1.620	0.105	0.00711	0.00303	2.350	0.019
Single household head (dummy)	0.00663	0.00635	1.040	0.296	0.00909	0.00589	1.540	0.123
Married household head (dummy)	0.00807	0.00557	1.450	0.147	0.00760	0.00518	1.470	0.142
Widowed household head (dummy)	0.00303	0.00594	0.510	0.609	0.00365	0.00550	0.660	0.507
At most elementary graduate (dummy)	-0.00313	0.00315	-1.000	0.320	-0.00160	0.00293	-0.550	0.585
At most high school graduate (dummy)	-0.00542	0.00391	-1.390	0.166	-0.00369	0.00364	-1.010	0.311
With some college education (dummy)	-0.00571	0.00455	-1.260	0.209	-0.00489	0.00422	-1.160	0.246
At least college graduate (dummy)	0.00328	0.00706	0.460	0.642	0.00479	0.00656	0.730	0.465
Single type of household (dummy)	-0.00227	0.00466	-0.490	0.626	-0.00228	0.00433	-0.530	0.598
Household in the poorest decile (dummy)	0.00446	0.00349	1.280	0.202	0.00417	0.00290	1.440	0.151
Household in Metro Manila District 2 (dummy)	0.00659	0.00415	1.590	0.112	0.00463	0.00385	1.200	0.229
Household in Metro Manila District 3 (dummy)	0.00823	0.00426	1.930	0.053	0.00820	0.00395	2.080	0.038
Household in Metro Manila District 4 (dummy)	0.00358	0.00432	0.830	0.407	0.00288	0.00403	0.720	0.475
_Intercept	-0.14531	0.07584	-1.920	0.055	-0.15945	0.06085	-2.620	0.009

Table 19. Augmented Working–Leser Nondurable Furnishings Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	z Value	p Value	Coefficient	Standard Error	z Value	p Value
Log of income/expenditure	0.00012	0.00042	0.270	0.785	-0.00026	0.00039	-0.660	0.509
Members of household younger than 1 year	-0.00039	0.00032	-1.200	0.231	-0.00041	0.00034	-1.180	0.238
Members of household who are 1 to 6 years old	0.00013	0.00011	1.210	0.226	0.00010	0.00012	0.830	0.408
Members of household who are 7 to 14 years old	-0.00017	0.00009	-1.980	0.048	-0.00018	0.00009	-1.950	0.051
Members of household who are 15 to 24 years old	0.00008	0.00011	0.660	0.506	0.00010	0.00012	0.820	0.415
Members of household who are 25 to 59 years old	-0.00001	0.00015	-0.060	0.951	0.00007	0.00016	0.430	0.666
Members of household who are 60 years and older	0.00012	0.00021	0.600	0.546	0.00022	0.00022	1.030	0.304
Number of nonrelative members of household	0.00009	0.00032	0.270	0.788	-0.00004	0.00034	-0.110	0.913
Male household head (dummy)	0.00009	0.00024	0.380	0.706	0.00009	0.00026	0.360	0.722
Household head is jobless (dummy)	0.00012	0.00022	0.560	0.576	0.00006	0.00024	0.240	0.810
Household head is 45 years old and older (dummy)	-0.00011	0.00021	-0.510	0.612	-0.00012	0.00023	-0.530	0.598
Single household head (dummy)	-0.00097	0.00042	-2.330	0.020	-0.00112	0.00044	-2.530	0.011
Married household head (dummy)	-0.00033	0.00036	-0.900	0.366	-0.00052	0.00039	-1.330	0.182
Widowed household head (dummy)	-0.00058	0.00039	-1.500	0.134	-0.00076	0.00041	-1.840	0.066
At most elementary graduate (dummy)	-0.00026	0.00021	-1.250	0.211	-0.00026	0.00022	-1.160	0.244
At most high school graduate (dummy)	0.00017	0.00026	0.670	0.503	0.00017	0.00027	0.640	0.525
With some college education (dummy)	0.00006	0.00030	0.200	0.844	0.00012	0.00032	0.380	0.704
At least college graduate (dummy)	0.00047	0.00046	1.010	0.311	0.00060	0.00049	1.220	0.222
Single type of household (dummy)	0.00022	0.00031	0.710	0.476	0.00025	0.00033	0.760	0.448
Household in the poorest decile (dummy)	-0.00001	0.00023	-0.060	0.948	-0.00024	0.00022	-1.100	0.270
Household in Metro Manila District 2 (dummy)	-0.00049	0.00027	-1.790	0.073	-0.00057	0.00029	-1.960	0.050
Household in Metro Manila District 3 (dummy)	-0.00029	0.00028	-1.030	0.305	-0.00032	0.00030	-1.090	0.278
Household in Metro Manila District 4 (dummy)	0.00015	0.00028	0.510	0.608	0.00010	0.00030	0.340	0.735
_Intercept	0.00013	0.00496	0.030	0.979	0.00471	0.00458	1.030	0.304

Table 20. Augmented Working–Leser Durable Furnishings Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	z Value	p Value	Coefficient	Standard Error	z Value	p Value
Log of income/expenditure	0.00788	0.00839	0.940	0.348	0.02523	0.00471	5.350	0.000
Members of household younger than 1 year	-0.00203	0.00641	-0.320	0.751	-0.00108	0.00413	-0.260	0.794
Members of household who are 1 to 6 years old	-0.00300	0.00219	-1.370	0.172	-0.00208	0.00142	-1.470	0.141
Members of household who are 7 to 14 years old	-0.00173	0.00171	-1.020	0.310	-0.00217	0.00111	-1.970	0.049
Members of household who are 15 to 24 years old	-0.00103	0.00227	-0.450	0.649	-0.00215	0.00147	-1.470	0.142
Members of household who are 25 to 59 years old	-0.00042	0.00293	-0.140	0.886	-0.00189	0.00188	-1.010	0.314
Members of household who are 60 years and older	-0.00440	0.00409	-1.070	0.283	-0.00504	0.00263	-1.920	0.055
Number of nonrelative members of household	-0.00039	0.00634	-0.060	0.951	-0.00154	0.00409	-0.380	0.706
Male household head (dummy)	0.00088	0.00486	0.180	0.856	0.00090	0.00313	0.290	0.775
Household head is jobless (dummy)	-0.00112	0.00439	-0.260	0.798	-0.00181	0.00283	-0.640	0.523
Household head is 45 years old and older (dummy)	-0.00400	0.00424	-0.940	0.345	0.00028	0.00274	0.100	0.918
Single household head (dummy)	-0.00530	0.00826	-0.640	0.521	-0.00376	0.00533	-0.710	0.480
Married household head (dummy)	0.00049	0.00725	0.070	0.946	-0.00243	0.00469	-0.520	0.604
Widowed household head (dummy)	-0.00296	0.00773	-0.380	0.702	-0.00342	0.00498	-0.690	0.493
At most elementary graduate (dummy)	0.00257	0.00410	0.630	0.530	0.00383	0.00266	1.440	0.149
At most high school graduate (dummy)	-0.00154	0.00509	-0.300	0.762	0.00115	0.00330	0.350	0.728
With some college education (dummy)	-0.00458	0.00592	-0.770	0.439	-0.00373	0.00382	-0.980	0.329
At least college graduate (dummy)	-0.00739	0.00919	-0.800	0.422	-0.00751	0.00594	-1.270	0.206
Single type of household (dummy)	0.00191	0.00607	0.320	0.752	0.00040	0.00392	0.100	0.918
Household in the poorest decile (dummy)	-0.00724	0.00455	-1.590	0.111	-0.00067	0.00263	-0.260	0.798
Household in Metro Manila District 2 (dummy)	0.01174	0.00540	2.170	0.030	0.00899	0.00348	2.580	0.010
Household in Metro Manila District 3 (dummy)	0.00754	0.00555	1.360	0.174	0.00584	0.00358	1.630	0.102
Household in Metro Manila District 4 (dummy)	0.00339	0.00563	0.600	0.547	0.00192	0.00365	0.530	0.599
_Intercept	-0.08033	0.09874	-0.810	0.416	-0.28091	0.05509	-5.100	0.000

Table 21. Augmented Working–Leser Education Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	z Value	p Value	Coefficient	Standard Error	z Value	p Value
Log of income/expenditure	0.00295	0.00421	0.700	0.484	0.00609	0.00364	1.670	0.094
Members of household younger than 1 year	-0.00488	0.00321	-1.520	0.129	-0.00473	0.00319	-1.480	0.138
Members of household who are 1 to 6 years old	-0.00126	0.00110	-1.140	0.254	-0.00128	0.00109	-1.170	0.241
Members of household who are 7 to 14 years old	0.00195	0.00086	2.280	0.023	0.00163	0.00085	1.910	0.056
Members of household who are 15 to 24 years old	0.00334	0.00114	2.930	0.003	0.00282	0.00113	2.500	0.013
Members of household who are 25 to 59 years old	-0.00136	0.00147	-0.930	0.355	-0.00153	0.00145	-1.050	0.292
Members of household who are 60 years and older	0.00074	0.00205	0.360	0.718	0.00065	0.00203	0.320	0.748
Number of nonrelative members of household	-0.00088	0.00318	-0.280	0.782	-0.00155	0.00316	-0.490	0.624
Male household head (dummy)	-0.00512	0.00244	-2.100	0.036	-0.00481	0.00242	-1.990	0.047
Household head is jobless (dummy)	0.00019	0.00220	0.090	0.931	0.00001	0.00218	0.000	0.996
Household head is 45 years old and older (dummy)	-0.00150	0.00212	-0.710	0.480	-0.00141	0.00212	-0.670	0.505
Single household head (dummy)	0.00241	0.00414	0.580	0.561	0.00330	0.00411	0.800	0.423
Married household head (dummy)	0.00274	0.00364	0.750	0.452	0.00280	0.00361	0.770	0.438
Widowed household head (dummy)	-0.00418	0.00388	-1.080	0.281	-0.00347	0.00384	-0.900	0.367
At most elementary graduate (dummy)	0.00028	0.00205	0.140	0.892	0.00103	0.00205	0.500	0.614
At most high school graduate (dummy)	0.00067	0.00256	0.260	0.793	0.00161	0.00255	0.630	0.528
With some college education (dummy)	0.00488	0.00297	1.640	0.100	0.00431	0.00295	1.460	0.144
At least college graduate (dummy)	-0.00195	0.00461	-0.420	0.673	-0.00293	0.00458	-0.640	0.522
Single type of household (dummy)	0.00295	0.00304	0.970	0.332	0.00231	0.00302	0.770	0.444
Household in the poorest decile (dummy)	-0.00207	0.00228	-0.910	0.364	-0.00156	0.00203	-0.770	0.441
Household in Metro Manila District 2 (dummy)	-0.00396	0.00271	-1.460	0.144	-0.00475	0.00269	-1.770	0.077
Household in Metro Manila District 3 (dummy)	-0.00344	0.00278	-1.240	0.217	-0.00388	0.00276	-1.410	0.159
Household in Metro Manila District 4 (dummy)	-0.00387	0.00282	-1.370	0.171	-0.00501	0.00281	-1.780	0.075
_Intercept	-0.02341	0.04953	-0.470	0.636	-0.05887	0.04249	-1.390	0.166

Table 22. Augmented Working–Leser Taxes Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	z Value	p Value	Coefficient	Standard Error	z Value	p Value
Log of income/expenditure	0.00104	0.00274	0.380	0.704	0.00247	0.00238	1.040	0.299
Members of household younger than 1 year	0.00276	0.00209	1.320	0.187	0.00251	0.00208	1.200	0.229
Members of household who are 1 to 6 years old	-0.00171	0.00072	-2.380	0.017	-0.00175	0.00071	-2.450	0.014
Members of household who are 7 to 14 years old	-0.00140	0.00056	-2.520	0.012	-0.00152	0.00056	-2.730	0.006
Members of household who are 15 to 24 years old	0.00002	0.00074	0.020	0.984	-0.00011	0.00074	-0.160	0.877
Members of household who are 25 to 59 years old	0.00142	0.00096	1.480	0.139	0.00117	0.00095	1.230	0.218
Members of household who are 60 years and older	0.00040	0.00134	0.300	0.765	0.00027	0.00132	0.200	0.838
Number of nonrelative members of household	-0.00068	0.00207	-0.330	0.744	-0.00082	0.00206	-0.400	0.691
Male household head (dummy)	0.00205	0.00159	1.290	0.196	0.00212	0.00158	1.340	0.179
Household head is jobless (dummy)	0.00209	0.00143	1.460	0.144	0.00193	0.00143	1.350	0.177
Household head is 45 years old and older (dummy)	-0.00356	0.00138	-2.570	0.010	-0.00349	0.00138	-2.520	0.012
Single household head (dummy)	0.00622	0.00270	2.300	0.021	0.00673	0.00269	2.510	0.012
Married household head (dummy)	-0.00071	0.00237	-0.300	0.764	-0.00077	0.00236	-0.330	0.743
Widowed household head (dummy)	0.00056	0.00253	0.220	0.823	0.00068	0.00251	0.270	0.788
At most elementary graduate (dummy)	-0.00133	0.00134	-0.990	0.322	-0.00109	0.00134	-0.820	0.414
At most high school graduate (dummy)	-0.00165	0.00167	-0.990	0.320	-0.00140	0.00166	-0.840	0.401
With some college education (dummy)	0.00324	0.00194	1.670	0.094	0.00347	0.00193	1.800	0.072
At least college graduate (dummy)	0.00910	0.00301	3.030	0.002	0.00847	0.00299	2.830	0.005
Single type of household (dummy)	-0.00043	0.00198	-0.220	0.828	-0.00052	0.00198	-0.260	0.793
Household in the poorest decile (dummy)	-0.00376	0.00149	-2.530	0.011	-0.00348	0.00133	-2.630	0.009
Household in Metro Manila District 2 (dummy)	0.00058	0.00176	0.330	0.742	0.00032	0.00176	0.180	0.858
Household in Metro Manila District 3 (dummy)	0.00153	0.00181	0.840	0.399	0.00146	0.00180	0.810	0.419
Household in Metro Manila District 4 (dummy)	0.00501	0.00184	2.720	0.006	0.00448	0.00184	2.440	0.015
_Intercept	-0.00916	0.03228	-0.280	0.777	-0.02508	0.02779	-0.900	0.367

Table 23. Augmented Working–Leser Repairs and Maintenance Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	z Value	p Value	Coefficient	Standard Error	z Value	p Value
Log of income/expenditure	0.00110	0.00156	0.700	0.482	0.00026	0.00141	0.180	0.856
Members of household younger than 1 year	-0.00098	0.00119	-0.820	0.410	-0.00096	0.00124	-0.780	0.438
Members of household who are 1 to 6 years old	0.00018	0.00041	0.430	0.666	0.00013	0.00042	0.300	0.768
Members of household who are 7 to 14 years old	0.00033	0.00032	1.030	0.302	0.00039	0.00033	1.170	0.242
Members of household who are 15 to 24 years old	0.00001	0.00042	0.030	0.979	0.00000	0.00044	0.000	0.999
Members of household who are 25 to 59 years old	-0.00074	0.00055	-1.350	0.178	-0.00071	0.00056	-1.260	0.209
Members of household who are 60 years and older	0.00105	0.00076	1.370	0.170	0.00109	0.00079	1.380	0.167
Number of nonrelative members of household	-0.00029	0.00118	-0.240	0.808	-0.00032	0.00123	-0.260	0.796
Male household head (dummy)	0.00042	0.00090	0.460	0.643	0.00014	0.00094	0.150	0.881
Household head is jobless (dummy)	-0.00123	0.00082	-1.500	0.133	-0.00138	0.00085	-1.630	0.103
Household head is 45 years old and older (dummy)	-0.00025	0.00079	-0.310	0.754	-0.00039	0.00082	-0.470	0.638
Single household head (dummy)	-0.00073	0.00154	-0.480	0.633	-0.00108	0.00160	-0.680	0.498
Married household head (dummy)	-0.00111	0.00135	-0.830	0.409	-0.00138	0.00141	-0.990	0.324
Widowed household head (dummy)	-0.00117	0.00144	-0.810	0.415	-0.00157	0.00149	-1.050	0.293
At most elementary graduate (dummy)	0.00087	0.00076	1.140	0.255	0.00088	0.00080	1.100	0.272
At most high school graduate (dummy)	0.00031	0.00095	0.330	0.742	0.00042	0.00099	0.430	0.669
With some college education (dummy)	-0.00020	0.00110	-0.180	0.855	-0.00043	0.00115	-0.370	0.710
At least college graduate (dummy)	-0.00063	0.00171	-0.370	0.711	-0.00053	0.00178	-0.300	0.766
Single type of household (dummy)	-0.00049	0.00113	-0.440	0.662	-0.00074	0.00117	-0.630	0.530
Household in the poorest decile (dummy)	-0.00040	0.00085	-0.470	0.639	-0.00096	0.00079	-1.220	0.223
Household in Metro Manila District 2 (dummy)	0.00189	0.00100	1.880	0.060	0.00197	0.00104	1.890	0.059
Household in Metro Manila District 3 (dummy)	0.00078	0.00103	0.760	0.450	0.00077	0.00107	0.720	0.471
Household in Metro Manila District 4 (dummy)	0.00024	0.00105	0.230	0.821	0.00025	0.00109	0.230	0.822
_Intercept	-0.01018	0.01836	-0.550	0.579	0.00067	0.01652	0.040	0.967

Table 24. Augmented Working–Leser Clothing and Footwear Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	z Value	p Value	Coefficient	Standard Error	z Value	p Value
Log of income/expenditure	0.00169	0.00263	0.640	0.520	0.00323	0.00226	1.430	0.153
Members of household younger than 1 year	-0.00092	0.00201	-0.460	0.648	-0.00108	0.00199	-0.540	0.587
Members of household who are 1 to 6 years old	0.00091	0.00069	1.330	0.183	0.00090	0.00068	1.330	0.183
Members of household who are 7 to 14 years old	0.00131	0.00053	2.450	0.014	0.00087	0.00053	1.650	0.100
Members of household who are 15 to 24 years old	-0.00015	0.00071	-0.220	0.828	-0.00044	0.00070	-0.620	0.534
Members of household who are 25 to 59 years old	-0.00159	0.00092	-1.730	0.083	-0.00161	0.00090	-1.780	0.074
Members of household who are 60 years and older	-0.00239	0.00128	-1.860	0.063	-0.00218	0.00126	-1.730	0.084
Number of nonrelative members of household	0.00762	0.00199	3.840	0.000	0.00724	0.00197	3.680	0.000
Male household head (dummy)	0.00198	0.00152	1.300	0.193	0.00212	0.00151	1.410	0.158
Household head is jobless (dummy)	0.00149	0.00137	1.080	0.279	0.00099	0.00136	0.730	0.466
Household head is 45 years old and older (dummy)	0.00102	0.00133	0.770	0.441	0.00160	0.00132	1.220	0.223
Single household head (dummy)	-0.00375	0.00259	-1.450	0.147	-0.00387	0.00256	-1.510	0.131
Married household head (dummy)	-0.00030	0.00227	-0.130	0.894	-0.00192	0.00225	-0.850	0.393
Widowed household head (dummy)	-0.00134	0.00242	-0.550	0.581	-0.00246	0.00239	-1.030	0.305
At most elementary graduate (dummy)	-0.00228	0.00128	-1.770	0.076	-0.00115	0.00128	-0.900	0.366
At most high school graduate (dummy)	-0.00048	0.00160	-0.300	0.763	0.00057	0.00159	0.360	0.721
With some college education (dummy)	0.00126	0.00185	0.680	0.497	0.00142	0.00183	0.780	0.438
At least college graduate (dummy)	0.00167	0.00288	0.580	0.563	0.00078	0.00285	0.270	0.785
Single type of household (dummy)	-0.00267	0.00190	-1.400	0.160	-0.00283	0.00188	-1.500	0.133
Household in the poorest decile (dummy)	0.00228	0.00143	1.600	0.109	0.00150	0.00126	1.190	0.236
Household in Metro Manila District 2 (dummy)	-0.00178	0.00169	-1.050	0.294	-0.00303	0.00167	-1.810	0.070
Household in Metro Manila District 3 (dummy)	-0.00031	0.00174	-0.180	0.856	-0.00052	0.00172	-0.300	0.763
Household in Metro Manila District 4 (dummy)	0.00128	0.00176	0.720	0.469	-0.00032	0.00175	-0.180	0.855
_Intercept	0.00269	0.03093	0.090	0.931	-0.01253	0.02646	-0.470	0.636

Table 25. Augmented Working–Leser House Rental Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	z Value	p Value	Coefficient	Standard Error	z Value	p Value
Log of income/expenditure	--0.03029	0.01479	-2.050	0.041	0.00084	0.01240	0.070	0.946
Members of household younger than 1 year	-0.01615	0.01129	-1.430	0.153	-0.01558	0.01087	-1.430	0.152
Members of household who are 1 to 6 years old	-0.01178	0.00387	-3.050	0.002	-0.01233	0.00372	-3.310	0.001
Members of household who are 7 to 14 years old	-0.00810	0.00301	-2.700	0.007	-0.01143	0.00291	-3.930	0.000
Members of household who are 15 to 24 years old	-0.01412	0.00400	-3.530	0.000	-0.01815	0.00386	-4.700	0.000
Members of household who are 25 to 59 years old	-0.02146	0.00517	-4.150	0.000	-0.02345	0.00494	-4.750	0.000
Members of household who are 60 years and older	0.00214	0.00722	0.300	0.767	0.00436	0.00691	0.630	0.528
Number of nonrelative members of household	-0.01120	0.01117	-1.000	0.316	-0.01894	0.01077	-1.760	0.079
Male household head (dummy)	0.01241	0.00857	1.450	0.148	0.01026	0.00824	1.240	0.213
Household head is jobless (dummy)	0.04002	0.00773	5.170	0.000	0.03017	0.00745	4.050	0.000
Household head is 45 years old and older (dummy)	0.01453	0.00746	1.950	0.052	0.02151	0.00721	2.980	0.003
Single household head (dummy)	-0.02578	0.01456	-1.770	0.077	-0.01003	0.01401	-0.720	0.474
Married household head (dummy)	-0.03385	0.01277	-2.650	0.008	-0.03817	0.01233	-3.100	0.002
Widowed household head (dummy)	-0.01484	0.01362	-1.090	0.276	-0.01463	0.01310	-1.120	0.264
At most elementary graduate (dummy)	-0.01830	0.00722	-2.540	0.011	-0.01296	0.00699	-1.850	0.064
At most high school graduate (dummy)	0.01111	0.00898	1.240	0.216	0.01728	0.00868	1.990	0.047
With some college education (dummy)	0.00724	0.01043	0.690	0.488	0.00389	0.01005	0.390	0.699
At least college graduate (dummy)	0.00412	0.01620	0.250	0.799	-0.01799	0.01562	-1.150	0.249
Single type of household (dummy)	0.00119	0.01069	0.110	0.912	-0.00145	0.01030	-0.140	0.888
Household in the poorest decile (dummy)	0.00325	0.00802	0.410	0.685	0.00294	0.00691	0.430	0.670
Household in Metro Manila District 2 (dummy)	-0.01342	0.00951	-1.410	0.158	-0.01918	0.00916	-2.090	0.036
Household in Metro Manila District 3 (dummy)	-0.02833	0.00977	-2.900	0.004	-0.02915	0.00940	-3.100	0.002
Household in Metro Manila District 4 (dummy)	-0.00855	0.00992	-0.860	0.389	-0.01771	0.00959	-1.850	0.065
_Intercept	0.59854	0.17399	3.440	0.001	0.25423	0.14490	1.750	0.079

Table 26. Augmented Working–Leser Special Occasions Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	*z* Value	*p* Value	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	0.00574	0.00322	1.780	0.075	0.00550	0.00272	2.020	0.044
Members of household younger than 1 year	-0.00067	0.00246	-0.270	0.784	-0.00085	0.00239	-0.350	0.723
Members of household who are 1 to 6 years old	0.00055	0.00084	0.650	0.514	0.00061	0.00082	0.740	0.458
Members of household who are 7 to 14 years old	-0.00182	0.00066	-2.770	0.006	-0.00214	0.00064	-3.350	0.001
Members of household who are 15 to 24 years old	-0.00045	0.00087	-0.510	0.607	-0.00071	0.00085	-0.840	0.402
Members of household who are 25 to 59 years old	0.00130	0.00113	1.150	0.249	0.00131	0.00109	1.210	0.226
Members of household who are 60 years and older	0.00219	0.00157	1.390	0.164	0.00249	0.00152	1.640	0.101
Number of nonrelative members of household	0.00245	0.00244	1.010	0.314	0.00182	0.00237	0.770	0.441
Male household head (dummy)	0.00051	0.00187	0.270	0.786	0.00008	0.00181	0.050	0.963
Household head is jobless (dummy)	-0.00339	0.00169	-2.010	0.044	-0.00376	0.00164	-2.300	0.022
Household head is 45 years old and older (dummy)	0.00043	0.00163	0.260	0.794	0.00067	0.00158	0.420	0.674
Single household head (dummy)	-0.00285	0.00317	-0.900	0.369	-0.00255	0.00308	-0.830	0.407
Married household head (dummy)	-0.00306	0.00279	-1.100	0.272	-0.00365	0.00271	-1.350	0.178
Widowed household head (dummy)	-0.00027	0.00297	-0.090	0.928	-0.00140	0.00288	-0.490	0.627
At most elementary graduate (dummy)	-0.00191	0.00157	-1.210	0.225	-0.00122	0.00153	-0.790	0.428
At most high school graduate (dummy)	0.00398	0.00196	2.030	0.042	0.00466	0.00191	2.440	0.015
With some college education (dummy)	0.00251	0.00228	1.100	0.271	0.00234	0.00221	1.060	0.289
At least college graduate (dummy)	0.00173	0.00353	0.490	0.625	0.00052	0.00343	0.150	0.879
Single type of household (dummy)	-0.00477	0.00233	-2.040	0.041	-0.00556	0.00226	-2.460	0.014
Household in the poorest decile (dummy)	0.00142	0.00175	0.810	0.417	0.00050	0.00152	0.330	0.744
Household in Metro Manila District 2 (dummy)	-0.00163	0.00207	-0.790	0.432	-0.00255	0.00201	-1.270	0.206
Household in Metro Manila District 3 (dummy)	0.00217	0.00213	1.020	0.309	0.00168	0.00207	0.810	0.416
Household in Metro Manila District 4 (dummy)	-0.00127	0.00216	-0.590	0.558	-0.00236	0.00211	-1.120	0.262
_Intercept	-0.05158	0.03794	-1.360	0.174	-0.04563	0.03183	-1.430	0.152

Table 27. Augmented Working–Leser Gifts and Contributions Income/Expenditure Engel Curves Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve				Expenditure Engel Curve			
	Coefficient	Standard Error	*z* Value	*p* Value	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	0.02012	0.00831	2.420	0.015	0.00996	0.00708	1.410	0.160
Members of household younger than 1 year	-0.01046	0.00634	-1.650	0.099	-0.01136	0.00621	-1.830	0.067
Members of household who are 1 to 6 years old	-0.00910	0.00217	-4.190	0.000	-0.00975	0.00213	-4.590	0.000
Members of household who are 7 to 14 years old	-0.00724	0.00169	-4.290	0.000	-0.00796	0.00166	-4.790	0.000
Members of household who are 15 to 24 years old	-0.00780	0.00225	-3.470	0.001	-0.00815	0.00220	-3.700	0.000
Members of household who are 25 to 59 years old	-0.01404	0.00290	-4.830	0.000	-0.01358	0.00282	-4.810	0.000
Members of household who are 60 years and older	-0.00890	0.00405	-2.190	0.028	-0.00997	0.00395	-2.530	0.011
Number of nonrelative members of household	0.00012	0.00628	0.020	0.985	-0.00042	0.00615	-0.070	0.945
Male household head (dummy)	0.00274	0.00481	0.570	0.570	0.00238	0.00471	0.510	0.613
Household head is jobless (dummy)	-0.00574	0.00435	-1.320	0.186	-0.00823	0.00425	-1.940	0.053
Household head is 45 years old and older (dummy)	-0.01129	0.00419	-2.690	0.007	-0.01220	0.00412	-2.960	0.003
Single household head (dummy)	0.00628	0.00818	0.770	0.443	0.00992	0.00800	1.240	0.215
Married household head (dummy)	0.01445	0.00718	2.010	0.044	0.01522	0.00704	2.160	0.031
Widowed household head (dummy)	0.00957	0.00765	1.250	0.211	0.01155	0.00748	1.540	0.123
At most elementary graduate (dummy)	0.00373	0.00406	0.920	0.358	0.00295	0.00399	0.740	0.459
At most high school graduate (dummy)	0.00092	0.00504	0.180	0.856	0.00135	0.00496	0.270	0.785
With some college education (dummy)	0.00386	0.00586	0.660	0.510	0.00429	0.00574	0.750	0.454
At least college graduate (dummy)	-0.00717	0.00910	-0.790	0.431	-0.00825	0.00892	-0.930	0.355
Single type of household (dummy)	-0.01331	0.00601	-2.220	0.027	-0.01547	0.00588	-2.630	0.009
Household in the poorest decile (dummy)	-0.00192	0.00450	-0.430	0.670	-0.00786	0.00395	-1.990	0.047
Household in Metro Manila District 2 (dummy)	-0.00133	0.00535	-0.250	0.804	-0.00187	0.00523	-0.360	0.721
Household in Metro Manila District 3 (dummy)	0.00478	0.00549	0.870	0.384	0.00288	0.00537	0.540	0.592
Household in Metro Manila District 4 (dummy)	-0.00528	0.00558	-0.950	0.344	-0.00635	0.00548	-1.160	0.246
_Intercept	-0.17617	0.09777	-1.800	0.072	-0.04999	0.08275	-0.600	0.546

Table 28. Augmented Working–Leser Savings Engel Curve Estimated via Seemingly Unrelated Regressions, Metro Manila Poor Households, 2009

Factors	Income Engel Curve			
	Coefficient	Standard Error	*z* Value	*p* Value
Log of income/expenditure	0.14097	0.02711	5.200	0.000
Members of household younger than 1 year	0.00049	0.02069	0.020	0.981
Members of household who are 1 to 6 years old	0.00053	0.00709	0.070	0.941
Members of household who are 7 to 14 years old	-0.01843	0.00551	-3.340	0.001
Members of household who are 15 to 24 years old	-0.01729	0.00733	-2.360	0.018
Members of household who are 25 to 59 years old	--0.00389	0.00947	-0.410	0.681
Members of household who are 60 years and older	0.01206	0.01323	0.910	0.362
Number of nonrelative members of household	-0.03947	0.02048	-1.930	0.054
Male household head (dummy)	0.00247	0.01570	0.160	0.875
Household head is jobless (dummy)	-0.03882	0.01417	-2.740	0.006
Household head is 45 years old and older (dummy)	0.03384	0.01368	2.470	0.013
Single household head (dummy)	0.05072	0.02669	1.900	0.057
Married household head (dummy)	-0.04368	0.02341	-1.870	0.062
Widowed household head (dummy)	-0.01155	0.02496	-0.460	0.644
At most elementary graduate (dummy)	0.04166	0.01323	3.150	0.002
At most high school graduate (dummy)	0.05188	0.01645	3.150	0.002
With some college education (dummy)	-0.00794	0.01912	-0.420	0.678
At least college graduate (dummy)	-0.06149	0.02970	-2.070	0.038
Single type of household (dummy)	-0.02100	0.01960	-1.070	0.284
Household in the poorest decile (dummy)	-0.00536	0.01469	-0.360	0.715
Household in Metro Manila District 2 (dummy)	-0.04724	0.01744	-2.710	0.007
Household in Metro Manila District 3 (dummy)	-0.01115	0.01791	-0.620	0.534
Household in Metro Manila District 4 (dummy)	-0.06296	0.01819	-3.460	0.001
_Intercept	-1.54647	0.31892	-4.850	0.000

Table 29. Correlation Matrix of Residuals Income Engel Curves and the Breusch–Pagan Test of Independence of Residuals

	ifood	ialbev	itbcco	ifuel	itrcom	ihoper	iprcre	ircrtn	imedic	idufur	indfur	ieduc	itaxes	irpair	icloth	ihouse	ioccsn	igftot	isavings
ifood	1.0000																		
ialbev	0.0282	1.0000																	
itbcco	−0.0271	0.2346	1.0000																
ifuel	0.0768	−0.0832	−0.0703	1.0000															
itrcom	0.0331	−0.0538	−0.0396	−0.0058	1.0000														
ihoper	0.0766	0.0009	−0.0112	0.0713	−0.0217	1.0000													
iprcre	0.2155	−0.0196	−0.0194	0.1535	0.1723	0.1295	1.0000												
ircrtn	0.0057	0.0716	0.0472	−0.0005	0.0450	0.0152	0.0381	1.0000											
imedic	−0.0358	−0.0134	−0.0540	−0.0363	−0.0342	−0.0472	−0.0201	−0.0085	1.0000										
idufur	−0.0430	−0.0073	−0.0440	0.0404	0.0108	−0.0123	0.0028	−0.0040	0.0761	1.0000									
indfur	0.0370	−0.0213	−0.0550	0.0345	0.0006	−0.0023	0.0877	0.0556	−0.0209	0.0482	1.0000								
ieduc	0.0143	−0.0209	−0.0213	0.0035	0.0512	−0.0416	−0.0135	−0.0116	−0.0207	−0.0100	−0.0045	1.0000							
itaxes	−0.0593	−0.0366	−0.0392	−0.0198	0.0677	−0.0015	−0.0150	0.0360	0.0067	−0.0111	−0.0280	−0.0286	1.0000						
irpair	−0.0479	0.0208	0.0045	−0.0296	−0.0399	0.0044	−0.0228	0.0309	0.0969	−0.0054	0.0346	0.0108	0.0273	1.0000					
icloth	0.0698	0.0342	0.0198	0.0299	0.0977	0.0097	0.2492	0.0846	−0.0063	−0.0084	0.2531	0.0130	0.1148	−0.0012	1.0000				
ihouse	−0.1434	−0.0655	−0.0371	0.1023	−0.1396	0.0761	−0.0816	−0.0356	−0.0662	0.0083	−0.0916	−0.0792	−0.0888	−0.0274	−0.1394	1.0000			
ioccsn	−0.0280	−0.0039	0.0046	0.0519	0.0390	−0.0123	0.0874	0.0036	0.0241	0.0412	0.0828	0.0134	−0.0121	0.0789	0.0969	−0.0927	1.0000		
igftot	−0.1613	−0.0057	−0.0665	−0.1037	−0.0295	−0.0837	−0.1205	−0.0276	−0.0755	−0.0500	−0.0235	−0.0491	0.0008	−0.0372	−0.0152	−0.0912	−0.0571	1.0000	
isavings	−0.6028	−0.0773	0.0049	−0.3349	−0.2507	−0.1630	−0.3140	−0.0722	−0.1500	−0.2884	−0.0394	−0.1002	−0.0476	−0.0120	−0.1717	−0.3158	−0.1018	−0.0384	1.0000

Note. Breusch–Pagan test of independence of residuals across equations: 1410.129; p value = 0.0000.

Table 30. Correlation Matrix of Residuals Expenditure Engel Curves and the Breusch–Pagan Test of Independence of Residuals

	sfood	salbev	stbcco	sfuel	strcom	shoper	sprcre	srcrtn	smedic	sdufur	sndfur	seduc	staxes	srpar	scloth	shouse	soccsn	sgftot
sfood	1.0000																	
salbev	−0.0342	1.0000																
stbcco	−0.0323	0.2158	1.0000															
sfuel	−0.1981	−0.1120	−0.0786	1.0000														
strcom	−0.1593	−0.0697	−0.0219	−0.1098	1.0000													
shoper	−0.0364	−0.0026	0.0001	0.0314	−0.0689	1.0000												
sprcre	0.0073	−0.0487	−0.0124	0.0665	0.0755	0.0938	1.0000											
srcrtn	−0.0452	0.0779	0.0689	−0.0409	0.0329	0.0031	0.0111	1.0000										
smedic	−0.1712	−0.0309	−0.0542	−0.0754	−0.0736	−0.0701	−0.0613	−0.0331	1.0000									
sdufur	−0.1817	−0.0219	−0.0412	−0.0305	−0.0778	−0.0464	−0.0736	−0.0144	0.0552	1.0000								
sndfur	−0.0055	−0.0294	−0.0619	0.0367	−0.0078	−0.0091	0.0759	0.0522	−0.0261	0.0700	1.0000							
seduc	−0.0607	−0.0273	−0.0228	−0.0329	0.0184	−0.0557	−0.0475	−0.0130	−0.0379	−0.0285	−0.0097	1.0000						
staxes	−0.1011	−0.0328	−0.0387	−0.0426	0.0528	−0.0125	−0.0226	0.0192	−0.0233	−0.0313	−0.0286	−0.0290	1.0000					
srpar	−0.0569	0.0135	0.0021	−0.0243	−0.0525	0.0108	−0.0171	0.0042	0.0937	0.0056	0.0363	0.0120	0.0091	1.0000				
scloth	−0.0742	0.0132	0.0225	−0.0129	0.0649	−0.0129	0.2086	0.0553	−0.0267	−0.0185	0.2466	−0.0048	0.1010	−0.0184	1.0000			
shouse	−0.4766	−0.1067	−0.0599	−0.0164	−0.2362	−0.0011	−0.2080	−0.0736	−0.0863	−0.0539	−0.1047	−0.1219	−0.1124	−0.0429	−0.2114	1.0000		
soccsn	−0.1108	−0.0095	0.0082	0.0400	0.0174	−0.0304	0.0600	−0.0042	0.0145	0.0080	0.0909	0.0067	−0.0203	0.0526	0.0908	−0.1405	1.0000	
sgftot	−0.2319	−0.0040	−0.0669	−0.1310	−0.0150	−0.0803	−0.1299	−0.0271	−0.0784	−0.0745	−0.0192	−0.0547	0.0052	−0.0387	−0.0208	−0.1286	−0.0629	1.0000

Note. Breusch–Pagan test of independence of residuals: $\chi^2_{(153)} = 977.554$; p value = 0.0000.

Table 31A. Seemingly Unrelated Regression (Iterated) Expenditure Engel Curves

Equation	Parameters		RMSE	R^2	χ^2	*p* Value
Food	854	23	0.0835	0.3439	447.6500	0.0000
Alcoholic beverages	854	23	0.0183	0.0627	57.1000	0.0001
Tobacco	854	23	0.0154	0.0790	73.2700	0.0000
Fuel	854	23	0.0354	0.0963	90.9700	0.0000
Transport and communication	854	23	0.0379	0.1160	112.0600	0.0000
Household operations	854	23	0.0137	0.0455	40.6600	0.0129
Personal care	854	23	0.0181	0.1661	170.1200	0.0000
Recreation	854	23	0.0092	0.0391	34.7600	0.0550
Medical care	854	23	0.0334	0.1040	99.1500	0.0000
Durable furnishings	854	23	0.0303	0.0734	67.6700	0.0000
Nondurable furnishings	854	23	0.0025	0.0369	32.6900	0.0867
Education	854	23	0.0233	0.0509	45.8300	0.0031
Taxes	854	23	0.0153	0.1042	99.3400	0.0000
Repairs and maintenance	854	23	0.0091	0.0244	21.3600	0.5588
Clothing and footwear	854	23	0.0145	0.0468	41.9400	0.0092
House rental	854	23	0.0796	0.2975	361.5900	0.0000
Special occasions	854	23	0.0175	0.0610	55.5000	0.0002
Gifts and contributions	854	23	0.0455	0.1199	116.3900	0.0000

Table 31B. Seemingly Unrelated Regression (Iterated) Income Engel Curves

Equation	Obs Parameters		RMSE	R^2	χ^2	*p* Value
Food	854	23	0.1061	0.3563	472.7800	0.0000
Alcoholic beverages	854	23	0.0178	0.0606	55.0400	0.0002
Tobacco	854	23	0.0150	0.0715	65.7300	0.0000
Fuel	854	23	0.0367	0.1137	109.5700	0.0000
Transportation and communication	854	23	0.0401	0.1182	114.5100	0.0000
Household operations	854	23	0.0143	0.0440	39.3400	0.0182

Table 31B continued...

Personal care	854 23	0.0191	0.1883	198.0900	0.0000
Recreation	854 23	0.0085	0.0414	36.9200	0.0332
Medical care	854 23	0.0360	0.0787	72.9800	0.0000
Durable furnishings	854 23	0.0469	0.0306	27.0000	0.2561
Non durable furnishings	854 23	0.0024	0.0373	33.0900	0.0795
Education	854 23	0.0235	0.0501	45.0000	0.0040
Taxes	854 23	0.0153	0.1015	96.5000	0.0000
Repairs and maintenance	854 23	0.0087	0.0225	19.6300	0.6641
Clothing and footwear	854 23	0.0147	0.0544	49.1400	0.0012
House rental	854 23	0.0827	0.2612	301.9500	0.0000
Special occasions	854 23	0.0180	0.0500	44.9500	0.0040
Gifts & contributions	854 23	0.0465	0.1052	100.3600	0.0000
Food	854 23	0.1515	0.1467	146.8500	0.0000

Note. Base equation for both sets of Engel curves is other expenditures.

9

Impact of Accessibility to Schools and Economic Centers

Alexis Fillone

Background and Rationale of the Study

In the Philippine provinces of Eastern Samar and Siquijor, more boys are employed than girls when both are of working age but are still expected to be studying while more girls are in school than boys in almost all age groups (Fillone et al., 2011). This is true regardless of access to school and economic centers. Is this finding also true in more urbanized areas of the country? This study would like to find out by getting more samples of provinces/cities with community-based monitoring system (CBMS) data. In this way, it is possible to statistically determine if this is true, and then if so, policy and program interventions in terms of skills training, livelihood, employment opportunities, and even the provision of roads could help the disadvantaged gender. Furthermore, incentives could also be provided or existing incentive mechanisms fine-tuned to encourage more children to go to school.

Several studies have shown some relation between poverty and access to jobs especially in the urban areas. Sanchez (2008) reviewed public transportation policies from 1960 to 2000 in the United States to highlight federal policies that affected urban areas during this period, especially in relation to low-income transportation mobility. Kalachek (1968) studied the African-Americans' experience as central city residents and their high unemployment even in times when the overall demand for labor was strong and hiring standards were quite relaxed. The findings of the US Government Accountability Office (1998) revealed that existing public transportation systems could not always bridge the gap between where the poor live and where jobs are located. However, studies by Blackley (1990) and Hughes (1991) showed the relative impacts of employment accessibility resulting from public transportation services, and both recommended increased public transportation expenditures in addressing urban unemployment problems. Diaz Olvera et al. (2003) pointed out the major deficiencies in urbanization and transportation systems in Dar es Salaam, Tanzania's largest city, conditions they viewed to be reinforcing patterns of social and urban segregation. They pointed out that there were numerous obstacles to the daily travel of the city's inhabitants, notably the poor. The poorest individuals tend to retreat into their neighborhoods where low-quality urban facilities are unable to assist in the development of human and social capital and economic opportunities.

Meanwhile, in rural areas, Porter (2007) studied the experiences of women and female children residents in rural areas of sub-Saharan Africa with poor physical accessibility (to services and markets) because of poor roads and inadequate transport (in terms of regularity, reliability, and cost). She examined to some detail the following: access to education, access to health services, and access to markets. She concluded that physical remoteness and isolation often compound the effects of poverty and deprivation. She further emphasized the interconnectedness of deprivations associated with remoteness, women's and girls' poor access to transport, basic (health and education) services and markets, and gendered division of labor. Models in location theory are sometimes used to locate optimally social service infrastructures in the light of limited resources in a developing country. Heng et al. (2007) investigated an integrated model to design an optimal rural road network considering financial and spatial constraints. The rural road network and new multipublic facility locations are optimally designed simultaneously in order to achieve the least total cost spent by government and residents.

In the Philippines, Barrios (2008) discussed the economic vulnerability of rural households. He proposed that as a starting point to address this problem, there must be comprehensive improvement in accessibility through public investment in infrastructure, coupled with the use of user fees for the continuous provision of new infrastructures and maintenance of existing ones. A recent study termed as Integrated Rural Accessibility Program (IRAP) by the International Labour Organization (ILO, 2000) defined accessibility as the ease or difficulty for rural folks to satisfy their access-related needs. It comprised a set of planning procedures and techniques that cut across sectors and can be used at the local government level for spatial access planning and at the village level for personal access planning. The interventions would mean either through improving people's mobility or by bringing goods and services closer to people. The former is done through improvements in the rural transport system, which includes rural road improvements, upgrading of village transport infrastructure (footbridges, footpaths, etc.), and improvement of low-cost means of transport and transport services. Access can also be improved through better siting of basic facilities such as water supplies, health centers, schools, and markets. IRAP is primarily applied at the municipal level. The application of IRAP at this level is primarily through capacity building of the planning and technical staff of the Municipal Planning and Development Offices (MPDO).

Hence, by expanding the number of samples to relate accessibility to poverty and gender issues in the Philippines, the significance of these relationships could be established. The availability of barangay-level CBMS data all over the Philippines could provide a great opportunity to explore the empirical link among accessibility, poverty, and gender so that policy recommendations could be developed to address the issue of providing equal opportunity to both genders.

Research Problem and Objectives

In less urbanized provinces like Easter Samar and Siquijor, regardless of access, more boys of school age are not in school compared to girls while more girls of working age are not working compared to boys (Fillone et al., 2011). It would be important to know whether this is also true in more urbanized provinces or cities. It is also important to know whether the general perception that boys are preferred more than girls in both the rural and urban areas is indeed true or false. The commonly held basis seems to be that boys are more economically useful as they can augment the household income through farm or factory work. By conducting a more detailed analysis of the impact of accessibility on several measures of poverty, significant relationships could be established among these variables and at the same time how these relationshipsaffect the gender issue can be determined.

Moreover, aside from using travel time to measure accessibility, another important variable is the cost of travel. It has been observed that some people in rural areas are constrained from traveling when money is scarce. It is then important to consider not only time spent per se, but also cost of travel in the accessibility measure, which we termed as the generalized cost (GC) of travel when measuring accessibility.

The following are the objectives of the study:

1. to determine the impact of accessibility to schools and economic centers on poverty and gender equity;
2. to use a generalized cost model to measure accessibility;
3. to develop regression models relating poverty and accessibility using the generalized cost function in the latter; and
4. to recommend policy measures to address gender bias especially in terms of employment opportunities and access to education.

Theoretical and Methodological Framework

The Simple Composite Index

As developed and defined by CBMS, the correlates of poverty using 14 indicators are embodied in the simple composite index (SCI) which at the barangay level, can be defined by the equation

$$SCI = \sum_{i=1}^{14} \left(\frac{Number\ of\ HH\ with\ unmet\ needs\ \boldsymbol{i}\ in\ the\ Barangay}{Total\ number\ of\ HH\ in\ the\ Barangay} \right)_i \quad \text{Eq. (1)}$$

The major advantage of this indicator is that it is simple and easy for local planners to apply. However, its main disadvantage is that it assigns equal weights to all components and this may distort the priority of each individual community in terms of resource allocation and planning. Nevertheless, as shown in Fillone et al. (2011), when SCI is regressed with accessibility measures, the relationship was significant at 0.464 for the integrated model (using both Siquijor and Eastern Samar data). When accessibility is better like in Siquijor, it is less significant compared to that of Eastern Samar where accessibility is still a problem. The same study also revealed on one hand that in the provinces of Eastern Samar and Siquijor, more males of school age are not in school compared to their female counterpart. On the other hand, in terms of employment, more females of working age are unemployed than males, and in general, this is regardless of access to the nearest school or economic center.

In the Philippines, facts have shown that inequality still exists between genders, for example, in terms of labor absorption and labor force participation rates (GSAPS, Kikuchi Project). However, with respect to access to education, the World Economic Forum reported that the Philippines has reached gender parity in primary, secondary, and tertiary education enrollments, which suggests that there is no preferential treatment for sons with respect to education. By obtaining a representative sample of provinces/cities with CBMS data in terms of urbanization, the gender parity could be statistically tested if this finding is true or not across provinces/cities.

The Generalized Cost of Travel

In this study, accessibility would be first analyzed using variable travel time and then also using generalized cost. Using the road and path networks of sample provinces/cities connecting barangays to town centers, the poverty incidence of barangays as well as its gender composition would be related to respective travel times and generalized costs associated with the process of accessing schools and economic centers.

In addition to the existing CBMS data set of Eastern Samar and Siquijor, an additional eight provinces and cities were further analyzed. As much as possible, the full range of poverty levels among provinces and cities in the country should be represented. The degree of urbanization of provinces and cities in the Philippines should also be considered in the sample selection. All in all, a total of 10 samples (i.e. 7 provinces and 3 cities) were used in order that a statistical analysis could be conducted.

Notably, only travel time was used to measure accessibility in an earlier and related study by Fillone et al. (2011). If we use GC of travel to measure accessibility, we can use the following equation:

$$GC = C_t + T_t \text{ x } C \qquad \text{Eq. (2)}$$

where

C_t = cost of travel from household to destination by public (i.e., fare) or private (i.e. fuel cost) mode, in Philippine peso (Php)
T_t = estimated travel time from household to destination, in minutes
C = cost of time/travel time savings of the individual (may be different for those going to school and those going to economic centers) in Php/unit of time

Since no primary data collection was conducted to estimate the cost of time of respondents, the study used the average daily wage or average monthly income in the sample areas to provide a rough estimate of the cost of time. This may be acceptable especially when it is considered that traffic congestion is insignificant in these places. Results from similar studies could also be used, such as the one by IT Transport Ltd. (2005) in the rural areas of Bangladesh, Ghana, and Tanzania. The average base travel time saving values for rural travellers in these countries were Taka 3.50 per hour (US$ 0.06) for Bangladesh, Cedi 1,627 per hour (US$ 0.18) for Ghana, and TZS 195 per hour (US$ 0.18) for Tanzania. Base values were 51%, 64%, and 49%, respectively, of the rural wage rate in the study areas of Bangladesh, Ghana, and Tanzania. The study pointed out that the inclusion of time-saving benefits in appraising rural projects would help in (a) redressing the bias against rural infrastructure investment, and (b) supporting the case for more prorural and propoor infrastructure development. However, for cities where traffic congestion is prevalent, cost of time values could be estimated by using similar values obtained from other locations where cost of time is available.

Furthermore, purchasing power parity (PPP) could then be used to adjust the relative purchasing power between the Philippines and the countries with data on travel time savings. The *Manual for Co-Benefit Measurement in Transport Sector* by the Institute for Global Environmental Strategies (IGES 2010) recommends the use of PPP in estimating the cost of accidents in developing countries with no reliable estimates of costs traffic accidents by using comparative Japanese data.

By considering cost of time in measuring accessibility, a better accessibility model could be developed, especially one that considers different trip purposes of going to school and employment centers.

Statistics Analysis and Model Development

This research used the GC of travel as a measure of accessibility aside from travel time and road distance measures. Descriptive analysis, correlation analysis, and regression modeling were used to relate the accessibility and poverty variables in relation to gender. A statistical significance test may be performed, given that 10 sample provinces/cities were used. The sample areas include seven provinces, namely, Biliran, Camiguin, Eastern Samar, Marinduque, Romblon, Siquijor, and Southern Leyte, while the three cities are and the three cities include Puerto Princesa City, Pasay City, and Bogo City. The choice of samples was greatly dictated by the availability of CBMS data among these provinces and cities as well as the size of the province given the limited time and budget of the research.

Figure 2.1 shows the flowchart of the methodology of the study.

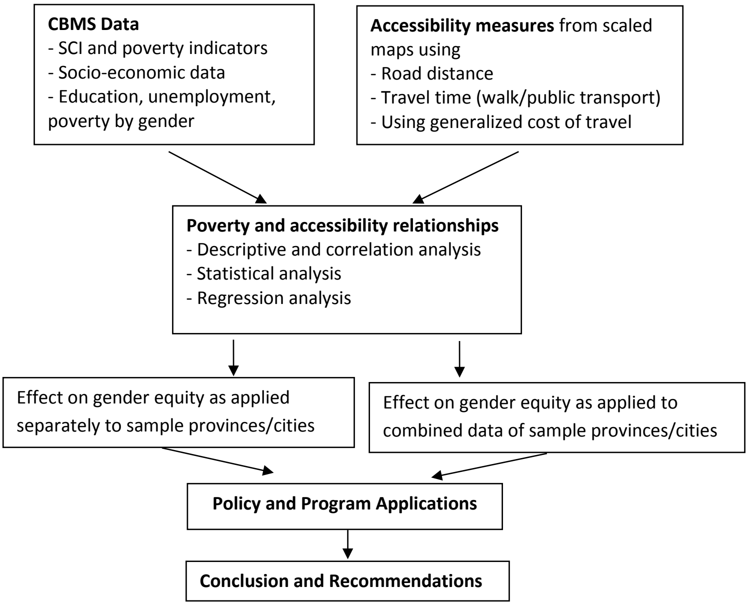


Figure 1. Flowchart of the study.

Regression models were developed by relating accessibility to poverty, unemployment, and school enrollment. Aside from using distance and time to determine accessibility, a generalized cost was also used to estimate accessibility.

Policy applications were then recommended to address the gender issue. Infrastructure programs, like the provision of roads, were also assessed with regard to their impact on employment and poverty at the barangay level while at the same time determining their effect on gender.

Descriptive Statistics

Characteristics of the Study Areas

A total of 10 locations consisting of 7 provinces (i.e., Biliran, Camiguin, Eastern Samar, Marinduque, Romblon, Siquijor, and Southern Leyte) and 3 cities (i.e. Bogo, Pasay, and Puerto Princesa) are included in this study. Initially, the island of Busuanga, composed of two towns, Busuanga and Coron (see Appendix B), was included but due to its incomplete CBMS data was dropped from the areas to be studied. See Figure 3.1 for the geographic locations of these cities and provinces in the Philippines.

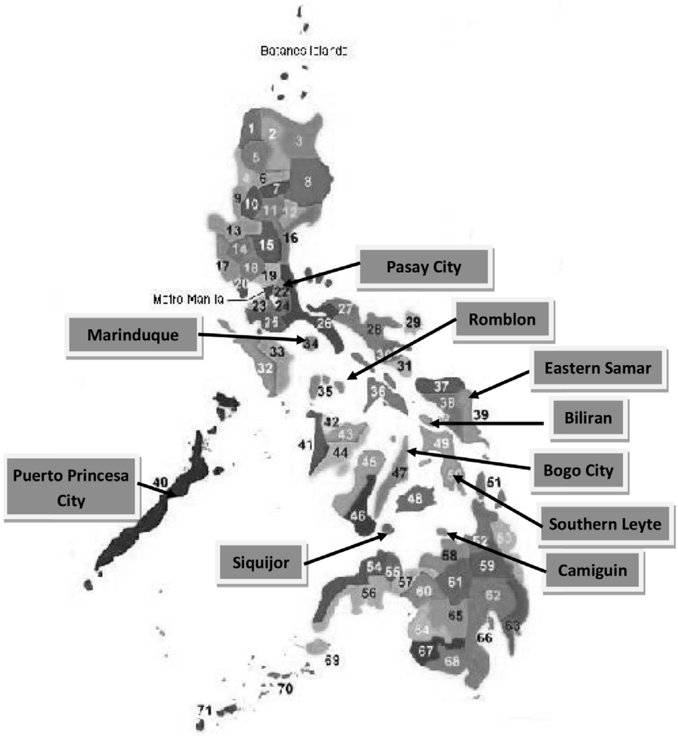


Figure 2. Geographic location of study areas.
Source: Philippine Travel Destination Guides.

Profile of CBMS Poverty Variables in the Study Areas

Since the primary focus of this study is the impact of school and economic center accessibility on poverty and gender equity, the following variables (by gender) were used:

- Children (by gender) not attending elementary school (6–12 years old)
- Children (by gender) not attending secondary school (13–16 years old)
- Households with income below the poverty threshold
- Households with income below the food threshold
- Households that experience food shortage

- Persons (by gender) in the labor force who are unemployed (15 years old and above)

Given the CBMS data, the primary work done to capture the accessibility variables going to schools and economic centers is to develop the road network of each province and city and locate with respect to the road network the schools, economic centers, and the centroid of populations at the barangay level. Table 1 shows the number of elementary and high schools in the study areas. In total, there are 1,305 elementary and primary schools and 246 high schools in the study areas. Eastern Samar has the highest number of elementary schools with Pasay City having the fewest with 19. Eastern Samar also got the highest number of high schools with 49, and both Bogo and Pasay cities had the fewest with 9 high schools. The exact locations in space of these schools were determined and plotted on the road network using a transport planning software for easy processing of accessibility variables.

Table 1. Number of primary, elementary, and high schools in the study areas

Province/City	No. of Elementary Schools	No. of High Schools
Biliran	125	16
Bogo City, Cebu Province	22	9
Camiguin	54	10
Eastern Samar	462	49
Southern Leyte	92	39
Marinduque	181	44
Pasay City	19	9
Puerto Princesa City	75	20
Romblon	215	37
Siquijor	60	13
Total	1,305	246

In the same manner, major economic and activity centers in each of the provinces and cities were identified and also plotted on the network. Included were city centers, town centers, airports, and major ports, among others, that are verifiable attractors of economic activities and employment. Table 2 summarizes this number of major economic centers per province or city. For example, in the case of Biliran as shown in Figure 3, there are three major economic centers located in Caibiran, Naval, and San Roque. Naval Town is the major trading and economic center of the province and also where the major port is located. The Caibiran and San Roque town centers are also economic centers but not as big as that of Naval Town. In the case of Romblon, where there are three main islands (i.e., Romblon, Sibuyan, and Tablas islands), there are five major activity centers: (1) Odiongan, (2) San Agustin, and (3) Alcantara (where the Tablas airport is located) in the biggest island of Tablas; (4) Romblon in the island of Romblon; and (5) Magdiwang in the island of Sibuyan. The inter island parts are located in Odiongan, San Agustin, and Magdiwang. Figure 3.3 shows these major economic centers in Romblon Province.

Table 2. Number of major economic centers in the study areas

Province/City	No. of Major Economic Centers	Location
Biliran	3	Caibiran, Naval,[1,2] Biliran[2]
Bogo City, Cebu Province	1	Bogo City[2]
Camiguin	3	Mambajao,[1,2] Mahinog,[2] Guinsiliban[2]
Eastern Samar	3	Guiuan,[1,2] Oras, Borongan[1]
Marinduque	3	Boac,[2] Buenavista, Gasan[1]
Pasay City	∞	The whole city is a major economic center.
Puerto Princesa City	1	Puerto Princesa City[1,2]
Romblon	5	Romblon,[2] Magdiwang,1 Odiongan,[2] Alcantara,[1] San Agustin[2]
Southern Leyte	4	Maasin,[1,2] Sogod,[2] Hinunangan, Liloan[2]
Siquijor	3	Siquijor,[1] Lazi,[2] Larena[2]

Note. [1w]with airport; [2]with port.

Connectivity to Schools and Economic Centers

<u>Biliran Province</u>

The island province of Biliran has a total of 125 elementary and 16 high schools. It has a very good circumferential road that is also a national road, as shown in Figure 2. One can go around the island using this circumferential road in around three hours.

Bogo City, Cebu Province

Bogo City had a total population of 82,237 in the year 2013 (NSO). With 18,295 households, the average household size in Bogo City is 4.50 members. There are 22 elementary and primary schools and 9 high schools in the city. Figure 3 shows the major road network of the city as well as the location of schools and economic centers.

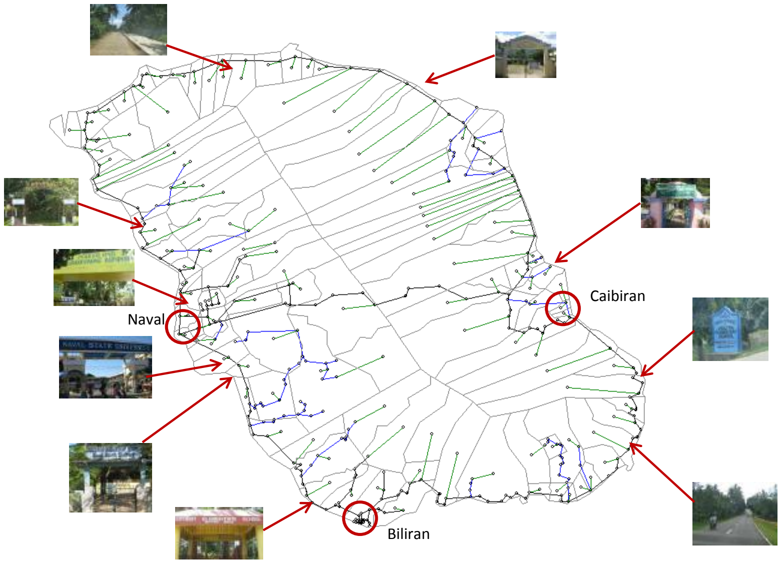


Figure 2. Map of Biliran Province showing the location of schools and economic centers.

Camiguin Province

The island province of Camiguin has 54 elementary schools and 10 high schools distributed throughout the province, and most can be accessed through its circumferential road. This road can be considered as very satisfactory, made mostly of cement and asphalt concrete. One can go around the island in two hours while driving leisurely. Figure 4 shows the road network of Camiguin, modes and its condition, and selection of elementary and high schools located throughout the Camiguin province. Also shown are available modes of transport in Camiguin Province.

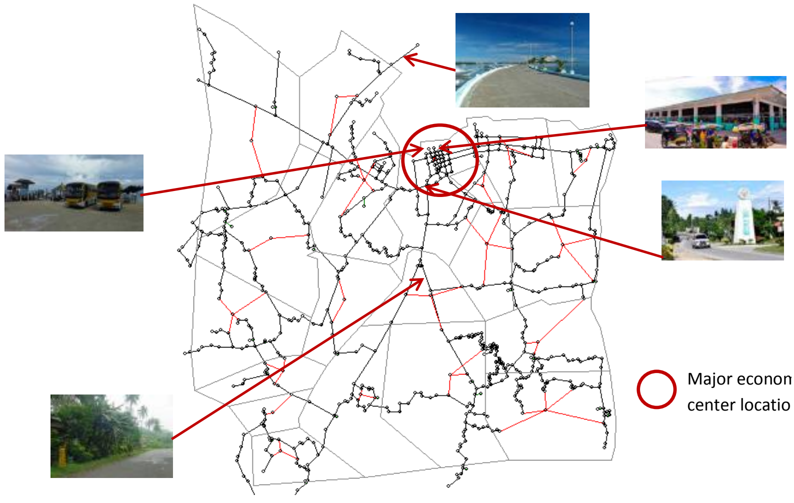


Figure 3. Map of Bogo City, Cebu, showing the location of schools and market centers.

Eastern Samar

In the case of Eastern Samar, there is a total of 462 elementary and 48 high schools in the province (Figures 4, 5, 6).

Although the national road spans the whole province of Eastern Samar, vehicles have to frequently slow down because of ongoing road maintenance work and also because of the rough roads that resulted due to lack of maintenance work. There are stretches of roads that are well paved with asphalt and concrete cement surfaces. Table 3 shows the representative and observed travel speeds depending on the road condition being used. There would be limited emphasis on the road surface condition's effect on accessibility as the presence or absence of public transport service is considered more important in this study. Along the national road that stretches from the north of Eastern Samar in the town of Arteche going south towards the town of Guiuan, the national road that passes through the southern towns of Balangiga, and Quinapondan and joins at the junction, the national road that traverses along the mountainous area going towards Calbayog, the frequency of public transport service like the jeepneys, air-conditioned vans, and air-conditioned and non–air-conditioned buses has such regularity that would allow one to travel on a daily basis. All the more, with destination choices such as Pasay and Cubao in Metro Manila, Tacloban City, and Calbayog City for areas in the north as well as intertown travel, the problem of access when one is along the national roads is considered not to be a problem. The problem is access from interior towns and hinterland barangays towards the national roads. For this reason, Eastern Samar is blessed with big river systems, and the people have taken advantage of this and major inland boat terminals are located in Oras, Dolores, and Llorente towns. In particular, the Dolores inland boat terminal that the major entry point going to the town of Maslog. There are also several island barangays separated from the mainland of Eastern Samar, and these include the Homonhon, Suluan, Manicani, and Sulangan island barangays for Guiuan Town; the Divinubo and Ando island barangays for Borongan Town; the Butig and Maliwaliw island barangays for Salcedo Town; the San Vicente island barangay for Sulat Town; the Mina-anod island barangay for Lllorente Town; and the Santa Monica island barangay for Oras Town. Depending on the population of these island barangays, the frequency of boat trips to the mainland varies with big islands like Homonhon, which is composed of eight barangays, having a high frequency of scheduled trips while for small islands, boat trips would depend on demand, which is costly at times for ordinary people.

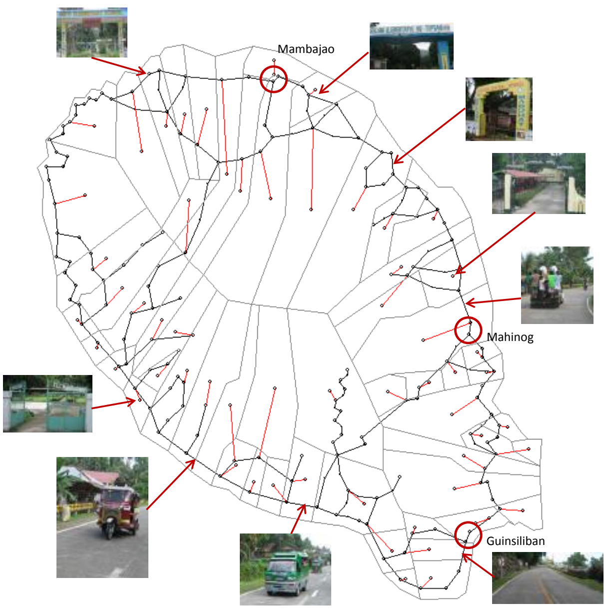


Figure 4. Map of Camiguin Island province showing the location of schools and economic centers.

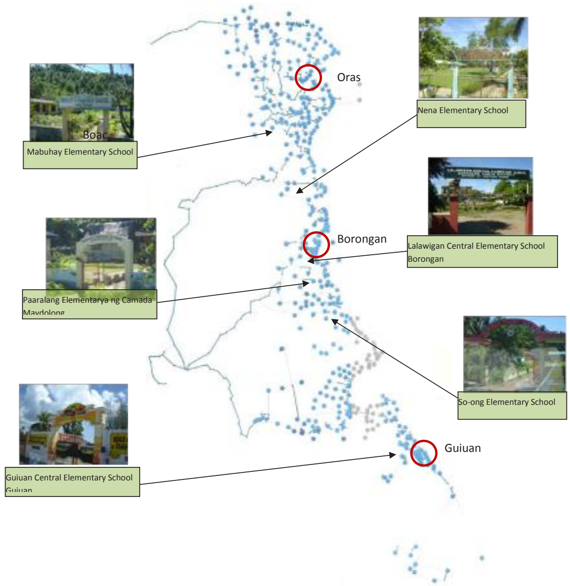


Figure 5. Map of Eastern Samar showing the estimated location of public elementary schools in Eastern Samar.

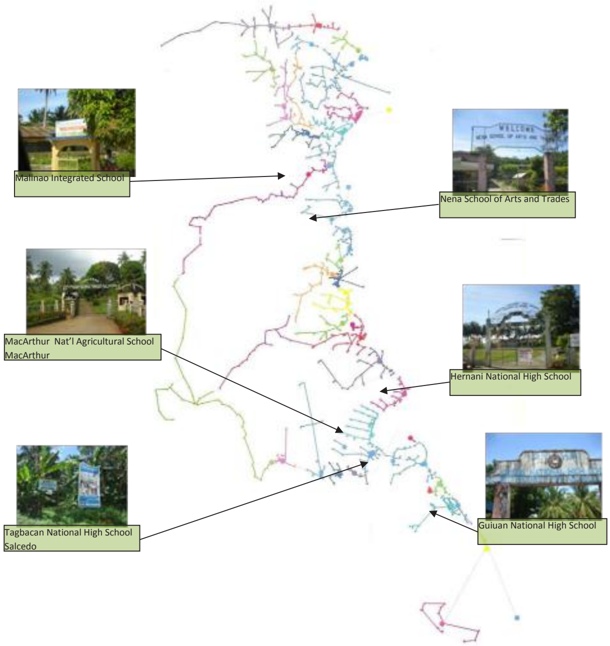


Figure 6. Estimated location of public high schools in Eastern Samar.

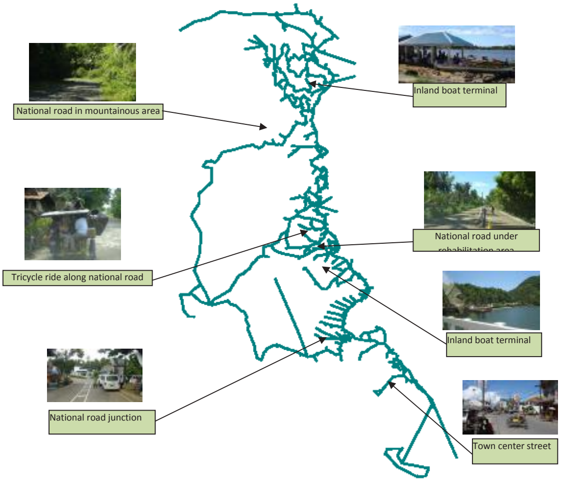


Figure 7. Transport network in Eastern Samar.

<u>Marinduque</u>

The island province has a total of 181 elementary and 44 high schools (Figure 8). The major market center is located in Boac, which is also the capital town. Other economic and employment centers considered are the airport in Gasan Town and the port in Mogpog Town; these two points are the main access to Marinduque Province.

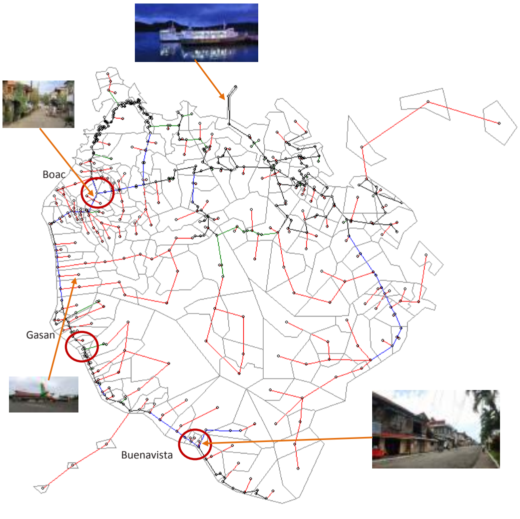


Figure 8. Map of Marinduque and location of schools and market centers.

Pasay City

Pasay City is one of the most urbanized areas included in the study; it was selected to ensure a more varied sample set in terms of rural and urban mix. The city hosts 19 elementary and 9 high schools (Fig. 9). The whole area can be considered as a major economic/market center within a few minutes of walking or riding a public transport from one's home, a person can easily take part in any of the major activity/economic centers located in the city.

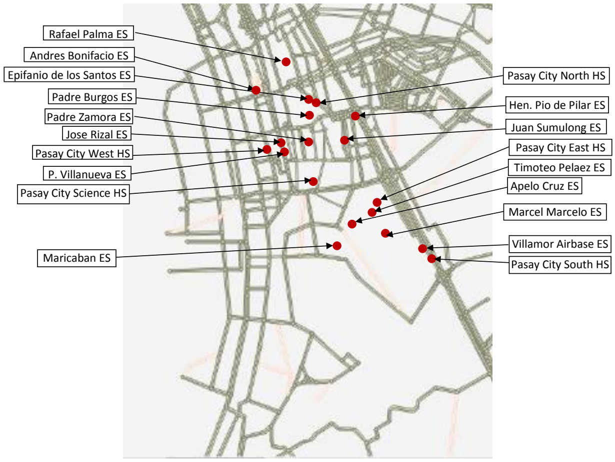


Figure 9. Map of Pasay City showing the location of schools.

Puerto Princesa City

Puerto Princesa City is the capital of Palawan Province. There are a total of 75 elementary and 20 high schools within the city. The major market centers are also located therein, including the port and international airport. The major modes of transport within the city are tricycles, multicabs, and jeepneys. Figure 10 shows photos of elementary schools as well as roads conditions, especially near the city center.

Romblon Province

Figure 11 shows the seven dispersed islands of Romblon and its three major islands, namely, Tablas, Romblon, and Sibuyan. There are 215 elementary and 37 high schools in the province. The seven islands have both elementary and high schools, so students do not have to cross the sea to go to school.

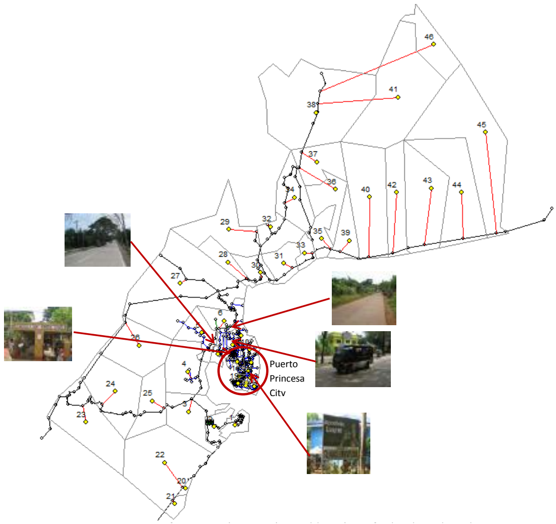


Figure 10. Map of Puerto Princesa City showing the location of schools and market centers.

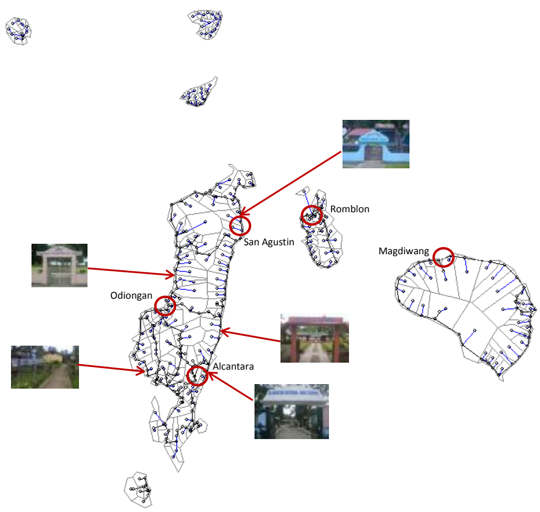


Figure 11 Map of the province of Romblon and location of schools and market centers.

<u>Siquijor Province</u>

In the case of Siquijor, there are a total of 60 elementary schools and 13 high schools available on the island. The major market centers were as previously identified in the study by Fillone et al. (2010). There are also three major ports in the island province. These are located in the towns of Siquijor, Larena, and Lazi. For boat trips going to or coming from Dumaguete City, the port of entry is either Siquijor or Larena, while for trips coming from or going to Mindanao, the port of entry is usually the port of Lazi (Fig. 3.12).

The island of Siquijor is still considered by most Filipinos as an island full of myths and mysteries. However, the more visible source of awe and wonder is the intertwining road network that covers the whole island as shown in Figure 3.12. In fact, it is one of the few provinces in the Philippines whose barangays are all accessible by road. From the updated road map provided by the province, the roads are basically classified as national, provincial, and barangay roads. Public transport modes available in the island, aside from personal vehicles, are minibuses, jeepneys, or smaller multicabs, tricycles, and the motorcycles, the latter being operated illegally since this mode is not allowed under current government regulations.

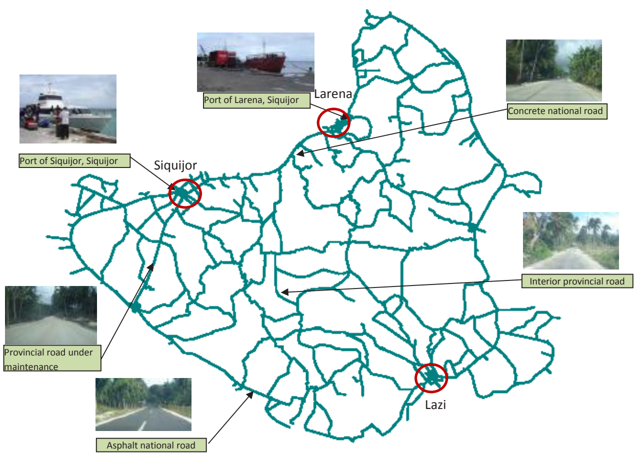


Figure 12. Transport network in Siquijor Island.

Figures 13 and 14 show the location of some of the elementary and high schools, respectively, in the island province of Siquijor.

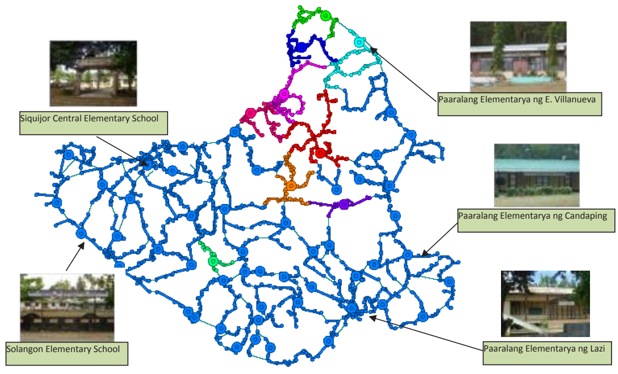


Figure 13. Estimated locations of public elementary schools in Siquijor province.

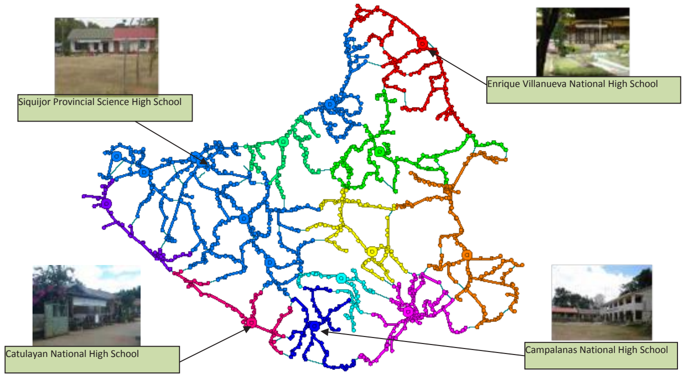


Figure 14. Estimated locations of public high schools in Siquijor Province.

Southern Leyte

In the case of Southern Leyte (Fig. 15), there are 296 elementary and 39 high schools spread throughout the province. Most of these schools are located along national roads as observed during the ocular survey. The major market centers are located in Maasin City, which is its capital, in the town of Sogod as well as that in Liloan, the latter being the jump-off point going to Mindanao island. However, since no official information was obtained regarding the list of both elementary and high schools in Maasin City, it was decided not to include the city in the study. Another town in Southern Leyte that has no CBMS data was also disregarded without much effect on the final outcome of this study.

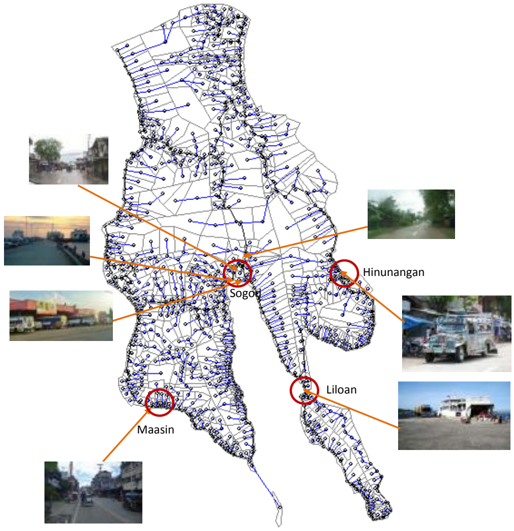


Figure 15. Map of Southern Leyte showing the location of schools and economic centers.

For data analysis, the study used similar assumptions in Fillone et al. (2010) on accessibility measures:

1. The pupil or student in the household attends the school nearest to his/her house. Elementary school children would prefer to walk to school than ride a particular transport mode.
2. A household member that is either school or work bound will have the first option to use the transport mode available in the household. If there is no available transport mode, he/she will use the most common transport mode available to reach his/her destination. When the destination is within the barangay, he/she will most likely walk to reach his/her destination.
3. High school students may also be already wage earners. This is used in the cost of time computation of high–school-aged students.
4. The marginal farmer or fisherfolk would most likely use public transport to sell his/her produce to increase his/her profit margin by minimizing transport costs of.
5. Following the topography of the land, barangays are connected to other adjacent barangays as well as to town centers when roads are not available. It is then assumed that people would walk when going

to/from the center of the town when roads are not available.

6. In the case of island barangays, these were connected to the mainland by considering the location of the ports or to the coast adjacent to the town while using motor boats as mode of transport. Barangays adjacent to inland rivers especially when road access is not present would also use boats to directly access the town center or disembark on the nearest road link then from there ride a public transport going to the destination.

Travel Time Using the Available Transport System

All observations about land and sea transport in the provinces and cities being studied and actual experience of riding were taken into consideration. Using the representative speeds of the transport modes given in Table 3.3 for both land and sea transportation, Table 4 provides the estimated time equation as provided previously in Eq. (1).

Table 3. Average travel speed by transport mode in the study areas

Purpose and Destination of Travel	Prevalent Transport Mode	Average Speed by Road Type (kph)			Water Transport (kph, knots)	
		National Road	Provincial Road	Barangay Road	Inland water	Ocean Water
Elementary school	Tricycle	25	20	15	8	12
High school	Tricycle, multicab	25	20	15	8	12
Market/economic centers	Jeepney, multicab, minibus	30	25	20	8	12

Travel time surveys, such as onboard-vehicle and car-following travel time surveys, were also conducted to obtain the average travel speeds of available modes. However, only the prevalent transport mode was used in the analysis of accessibility, depending on the destination of the individual. For example, if town-to-town travel was being analyzed, the prevalent road public transport mode would be the jeepney or multicab. Except for the island towns of Jipapad and Maslog in Eastern Samar, Maripipi in Biliran, the seven dispersed islands of Romblon, and some other smaller islands where one has to use the boat for access and island barangays, all other towns accessible by road use the tricycle, multicab, jeepney, or minibus to travel between towns.

Table 4 Travel time equations for the study areas.

<table>
<tr><th rowspan="3">Purpose/Destination of Travel</th><th rowspan="3">Prevalent Transport Mode on Land</th><th colspan="5">Travel time equation (min)</th></tr>
<tr><th rowspan="2">National Road</th><th rowspan="2">Provincial Road</th><th rowspan="2">Barangay Road</th><th colspan="2">Water transport</th></tr>
<tr><th>Inland water</th><th>Ocean Water</th></tr>
<tr><td>Elementary School</td><td>Tricycle</td><td>2.4S</td><td>3.0S</td><td>4.0S</td><td rowspan="4">7.5S</td><td rowspan="4">5.0S</td></tr>
<tr><td>High School</td><td>Tricycle, jeepney</td><td>2.4S</td><td>3.0S</td><td>4.0S</td></tr>
<tr><td>Market/Economic Centers</td><td>Jeepney, multicab, minibus</td><td>2.0S</td><td>2.4S</td><td>3.0S</td></tr>
<tr><td></td><td>Walking</td><td colspan="3">20.0S</td></tr>
</table>

Generalized Cost of Travel in the Study Areas

The average annual family income in the study areas was obtained from the Philippine Statistics Authority (PSA 2013) website. (See Appendix C for the sample computation). The values as plotted are shown in Figure 16. These values were then interpolated for those years that the CBMS data were obtained in a particular city or province. The average annual family income was used to obtain the average monthly, daily, and hourly incomes in a particular study area. These computed values are shown in Table 5.

The average hourly rate by study area (as shown in Table 5) was used in the cost of time computation to obtain the generalized cost of travel which was previously presented in Eq. (2).

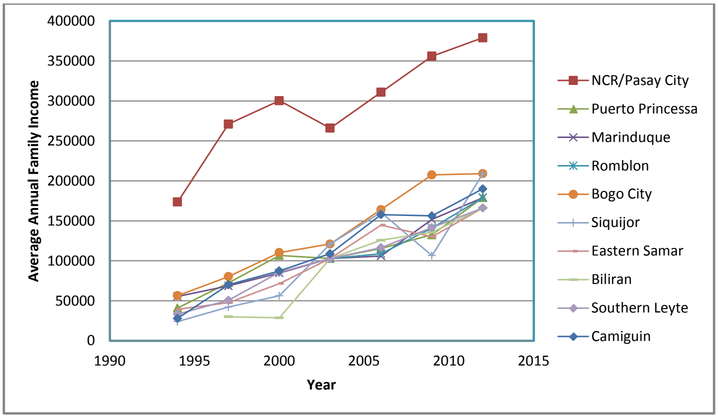


Figure 16. Average annual family income in the study areas

Table 5. Wage rates in the study areas for year 2012 (NSCB)

Region	Province/City	Year	Average Annual Income (Php)	Average Monthly Income (Php)	Average Daily Wage (Php)	Average Hourly Rate (Php)
NCR	Pasay City	2011	371,333	30,944	944	118
IVB	Puerto Princessa	2009	132,640	11,053	337	42
	Marinduque	2008	136,496	11,375	347	43
	Romblon	2007	119,631	9,969	304	38
VII	Bogo City	2009	207,478	17,290	527	66
	Siquijor	2006	160,616	13,385	408	51
VIII	Eastern Samar	2006	144,649	12,054	368	46
	Biliran	2006	125,731	10,478	320	40
	Southern Leyte	2008	133,218	11,102	339	42
X	Camiguin	2010	167,507	13,959	426	53

SCI Variable of the Study Areas

The average SCI variables of the study areas are shown in Table 3.6. Eastern Samar has the highest mean barangay SCI at 2.72, and its standard deviation is also highest at 1.03. This means that the barangay SCI of Eastern Samar is quite spread out among the barangays due to the extent of the land area of the Eastern Samar province. Pasay City being in Metro Manila has the lowest SCI of 0.52, in an area where highly urbanized socioeconomic services are easily accessible to its constituents.

Table 6 Average barangay SCI of the study areas

Province/City	No. of Barangays	SCI	
		Average Barangay SCI	SCI S.D.
Eastern Samar	596	2.72	1.03
Biliran	132	2.53	0.644
Romblon	218	2.16	0.631
Bogo City	27	2.12	0.737
Southern Leyte	484	2.01	0.638
Camiguin	58	1.49	0.449
Siquijor	134	1.49	0.511
Marinduque	218	1.42	0.665
Puerto Princesa City	66	1.32	0.862
Pasay City	201	0.52	0.456
Total	2,134		

Gender Comparison of Elementary and High School Enrollment

Population data by gender of elementary and high school students in the provinces and cities studied are shown in Table 7 below. The data show that there are more males than females whether of elementary school or high school ages in all the study areas. The highest absolute difference at 2,422 between the two genders occurred in Eastern Samar Province, which also has the highest population of both genders in the elementary level. However, in the case of high school aged segment, the highest difference occurred in Southern Leyte Province at 1,799. Meanwhile, the smallest difference in population between genders of elementary school age occurred in Siquijor Province at 154. For high-school-ages, the smallest difference occurred in Puerto Princesa City at 6. Overall, the population difference between genders stands at 10,566 for elementary school ages and 6,850 for high school ages, consistently in favor of males.

Table 7. Population by Gender of Elementary and High School Ages in the Study Areas

Province/City	Elementary School, Ages 6–12 Years Old			High School, Ages 13–16 Years Old		
	Male	Female	Difference	Male	Female	Difference
Biliran	14,331	13,714	617	7,846	7,050	796
Bogo City	3,670	3,364	306	2,364	2,096	268
Camiguin	6,121	5,882	239	3,485	3,176	309
Eastern Samar	38,923	36,501	2,422	19,877	18,864	1,103
Marinduque	20,207	19,083	1,124	11,332	10,352	980
Romblon	26,278	24,178	2,100	14,076	12,843	1,233
Pasay City	18,206	17,510	696	9,977	9,605	372
Puerto Princesa City	15,064	14,175	889	7,911	7,905	6
Siquijor	5,837	5,683	154	3,620	3,546	74
Southern Leyte	29,396	27,377	2,019	17,033	15,234	1,799
Grand Total	178,033	167,467	10,566	97,521	90,671	6,850

Going over the enrollment levels in elementary school by gender, the province of Biliran has the highest mean difference between male and female at 3.76, followed by Eastern Samar at 3.1 and Southern Leyte by 2.34. It is important to note that all these three provinces are located in Region 8. Table 8 shows the complete list of the provinces in terms of the mean difference between the proportion of males and females not enrolled in the elementary level. In the City of Bogo, Marinduque, and Siquijor, more females are not enrolled than males, as shown by the negative mean difference.

The three provinces with the biggest difference in the mean proportions between males and females not in elementary schools are Biliran (3.76), Eastern Samar (3.1), and Southern Leyte (2.34). It so happened that these provinces are in Eastern Visayas, while the three provinces with the lowest differences in the mean proportions are Bogo City (−1.98), Marinduque (−0.15), and Siquijor (−0.07). Figure 17 shows the spatial distribution of the mean proportions of males and females 6–12 years old who are not in elementary schools in Biliran Province, where we got the highest difference in the mean proportions of not in elementary between genders.

Figure 18 shows the graphical presentation of these mean differences.

Table 8. Mean Proportions of males and females 6–12 Years Old Not in Elementary School at the Barangay Level

Province/City	Mean Proportions of 6- to 12-Year-Olds Not in Elementary School, Barangay Level				Difference in Means
	Male		Female		
	Mean	S.D.	Mean	S.D.	
Biliran	24.70	7.02	20.94	6.72	3.76
Bogo City	18.99	6.28	20.97	5.71	-1.98
Camiguin	21.76	7.09	21.18	7.49	0.58
Eastern Samar	25.36	12.23	22.26	11.08	3.10
Marinduque	17.32	6.42	17.47	6.23	-0.15
Romblon	23.12	7.57	21.69	6.95	1.43
Pasay City	18.35	7.86	17.09	7.54	1.26
Puerto Princesa City	22.01	8.87	20.01	6.02	2.00
Siquijor	18.57	10.05	18.64	10.13	-0.07
Southern Leyte	23.69	10.75	21.35	9.72	2.34
Mean	21.39		20.16		1.23

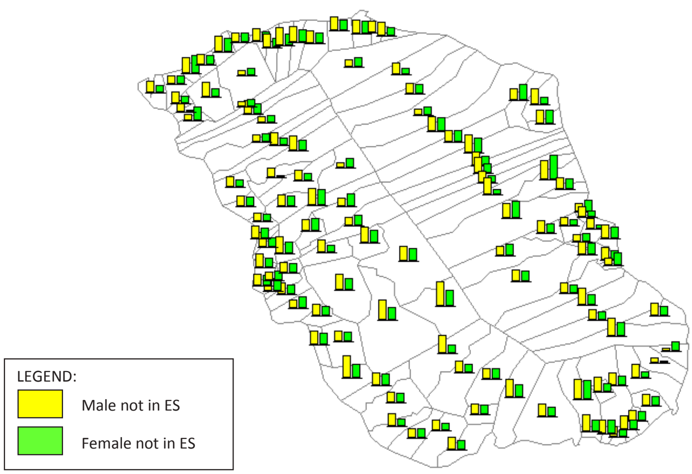


Figure 17. Mean proportions of males and females 6–12 years old not in elementary school in Biliran province.

In the case of Siquijor Province, Figure 19 shows that there are more 6- to 12-year-olds not in elementary school in the right portion of the province, which is in the town of Maria, regardless of gender.

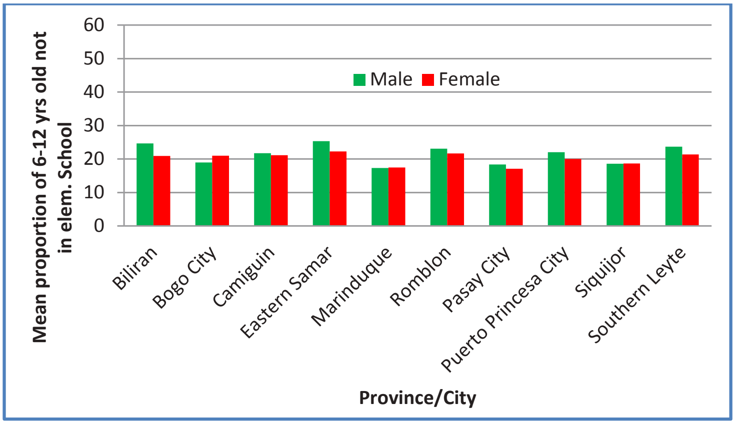


Figure 18. Mean proportion of males and females 6–12 years old not in elementary school at the barangay level.

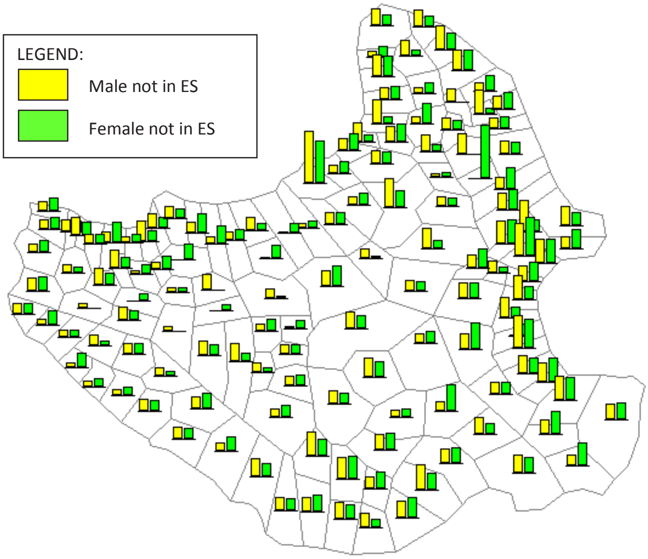


Figure 19. Mean proportions of males and females 6–12 years old not in elementary school (barangay level, Siquijor Province).

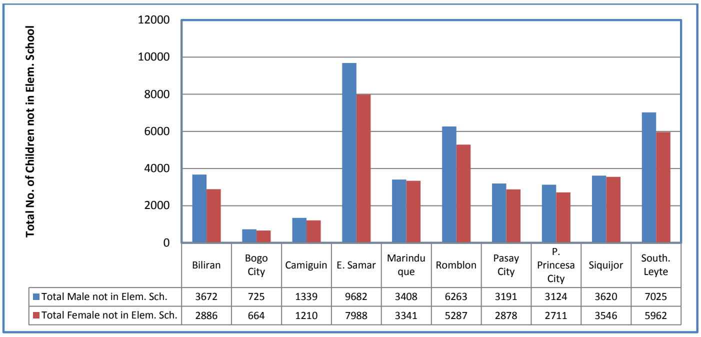


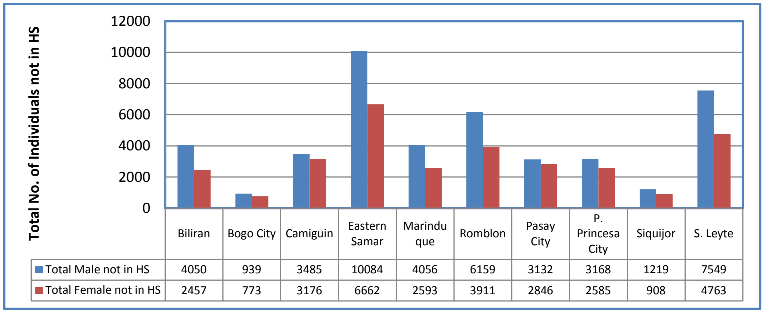
Figure 20. The total number of males and females of ages 6–12 years old not in elementary school.

As shown in Figure 20 above, there are more males (42,029) than females (36,473) who are not in elementary school in all the study areas, with a total difference of 5,556. Although as shown previously in Table 8, Bogo City, Marinduque, and Siquijor are areas where the mean proportion of females not in elementary schools is higher than males; in terms of the actual number of those not in elementary schools, there are still more males than females in all these areas.

Table 9. Mean proportions of males and females 13–16 years old not in high school at the barangay level

Province/City	Mean Proportions of 13- to 16-Year-Olds Not in High School				Difference in Means
	Male		Female		
	Mean	S.D.	Mean	S.D.	
Biliran	52.48	14.18	34.93	13.32	17.55
Bogo City	38.54	9.38	37.59	8.46	0.95
Camiguin	39.08	11.9	30.37	10.06	8.71
Eastern Samar	53.83	22.72	38.4	22.19	15.43
Marinduque	35.83	15.07	26.01	13.23	9.82
Romblon	42.52	16.28	29.86	12.28	12.66
Pasay City	31.7	11.81	30.84	12.41	0.86
Puerto Princesa City	42.18	14.11	33.76	11.28	8.42
Siquijor	33.54	15.2	26.12	12.97	7.42
Southern Leyte	45.23	17.43	32.02	15.86	13.21
Mean	41.49		31.99		9.50

Between the mean proportions of males and females not in high school (Table 9), the difference is still consistent among the three provinces mentioned previously for those who are not in elementary school and these have even increased. Biliran still gets the highest difference of 17.55%, followed by Eastern Samar at 15.43% and Southern Leyte at 13.21%. This would mean that the proportion of those who are not in school increased as they move from the elementary level up to the high school level.



	Biliran	Bogo City	Camiguin	Eastern Samar	Marindu que	Romblon	Pasay City	P. Princesa City	Siquijor	S. Leyte
Total Male not in HS	4050	939	3485	10084	4056	6159	3132	3168	1219	7549
Total Female not in HS	2457	773	3176	6662	2593	3911	2846	2585	908	4763

Figure 21. The total number of males and females of ages 13–16 years old not in high school.

In terms of the actual number of males and females at ages 13–16 years old who are not in high school (Fig. 21), there are more males (43,841) than females (30,670) in all the areas, with a difference of 13,171. This result is consistent with the mean proportions of males, which are higher than those of females not in high school, as previously shown in Table 9.

In Table 10, the positive values of the seven provinces like in Biliran (3.76), Eastern Samar (3.1), and so on, with regard to their difference in mean proportions between male and female not in elementary school would mean that more males are not in elementary school than females. There are only three areas—Bogo City, Marinduque, and Siquijor—where more females than males are not in elementary school as shown by the negative values of the differences. Regarding the comparison between the differences between means of those males and females going to high school and elementary school, all areas except Pasay City have increasing differences in mean proportions. This would mean that the difference between males and females not going to school is increasing as they move from elementary school to high school. Hence, this means that more males than females are dropping out of school as they move up from elementary to high school.

Table 10. Comparison of the difference in mean proportions between males and females in the elementary and high school levels

	Difference in Mean Proportions Between Males and Females Not Going to Elementary Schools	Difference in Mean Proportions Between Males and Females Not Going to High School	Difference in Mean Proportions Between Males and Females Not in School
	Mean Difference		
Biliran	3.76	17.55	13.79
Bogo City	–1.98	0.95	2.93
Camiguin	0.58	8.71	8.13
Eastern Samar	3.1	15.43	12.33
Marinduque	–0.15	9.82	9.97
Romblon	1.43	12.66	11.23
Pasay City	1.26	0.86	–0.40
Puerto Princesa City	2.00	8.42	6.42
Siquijor	–0.07	7.42	7.49
Southern Leyte	2.34	13.21	10.87
Grand Mean	1.23	9.50	8.28

In terms of the proportion of males and females of ages 6–12 years old who are not in elementary school, more barangays have a bigger proportion of females than males when the proportion of males and females who are not in elementary school is 20% or less. For a proportion of males and females higher than 20%, more barangays have a bigger proportion of males than females who are not in elementary school. Figure 22 shows this graphical presentation.

In the case of high schools, more barangays have a bigger proportion of females than males who are not in high school when the mean proportion of males and females who are not in high school is 30% or less. Beyond 30%, more barangays have males that are not in high school than females (Fig. 23).

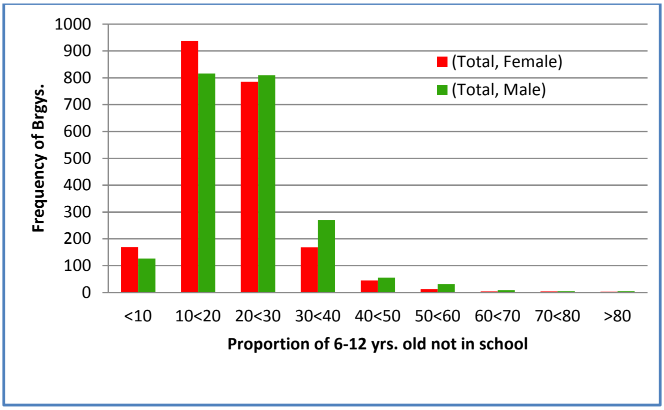


Figure 22. Frequency of barangays with proportion of 6- to 12-year-olds not in elementary school.

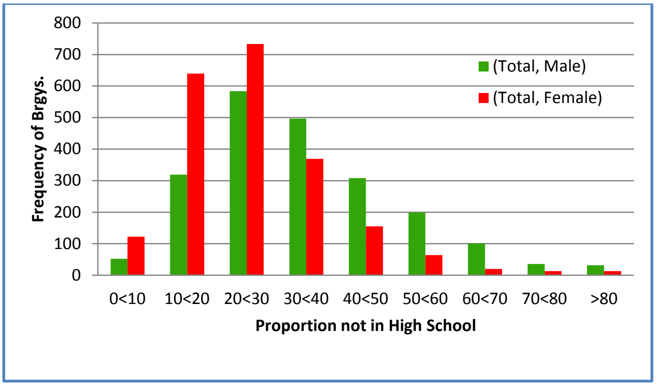


Figure 23. Frequency of barangays with proportion of 13- to 16-year-olds not in high school.

Gender Comparison on Unemployment

There is a big disparity in terms of working-age population between genders in all the provinces and cities being studied, in favor of the males. In total, there are 443,864 males compared to 227,399 females of employment age. In terms of the unemployed, the number of unemployed males (38,824) is more than the number of unemployed females (38,245) in the study areas with a difference of 579. Table 11 shows that it is only in the two provinces of Biliran and Eastern Samar and the city of Puerto Princesa where there are more unemployed females than males; the rest have more unemployed males than females. Eastern Samar has the highest number of unemployed females at 15,027 compared to 12,963 unemployed males with a difference of 2,064, while there were only 46 more unemployed males than females in Bogo City.

Table 11. Population of employment age and unemployed by gender in the study areas

Province/City	Population of Employment Age			Population of Unemployed		
	Male	Female	Difference	Male	Female	Difference
Biliran	34,206	16,921	17,285	5,339	6,069	-730
Bogo City	10,493	5,099	5,394	150	104	46
Camiguin	15,869	6,979	8,890	314	205	109
Eastern Samar	93,274	46,190	47,084	12,963	15,027	-2,064
Marinduque	41,822	21,812	20,010	801	443	358
Romblon	46,112	22,972	23,140	956	611	345
Pasay City	59,134	38,864	20,270	891	593	298
Puerto Princesa City	39,391	20,098	19,293	2,933	3,098	‹165
Siquijor	21,827	10,235	11,592	2,961	2,243	718
Southern Leyte	81,736	38,229	43,507	11,516	9,852	1,664
Grand Total	443,864	227,399	216,465	38,824	38,245	579

Table 12. Mean barangay population of unemployed by gender

Province/City	Mean Barangay Population of Unemployed by Gender		
	Male	Female	Difference
Biliran	40.45	45.98	–5.53
Bogo City	5.56	3.85	1.71
Camiguin	5.41	3.53	1.88
Eastern Samar	21.75	25.21	–3.46
Marinduque	3.67	2.03	1.64
Romblon	4.39	2.80	1.59
Pasay City	4.43	2.95	1.48
Puerto Princesa City	44.44	46.94	–2.50
Siquijor	22.10	16.74	5.36
Southern Leyte	23.74	20.31	3.43
Grand Mean	17.59	17.03	0.56

Looking at the mean barangay population of the unemployed between genders, Table 12 is consistent with the values in Table 11 since we simply divided the values in the latter by the number of barangays in the study areas. However, if we look at the proportion of unemployment between genders, we can see in Table 13 that all differences are negative, which may mean that more males are employed than females in all provinces, which contradicted the previous findings, but this may not be the case. Biliran (–21.25%), Eastern Samar (–17.14%), and Southern Leyte (–11.35%) are again the top three with big differences between male and female unemployment while those with very small differences are Pasay City (–0.05%), Marinduque (–0.14%), and Puerto Princesa City (–0.62%). There is nothing strange about this result however, since in the first place there are fewer females of employment age than males (from Table 11), resulting to a higher proportion of unemployment for the former.

Table 13. Mean proportions of unemployed by gender at the barangay level

	Unemployed				Mean Difference
	Male		Female		
	Mean	S.D.	Mean	S.D.	
Biliran	15.72	8.97	36.97	20.37	-21.25
Bogo City	1.54	2.41	2.29	3.06	-0.75
Camiguin	2.51	4.39	3.88	5.52	-1.37
Eastern Samar	13.74	10.13	30.88	19.33	-17.14
Marinduque	1.96	1.74	2.1	2.28	-0.14
Romblon	2.19	3.48	3.61	7.54	-1.42
Pasay City	1.36	1.96	1.41	2.1	-0.05
Puerto Princesa City	1.24	1.1	1.86	1.9	-0.62
Siquijor	13.3	7.31	22.29	12.5	-8.99
Southern Leyte	13.43	10.11	24.78	16.71	-11.35
Mean	6.70		13.01		-6.31

Figure 24 is a map of Biliran province showing the proportion of unemployment by gender at the barangay level. There is indeed a disproportionate number of unemployed females compare to males across the province. This is not the case for Pasay City, where in some barangays the proportions of unemployed males are higher than the unemployed females as shown in Figure 25.

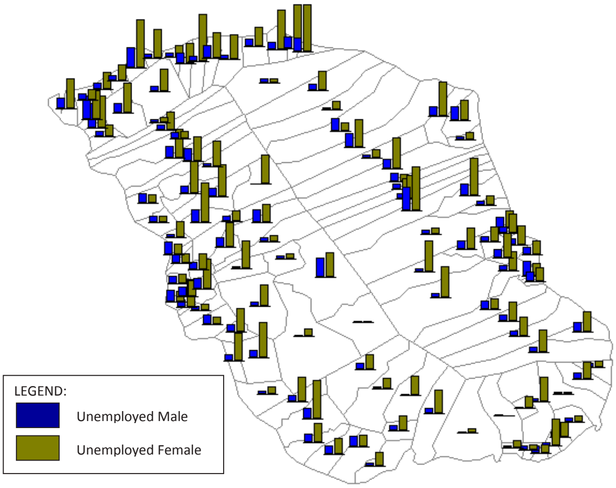


Figure 24. Graphical presentation of the proportion of unemployed between genders at the barangay level in Biliran Province.

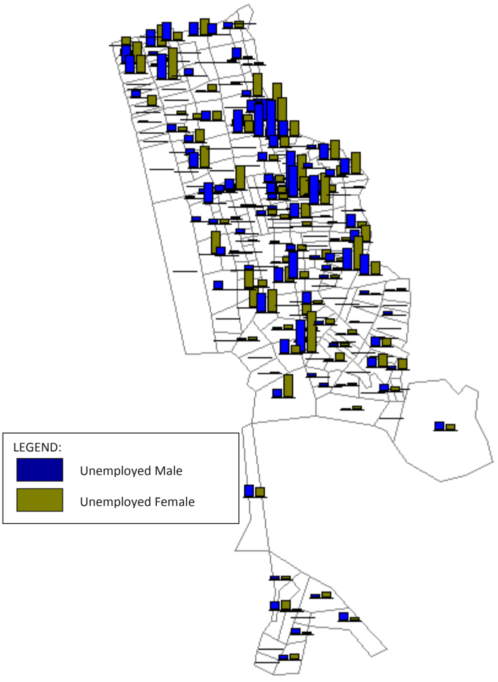


Figure 25. Graphical presentation of unemployed between genders in Pasay City.

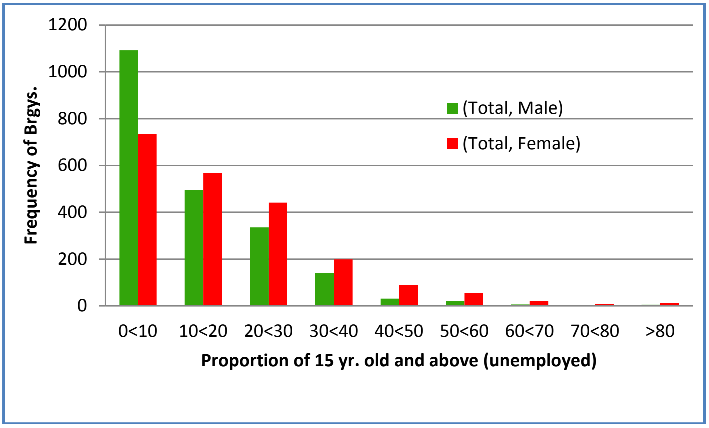


Figure 26. Frequency of barangays with proportions of 15-year-olds and older by gender who are unemployed.

When the proportion of the unemployed in the barangays is low, like 10% or less for both males and females, more barangays have a bigger proportion of males who are unemployed compared to females. Beyond 10% unemployment in the barangay, more barangays have a bigger proportion of females than males who could not find employment (Fig. 26).

Gender Comparison on Income Below the Poverty Threshold

In terms of the population by gender of those who felt their income is below the poverty threshold, Table 14 shows that more males (569,047) than females (532,700) felt they are poor. It is only in Pasay City where there are more females than males who felt that they are poorer. The mean barangay population in poverty by gender in the other half of Table 4.9 is also consistent with this result.

However if we look at the mean proportion by gender of those in poverty at the barangay level in Table 15, it is only in Puerto Princesa City where the proportion of females in poverty is higher than that of the males by 0.10%.

Table 14. Population Whose Income Falls Below the Poverty Threshold by Gender

Province/City	Total Population in Poverty by Gender			Mean Barangay Population in Poverty by Gender		
	Male	Female	Difference	Male	Female	Difference
Biliran	52,476	49,113	3,363	397.55	372.07	25.48
Bogo City	17,224	16,702	522	637.93	618.59	19.34
Camiguin	25,787	24,078	1,709	444.50	415.14	29.36

Table 14 continued...

Eastern Samar	139,847	128,128	11,719	234.64	214.98	19.66
Marinduque	59,828	56,602	3,226	274.44	259.64	14.8
Romblon	89,732	85,436	4,296	411.61	391.91	19.7
Pasay City	24,422	24,618	−196	121.50	122.48	-0.98
Puerto Princesa City	24,967	23,360	1,607	378.29	353.94	24.35
Siquijor	17,822	17,330	492	133.00	129.33	3.67
Southern Leyte	116,942	107,333	9,609	241.12	221.31	19.81
Grand total	569,047	532,700	36,347	3,274.58	3,099.39	175.19

Table 15 Mean Proportion of Poverty Between Genders in the Study Areas

Province/City	Proportion in Poverty				Difference in the Mean
	Male		Female		
	Mean	S.D.	Mean	S.D.	
Biliran	75.41	14.3	73.6	15.05	1.81
Bogo City	71.83	20.82	70.57	21.59	1.26
Camiguin	69.71	17.47	68.42	17.74	1.29
Eastern Samar	72.25	21.22	71.57	21.87	0.68
Marinduque	56.67	18.24	54.99	18.81	1.68
Romblon	71.03	14.44	69.66	14.88	1.37
Pasay City	18.98	13.48	18.72	13.8	0.26
Puerto Princesa City	34.92	23.91	35.02	24.2	−0.1
Siquijor	49.02	23.87	47.99	23.66	1.03
Southern Leyte	71.59	16.39	70.34	17.04	1.25
Mean	59.14		58.09		1.05

Figure 27 shows the frequency of barangays in the study areas in terms of the mean proportion of males and females who felt that their income is below the poverty threshold. Figure 28 shows the proportion of those in poverty between genders at the barangay level in the island province of Biliran while Figure 29 shows that of Puerto Princesa City. The mean difference of 1.81% in the mean proportion between genders who felt that their income is below the poverty threshold in Biliran Province is not that discernible as is the case when the mean difference is –0.10% for Puerto Princesa City.

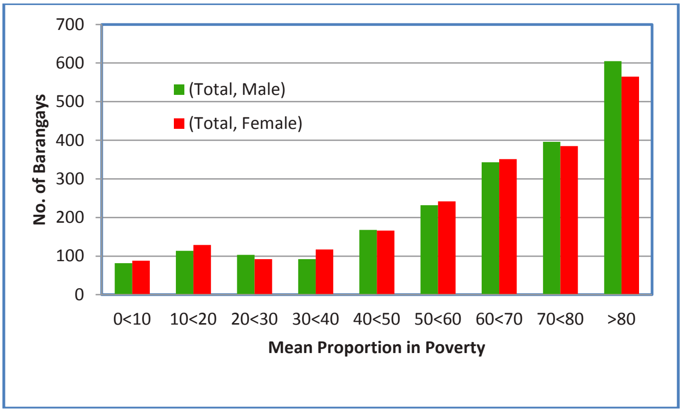


Figure 27. Mean proportion of poverty in the barangays by gender.

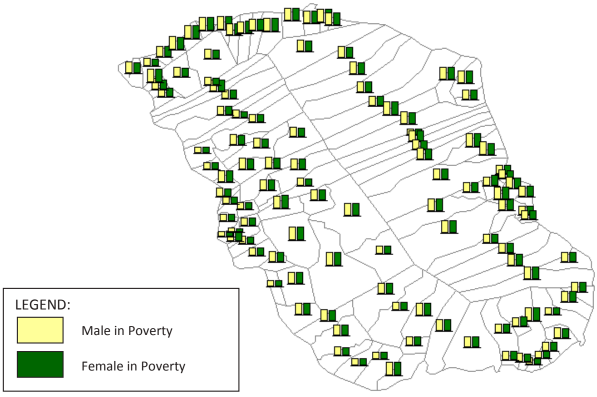


Figure 28. Proportion of those in poverty between genders in Biliran province.

Gender Comparison on Income Below the Food Threshold

The males again dominate the females in terms of their income being below the food threshold in all the provinces and cities studied as shown in Table 16. Overall, 455,017 males felt their income falls below the food threshold compared to 423,492 females. In terms of the mean barangay population by gender whose income falls below the food threshold, Camiguin Province has the highest difference between males and females at 25.17 followed by Biliran Province (22.85) and Romblon Province (18.09).

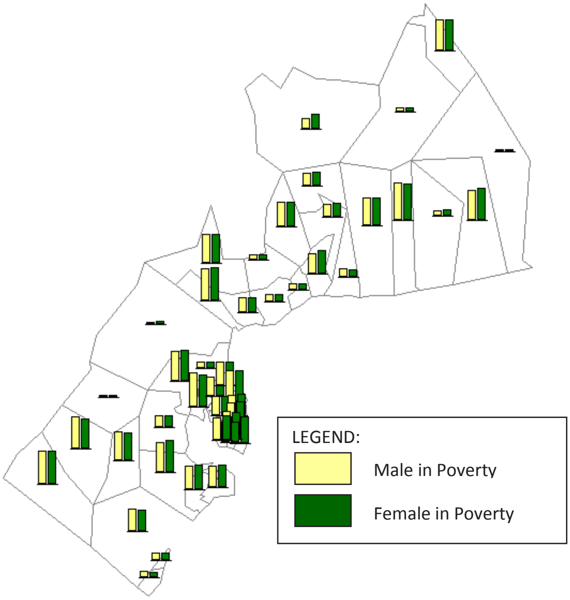


Figure 29. Proportion of those in poverty between genders in Puerto Princesa City.

Table 16. Population whose income is below the food threshold by gender

Province/City	Income Under Food Threshold by Gender			Mean Barangay Population by Gender With Income Below the Food Threshold		
	Male	Female	Difference	Male	Female	Difference
Biliran	43,901	40,884	3,017	332.58	309.73	22.85
Bogo City	15,128	14,662	466	560.30	543.04	17.26
Camiguin	20,672	19,212	1,460	356.41	331.24	25.17
Eastern Samar	119,667	109,543	10,124	200.78	183.80	16.98
Marinduque	43,965	41,247	2,718	201.67	189.21	12.46
Romblon	74,080	70,137	3,943	339.82	321.73	18.09
Pasay City	13,325	13,246	79	66.29	65.90	0.39
P.Princesa City	14,393	13,342	1,051	218.08	202.15	15.93
Siquijor	13,381	12,979	402	99.86	96.86	3.00
Southern Leyte	96,505	88,240	8,265	198.98	181.94	17.04
Grand Total	455,017	423,492	31,525			

Table 17. Mean proportion of income below the food threshold between gender in the barangay

	Proportion With Income Below the Food Threshold				Difference in the Mean
	Male		Female		
	Mean	S.D.	Mean	S.D.	
Biliran	65.04	18.17	63.27	18.49	1.77
Bogo City	63.47	24.97	62.53	25.20	0.94
Camiguin	56.97	19.88	55.63	20.24	1.34
Eastern Samar	62.42	23.27	61.88	23.72	0.54
Marinduque	41.61	18.38	40.14	18.58	1.47
Romblon	58.99	16.87	57.69	16.95	1.3
Pasay City	8.55	5.94	7.53	5.69	1.02
Puerto Princesa City	22.00	19.69	22.43	20.07	-0.43
Siquijor	36.58	21.49	35.83	21.63	0.75
Southern Leyte	59.81	19.39	58.75	19.83	1.06

As shown in Table 17, it is only in Puerto Princesa City where there is a greater mean proportion of females than males with income below the food threshold at the barangay level. When the proportion is less than 50%, there are more barangays whose females have income below the food threshold. On the other hand, when the proportion is more than 50%, there are more barangays with more males whose income is below the food threshold.

Gender Comparison on Experience on Food Shortage

As Table 18 would show, more males (73,604) than females (66,613) experience food shortage in the study areas. This is also consistent with the mean barangay population who experience food shortage as also shown in Table 18. In terms of the total number of those who experience food shortage, it is Eastern Samar that has the highest difference between males (29,107) and females (26,295) at 2,812. But in terms of the mean number of population at the barangay level, it is the province of Biliran that has the highest mean between males (80.72) and females (75.06) at 5.72.

Table 18. Population experiencing food shortage by gender

Province/City	Population in Food Shortage by Gender			Mean Barangay Population With Food Shortage by Gender		
	Male	Female	Difference	Male	Female	Difference
Biliran	10,663	9,908	755	80.78	75.06	5.72
Bogo City	291	260	31	10.78	9.63	1.15
Camiguin	155	123	32	2.67	2.12	0.55
Eastern Samar	29,107	26,295	2,812	48.84	44.12	4.72
Marinduque	6,338	5,560	778	29.07	25.50	3.57
Romblon	4,020	3,616	404	18.44	16.59	1.85
Pasay City	2,154	2,101	53	10.72	10.45	0.27
Puerto Princesa City	3,035	2,814	221	45.98	42.64	3.34
Siquijor	1,495	1,417	78	11.16	10.57	0.59
Southern Leyte	16,346	14,519	1,827	33.70	29.94	3.76
Grand Total	73,604	66,613	6,991			

In terms of the mean proportion at the barangay level, however, only Puerto Princesa City has the highest proportion of females (4.99) to males (4.96) who experienced food shortage as shown in Table 19. Eastern Samar Province has the highest mean proportion at the barangay level of both males (15.47) and females (15.27) who experience food shortage.

Table 19. Mean proportion who experienced food shortage between gender in thebarangay

	Proportion Who Experienced Food Shortage				Difference in the Mean
	Male		Female		
	Mean	S.D.	Mean	S.D.	
Biliran	14.05	19.17	13.59	18.93	0.46
Bogo City	1.03	2.09	0.96	2.03	0.07
Camiguin	0.41	0.88	0.35	0.71	0.06
Eastern Samar	15.47	22.34	15.27	22.21	0.2
Marinduque	5.60	10.07	5.03	9.08	0.57
Romblon	2.80	6.84	2.63	6.52	0.17

Table 19 continued...

Pasay City	1.48	3.92	1.37	3.49	0.11
Puerto Princesa City	4.96	6.89	4.99	6.93	<0.03
Siquijor	4.22	9.04	4.01	8.67	0.21
Southern Leyte	9.97	17.03	9.58	16.72	0.39

Figure 30 below shows a very high number of barangays with both genders having experienced less than 10% of food shortage. Compared to the previous data on males and females who have incomes below the poverty and food threshold, those who experienced food shortage are quite low.

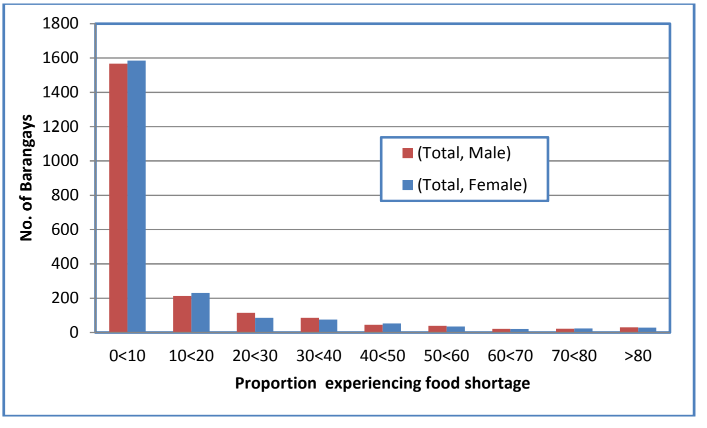


Figure 30. Mean proportion in the barangays experiencing food shortage by gender in the study areas.

Poverty, Accessibility, and Gender Relationships

Correlation of Poverty Variables and Gender

Figure 31 shows (a) a graphical presentation of the total number of males and females who are unemployed, (b) whose income falls below the poverty threshold, (c) whose income falls below the food threshold, and (d) who experience food shortage in all the provinces and cities studied. There are more males than females who are unemployed and whose incomes fall below the poverty threshold and food threshold. There is, however, fewer males and females who are suffering from food shortage compared to the other poverty measures.

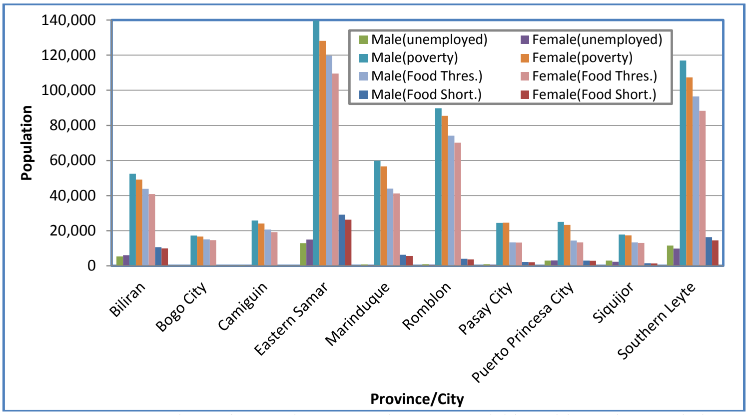


Figure 31. Comparison of unemployment and poverty variables with gender population.

Table 20. Correlation of Barangay SCI and Poverty Variables by Gender Population

	Barangay SCI	Male (Unemployed)	Female (Unemployed)	Male (Poverty)	Female (Poverty)	Male (Food Threshold)	Female (Food Threshold)	Male (Food Shortage)	Female (Food Shortage)
SCI	1								
Male (unemployed)	0.5649	1							
Female (unemployed)	0.6140	0.9828	1						
Male (poverty)	0.6209	0.8120	0.8018	1					
Female (poverty)	0.6157	0.8001	0.7898	0.9997	1				
Male (Food Threshold.)	0.6693	0.8185	0.8123	0.9971	0.99613	1			
Female (Food Threshold)	0.6693	0.8088	0.8029	0.9970	0.9965	0.9998	1		
Male (Food Shortage)	0.6289	0.9306	0.9619	0.8879	0.8799	0.8924	0.8860	1	
Female (Food Shortage)	0.6303	0.9297	0.9629	0.8829	0.8749	0.8878	0.8814	0.9998	1

Figure 32 shows that the province with the highest mean number of unemployed at the barangay level is Bogo City, while the lowest is Pasay City. Using the average number of unemployed by gender at the barangay level, the correlation between the barangay SCI and the poverty variables of the population (Table 21) is less significant as compared to the correlation between the barangay SCI and the actual count of the population with these poverty characteristics (Table 20).

Table 21. Correlation of barangay SCI and poverty variables by gender population at the barangay level.

	Barangay SCI	Male (Unemployed)	Female (Unemployed)	Male (Poverty)	Female (Poverty)	Male (Food Threshold)	Female (Food Threshold)	Male (Food Shortage)	Female (Food Shortage)
Barangay SCI	1								
Male (unemployed)	0.2725	1							
Female (unemployed)	0.3243	0.9881	1						
Male (poverty)	0.3883	-0.0752	-0.0244	1					
Female (poverty)	0.3691	-0.0979	-0.0484	0.9990	1				
Male (Food Threshold.)	0.4951	-0.1641	-0.1132	0.9742	0.9754	1			
Female (Food Threshold.)	0.4780	-0.1812	-0.1319	0.9719	0.9749	0.9992	1		
Male (Food Threshold.)	0.5407	0.7758	0.8398	-0.0045	-0.0291	-0.0280	-0.0495	1	
Female (Food Threshold.)	0.5289	0.7841	0.8479	-0.0056	-0.0298	-0.0310	-0.0520	0.9995	1

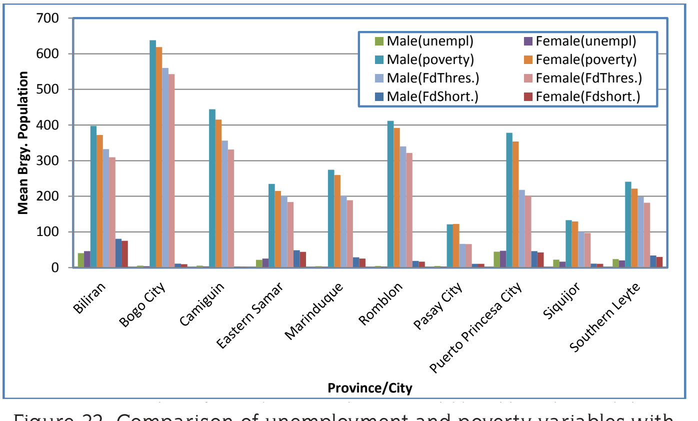


Figure 32. Comparison of unemployment and poverty variables with gender population at the barangay level.

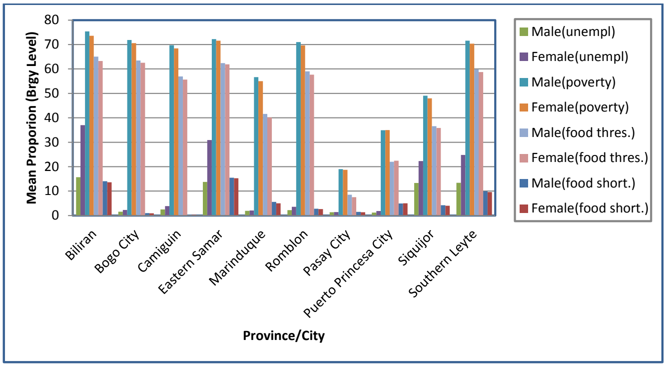


Figure 33. Mean proportion of the poverty variables by gender at the barangay level

However, if we consider the proportion of both genders with regard to their poverty characteristics at the barangay level (Fig. 33) and to the barangay SCI, their correlation is quite high as shown in Table 22.

Table 22. Correlation of barangay SCI and mean proportion of poverty variables by gender at the barangay level

	Barangay SCI	Male (Unemployed)	Female (Unemployed)	Male (Poverty)	Female (Poverty)	Male (Food Threshold)	Female (Food Threshold)	Male (Food Shortage)	Female (Food Shortage)
Barangay SCI	1								
Male (unemployed)	0.5786	1							
Female (unemployed)	0.6500	0.9828	1						
Male (poverty)	0.8734	0.4101	0.4507	1					
Female (poverty)	0.8787	0.4110	0.4523	0.9998	1				
Male (Food Threshold.)	0.8905	0.4217	0.4678	0.9955	0.9961	1			
Female (Food Threshold.)	0.8968	0.4226	0.4686	0.9947	0.9958	0.9996	1		
Male (Food Threshold.)	0.6743	0.8077	0.8720	0.3977	0.4021	0.4055	0.4099	1	
Female (Food Threshold.)	0.6768	0.8059	0.8715	0.3927	0.3977	0.4021	0.4071	0.9995	1

The correlation analysis also shows that the food shortage variable may not be a good indicator of poverty. Being in poverty may not necessarily mean that there is food shortage regardless of gender. Also, the average barangay SCI is more positively correlated with the average barangay proportion of the gender population in terms of their poverty characteristics than the average barangay population. Hence, in the subsequent analysis, the accessibility variables would be analyzed using the proportions of the poverty variables of both genders and not the actual number of the population having these poverty variables.

Effect of the Presence of a National Road on Unemployment by Gender

A good road (i.e., a national road) passing through the barangay ensures year-round access compared to earth roads that usually serve interior barangays in a locality. It then follows that employment opportunities in the locality could improve with good roads. As the trend would show in Table 23, the effect on unemployment, regardless of gender, of a national road passing through the barangay is mixed. The grand mean of unemployment is even higher for males when there is a national road passing through the barangay. This may mean that employment opportunities in the barangay are not dictated by the availability of a national road. However, it is clear that a higher proportion of females compared to males, regardless of the location of the barangay with respect to the national road, are unemployed. Note that in the case of Pasay City, all barangays are passed by national roads.

Table 23. Effect of barangay location with respect to national road on unemployment by gender

Province/City	Barangay Location With Respect to National Road	Gender Proportion on Unemployment (Barangay Level)	
		Male	Female
Biliran	Not along national road	13.55	37.00
	Along national road	16.36	36.96
Bogo	Not along national road	0.20	0.00
	Along national road	1.60	2.38
Camiguin	Not along national road	4.03	5.68
	Along national road	2.02	3.30
Eastern Samar	Not along national road	11.33	30.99
	Along national road	16.21	30.76

Table 23 continued...

Marinduque	Not along national road	1.87	2.07
	Along national road	2.13	2.16
Puerto Princesa	Not along national road	1.29	1.82
	Along national road	1.18	1.90
Pasay	Not along national road	—	—
	Along national road	1.36	1.41
Romblon	Not along national road	2.17	3.93
	Along national road	2.29	2.70
Siquijor	Not along national road	12.46	20.79
	Along national road	15.58	26.37
Southern Leyte	Not along national road	12.15	25.25
	Along national road	15.03	24.19
Grand Mean	Not along national road	8.55	19.27
	Along national road	10.18	18.44

Effect of the Presence of a National Road on Poverty by Gender

In the case of the effect of a national road on barangay poverty, Table 24 shows that when a national road passes through the barangay, less poverty is experienced regardless of gender. However, overall there is only a slight difference in poverty measures between genders, with less females experiencing poverty than males.

Table 24. Effect of barangay location with respect to national road on poverty by gender

Province/City	Barangay Location With Respect to National Road	Gender Proportion in Poverty (Barangay Level)	
		Male	Female
Biliran	Not along national road	76.42	74.17
	Along national road	75.11	73.44
Bogo	Not along national road	76.00	73.70
	Along national road	71.64	70.45
Camiguin	Not along national road	64.77	64.04
	Along national road	71.28	68.42

Table 24 continued...

Eastern Samar	Not along national road	79.63	79.45
	Along national road	64.66	63.47
Marinduque	Not along national road	58.33	56.86
	Along national road	53.30	51.20
Puerto Princesa	Not along national road	26.64	25.94
	Along national road	43.71	44.66
Pasay	Not along national road	—	—
	Along national road	18.98	18.72
Romblon	Not along national road	70.67	69.23
	Along national road	72.04	71.00
Siquijor	Not along national road	52.14	51.08
	Along national road	40.53	39.57
Southern Leyte	Not along national road	74.43	73.51
	Along national road	68.03	66.40
Grand Mean	Not along national road	69.44	68.53
	Along national road	56.41	55.26

Correlation of Poverty Measures and Accessibility by Gender

Four types of accessibility measure were used in this study: (a) the road distance (in kilometers) from the barangay (using a hypothetical center) to the school or economic center location, (b) walking time (in minutes) from the barangay to the school or economic center location, (c) the travel time (in minutes) by public transport to the school or economic center location, and (d) generalized cost using Eq. (2), which uses the travel time result and the cost of time values in Table 5 by province plus the cost of fare using public transport. For accessibility to elementary schools, accessibility definitions (a) to (c) were used since the cost of time among children who are not yet wage earners were considered 0. In the case of accessibility to high schools and to economic centers, accessibility definitions (b) to (d) were used. It was assumed that high school aged students may also be already wage earners.

Table 25. Correlation between the proportion of children 6–12 years old not in school by gender at the barangay level with accessibility to elementary schools

Province/City	Proportion of 6-to 12-Year-Olds Not in School by Gender	Accessibility Variables		
		Road Distance to Elementary School	Walk Time to Elementary School	Travel Time by Public Transport to Elementary School
Biliran	Male	0.173	0.173	0.173
	Female	0.219	0.219	0.219
Bogo	Male	-0.080	-0.080	-0.080
	Female	-0.124	-0.124	-0.124
Camiguin	Male	-0.042	-0.042	-0.042
	Female	-0.088	-0.088	-0.088
Eastern Samar	Male	0.071	0.071	0.070
	Female	0.095	0.095	0.095
Marinduque	Male	-0.000	-0.000	-0.000
	Female	0.111	0.111	0.111
Pasay City	Male	-0.021	-0.021	-0.021
	Female	0.015	0.015	0.015
Puerto Princesa City	Male	-0.013	-0.013	-0.013
	Female	-0.300	-0.300	-0.300
Romblon	Male	0.174	0.174	0.174
	Female	0.096	0.096	0.096
Siquijor	Male	-0.003	-0.003	-0.008
	Female	0.084	0.094	0.099
Southern Leyte	Male	-0.028	-0.028	-0.028
	Female	-0.032	-0.032	-0.032

Considering now the relationship between accessibility variables and the proportion of children 6–12 years old who are not in elementary school, Table 25 above would show that their correlations are quite low for both genders. This may be due to the fact that most of the barangays in the study areas already have elementary schools and access to these elementary schools is not a problem. In other words, a barangay having a high proportion of children 6–12 years old not in elementary school is not attributable to the accessibility of the schools.

In the case of the proportion of 13- to 16-year-olds not in high school, it can be seen in Table 26 below that the accessibility variables are quite significantly correlated with the proportion of males and females aged 13–16 years old who are not in high school especially in the provinces of Marinduque, Romblon, and Biliran; it is not significant in the cities of Pasay and Bogo since accessibility is not a problem in the latter cities. When the area has good road connectivity like in Puerto Princesa City and Siquijor and hence less accessibility problems, the correlation of the accessibility variables with the proportion of males and females 13–16 years old who are not in high school at the barangay level is also not significant. Hence, it can then be said that accessibility of high school locations to some extent affects the proportion of males and females aged 13–16 years old who are not studying in the barangay level.

Table 26. Correlation between the proportion of persons 13–16 years old not in school by gender in the barangay level with accessibility to high schools

Province/City	Gender	Accessibility Variables		
		Walk Time to High School	Travel Time to High School	Generalized Cost to High School
Biliran	Male	0.409	0.409	0.391
	Female	0.365	0.365	0.378
Bogo City	Male	-0.034	-0.034	-0.013
	Female	0.131	0.131	0.105
Camiguin	Male	0.333	0.333	0.365
	Female	0.065	0.065	0.083
Eastern Samar	Male	0.387	0.387	0.389
	Female	0.401	0.401	0.405
Marinduque	Male	0.458	0.458	0.462
	Female	0.361	0.361	0.375
Pasay City	Male	0.016	0.016	0.016
	Female	0.014	0.014	0.014
Puerto Princesa City	Male	0.212	0.212	0.189
	Female	0.064	0.064	0.048
Romblon	Male	0.421	0.421	0.402
	Female	0.458	0.458	0.448
Siquijor	Male	0.116	0.136	0.135
	Female	0.032	0.097	0.101
Southern Leyte	Male	0.292	0.292	0.288
	Female	0.258	0.258	0.272

As for the impact of economic center locations on the proportion of those in poverty and unemployed (Table 27), the proportion of poverty by gender in the barangay is affected more by accessibility to economic centers than the proportion of unemployed by gender. This may be due to the fact that in most of these provinces and even cities, employment can be found near their homes. Several of these employment opportunities can be considered self-employment, such as farming and fishing. Considering now the data set of all the provinces and cities studied, Table 28 shows the correlation of the education and economic variables by gender and accessibility. For the relationship between accessibility variables and the proportion of children 6–12 years old who are not in elementary school, Table 4.9 shows that their correlations are quite low for both genders. Accessibility to high school, however, whether by walking, using the public transport, or the general cost measure, would greatly influence the number of males and females who are 13–16 years old in going to high school with correlation ranging from 0.414 to 0.418 for males and 0.386 to 0.389 for females.

Access to market and economic centers is more positively correlated with the proportion of poverty in the barangay regardless of gender compared to the proportion of unemployed. As earlier mentioned, location of employment can be closer to home especially for fishermen and farmers, more particularly in the provinces. Looking at the correlation of poverty and employment, male unemployment has a very low correlation with gender poverty (male or female), while female unemployment to some degree is correlated to gender poverty (male or female). We can surmise here that even with the male being employed, poverty still exists, while if the female is employed poverty may not exist in the household.

Table 27. Correlation between the proportion people of working age (15 Years Old and Older) by gender at the barangay level with accessibility to market/economic centers

Province/City	Poverty and Unemployment	Gender	Accessibility Variables		
			Walk Time to Economic Centers	Travel Time to Economic Centers	Generalized Cost to Economic Centers
Biliran	Poverty	Male	0.276	0.276	0.265
		Female	0.273	0.273	0.261
	Unemployment	Male	-0.129	-0.129	-0.115
		Female	-0.090	-0.090	-0.102

Table 27 continued...

Bogo	Poverty	Male	0.369	0.369	0.414
		Female	0.357	0.357	0.401
	Unemployment	Male	0.117	0.117	0.192
		Female	0.019	0.019	0.110
Camiguin	Poverty	Male	0.103	0.103	0.097
		Female	0.100	0.100	0.095
	Unemployment	Male	0.267	0.267	0.270
		Female	0.335	0.335	0.337
Eastern Samar	Poverty	Male	0.312	0.312	0.312
		Female	0.328	0.328	0.328
	Unemployment	Male	-0.225	-0.225	-0.226
		Female	-0.078	-0.078	-0.079
Marinduque	Poverty	Male	0.060	0.060	0.049
		Female	0.072	0.072	0.060
	Unemployment	Male	-0.088	-0.088	-0.083
		Female	-0.047	-0.047	-0.049
Pasay City	Poverty	Male	-0.001	-0.001	-0.001
		Female	-0.005	-0.005	-0.005
	Unemployment	Male	0.134	0.134	0.134
		Female	0.144	0.144	0.144
Puerto Princesa	Poverty	Male	0.795	0.795	0.796
		Female	0.802	0.802	0.802
	Unemployment	Male	-0.160	-0.160	-0.160
		Female	0.109	0.109	0.107
Romblon	Poverty	Male	0.192	0.192	0.184
		Female	0.189	0.189	0.180
	Unemployment	Male	-0.005	-0.005	-0.007
		Female	0.005	0.005	0.002
Siquijor	Poverty	Male	0.161	0.198	0.196
		Female	0.183	0.224	0.221
	Unemployment	Male	-0.038	-0.039	-0.038
		Female	-0.061	-0.127	-0.128

Table 27 continued...

Southern Leyte	Poverty	Male	0.202	0.202	0.194
		Female	0.207	0.207	0.199
	Unemployment	Male	0.036	0.036	0.038
		Female	0.022	0.022	0.019

Table 28. Correlation between academic and economic variables in the barangay level with accessibility by gender (aggregated data)

Gender Characteristics	Access to Elementary School		
	Road Distance to Elementary School	Walk Time to Elementary School	Travel Time by Public Transport to Elementary School
Proportion of males 6–12 years old not in elementary school	0.065	-0.006	-0.007
Proportion of females 6–12 years old not in elementary school	0.067	0.002	0.001
	Access to High School		
	Walk Time to High School	Travel Time to High School	Generalized Cost to High School
Proportion of males 13–16 years old not in high school	0.402	0.398	0.396
Proportion of females 13–16 years old not in high school	0.387	0.386	0.389
	Access to Market/Economic Centers		
	Walk Time to Economic Centers	Travel Time to Economic Centers	Generalized Cost to Economic Centers
Male (poverty)	0.340	0.334	0.332
Female (poverty)	0.351	0.345	0.342
Male (unemployed 15 years old and older)	-0.026	-0.010	-0.048
Female (unemployed 15 years old and older)	0.078	0.101	0.044

There is also some correlation between the gender (male or female) being in poverty when the male is not in high school more than the female (Table

4.10). It can be surmised that when the female household member is not in high school, it does not necessarily mean that the household is poor because the female household member may be working. But if the male household member is not in high school even though he is working, the household is most likely poorer than when the female household member is not in high school.

Table 29. Correlation of education, poverty, and unemployment variables

	brgy_ ntElem612 _Male_Prop	brgy_ ntElem612 _Female_ Prop	brgy_ ntHS1316 _Male_Pro	brgy_ ntHS1316 _Female_ Prop	brgy_ MemPovp _Male_Prop	brgy_ MemPovp _Female_ Prop	brgy_ Unempl15ab _Male_Prop	brgy_ Unempl15ab _Female_ Prop
brgy_ntElem612 _Male_Prop	1							
brgy_ntElem612 _Female_Prop	0.545954	1						
brgy_ntHS1316 _Male_Prop	0.44709	0.366193	1					
brgy_ntHS1316 _Female_Prop	0.440096	0.361589	0.646534	1				
brgy_MemPovp _Male_Prop	0.237757	0.158377	0.480217	0.307355	1			
brgy_MemPovp _Female_Prop	0.246765	0.16294	0.494809	0.326038	0.992049	1		
brgy_ Unempl15ab _Male_Prop	0.101433	0.082333	0.024668	-0.02556	0.178088	0.167085	1	
brgy_ Unempl15ab _Female_Prop	0.165425	0.13056	0.262968	0.173097	0.363278	0.362374	0.700159	1

Regression Models

Clearly, the relationship between children 6–12 years old not in elementary schools and access time by walking to elementary schools is not well established (Figure 34). This result is consistent with what was previously stated that due to the presence of elementary schools in most barangays in the study areas, accessibility is not a problem anymore except for a few barangays in the interior parts of Eastern Samar and Southern Leyte provinces.

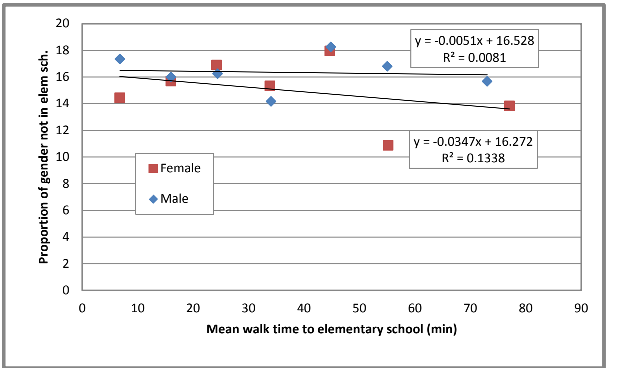


Figure 34. Regression models of proportion of children not in school by gender against walk time to elementary school.

In the case of the relationship between the proportion of children 13–16 years old not in high school by gender against the general cost of travel in pesos to high school, a polynomial regression model was developed with good fit as shown in Figure 35. The polynomial regression models have an adjusted R^2 of 0.9874 and 0.9261 for the boys and girls models, respectively. The curves suggest that more boys than girls are likely to be not in high school when the generalized cost of travel is about less than Php20 when the school is near their households. As the generalized cost of travel becomes higher than Php 20, a higher proportion of girls of high school age are most likely not in school than boys.

As the curves would suggest, for most part of the accessibility concern to economic centers where there are employment opportunities, in terms of the generalized cost of travel in pesos, a higher proportion of females are unemployed than males as shown in Figure 36.

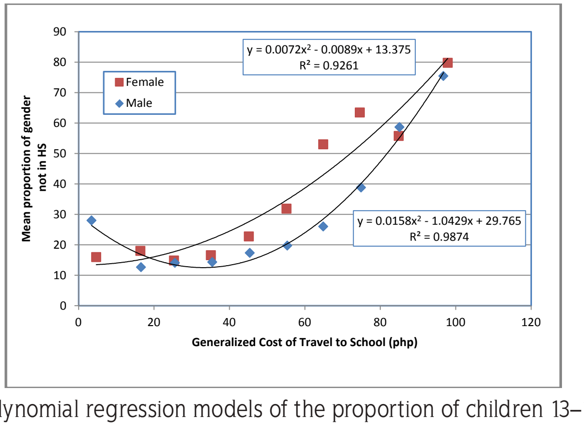


Figure 35. Polynomial regression models of the proportion of children 13–16 years old not in high school by gender against general cost of travel (in Php) to high school.

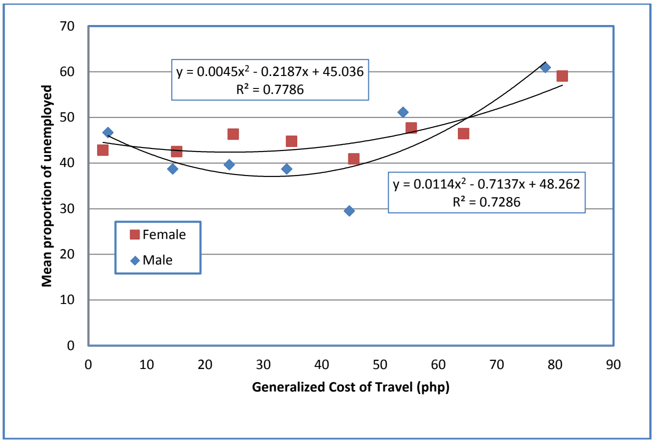


Figure 36. Polynomial regression models of the mean proportion of individuals ages 15 and older who are unemployed by gender against general cost of travel (in Php) to economic centers.

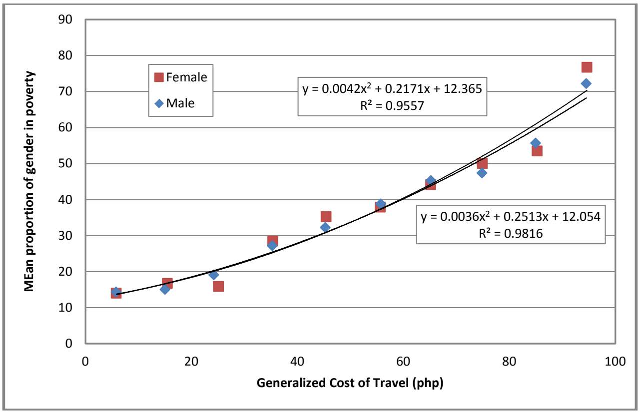


Figure 37. Polynomial regression models of the mean proportion of individuals whose income is below the poverty threshold by gender against the generalized cost of travel (in Php) to economic centers.

Figure 37 provides a best-fit relationship between the mean proportions of those who experience poverty regardless of gender versus accessibility to economic cernters using the generalized cost of travel in pesos. These economic centers are those areas where employment opportunities are available as well as where one can get involved in economic activities like selling of farm and fishery products. Most often, these are where social services are also located.

Summary of Findings and Conclusion

In terms of gender and education, there were more males than females of corresponding school ages in both the elementary and high school levels in all the provinces and cities studied. There were 10,566 more males than females at the elementary level, while there were 6,850 more males than females at the high school level. The proportion of both genders at the barangay level of those who are not in school increases as the expected school-age population moves up from elementary to high school. However, the proportion of males is much higher than females as this school-age population moves up from elementary to high school. It is therefore safe to say that more males are dropping out of school than females as they move up from elementary to high school. In the case of the actual number of school-age population, more males are not in high school (43,841) than in elementary school (42,029) while the opposite is true for females with 30,670 not in high school compared to 36,473 not in elementary school.

For the actual number of unemployed in the study areas, there were more males (38,824) than females (38,245) who are unemployed. However, in terms of the mean proportion of unemployed at the barangay level by gender, that of the males is consistently lower than that of the females in all the provinces and cities studied. This is understandable since in the first place there are fewer females of employment age than males resulting to the higher proportion of unemployment in the former.

Comparing the population by gender of those who felt that their income is below the poverty threshold, there are more males (569,047) than females (532,700) who felt that they are poor. In terms of the mean proportion by gender of those who felt that their income is below the poverty threshold, all except Puerto Princesa City have more males than females who felt that they are poor.

The results regarding income below the food threshold and those who experienced food shortage between genders are also consistent with the result of those whose income is below the poverty threshold. However, those who experienced food shortage are consistently lower than the other two measures of poverty. The variable on food shortage experience is not a good indicator of poverty as the correlation analysis would show. Being poor may not necessarily mean that there is food shortage, regardless of gender, compared to the other measures of poverty.

There is no significant relationship between accessibility to the nearest elementary school, whether by walking to school or using a public transport, and the proportion of children 6–12 years old regardless of gender who are not in elementary school. This may be due to the fact that most barangays in the study areas already have elementary schools and their access to those schools is not a problem. There is however a significant relationship between accessibility to the nearest high school, whether by using public transport or the generalized cost of travel, and the proportion of males or females 13 to 16 years old who are not in high school. This is more pronounced in provinces where some of the barangays have poor accessibility due to poor roads or where public transport is not available. It can be concluded that accessibility to high schools to some extent affects the proportion of males and females 13 to 16 years old who are not studying at the barangay level.

The proportion of those who felt that their income is below the poverty threshold by gender in the barangay level is affected by accessibility to economic centers, while the proportion of those unemployed by gender at the barangay level is not. This may be due to the fact that employment can be found near their residences, especially among those who are self-employed like farmers and fishermen in the provinces. It can therefore be concluded that access to market and economic centers is more positively correlated with the proportion of those in poverty at the barangay level regardless of gender, but not the proportion of unemployed regardless of gender.

There is some correlation between genders (male or female) being in poverty when the male is not in high school more than the female. It can be concluded that when the female household member is not in high school, it does not necessarily mean that the household is poor because it is possible that the female household member may be working. But if the male household member is not in high school even though he is working, the household is most likely poorer than when the female household member is not in high school.

The effect on unemployment regardless of gender of a national road passing through the barangay is not clear. Unemployment is even higher for males when there is a national road passing through the barangay. This may mean that employment opportunities in the barangay are not dictated by the availability of a national road. However, it is clear that a higher proportion of females compared to males regardless of the location of the barangay with respect to the national road is unemployed. On the other hand, when a national road passes through the barangay, less poverty is experienced regardless of gender. However, overall there is only a slight difference on poverty expressed between genders, with less females experiencing poverty than males.

The developed polynomial regression models showed that there is a very significant relationship between the mean proportions of those who experience poverty regardless of gender versus accessibility, using the generalized cost of travel, to economic centers. While the polynomial regression model between the proportion of children 13–6 years old not in high school by gender against accessibility in terms of the generalized cost of travel to high school suggests that more boys are likely to not be in high school when the generalized cost of travel is less than Php 20 than girls. As the generalized cost of travel increases above Php 20, a higher proportion of high school age are more likely not in school than boys.

Recommendations

With the use of aggregated data of CBMS at the barangay level, it was shown that accessibility concerns especially going to high school and to economic centers greatly affected the poverty situation at the barangay level regardless of gender. A more disaggregated data especially on accessibility could be further obtained regarding the actual modes of transport used and the corresponding service characteristics by people of different genders at the barangay level going to high school and economic centers. It will improve further establish the relationships among these variables. The CBMS questionnaire survey forms could be modified to include questions related to accessibility concerns going to high schools and economic centers.

From the four measures of poverty, regardless of gender, namely, the barangay SCI, the households with income below the poverty threshold, the households with income below the food threshold, and the households who experience food shortage, it was the households who experience food shortage which are less correlated to the other three measures of poverty. If one has a choice of expressing poverty at the barangay level, households who experience food shortage should not be used.

The government policy of putting up elementary schools in every barangay has a very significant impact on the accessibility issue of children going to these elementary schools and in fact the study showed that it is not a concern anymore. However, in the case of children 13 to 16 years old who are not going to high schools, the accessibility problem is very much a concern. Since not all barangays could be provided with high schools because of the minimum number of enrollees required, the optimal location of high schools, especially if a new one would be put up, should be studied carefully with regards to its catchment area (i.e., which barangays have a high number of children of high school age) and also in relation to the existing location of high schools in the province or city.

Employment opportunities in the barangay are not dictated by the availability of a national road that passes through the barangay. Meaning, if you build a good road like the national road, the availability of jobs does not necessarily follow. However, it is clear that a higher proportion of females compared to males, regardless of the location of the barangay with respect to the national road, are unemployed. The policy and programs of providing jobs in a locality does not end with the provision of a good road but should try to identify livelihood opportunities especially for women and helping them look for markets (given the good roads) to sell their products.

Since not all provinces and cities were visited, the definition of the major economic centers in some cases was based on the population and intensity of development, with major port or airport infrastructure, and are as seen from internet-based maps. There may be a need to provide a more refined definition of a major economic center in a province.

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Appendix A

CBMS Poverty Indicators

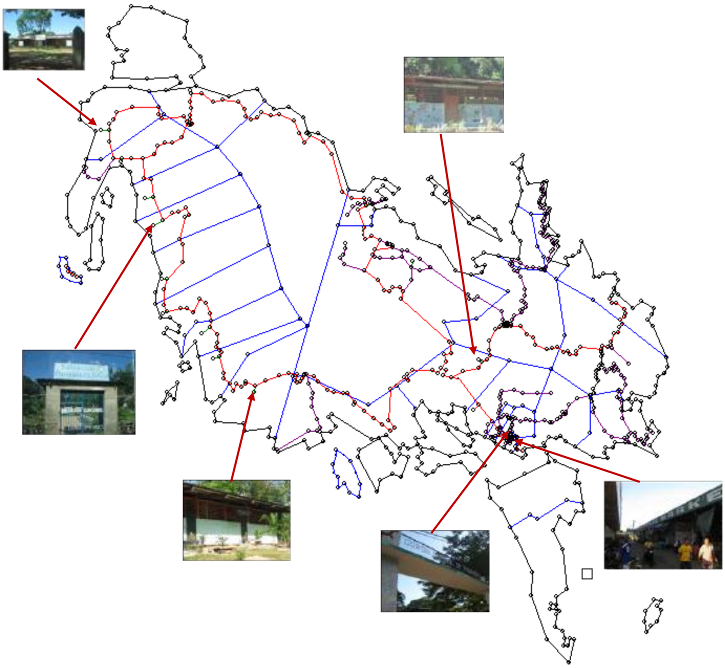
Table A.1. The CBMS 14 Poverty Indicators and Their Decision Variables

Poverty Variables	Binary Choice/Description
1. HH_wMaln05	0—without malnourished children 0-5 years old/without children between 0-5 years old 1—with malnourished children 0–5 years old
2. HH_wDeath05	0—without child death 0–5 years old/without children 0–5 years old 1—with child death 0–5 years old
3. HH_wDeathPreg	0—without death due to pregnancy related causes/not applicable (no pregnancy in the household) 1—with death due to pregnancy related causes
4. HH_Squat	0—formal settler 1—informal settler
5. HH-MSH	0—not living in makeshift housing 1—living in makeshift housing
6. HH_ntSWS	0—with access to safe water 1—without access to safe water
7. HH_ntSTF	0—with access to sanitary toilet 1—without access to sanitary toilet
8. HH_wntElem612	0—all members 6–12 years old attending elementary/no members 6–12 years old 1—with members 6–12 years old not in elementary
9. HH_wntHS1316	0—all members 13–16 years old attending high school/no members 13–16 years old 1—with members 13–16 years old not in high school
10. HH_povp	0—nonpoor household 1—poor household
11. HH_Subp	0—subsistently non-poor 1—subsistently poor
12. HH_Fshort	0—did not experience food shortage 1—experienced food shortage
13. HH_wUnemp15ab	0—all members in the labor force are employed 1—with unemployed members of the labor force
14. HH_wVictcr	0—no victims of crime 1—with victims of crime

Appendix B

Busuanga Island

Busuanga Island is composed of two towns, Busuanga and Coron. There are 44 elementary and 4 high schools in Busuanga Island. The major market center is located in Coron as shown in Figure 3.2, which is open every day of the week. There are no other major markets in the island. Due to the incomplete CBMS data of the two towns of Busuanga and Coron in Busuanga Island, this study area was dropped from the accessibility analysis.



Map of Busuanga Island and the Location of Schools and Major Markets.

Appendix C

For Daily-Paid Employees

The following formula may be used in computing the EMR of different groups of daily-paid employees for purposes of entitlement to minimum wages and allied benefits under existing laws:

a) For those who are required to works everyday including Sundays or rest days, special days and regular holidays.

$$\text{EEMR} = \frac{\text{Applicable daily rate} \times 393.50 \text{ days}}{12}$$

Where 393.50 days =	298.00 days—ordinary working days
	24.00 days—12 regular holidays × 200%
	67.60 days—52 rest days × 130%
	3.90 days—3 special days × 130%
	393.50 days—total equivalent no. of days in a year

Source: http://www.nscb.gov.ph/secstat/d_income.asp

10

Analysis of Climate Risks on the Food Security of Saguday, Quirino Province

Jose Santos R. Carandang VI and Glenn S. Banaguas

Problem Statement

The municipality of Saguday in Quirino Province was formerly a barrio of the municipality of Santiago in Isabela; however, upon the final settlement of the boundary dispute between Isabela and Nueva Vizcaya, Saguday became a regular barrio of Diffun in Nueva Vizcaya by virtue of Executive Order No. 386, issued by President Elpidio Quirino. In June 21, 1959, Saguday was elevated into a regular municipality of the province of Nueva Vizcaya by virtue of House Bill No. 2541, which was authored by Hon. Leonardo B. Perez, then congressman of the lone district of Nueva Vizcaya. Saguday was born as a sixth-class municipality composing of seven barrios; however, two additional barangays were created in the early 80s. Barangay Cardenas was created in 1980 pursuant to Sangguniang Bayan Resolution No. 02, series of 1980, while Barangay Gamis was founded in 1981, pursuant to Resolution No. 05, Series of 1981. At present, Saguday is still a fifth-class municipality with limited income and scarce resources.

Saguday is comprised of nine barangays. These are La Paz, Cardenas, Salvacion, Santo Tomas, Rizal, Tres Reyes, Dibul, Cardenas, and Gamis. All nine barangays of Saguday are vulnerable to climate change and extreme events due to their geographical location and climatological condition. Being located in Quirino Province, it is part of the biggest watershed area in the region. The Cagayan Valley Plains actually start at the foothills of Quirino. Given its allocation of vast highlands, Quirino Province including Saguday could pose a region-wide environmental threat if its water resources are not adequately managed and protected (PENRO Quirino, 2013). The major industry in the province of Quirino is farming. Aside from cultivating staple crops like rice and corn, they also raise crops with high commercial value including banana, mango, and vegetables. Another industry related to farming is the furniture and gifts and decor making. There is also some tourism activity ongoing in the province. The present study identified the climatological problems and difficulties particularly in food security that confront the municipality due to climate change.

A policy framework has been proposed to help mitigate the effects of the projected impacts faced by Saguday citizens and other stakeholders. These impacts brought about by climate change include those that are affecting food production. This study will be valuable and beneficial not only to policy-making bodies/institutions but also to other communities that are vulnerable to the impacts of climate change.

Review of Related Literature

Risks created by disasters and the impacts of climate change are major threats to humans and the environment, and both can adversely reinforce the other's effects. Exposure to disaster risk is an inherent feature of human settlements. Often, disasters arise from the combination of natural and anthropological factors. The adverse impacts of climate change on society and the individual may aggravate disaster risk effects by eroding environmental and social resilience. This in turn further increases our vulnerability to climate change. More data on the link between extreme weather events and climate change are needed, and these data can facilitate the formulation of strategies to reduce vulnerability. Interestingly, both preparatory actions and responses to climate variability and long-term climate change are often similar to one another (O'Brien & Sygna, 2008).

Recent findings also emphasize the nexus between rapid urbanization and occurrences of disasters. Unfortunately, urbanization has become the dominant feature of human settlement patterns over the past centuries. More than half of the world's current population lives in cities. By the year 2015, there are 60 megacities expected to be in the world, each with a population of 10 million or more people. Over the next several decades, the largest urban population changes are expected to occur in coastal areas, particularly in

Asia and Africa (O'Brien & Sygna, 2008). In the Philippines, the population is expected to be 94 million by 2010 and 14.6 million by 2040 (ADB, 2008).

This linkage between rapid urbanization and increased occurrence of disasters is sometimes described as reflexive. As an example, cities create their own risks by causing degradation of the local, regional, and global environments. Putting a large concentration of resources and people within cities also means that the economic, social, and environmental costs of extreme events are high in urban areas. These costs are more likely to increase as a result of growing populations in coastal settlements, many of which are already highly vulnerable to sea-level rise, tsunamis, typhoons, and other hazards (O'Brien & Sygna, 2008).

Consequently, there are emergent calls for a common framework in approaching the reduction and diminution of hazards and vulnerability to disasters, climate variability, and long-term climate change. Coming up with such framework is the main objective of this study. This was undertaken by conducting an in-depth risk analysis, which is composed of two phases: Phase 1, the risk assessment, and Phase 2, the risk management (Banaguas, 2010, and Smith, 1994). A definition of terms is also necessary to facilitate the discussion.

One of the important concepts that need to be well understood is risk. *Risk* is defined by the US Presidential/Congressional Commission on Risk Assessment and Risk Management as the probability that a substance or situation will produce harm under specified conditions (Jones, 2001). Risk is a combination of two factors: the probability that an adverse event will occur and the consequences of the adverse event. In many cases, a huge amount of money is involved. The (+) principal concern is its low-probability (-) high-consequence events, events that lead to damage, loss, injury, death, or environmental impairment, for example. Often, the work of predicting risk is done as an aid to decision making. In consequence, risk analysis pervades modern technical life.

There are three elements involved in risk analysis. These are (a) hazard, (b) exposure, and (c) vulnerability (Crichton, 1999) (see Fig. 1). *Hazard* as defined by RA No. 10121 (also known as the "Philippine Disaster Risk Reduction and Management Act of 2010") as a dangerous phenomenon, substance, human activity, or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihood and services, social and economic disruption, or environmental damage. Climate and weather-related hazards refer to the direct and indirect effects of observed changes and/or projected deviations from present-day conditions of natural climate events and impacts of changes in the frequencies and occurrences of extreme weather/climate events (such as increases and decreases in precipitation and temperature) and impacts of changes in the frequencies and occurrences of extreme weather/climate events (i.e., tropical cyclones, droughts, and El Niño and La Niña events). Tropical cyclones that enter the Philippine Area of Responsibility (PAR) are one of the hazards considered in this research. These tropical cyclones can be classified into four different types: (a) tropical depression (TD, ≈45–61 kph), (b) tropical storm (TS, ≈62–117 kph), (c) typhoon (TY, ≈118–239 kph), and (d) super typhoon (STY, ≈>240 kph; NWSI, 2013). The occurrence of floods and droughts and their frequencies are also included in this study.

RA No. 10121 of 2010 defines *exposure* as the degree to which the elements at risk are likely to experience hazard events of different magnitudes. It is an access of what bridges the gap between a hazard and a risk. Release mechanisms, transport and transformation characteristics, and the nature, location, and activity patterns of the exposed population (receptors) are important aspects of the exposure condition. Population is the parameter in this study.

Vulnerability is defined as a condition determined by physical, social, economic, and environmental factors or processes, which increases the susceptibility of a community to the impact of hazards (UNISDR, 2009). The Human Development Index (HDI) is the vulnerability indicator that is measured in terms of (a) life expectancy, (b) weighted average of functional literacy and combined elementary and secondary net enrolment rate, and (c) real per capita income. Human development, as described in the Human Development Report 1990 of the United Nations Development Programme (UNDP), is a process of enlarging people's choices, most critical of which are to lead a long and healthy life, to be educated, and to enjoy a decent standard of living. Poverty incidence, another vulnerability parameter, is the proportion of individuals whose income cannot provide for the basic food and nonfood requirements (Virola & Martinez, 2007).

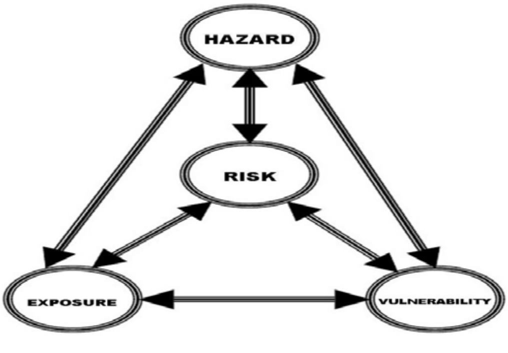


Figure 1. Modified risk triangle model (adapted from Crichton, 1999).

The influence of climate change on the achievement of food security is evident in many forms including direct nutritional effects (e.g., changes in consumption levels and nutritional value) and effects on earning capacity and thus capacity to buy food (e.g., changes in employment opportunities and cost of acquiring adequate nutrition) (see Ericksen et al., 2011; FAO, 2007; FAO, 2008; and HLPE, 2012). Climate change can also have biophysical effects on crop, livestock, and farming system (through sudden and drastic weather and geophysical changes in the environment). Furthermore, changes in environmental temperature and amount of precipitation affect food production, which translates to lesser earnings for farmers and higher prices for consumers (Cline, 2007; Dinar et al., 2008; FAO, 2011; European Commission, 2006; Gornall et al., 2010; Hassan, 2010; Hatfield et al., 2011; and HLPE, 2012).

Conceptual Framework

The warming up of the atmosphere lowers its capacity to hold water, resulting in increases in extreme precipitation events. Both observational data and modelling projections show that with atmospheric warming, wet regions will generally (but not universally) become wetter, and dry regions will become drier (Sanderson et al., 2011; John et al., 2009). In the Sahel area of Africa, the timing of critical rains will shift, shortening the growing season (Biasutti & Sobel, 2009), and more extensive periods of drought may result as temperatures rise (Lu, 2009). In the Haihe River basin of northern China, projections call for less total rainfall but more extreme weather events (Chu et al., 2009). Indian monsoon rainfall has already become less frequent but more intense, part of a pattern of climate change that is reducing wet-season rice yields (Auffhammer et al., 2011).

Knutson et al. (2010) noted however that although there have been a lot of studies made about the effects of climate change on tropical cyclone activities, the actual magnitude of the projected impacts still remain uncertain. Rainfall rates are projected to increase due to climate change on the order of +20% within 100 km of the tropical cyclone center. There will also be some likely increase in mean tropical cyclone maximum wind speed (+2% to +11% globally) due to the projected 21st-century warming. However, these increases may not occur in all tropical regions. Nevertheless, the global frequency of tropical cyclones will either decrease or remain essentially unchanged due to greenhouse warming. This information is important because the main drivers of agricultural responses to climate change are biophysical effects and socioeconomic factors (Matthews, 1997; Parry et al., 2004).

Crop production is also affected biophysically by meteorological variables, including rising temperatures, changing precipitation regimes, and increased atmospheric carbon dioxide levels. On the other hand, socioeconomic factors influence responses to changes in crop productivity, with price changes and shifts in comparative advantage. A global assessment of the potential impact of climate change on world food supply suggests that doubling of the atmospheric carbon dioxide concentration will lead to only a small decrease in global crop production (Rosenzweig & Paiz, 1994). But developing countries are likely to bear the brunt of the problem, and results from the simulation of the effectiveness of adaptive measures by the former imply that these will do little to reduce the economic disparity between developed and developing countries.

A new advocacy is needed urgently to bring together governments, international agencies, nongovernmental organizations (NGOs), communities, and academics from all disciplines to adapt to the effects of climate change (Costello et al., 2009). Any adaptation should sit alongside the need for primary mitigation: reduction in greenhouse gas emissions and the need to increase carbon biosequestration through reforestation and improved agricultural practices. The recognition by governments and electorates that climate change has enormous health implications should assist the advocacy and political change needed to tackle both mitigation and adaptation. Management of climate change will require inputs from all sectors of government and civil society, collaboration between many academic disciplines, and new ways of international cooperation that have hitherto eluded us. Involvement of local communities in monitoring, discussing, advocating, and assisting with the process of adaptation will be crucial.

As an example of a strategy, an integrated and multidisciplinary approach to reduce the adverse effects on food production by climate change requires at least three levels of action. First, policies must be adopted to reduce carbon emissions and to increase carbon biosequestration and thereby slow down global warming and eventually stabilize temperatures. Second, action should be taken on the events linking climate change to impacts. Third, appropriate response systems should be put into place to deal with adverse outcomes.

Research Questions

Climate risk assessment is used to help decision makers optimize resources for responding to climate-related disasters and reducing risks and impacts associated with current and future-projected climate variability and change. Climate risk assessments typically include statistical analyses of historical climate indicator records and assessment of information on climate-sensitive impacts, together with understanding of the climate mechanisms and the cascade of processes leading to these impacts. Indicators of climate-related risks (impacts, hazards, and vulnerabilities) are often used to focus a risk assessment on the specific areas of interest for the decision maker. Indicators are values that can be monitored (and/or modelled) to assess changes in the state of a system and are important tools for simplifying complex processes, with potentially multiple drivers and feedbacks, into useful and accessible information (Linkov & Bridges, 2011). It is along this paradigm that the following research questions guided the course of this study:

1. To what climate risks is the municipality of Saguday exposed and vulnerable? To which of these hazards are the residents of Saguday exposed? To which hazards are the residents of Saguday vulnerable?
2. What are the projected costs of these hazards in terms of casualties and money?
3. What areas of Saguday are most sensitive to the hazards?
4. What approach is most appropriate for Saguday in order to mitigate the impacts of climate change?

Methodology

Sources of Data/Information

The data and other types of information that were used in this study were provided by the United Nations International Strategy for Disaster Reduction, Institute of Social Order, Ateneo De Manila University, Manila Observatory, and Municipality of Saguday in Quirino. Interviews of Saguday public officials and focus group discussions with barangay officials were also conducted.

Research Question 1: To what climate risks is the municipality of Saguday exposed and vulnerable? To which of these hazards are the residents of Saguday exposed? To which hazards are the residents of Saguday vulnerable?

Probabilistic modelling is any form of modelling that utilizes presumed probability distribution for chosen output metrics. This statistical analysis tool estimates, on the basis of past (historical) data, the probability of an event occurring again. This differs from a standard deterministic model (e.g., Excel spreadsheet) where you can change the values of input assumptions at random and see the impact of those changes on the outputs. These key analytical tools (e.g., Monte Carlo simulation, real options, game theory) had been used for several decades already for dealing with uncertainty. Probabilistic and similar modelling methods can be tremendously useful as a structuring device to organize and combine all available insights about the relevant uncertainties and their impact. To address the first research question, the risk simulation model, mathematical algorithm, and the Monte Carlo simulation were used.

The probabilistic and deterministic simulation model was used in determining the risk parameters such as hazard, vulnerability, and exposure. The indicators (tropical cyclone, drought, and flood for hazard; the Human Development Index for vulnerability; and population for exposure) were the inputs both in the probabilistic and controllable model. Figure 2 as shown provides the risk simulation model employed by the study. On the other hand, the simulation experiment involves the use of the following algorithms:

a. Generate a random number of *indicators* using Poisson distribution.
b. Generate a discrete random number for each produced random number using the *indicator* distribution probability.
c. Generate the discrete random number of months (α).
d. Generate the discrete random number of days (β).
e. Multiply the number of months and days column ($\alpha\beta$) to produce the total number of months and days each *indicator* will enter for a particular *hotspot*.
f. If the sum of all the generated products of number of months and days column is less than or equal to "σ" days, then go to step 1 (next iteration), else stop.
g. Compute for the total number of "indicator," which is equal to the total number of iterations (n).

The sequence of logical and mathematical operations required to conduct a risk simulation is depicted with a flowchart (see Fig. 3 below). Several Monte Carlo simulations (1,000 replications per indicator) using MATLAB software were made in order to come up with the optimal results.

Research Question 2: What are the projected costs of these hazards in terms of casualties and money?

Risk in terms of *casualties per year* was determined using the formula ***R****isk* = ***H****azard* × ***E****xposure* × ***V****ulnerability,* while risk in terms of *cost per casualty per year* was determined using the formula *(Millions in USD) = Risk (casualties per year) × USD 50,000.00 / casualty.*

In theory, one's life is worth \$50,000.00 (which is around PhP 2,100,000.00 at 1 USD = PhP 42) according to the international standard most private and government-run health insurance plans worldwide use (Kingsbury, 2008). *If and only if* fatal outcome really enters into the arena, for instance, can the risks be gauged to its financial correspondence.

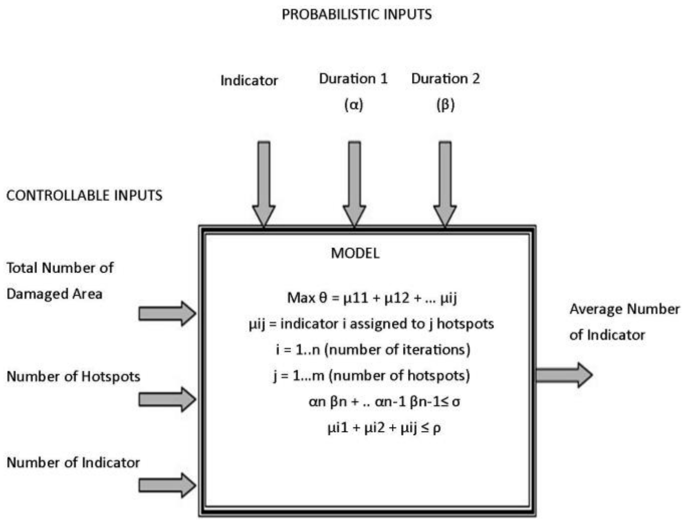


Figure 2. Diagram of the risk simulation model (Carandang & Banaguas, 2014).

Research Question 3: What areas of Saguday are most sensitive to the hazards?

To determine the levels of risk each barangay is facing, the geographic information system modelling and the risk rank system were used. Using the geographic information system (GIS) modelling, the three parameters of risk (hazard, exposure, and vulnerability) were mapped. This was used to identify the most vulnerable areas during climate change and other related events. On the other hand, the barangay with the highest risk was determined using the risk rank system. This particular method provides the order of the most susceptible areas during extreme perils. This is a significant stratagem in order to identify what area needs a particular assistance and attention from the threats of a pandemonium.

Research Question 4: What approach is most appropriate for Saguday in order to mitigate the impacts of climate change?

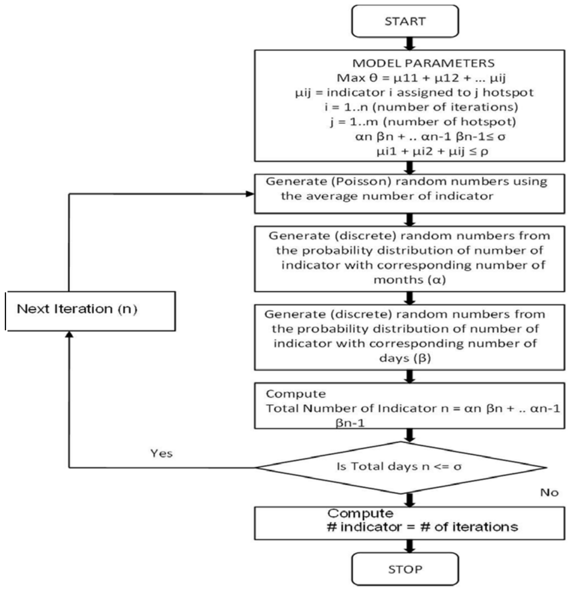


Figure 3. Flowchart of Risk Simulation Modelling (Carandang & Banaguas, 2014)

The outputs from the risk assessment were further evaluated for policy formulation and evaluation through consultations in the form of key informant interviews of local heads and focus group discussions with the officials of each barangay. The existing disaster management strategy was checked for conformity with the local and international laws essential to a community. Figure 4 provides the steps in risk management and was used as a guide in evaluating the current disaster risk management policy of Saguday. Based on the results of consultations with the community leaders, a modified DPSIR model was developed for the formulation of an upgraded disaster risk management policy more appropriate to their current and future needs.

The DPSIR Framework. The DPSIR model provides a useful cause and effect framework (which is used internationally to explore the relationships between the environment and socioeconomic systems) to introduce the linkages between a natural disaster/climate change–related hazard and PPPs (planning, policy, and program). ***Drivers*** such as hazard, vulnerability, and exposure create ***pressures*** including tropical cyclones, the Human

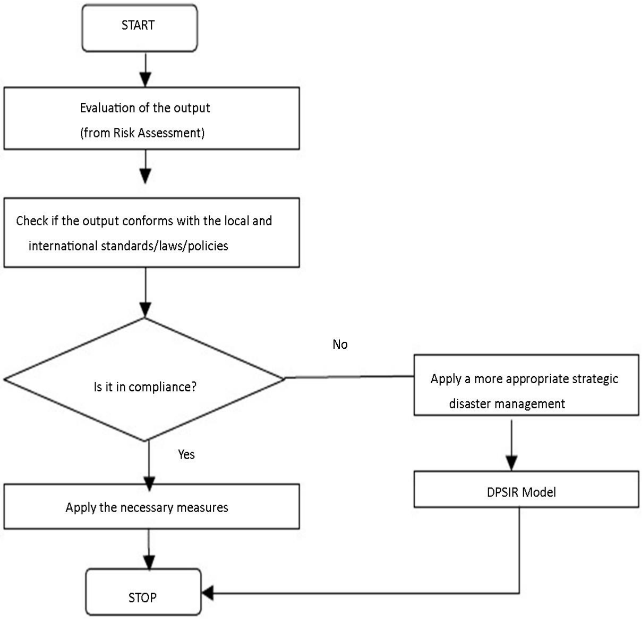


Figure 4. Steps in the risk management (Carandang & Banaguas, 2014).

Development Index (HDI), and population to a ***state*** of the environment/area where there is a greater risk. This leads to social, environmental, and economic ***impacts*** and consequently a need to develop ***responses*** to mitigate the frequency, duration, and intensity of these impacts and risks. Aside from strategies to reduce the risks of hazard, responses can also be targeted towards influencing the drivers, relieving the pressures, and altering the state of the environment that contributes to the problem of risks. Figure 5 describes the DPSIR model adapted from Omann et al. (2009).

Results and Discussion

Risk Studies

Monte Carlo Simulation Output

Climate change has resulted in less and more erratic rainfall, especially in regions where food security is very poor (IPCC, 2007; Funk et al., 2008; Lobell et al., 2008). The risks being faced by the citizens of Saguday

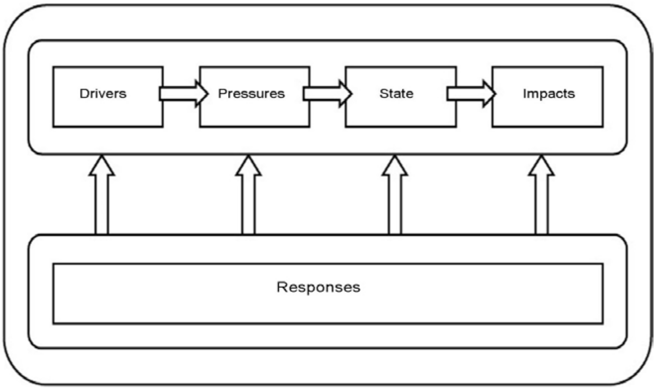


Figure 5. The basic DPSIR model (adapted from Omann et al., 2009)

as brought about by climate change are similar to what our neighbors in Southeast Asia are exposed to. In South Asia, where millions of smallholders depend on irrigated agriculture, climate change will drastically affect river flow and groundwater, the backbone of irrigation and rural economy (Nellemann et al., 2009). Furthermore, high-magnitude flooding often leads to losses of cropland, uprooting of fruit trees, death of animals caught in high floodwater surges, and destruction of infrastructure, such as irrigation facilities and rural roads. The damages done by floods tend to be exacerbated by an ongoing desertification process and land degradation (Wiebelt et al., 2011).

For the hazard studies, 1,000 simulation experiments were performed. The results (see Table 1) suggest that there will be an increase in the number of tropical cyclones (an average of 33) that would enter and would stay for 5 days in the Philippine Area of Responsibility (PAR). These tropical cyclones would place the nine barangays of the municipality of Saguday in a vulnerable situation. There will also be 6 tropical depressions (TD), 10 tropical storms, 14 typhoons, and 6 super typhoons. Furthermore, there would be 20 floodings, and each would last for 3 days. For the projected drought occurrence, five events are projected and each would last for 3 days.

Table 1. Types and Frequency of Occurrence of Hazards During Simulations

Type of Hazard	Frequency of Occurence
Tropical cyclones (TC)	33
Floods	20
Typhoons (TY)	14

Table 1 continued...

Tropical storms (TS)	10
Droughts	5
Super typhoons (STY)	5
Tropical depression	4

Note. Results were obtained from 1,000 simulation experiments using the Monte Carlo method.

To simulate the probable exposure of the population to the hazard, another 1,000 simulations were performed to calculate the optimum number of people that may be exposed to the hazards in Saguday. The population of Saguday was 15,392 as of 2009. Results of the simulation exercise indicated an exposure value for 17,023 individuals or that the whole population of Saguday is potentially exposed to these hazards.

For estimates of vulnerability of Saguday to hazards, the simulated Human Development Index value was 0.77, which suggests that the municipality of Saguday is at the medium level (0.500–0.799) in terms of growth and progress (Virola & Martinez, 2007). This result suggests the capability of Saguday residents to adapt to an extreme event. Take note that the actual Human Development Index of Saguday is 0.78, which is very close to the simulation value.

Calculation of Risks

Risk Calculations in Terms of Casualties per Year

Based on the results of the simulation exercises, there are 33 tropical cyclones (TC) that may enter in the Philippine Area of Responsibility (PAR). The risk in terms of probable casualties per year is expressed as follows:

Table 2. Calculation of Risk in Terms of Casualties per Year.

Risk = Hazard × Exposure × Vulnerability	Probable Casualty per Year (× 1,000)
Tropical cyclone = 33 × 17.023+ × 0.77*	432
Flooding = 20 × 17,203 × 0.77	262
Drought = 5 × 17,023 × 0.77	65

Note. +Calculated exposure value of the Saguday population; *simulated Human Development Index value.

Risk Calculations in Terms of Cost per Casualty per Year

In practice, one's life has been valued to be equivalent to USD 50,000.00 (which is around PhP 2,500,000.00 at USD 1 = PhP 42). This value is the international standard most private and government-run health insurance plans use worldwide (Kingsbury, 2008). However, *if and only if* a fatal outcome really enters into the question can the risk be gauged to its financial correspondence. To estimate the cost per casualty per year, the following calculations were made:

Table 3. Calculation of Cost of Risk in Terms of Casualties per Year.

Cost of Risk = Risk × USD 50,000* per Casualty	Cost per Year in Billions of Pesos (1 USD = PhP 42)
Tropical cyclone = 432,554/year × USD 50,000/casualty	908
Flooding = 262,154/year × USD 50,000/casualty	550
Drought = 65,538/year × USD 50,000/casualty	137

Note. *Estimated value of one's life (Kingsbury, 2008).

Budget Allocation by the Local Government Unit (Municipality of Saguday)

According to Sec. 324-d of the Local Government Code of the Philippines (Republic Act 8185), 5% of the estimated revenue from regular sources shall be set aside as an annual lump sum appropriation for unforeseen expenditures arising from the occurrence of calamities: provided, however, that such appropriation shall be used only in the area, or portion thereof, of the local government unit (LGU) or other areas declared by the president in a state of calamity.

Table 4. Budget Allocation for One Hazard (Municipality of Saguday, 2009)

% of Affected Population (Population Size = 15,392)	Budget Allocation	
	PhP for 5 Days	PhP for 1 Day
100	20	102
80	25	128
60	34	170
40	51	256
20	102	512

Based on the revenue allotment of 2009, the Municipality of Saguday registered a total collection of PhP 31,575,441.91. This was culled from the report of the Comprehensive Land Use Plan (CLUP) in the province of Quirino. Based on 5% of the total revenue, the local government of Saguday can only allot PhP 1,577,782 for the calamity fund. Table 4 provides the summary of the probable affected population and the budget distribution based on the above figure. Apparently, a budget of around PhP 20.00 is allotted per individual for a worst-case scenario. This sum is not even enough to buy a decent meal for each victim.

Identification of Hazard Areas and Intensity of Hazard for Each Barangay

Geographic Information System Modelling Output

Hazard modelling. Extant data collected indicated that Saguday has been experiencing disasters (e.g., tropical cyclones, floods, droughts) for the last 10 years. The figure resulting from the hazard modelling (see Fig. 6) confirms this fact. This finding coincided with the records of the National Disaster Risk Reduction and Management Council (NDRRMC) indicating that Saguday is one of the most susceptible areas in the region during disasters and other extreme events.

Figure 6. Hazard modelling.

Exposure modelling. Results of the exposure modelling exercises (see Fig. 7) show how differently each barangay of Saguday is exposed to hazards. The redder the color coding of the barangay, the more densely populated it is. Conversely, the more people in the barangay, the more people are exposed to the hazard since the simulation exercises showed that 100% of Saguday's population is potentially exposed to the identified hazards. La Paz, Rizal, and Magsaysay are the three barangays projected to be the most exposed to hazards while Cardenas, Gamis, and Tres Reyes are the least exposed. The intensity of exposure to hazard by the different barangays follows this sequence: La Paz = Rizal = Magsaysay > Salvacion = Santo Tomas = Dibul > Cardenas = Gamis = Tres Reyes.

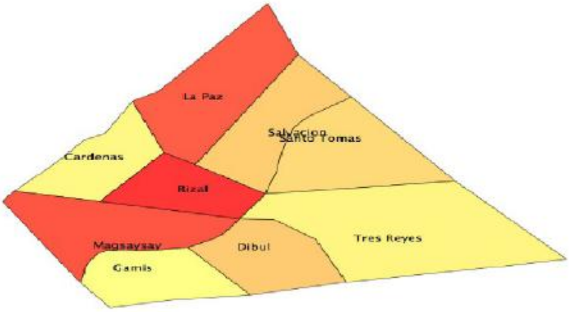


Figure 7. Exposure Modelling.

Vulnerability modelling. Based on these results of the vulnerability simulation exercises, Tres Reyes is the most vulnerable to hazards because it has the lowest capacity amongst the nine barangays to respond to the projected hazards (see Fig. 8). Rizal, Gamis, Dibul, and Cardenas are the most capable of the nine to respond to hazards and thus the least vulnerable. The red color-coded barangays in the figure signifies the highest HDI, and the green should imply a lower HDI although there is no green color-coded barangay in the model. This means that barangays with the redder color have a lower capacity to respond to a hazard. The sequence of vulnerability of the nine barangays is as follows: Tres Reyes > La Paz > Magsaysay = Santo Tomas > Salvacion > Rizal = Gamis = Dibul = Cardenas.

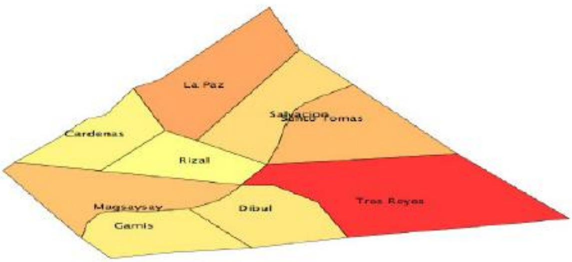


Figure 8. Vulnerability modelling.

Risk modelling. The risk model shown in Figure 9 is the outcome of the integration of hazard, exposure and vulnerability models. Based on the modelling results, the barangays most at risk or the "hotspots" during disaster and climate change modulations are the barangays of La Paz, Magsaysay, and Rizal. The projected risks involve life, property, and livelihood and even food security of the residents of Saguday. The model show that barangays with the redder color are at a higher risk to a hazard event. The barangays by order of decreasing risk factor are listed as La Paz = Magsaysay = Rizal > Dibul = Salvacion = Santo Tomas > Cardenas = Gamis = Tres Reyes.

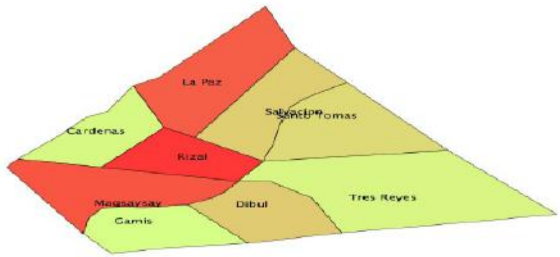


Figure 9. Risk modelling.

Risk rank system. Table 6 in turn provides the order of the most vulnerable areas in terms of their individual ranks per simulated indicator. Based on the results of the study, Rizal, Magsaysay, and La Paz have the largest populations but the lowest capacity to respond to climate hazards. These combined put them at a higher risk that the other barangays although all of the barangays of Saguday are vulnerable to the climate hazards identified.

Table 6. Risk Ranking by Barangay

Barangay	Rank
Rizal	1
Magsaysay	2
La Paz	3
Dibul	4
Salvacion	5
Santo Tomas	6
Tres Reyes	7
Gamis	8
Cardenas	9

Proposed Disaster Risk Management Policy Recommendations

The findings of this project were relayed to local government officials up to the barangay level. A series of meetings in the form of key informant interviews with elected officials and focus group discussions with local residents was conducted during site visits. It was apparent that the citizens of Saguday are familiar with the climate-related hazards and how these affect their lives and compromise the food security of their locality. It was also apparent to them that there is a need for a disaster risk management program that should be formulated and be implemented the soonest time possible. However, the planning and implementation of actions in reducing the risks, mitigating potential losses, and preserving imminent prospects are critical challenges the local government of the municipality of Saguday must face.

A number of risk management approaches to the adverse effects of climate change are found in literature (UNFCCC, 2014). The first is the provision of pertinent insurance schemes to the poorest and most vulnerable localities. Insurance has become a key component of adaptation to climate change and disaster risk reduction because it can provide economic security and enable vulnerable populations to pool economic losses, thereby mitigating the impacts of adverse weather events and avoiding knock-on effects. The type of insurance scheme to be set up should be tailor-made to the actual need of the stakeholders. Another approach is the use of innovative technologies to counter the adverse effects of climate change. Drought-resistant or flood-resistant crops or cash crops that grow well in extreme conditions can be introduced in vulnerable agricultural communities. Fabrication and improvement of postharvest facilities can also minimize spoilage and maximize agriculture outputs. Innovative technologies have been used also as an adaptation option in different economic sectors. The third approach is economic diversification. Economic diversification may be defined as the process in which a growing range of economic outputs is produced. Sectors such as tourism, agriculture, fisheries, forestry, and energy production are all sensitive to the adverse effects of climate change. Mixing more stable sources of income with the traditional economic activities can enable the community to be resilient during adverse conditions. To help the local government to face these challenges, policy recommendations are given below.

Current disaster risk management of Municipality of Saguday. Due to the climate change and extreme events that have been happening in the municipality for the last 50 years, a municipal disaster preparedness plan was developed. This plan focuses on the strategies on how different stakeholders would play their roles during disasters. There was also a contingency plan for typhoons that was prepared by the municipal disaster coordinating council and that helps the entire community to strengthen their disaster control capability. Nevertheless, climate change has been predicted to increase not only the frequency but also the intensity of climate hazards. It is timely that the municipality of Saguday update their disaster risk management program to compensate for the effects of climate change.

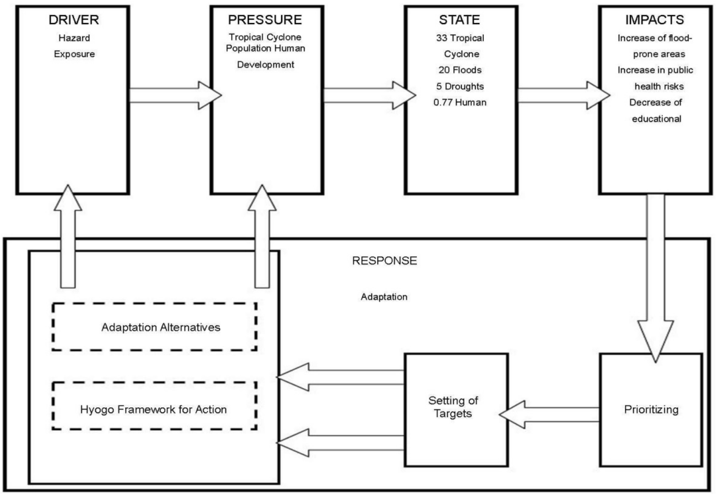


Figure 10. Proposed DPSIR framework for Saguday (Carandang & Banaguas, 2014).

Proposed management system framework. A new disaster risk management framework was developed for the municipality based on the DPSIR model. This model is being proposed to be applied as a strategic management tool. The DPSIR model provides a useful cause-and-effect framework (which is used internationally to explore the relationships between the environment and socioeconomic systems) to introduce the linkages between a natural disaster/climate change-related hazard and PPPs (planning, policy, and program). Drivers such as hazard, vulnerability, and exposure create pressures including tropical cyclones, Human Development Index (HDI), and population to a state of the environment/area where there is a greater risk. This leads to social, environmental, and economic impacts and consequently a need to develop responses to mitigate the frequency, duration and intensity of these impacts and risks through the Hyogo Framework for Action (HFA) and adaptation alternatives. Figure 10 illustrates the proposed DPSIR model.

Adaptation as the main response. The Hyogo Framework for Action (HFA) provides a strategic and comprehensive global approach in reducing vulnerabilities to natural hazards and represents a significant reorientation of attention toward the root causes of disaster risks, as an essential part of sustainable development, rather than on disaster response alone. It stresses the need for greater political commitment and public awareness and defines an expected outcome, three strategic goals, and five priority areas of action (UNFCCC, 2008). This framework is beneficial as a response to the adaptation and disaster risk management. Table 4 identifies the adaptation alternatives that can be applied to the municipality of Saguday. The recommendations given in Table 5 were culled from the results of the key informant interviews of local government officials and the focus group discussions with local residents and the review of the current disaster preparedness plan of Saguday.

Table 5. Proposed Disaster Risk Management Program Policy Recommendations for the Municipality of Saguday

Policy Issues	Recommendations
Lack of infrastructure	Improve flood control system, improve irrigation system, construct food storage facilities, install weather monitoring facilities
Capacity building	Improve environmental education, build staff capacity and infrastructure to implement flood warning system, build capacity in weather forecasting, install hydroclimatic network monitoring, strengthen commodity value chains and find new markets, build knowledge and capacity in adaptation to climate change impacts
Policy development and implementation	Design and implement zoning regulations and building codes, intersectoral allocation, facilitate access to credit, water conservation and demand management (including metering and price structure), compensation for flood damages, develop coastal resource management plans at the barangay levels
Adaptation of best practices	Incorporate risk assessment and mitigation information system into micro-watershed management plans, implement rainwater harvesting

Hyogo Framework for Action (HFA). The *Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters* was adopted at the World Conference on Disaster Reduction held in Kobe, Hyogo, Japan, on January 18–22, 2005. It provides a strategic and comprehensive global approach to reducing vulnerabilities to natural hazards and represents a significant reorientation of attention toward the root causes of disaster risks, as an essential part of sustainable development, rather than on disaster response alone. It stresses the need for greater political commitment and public awareness and defines an expected outcome, three strategic goals, and five priority areas of action.

The framework's implementation is identified as primarily the responsibility of the state, but with the active participation of others such as local authorities, nongovernment organizations, the scientific community, and the private sector. Regional and international communities, including the international financial institutions, the UN system, and the International Strategy for Disaster Reduction (ISDR), are called on to provide an enabling environment and to support capacity development. The ISDR system undertakes international efforts to reduce disaster risk and includes governments, intergovernmental and nongovernmental organizations, international financial institutions, scientific and technical bodies, and civil society (UNFCCC, 2008). The Hyogo Framework calls for the following priority actions that can be adopted by the Municipality of Saguday. These are given in Table 6 below.

Table 6. Recommended Priority Actions to Mitigate the Impacts of Climate Change for the Municipality of Saguday

Recommendations	Priority Actions
1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.	Methodical local risk assessment with the help of the different institutions such as Manila Observatory may coalesce downscaled climate models that focus on projected changes with local-level vulnerability assessments and on current threats in order to increase understanding of climate change/natural disaster impacts on human life, food security, access to natural resources, agriculture, fisheries, marshland other industries. This will require a) reviewing climate risk information available at the local level; b) determining capacities for data collection and use; c) undertaking wide risk profiling with a focus on vulnerable areas, sectors and groups; and d) reviewing the Saguday zoning and land use plan taking into account the danger areas. Furthermore, planning, sufficient budgeting and implementation of risk reduction policies have to be done in order to avoid settlement in hazardous areas and the protection of crops from floodings and drought. For instance, it is a must that there are enough hospitals and schools that are hazard resistant to minimize the perils. Other examples like construction of "day care centers" in certain barangays have to be one of the priorities that will serve as the permanent evacuation centers in times of catastrophes. The construction of dikes and embankments to minimize flood levels and to put up postharvest logistical facilities for temporary storage of harvest during heavy rains and flooding.

Table 6 continued...

2. Identify, assess, and monitor disaster risks and enhance early warning.	Knowing the risks and taking action involves identifying, assessing, and monitoring disaster risk and enhancing early warning are some of the most important things that need to be undertaken and applied in the Saguday area. Enhanced people-centered early warning systems and mechanisms are necessary to allow for early alerts to trigger early action taking into consideration issues of trust and differences in access to information because of gender, social status, or age and people mobility potential. In Saguday, it is not enough to have a warning gadget/device that will monitor the risks. The siren/warning device should provide sophisticated services such as full automation that will air 8 to 14 km (from southeastern to southwestern point) in order for the people to prepare in advance.
3. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels.	Improved use of climate change/natural disaster information that requires more investment in networks of climate stations, capacity building for interpreting information, user-friendly forecasting tools and products, linkages between service providers (researchers and hydro-meteorological services) and service users (humanitarian actors and climate sensitive sectors), and production of impact outlooks for specific audiences. Also, raising awareness and educating all sectors in the society, through school curricula and segmental trainings to reduce vulnerability, have to be done. These trainings should also be given not only to the educated and professionals but also to the marginalized sectors in the society. Seminars, conferences, and forums should be organized by the overseers to be given to all the barangays. Apparently, these trainings will be conducted and taught by the barangay officials to their different cohorts and subsidiaries. Farmer awareness about drought- and flood-resistant crops should also be enhanced.
4. Reduce the underlying risk factors.	Reducing communities' vulnerability and risk in sectors through land-use zoning and building codes, by protecting ecosystems and natural defenses, and developing insurance and microfinance initiatives can be done by integrating the risk mitigation measures and climate change adaptation. Some of the specifics are the following: a. Adapting agriculture, fisheries, and other industry practices through, for example, adjustment of crop and fishing calendars, and introduction of climate-resilient crop and tree varieties; b. Climate proofing of post-production management practices such as storage, drying and processing; c. Improving sustainable natural and coastal resource management to increase resilience of food production systems;

Table 6 continued...

	f. Investing in infrastructure and hazard proofing critical facilities; and g. Diversifying livelihoods through decreasing dependence on the usual activities, and increasing small-scale enterprise development.
5. Strengthen disaster preparedness for effective response at all levels.	Being prepared and ready to act, which can be maximized by developing and testing contingency plans, establishing emergency funds and coordination systems that are vital and essential at all times. In strengthening this preparedness, the following have to be taken into consideration: a. Expanded contingency planning, especially in areas prone to flood, windstorms or drought, that considers new and evolving risk scenarios and integrates the three "build back better" (3Bs) principles to induce prevention and adaptation in rehabilitation; b. More flexible funding mechanisms at the international level that allow development and humanitarian resources to be invested in preparedness; c. Preparedness for diversified livelihoods response options combined with social protection measures both to individuals and households; and d. Proper communication through responsible avenues with the use of TV and radio stations.

Conclusion and Recommendations

The results of the study indicate the vulnerability of Saguday, Quirino, to climate hazards, that is typhoons, floodings, and drought. It was projected that Saguday will experience 33 typhoons with 20 floodings that would stay 3 days per flooding. Five drought occurrences with a duration of 2 days each were also projected. When these disasters occur, food production and availability in the municipality will certainly be affected. The forecast derived from the present study is comparable with those made by the National Disaster Risk Reduction and Management Council (NDRRMC). Amongst the nine barangays of Saguday, Tres Reyes is the most vulnerable to the three hazards although it is third only to Gamis and Cardenas in terms of risk exposure. To lower the vulnerability of Saguday to these hazards, it is recommended that infrastructure support to coastal resource management be improved; technical capacity building be conducted to improve weather surveillance, disaster preparedness, and environmental infrastructure buildup; environmental policy implementation be improved; and best practices to alleviate the impacts of climate change particularly on food production and security into the governance and management of Saguday be incorporated. The DPSIR model and the Hyogo Framework for Action (HFA) were used as a guide for this pursuit.

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11

Urban Rooftop Hydroponics for Diversified Agriculture

Jose Santos R. Carandang VI, Robert W. Taylor, and Josemarie S. Calleja

There has been significant research done on hydroponics as an agricultural production technique for vegetable production. The University of the Philippines in Los Baños has done groundbreaking work in hydroponics, and there are a number of Filipino researchers that are leaders in the field. What has not been done, and where this research is acutely relevant, is in the application of hydroponics to urban rooftops and the use of a competitive business model linking onsite production to onsite utilization, reducing the costs of the food supply chain. This model not only provides a sustainable solution to agriculture but also provides a commercially viable business model.

The research falls under the category of sustainable agriculture. The global population is estimated to reach seven billion people in 2012. How will all these people be fed while protecting and preserving the global ecosystem at the same time? Food production consumes a large amount of natural resources, that is, water, land, and minerals. Also, industrial agricultural practices based on chemical pesticides and herbicides, although it increases yield, have caused public health risks and ecosystem pollution.

Can the world provide food for its growing population and still maintain a viable environment?

The industrial revolution, with massive increases in fossil-fuel production and use, spurred dramatic growth of human population and economies (LeClerc & Hall, 2007). This has often led to environmental degradation (Millennium Ecosystem Assessment [MEA], 2003). The globalization of market forces, agricultural industrialization, migration, public policy, and cultural changes have transformed agriculture from a diverse, traditional, and smaller scale system into an agro-industrial system dependent on chemical inputs and mechanization (Conway, Murray, & Rosset, 1996; Perfecto, Rice, Greenberg, & Van der Voort, 1996). In *The Potential for a New Generation of Biodiversity in Agro-Ecosystems of the Future*, scientist and farmer Fred Kirschenman (2007) pointed out the basic assumptions for industrial agriculture. They are as follows: production efficiency can best be achieved through specialization, simplification, and concentration; intervention is the most effective way to control undesirable events; technological innovation will always be able to overcome production challenges; control management is the most effective way to achieve production results; and cheap energy to fuel this energy-intensive system will always be available. Negative effects of these assumptions include biodiversity loss, loss of species and genetic diversity, severe degradation of health of inland and coastal waterways, high-energy use, and reduced or eliminated ecosystem resiliency. The 21st century has arrived with many believing that most of industrial agriculture's assumptions have been found wanting and are in need of regenerative thought and practice.

Over the past several decades, many writers pointed out that the trajectory of rapid growth of the past two to three centuries, with its reliance on natural resources and energy, may reach an environmental threshold or tipping point in the future (Odum & Odum, 2001). Industrial agriculture worldwide is energy intensive. They also pointed out that industrial agriculture, conventionally accepted worldwide, has reduced soil carbon content in Midwestern US soils from 20% carbon in the 1950s to its current 1%–2%. This contributes greatly to increasing soil erosion, vulnerability to drought, and decreasing nutrient values. Industrial practices break down soil carbon resulting in atmospheric release of CO_2, contributing nearly 20% of the total atmospheric carbon dioxide emissions in the US. Globally, these conventionally accepted agricultural practices contribute 12% of global greenhouse gas (GHG) emissions. Increasing population and industrial food production practices have resulted to excessive nitrogen buildup that eventually ends up in rivers and streams. This leads to eutrophication and episodic and persistent hypoxia in coastal waters worldwide (Nixon et al., 1996; National Research Council, 2000). Synthetic production of chemical fertilizers, pesticides, fungicides, and herbicides have resulted in large-scale industrialized energy-consumptive agriculture that many contend is not compatible with ecosystem preservation.

Writer and organic farmer Wendell Berry (1990) had admonished farmers for decades to preserve the fertility and ecological health of the land. Society, he contended, must recognize this need and learn or relearn to integrate their activities with natural ecosystems, including and especially integrating sustainable agro-ecosystems. Day et al. (2009) maintained that the functioning of natural ecosystems and the health of the human economy have been intrinsically linked throughout our evolution. Solar-driven ecosystems powered the preindustrial world; materials such as food, fuel, and fiber, as well as ecosystem services, such as clean freshwater, fertile soils, wildlife, and assimilation of wastes through inherent regenerative and assimilative capacities, were largely dependent on solar-driven ecosystems and agro-ecosystems (Day et al., 2009).

Many believe that efficient and sustainable ways to support food production through regenerative and mutualistic ecological design while requiring less energy is currently available. Studies in Mesoamerica provide scientific evidence that certain agricultural landscapes and practices contribute to biodiversity conservation while simultaneously contributing to increase food production and rural income (Estrada & Coates-Estrada, 2002; Daily, Ceballos, Pacheco, Suzan, & Sanchez-Azofeifa, 2003; Mayfield & Daily, 2005). Heterogeneous agricultural landscapes that retain abundant tree cover (as forest fragments, fallows, riparian areas, live fences, dispersed trees, or canopies) provide complementary habitats, resources, and landscape connectivity for a significant portion of the original biota (Harvey et al., 2006). Landscape configurations that connect forests, maintain a diverse array of habitats, and retain high structural and floristic complexity generally conserve species (Benton, Vickery, & Wilson, 2003; Bennet, Radford, & Haslem, 2006).

Organic agricultural practices can often provide the means for building agricultural and associated ecosystem resiliency in the face of climate change. Regenerative organic agricultural practices can increase biological activity in soil organic matter. This improves carbon sequestration of soil by removing carbon from the air, while also increasing water retention and improving system resiliency. Manure-based soil systems show an increase in carbon storage over legume-based organic systems. Also, energy use and carbon dioxide emissions are substantively reduced through organic practices. In a farm study of organically grown corn/soybeans, Pimentel (2006) demonstrated that a 33% reduction in fossil-fuel use was possible.

By adopting an organic system that used cover crops or compost instead of chemical fertilizer, GHG emissions were reduced.

Coexistence in agriculture refers to a state where different primary production systems, that is, organic, industrial, and genetically modified (GM) systems, occur simultaneously or adjacent to one another while contributing mutual benefit (Altieri, 2006). Genetically modified agriculture has been viewed by some as a technological innovation that can substantially increase yield while contributing much less ecosystem damage than traditional industrialized agriculture but is still capable of producing the same high agricultural yields. Critics of genetic engineering and coexistence state that transgenes cannot be contained and will move beyond their intended destinations. Also, other problems can occur such as hybridization with weedy relatives and contamination with other non-GM crops (Marvier, 2001). Opponents maintain that releases of transgenic crops can promote transfer of trans-genes from crops to other plants and can transform wild/weedy plants into new or more invasive weeds (Rissler & Mellon, 1996). Unless whole regions are declared GM free, they maintain, the development of distinct systems of agriculture will be compromised. Proponents of GM crops such as the Royal Society of London (2000) maintained that growing global population needs will require either a high-yield agricultural production or more conversion of natural biomes and marginal land into agricultural production. This, of course, would damage natural ecosystems. Also, proponents say that the advantages of genetic engineering outweigh its disadvantages. The use of trans-genes can reduce the need for chemical pesticides and herbicides as biotechnology can select genetic input that can strengthen predator resistance. Food output could increase if spoilage could be limited, if food shelf life could be extended genetically, particularly for high-value fruits and vegetables, while placing less stress on natural ecosystems. Also, the loss of topsoil could be minimized through a no-till application of seed.

David Homgren (2011) holds that food production can be compatible with ecosystem presentation if permaculture is universally adopted. Permaculture is a food production system that is modelled on interactions seen in nature and draws from all the sciences, both physical and social. It is an agricultural system that is based on agro-ecological approaches to food production that the author believes can preserve and actually promote ecological health of natural systems. Homgren stated, "I see permaculture as providing the eco-technic design solutions able to cushion the decline of non-renewable resources and accelerate the healing processes of nature by use of a broader range of species from similar climates around the world" (2011, p. 3). He believed that permaculture is a system that can accomplish that goal.

Problem Statement and Policy Issue

The Philippines is rapidly urbanizing with almost 49% of Filipinos now living in urban areas, and by 2030, that number is expected to jump to 77% (Basingan & Ilagan, 2012). Much of this urbanization has occurred in its largest cities. Metro Manila, for instance, contains close to 12 million people, many living in dense communities with a large building stock. Traffic congestion, rising fuel prices, and poor road infrastructure have produced a problem in transporting agricultural products from rural areas to urban markets where more people reside and where the food is consumed more. An increase in rates of spoilage of perishable vegetables and transportation costs constitutes a food security issue that needs to be addressed. This project sought one solution—utilizing the rooftops of urban buildings to grow vegetables. Already, a number of cities are exploring this option. Singapore has calculated that they have 212 hectares of available building rooftops that are underutilized and have the capacity of producing 39,000 tons of vegetables annually. Other cities such as Montreal, Toronto, and New York are exploring the possibilities of urban rooftop agriculture as well.

This project developed a hydroponics installation on the rooftop of Saint Joseph Hall at De La Salle University that cultivated lettuce that was consumed by the community on-site. This pilot project hoped to address several issues. First, it addressed the need for agriculture to be grown locally and consumed on-site, which is defined by coauthor Taylor as "diversified agriculture." This type of agriculture emphasizes the following characteristics: (1) It is grown on-site, which reduces the cost of transportation and spoilage, and (2) it meets the demand for on-site food supply, that is, the immediate deployment of food through an existing food delivery infrastructure (canteens).

Second, the project utilized an underdeveloped and vacant urban-space resource—building rooftops—and put them to productive use. Third, it employed a type of agriculture, hydroponics, that does not use soil but, in this case, a continuous flow of water to grow food. This type of agriculture uses only 10% of the water requirements for traditionally grown agriculture, saving water, which is a valuable resource. Fourth, it used a nutrient base that is recycled and controlled so that surplus nutrients are not emitted into the environment as pollutants, that is, the wastewater runoff of nitrates for agriculture into streams and rivers. Also, the amount of nutrients applied was professionally managed, which saved cost through a more efficient application regime. And fifth, through hydroponics, a controlled environment was maintained in order to reduce diseases, pest infestation, sunlight application and shading, and temperature—all factors that can contribute to crop loss but through scientific management can produce greater yield.

Conceptual Framework

The proposal sought to establish a pilot program for an urban rooftop hydroponics installation that would grow lettuce. It utilized the NFT (nutrient film technique), whereby continuous water is pumped through PVC using a solar water pump. Metrics derived from the project were measured: amount of water used per growth output, amount of nutrient applied per growth output, and the cost of production of growth output measured against traditionally grown lettuce produced in rural areas and trucked to the local university canteen (cost of rooftop hydroponics measured against the true price of traditionally grown lettuce incorporating externalities). The project hoped to prove that both an agricultural model and a business model could be created with the growth and consumption of vegetables on-site as an alternative to traditionally grown vegetables grown in rural areas and trucked to institutional food consumption sites, that is, any place where food is consumed commercially. The project identified areas such as malls, universities, schools, public buildings with canteens, and corporate sites with canteens as ideal locations for the commercial application of this concept. It is particularly relevant for schools and universities and areas of learning where students will have the opportunity to reconnect with nature and the food supply chain.

Research Questions

The following research questions were addressed:

- What is the best design for an urban rooftop hydroponics installation? This question dealt with issues related to physical location of the installation; it sought to control heat, sunlight, moisture, and so forth.
- What quantities of water and nutrients are optimal for growing lettuce in urban rooftop hydroponics? This question tested whether urban hydroponics sufficiently reduces water and nutrients use as compared to the traditional agricultural food supply chain.

What are the costs of urban hydroponics lettuce production based on the model of on-site production and on-site consumption and compare this price to the price of lettuce purchased on-site for the local canteens? This question dealt also with whether the true costs of lettuce production is contained in the wholesale price of lettuce and whether a premium should be placed on on-site grown lettuce due to its superior taste due to freshness as measured by the amount of time from picking to consumption.

Methodology

A hydroponics pilot project was undertaken on the rooftop of the Saint Joseph Hall at De La Salle University. This project was made up of two parts: an installation part and an operations part.

In the installation part, a space of approximately 18.5 m^2 was utilized to install an NFT (nutrient film technique) hydroponics installation for the growing of lettuce. There were a variety of hydroponics systems that were utilized, often determined by the type of vegetable grown. The NFT system was used because it consists mostly of lightweight PVC piping, uses less water and nutrients, and is easily adapted to the physical limitations of some rooftops (although the rooftops of building in Metro Manila are considered to be strong concrete and easily adaptive to heavier vegetable products with longer root systems such as tomato). The amount of physical stress on a building is minimal using NFT, which is also ideal for growing leafy vegetables that are short rooted and do not place great weight on a building. A second installation issue is what was referred to as the "sun positioning system" through the construction of a nylon-tented rain and sun shelter based on the rotation of the sun and the specific location of the installation so that heat and wind effects would be minimized.

An important part during the installation was the building of a solar-panel water pump and aeration system for the NFT, which meant that the system had its own off-grid power supply and did not use energy from any fossil-fuel base.

The second part of the project was the operations. The key in this part was to select an appropriate growth medium, that is, floral foam, coco peat, and so forth. It was initially hypothesized that coco peat constituted the best growth medium as it was locally produced, cheap, and readily available. A second issue was the nutrient solution. A selection of a nutrient solution was based on its capacity to be cheaply manufactured, its availability locally, and its being suited for the particular vegetable that is being grown. And finally, a third issue was to explore the varieties of leafy vegetables that can be grown using rooftop hydroponics.

The materials required were NFT parts—PVC pipes, a water and nutrient reservoir, plastic pots, a coco-peat growth medium, floral foam, a solar panel–D.C. solar water pump and aeration system, a timer, a lightweight and nylon tented rain and sun shelter, and lettuce seeds.

A literature survey was undertaken to access the cost of wholesale purchasing of lettuce for on-campus canteen consumption and the source of this produce to determine the true costs of production, that is, transportation costs, freshness and spoilage, and environmental impacts.

Results and Discussion

The following research questions were addressed:

1. What is the best design for an urban rooftop hydroponics installation? This question dealt with issues related to physical location of the installation, it sought to control heat, sunlight, moisture, and so forth.

The hydroponics setup was installed at the northern end of the roof top of St Joseph Hall at De La Salle University, Manila. This building is six stories high with no immediate neighbouring taller structures. The location of the setup was a vacant space and is directly exposed to the elements. To protect the plants from direct sunlight, heavy rainfall, and strong winds, a shed was constructed using steel pipes as framework and nets wrapped around the whole structure as covering material against the elements (Fig. 1). Three layers of nets were found to be adequate to protect the plants against gusty winds and very heavy rainfall without lessening much of the sunlight penetrating the shed. However, we have apprehensions that the plants might be destroyed by strong winds and heavy rains caused by typhoons. For such emergencies, we have prepared waterproof canvas sheets ready on hand to cover the roof side of the shed.

To save on water by minimizing loss through evaporation, a closed hydroponics system was devised using PVC pipes (Fig. 2). The water is bubbled and circulated for one hour every six hours using submersible pumps and aerators. The whole system is powered by a solar panel. The mini weather station installed recently to monitor air temperature, relative humidity, and to predict rainfall is powered by rechargeable batteries. The environmental footprint of this setup is thus minimal.

Results of the germination studies indicated that growing mix (a soilless medium from compost material) is a better germination medium than coco coir. Of the three lettuce varieties tested using the growing mix, fanfare germinated fastest (faster by around one week) with green wave slower by a few days, and grandee had the slowest germination. The germination rate for fanfare was at 90%, which is higher than what the seed company claims (85%). On the other hand, the germination rate for green wave was only at 69%, which is lower by 16% from what is claimed. The percentage germination of grandee was less than 20%.

Using coco coir as the growth substrate of lettuce also presented problems. Most prominent of which is that the growing roots get entangled with the coco coir fibers, which apparently inhibited root growth and development. Underdeveloped roots were probably the cause of stunted growth typical of most plants grown in coco coir. On the other hand, survival and growth rates were better using floral foam as the substrate. The few deaths observed using floral foam was due to heavy rainfall and strong winds.

Figure 1. The hydroponics set up enclosed in a net-wrapped shed.

2. What quantities of water and nutrients are optimal for growing Lactuca sativa (lettuce) in urban rooftop hydroponics? This question tested whether urban hydroponics sufficiently reduces water and nutrient use as compared to the traditional agricultural food supply chain.

During a preliminary study, we tried using wastewater from an urban tilapia farm as source of nutrients for lettuce. The growth rates and yield of lettuce in tilapia wastewater were very poor in comparison to a commercial hydroponics medium comprised of Peters Hydrosol (derived from potassium phosphate, potassium nitrate, magnesium sulphate, boric acid, copper EDTA, iron EDTA, manganese EDTA, sodium molybdate, and zinc EDTA) and Peters calcium nitrate in 1:1 proportions and fortified with magnesium sulphate and ferrous sulphate.

Results of the experiment indicated that 140 L of nutrient solution is enough to support 50 lettuce plants to maturity (around two weeks after germination). On extremely warm and dry days, there might be the need to replenish evaporated water. Nevertheless, the nutrient solution after two weeks is still able to grow a second batch of lettuce before more nutrient solution needs to be added. When we consider that 140 L can support 100 plants using our methods and that our average yield per plant harvested is 25 g for green wave and 50 g for fanfare, then 140 L of nutrient solution is required to grow 2.5 kg and 5 kg of lettuce, respectively, or 56 L of nutrient solution is needed by green wave and 28 L is needed by fanfare to grow 1 kg of lettuce. According to Waterfootprint.org (2008), the global average water footprint of 1 kg of lettuce is equivalent to 130 L. The water footprint of our methods is less than half of the global estimates.

Figure 2. The closed hydroponics setup using PVC pipes.

3. What are the costs of urban hydroponics lettuce production based on the model of on-site production and on-site consumption and compare this price to the price of lettuce purchased on-site for the local canteens? This question dealt also with whether the true costs of lettuce production is contained in the wholesale price of lettuce and whether a premium should be placed on on-site grown lettuce due to its superior taste due to freshness as measured by the amount of time from picking to consumption.

According to the Bureau of Agricultural Statistics (BAS, 2011), the average national wholesale prices of lettuce has more than tripled from PhP 12 in 1990 to PhP 43 in 2010 with Metro Manila prices higher by PhP 2 only in 1990 but now by at least PhP 10. The retail prices are however much higher. The Bureau of Agricultural Research (2005) reported that the lettuce markets are in the major urban centers of Manila, Cebu, Iloilo City, and Cagayan de Oro City. The retail prices vary primarily whether the lettuce is imported or locally grown. Two of the more popular varieties are Iceberg and Romaine. Locally grown Iceberg can be retailed at as low as PhP 75 and the imported kind can be sold at PhP 280. Hydroponically grown lettuce by RFM Hydroponics from Parañaque is sold at PhP 30 per pot or based on our estimates up to PhP 600 per kilogram (Fig. 3).

Including the cost of electricity for sterilizing the water used for preparing the nutrient solution, the total cost of materials per 100 plants is less than PhP 500. If we are to sell the lettuce at PhP 30 per pot, PhP 3,000 will be earned per harvest or a profit of PhP 2,500. If we are to recover the cost of the whole setup or PhP 100,000 and that one cycle of germination and growth period takes a month, then at least 40 months or 3.3 years is needed. The main profit however is the reduction in the ecological footprint brought by our method most especially if the lettuce we are eating is imported.

Figure 3. Lettuce plants being sold by RFM Hydroponics at PhP 30 per pot. Photo from RFM Hydroponics (2011). Retrieved from http://www.sulit.com.ph/index.php/view+classifieds/id/1584565/Lettuce+for+Sale%2C+Fresh+Live+%2C+Lettuce+?referral Keywords=lettuce

Conclusions and Recommendation

This study shows that urban farming in open areas such as rooftops is not only feasible but also productive. The growing time is not only shorter and the yield is not only higher; the setup can also be designed so that the ecological footprint of the methods used is drastically reduced not only because the lettuce need not be transported from faraway places anymore but also because energy is saved by using alternative sources of power supplies such as solar-powered pumps and aerators. Furthermore, water conservation is also enhanced by the hydroponic method adopted in this study.

To add value to our hydroponic product, it will be necessary to compare the quality and quantity of the yield with the other method that has a growing number of consumers: organic farming. A hydroponic method whose yield is not only higher but also has a better nutritional value than those grown organically will have a higher market value.

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Urban Hydroponics for Diversified Agriculture: Part II

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Problem Statement

Achieving food security in urban areas has been proven to be challenging. The inability of urban areas to produce their food requirement means that food has to be imported from elsewhere, more often than not from faraway places. If we use lettuce as a model, the nearest source of lettuce for Metro Manila's consumption is Cavite, but still, most of the lettuce that is sold in the markets is from the Cordillera Region of northern Luzon. Lettuce served in hotels as a salad still comes from Mindanao or even as far away as Australia. Traffic congestion, rising fuel prices, and poor road infrastructure has produced a problem in transporting agriculture from rural areas to urban markets where people reside and where the food is consumed. Increase in rates of spoilage of perishable vegetables and transportation costs constitute a food security issue that needs to be addressed. Our proposed solution is urban agriculture. In the previous project, we had shown that raising lettuce hydroponically in open areas such as a building rooftop is not only feasible but may also be profitable. Issues of water and carbon footprints are also addressed by this method. In this part of the world, Singapore is at the forefront of this technology.

Another method that addresses the environmental concerns of food security is organic farming. Organic farming may also be adopted for urban agriculture. Giving urban farming enthusiasts more choices of methods can help popularize the concept of urban agriculture. The surveys we had done indicate that organic farming is more popular to farming enthusiasts than hydroponics. Furthermore products of organic farming are perceived to be more nutritious than those that are chemically grown (using chemical fertilizers and pesticides). To be able to showcase the merits of hydroponics over other methods, we have compared the yield, growth parameters, nutritional value, and even the chemical contaminants that can be found in lettuce grown using both methods.

Review of Related Literature

Urban Agriculture

It is a widely accepted fact that high yields are central to sustainable food security given a finite land resource (Godfray et al., 2010; Foley et al., 2011), thus creating the motivation for innovative agricultural practices such as urban (e.g., hydroponics) and organic farming. Organic farming is a system aimed at producing food with minimal harm to ecosystems, animals, or humans (McIntyre et al., 2009; De Schutter, 2010). On the other hand, urban agriculture involves the growing, processing, and distribution of food and its by-products by way of intensive plant cultivation and animal husbandry in and around cities (Bailkey & Nasr, 2000). The purpose of urban agriculture is the growing and raising of food crops and animals for the explicit purpose of feeding local populations in urban areas (Goldstein et al., 2011). Among the benefits of urban agriculture include increased access to healthy and affordable produce for urban residents, while creating less pollution from transportation and waste products (Mukherji & Morales, 2010). However, to make full use of the potentials of urban agriculture, city officials should consider a more comprehensive approach for incorporating urban agriculture into their zoning regulations (Mougeot & International Development Research Centre Canada, 2004). To intensify support for urban farming, standards that would regulate the permitted urban farming activities as well as facilitate the sale of goods produced from those regulated activities should be created (Mukherji & Morales, 2010).

Hydroponics

The word *hydroponics* was first used by Dr. William F. Gericke in the 1930s. The term describes the agricultural applications of hydroponics, taken from the Greek words *hydro* ("water") and *ponos* ("labor"; Agricultural Information, 2013). Hydroponics is a method of growing plants without using soil. In hydroponics, plants get their nutrients directly from solution. This technology is not new. Experiments in growing mint plants without soil can be traced back to 17th-century France and England. By 1925, the United States began experimenting with different ways to make plant nutrient solutions in order to replace greenhouse soil that is difficult to maintain. This method allows plants to grow two to 10 times the amount in half the time.

Besides the commercial uses, people can grow plants hydroponically at home by setting up their own system. Home growers need to have the container in which to grow the plants, water that is mixed with nutrients, a light source that can be either natural or artificial lighting, a flow of oxygen, and an appropriate temperature maintained for the type of plant grown. Hydroponics is therefore a good solution for people who live in urban or suburban areas and want to grow and produce flower, fruit, and vegetable crops on a patio, small garden, rooftop, or garage. Many types of plants are suitable for growing hydroponically such as tomatoes, lettuce, carrots, strawberries, melons, parsley, and flowers. Growing plants hydroponically can provide families with fresh, uncontaminated produce that is harvested immediately before use.

Hydroponic technology produces many benefits in that it is highly productive and it conserves water and land. Normally, with hydroponics, plants grow inside enclosures that control temperature, light, water, and nutrition. Hydroponics is a cleaner way to grow plants and is useful when land and natural resources are scarce. The plants produced are of better quality than plants that come from soil because soil contains impurities and bacteria.

Organic Farming

Organic farming or agriculture matches—or even exceeds—conventional yields. While nonorganic methods resulted in slightly higher yields in developed areas, organic methods resulted in slightly higher yields in developing areas (Badgley et al., 2006). Other studies (Crowder et al., 2010; Bengtsson et al., 2005) have also suggested that organic agriculture can have a reduced environmental impact compared to conventional agriculture. Likewise, organic farms had been observed to withstand severe weather conditions better than conventional farms, sometimes yielding 70%–90%

more than conventional farms during droughts (see Lotter, 2003). It has been suggested that organic farming could actually produce enough food per capita to sustain the current human population (UNEP-UNCTAD, 2008). Organic agriculture can also improve farmer livelihoods owing to cheaper inputs, higher and more stable prices, and risk diversification (Scialabba & Hattam, 2002). However, organic farming is often an export-oriented system tied to a certification process by international bodies; therefore, its profitability can likely vary between locations and years (Valkila, 2009; Raynolds, 2004).

There are four types of organic farming models in the Philippines, namely, (1) indigenous organic farming, (2) traditional organic farming or the pre–"green revolution" type of farming, (3) large-scale commercial farms, and (4) the small-scale subsistence organic farming (Carating & Tejada, 2012). Indigenous agriculture is known to be intertwined with indigenous culture, customs, and beliefs and has largely remained isolated and unintegrated into the mainstream of Philippine agriculture. In more ways than one, indigenous organic farming mirrors natural farming in that they both are a closed system, which demands no inputs and mimics nature (Mirret, 2001). Traditional organic agriculture can be considered as a step-up development from indigenous farming practices. Traditional Filipino organic farmers are more likely to practice a variation of biodynamic agriculture that revolves around the concept of treating soil fertility, plant growth, and livestock care as ecologically interrelated tasks; proponents have described the method as a holistic understanding of agricultural processes (Abbot & Murphy, 2007). Large-scale commercial organic farming enables local producers to compete with multinational corporations and afford the cost of organic certification. They are known to adopt modern organic practices by doing their own breeding, fertilizer production, and pesticide concoction, vertical and horizontal integration of operations by waste recycling as they follow biodynamic and natural farming principles. Commercial organic farming is not necessarily all on the export trade, as they also focus on the increasing organic preferences of domestic consumers (Carating & Tejada, 2012). Conversely, small-scale subsistence organic farming is practiced by small-time farmers who wish to free themselves from depending on multinational agro-chemical companies and seed corporations. These farmers breed their own seed requirements, produce their fertilizers, concoct their botanical-based pesticides, and practice biodynamic and natural farming principles. Small-scale subsistence organic farms are into multiple cropping, diversified, and integrated farming so that they are sufficient in their food needs, selling the excess to be able to purchase those items needed but could not produce in the farm. Small-scale organic farmers are likely practitioners of biointensive agriculture, which emphasizes greater yields despite a minimum area of land, while continually improving and maintaining the fertility of the soil (BIONICA, 2013).

Conceptual Framework

The present project sought to establish that lettuce grown using urban hydroponics is comparable in productivity and marketability with those grown using organic methods in terms of nutrient content and environmental footprints. Metrics derived from the project include the amount of nutrient applied per growth output, the nutrient content of the yield and levels of chemical contamination in urban hydroponics measured against organically grown lettuce. This project hoped to derive added value to urban hydroponics crops by generating evidence that hydroponically grown lettuce is comparable if not better than those that are organically grown in terms of nutrient content. The comparative levels of contaminants to the harvested lettuce from both methods were also investigated to illustrate food safety.

Research Questions

The following research question was addressed: How does hydroponics and organic farming of lettuce compare with one another in terms of:

1. Percentage germination, maturation period, and harvest yield when grown using hydroponics and when vermicasts applied as vermitea were applied as fertilizer;
2. The level of vitamins and mineral (vitamin A, vitamin D3, and vitamin E or α-tocopherol) of the harvested yield when grown using hydroponics and when vermicasts are applied as fertilizer; and
3. The level of contaminants (heavy metals Cu, Pb, and Cd; diesel fuel combustion product oxirane, tetradecyl; plant metabolite 1,2 dithiane; and pesticides endosulfan and dieldrin) of the harvested yield when grown using hydroponics and when vermicasts are applied as fertilizer.

Methodology

The study employed the experimental design shown in Table 1, in order to compare the performance of hydroponics and organic agriculture. Growth data, which included percentage germination, maturation period, and harvest yield, were compared between both setups. Nutrient content and toxicity were also studied.

Table 1. The Experimental Design of the Study

Culture Method	Nutrient Source	Parameters
Hydroponics	Commercial nutrients	Growth data
Organic method	Vermitea	Nutrient content
		Toxin content

This project is a continuation of the hydroponics project (using the nutrient film technique) performed on the rooftop of St. Joseph Hall at De La Salle University. The setup is comprised of PVC pipes where the hydroponic solution is circulated every 8 hr using solar-powered pumps. The solutions were also bubbled with air using aquarium compressors that are also solar powered. All in all, 100 plants could be grown in this setup. The plants were protected from direct sunlight, wind action, and predatory birds by several layers of nets.

For this project, the lettuce (Romaine variety) was raised using the hydroponics method described above and using organic farming methods done in the De La Salle University–Dasmariñas campus. The organic methods used include the sowing of seedlings in pure garden soil in plots, sowing in different proportions of garden soil, and vermicasts in plots or in different containers (Table 1). The combinations are shown in Table 2 below. The plants will be harvested at maturation.

Table 2. The Media and the Corresponding Containers Used in the Organic Culture Method Used

#	Medium	Container Used
1	Pure garden soil	Garden plot
2	75% Garden soil: 25% vermicast	Garden plot
3	50% Garden soil: 50% vermicast	Garden plot
4	50% Garden soil: 50% vermicast	Small container

Table 2 continued...

5	50% Garden soil: 50% vermicast	Medium container
6	50% Garden soil: 50% vermicast	Large container
7	50% Garden soil: 50% vermicast	Halved bamboo shoot

Procedures for Determining the Level of Nutrients of Harvested Lettuce Leaves

Metal Analysis of Samples and Medium Used

Analysis of metals in the samples was performed using the Shimadzu Atomic Absorption Spectrophotometer (AA-6300). One gram each of freeze-dried vegetable samples and oven-dried soil samples were subjected to dry ashing and acid digestion, respectively. Dry ashing was done by placing the vegetable samples on a dried crucible, which were heated using a furnace set at 480°C for 4 hr. The ash was treated with acid and was diluted to 25 mL using deionized water. Acid digestion of soil samples was done using a modified method by Badri (1984). Soil samples were placed into separate Erlenmeyer flasks, which were treated with 25:10 HNO_3/HCl. The samples were placed on a sand bath maintained at 100°C. Digestion was ceased when the solution turned clear. The samples were filtered and were diluted to 25 mL using deionized water.

Metal standards (Cu, Pb, and Cd) with varying concentrations (0.05 to 10 ppm) were prepared from 1,000-ppm stock solutions to generate standard curves. Analysis of the standards and samples was performed using the Shimadzu Atomic Absorption Spectrophotometer (AA-6300). The amount of metals (ppm) present in the samples was calculated from the standard curve generated.

Analysis of Vitamins A, D3, and E From the Harvested Lettuce Leaves

HPLC analysis was performed on an Agilent Technologies 1200 Series HPLC with a UV detector. A reversed-phase C18 column was used as stationary phase.

The extraction of the three fat-soluble vitamins from the samples was patterned from a method by Konings et al. (1996). One gram of freeze-dried samples was placed in an Erlenmeyer flask. The samples were subjected to saponification for 40 min at 80°C after adding a mixture of 6-mL water, 4.2-g potassium hydroxide (KOH), 20-mL ethanol, and 0.25-g ascorbic acid. Distilled water (60 mL) was added to the flask to bring the ratio of ethanol/

water to 0.3. The saponified mixture was extracted with 9:1 n-hexane/ethyl acetate (20 mL × 3). The organic layer was collected and was evaporated at 40°C under reduced pressure. The residue was dissolved in 4 mL of n-hexane prior to analysis.

Standards with concentrations ranging from 0 ppm to 200 ppm were prepared for the standard calibration technique. Analysis was performed using an Agilent Technologies 1200 Series HPLC with a reversed-phase C18 column. The equipment utilized a gradient solvent system consisting of methanol/water at a flow rate of 1.0 mL/min. The analysis was monitored using a UV detector set at 210 nm for 21 min (Agilent Technologies, 1998; see Table 3 below). The concentrations of the vitamins were reported in micrograms per gram sample based on the generated calibration curves.

Table 3. Agilent Technologies 1200 Series HPLC with a UV Detector Data

Injection volume	5 µL
Column temperature	20°C
Mobile phase	A = Water B = Methanol
Gradient system	At 0 min 90% B At 15 min 100% B At 20 min 100% B At 21 min 90% B (column wash)
Flow rate	1.0 mL/min
UV detector	210 nm
Column	Supelco C18 25 cm × 4.6 mm × 12 µm

Analysis of Pesticide Residues From the Harvested Lettuce Leaves and Medium Used

Analysis of pesticide residues was done using a Perkin–Elmer gas chromatograph (Clarus 500 GC) with an Elite 5MS GC column and characterized using MS. The method used for the pesticide analysis is patterned from an official method by AOAC International (2007). The method employed is a Quick, Easy, Cheap, Effective, Rugged, and Safe (QuEChERS) procedure, which is being used by many researchers focusing on pesticide analysis. One gram of sample was placed in a tube, followed by spiking with 80 µL of 500 mg/L of Endosulfan standard. A 1.00 mL of acetonitrile (with 1% acetic acid) and 0.5 g of 4:1 magnesium sulfate/sodium acetate ($MgSO_4$/NaOAc) were then added to the same tube. The tube was vortex mixed and was centrifuged at 4,000 rpm for 5 min. The upper layer was collected and was transferred into a 2-mL plastic vial. Then, 0.2 g of Florisil was added to the tube for sample clean-up. The vial was vortex mixed and centrifuged at 13,000 rpm for 2 min. The final extract was filtered by Millipore and was transferred into a GC vial prior to instrumental analysis.

The amount of pesticide residues was calculated using the internal standard addition method and was reported as microgram of pesticide residue per gram sample. The parameters used are summarized in Table 4 below.

Table 4. Perkin–Elmer Gas Chromatograph (Clarus 500 GC) With an Elite 5MS GC Column Data

Carrier gas	Helium (30 cm/sec)		
Injector temperature	275°C		
Injection type	Splitless		
Oven program	T	Hold Time	Rate
	80°C	0 min	20°C/min
	290°C	4.75 min	End
GC inlet temperature	275°C		
Ion source temperature	275°C		
Scan range	40–450 m/z		

Statistical analysis. All data reported are mean values of at least a duplicate setup and at least duplicate samples or duplicate instrument readings. All comparisons between data from the hydroponics setup and the organic method setup were subjected to Student's *t*-test ($\alpha = 0.05$) to determine if there is a significant difference between the two results.

Results and Discussion

Comparison of Growth Effects in Terms of Percentage Germination, Maturation Period, and Harvest Yield

The percentage germination in both setups (the hydroponics method and the organic method) was at around 85%, which is close to what has been advertised by the source of the seeds (Condor quality seeds from Allied

Botanical Corporation). However, the plants grown using the hydroponics method or using the hydroponics medium grew faster and were harvestable already 21 days after sowing (Table 5). The plants grown organically using vermicasts as nutrient source and garden soil as medium were harvested 52 days after sowing.

The harvest yield or mean weight at harvest of lettuce grown using different media and containers is also shown in Table 5. The soil-grown lettuce plants do not vary much in harvest weight regardless of container. Analysis by Student's *t*-test also indicated that there is no difference in the mean harvest weights of lettuce grown in garden plots and those grown in containers, although plant density apparently affects the harvest weight inversely meaning smaller containers (thus more densely planted) seem to have lower yield.

Even if the hydroponically grown lettuce was smaller at harvest size, as indicated by Student's *t*-test, maturation takes less than half the time as that grown in soil. These results indicated that the overall harvest yield of hydroponically grown lettuce could be higher (even if yield in terms of biomass is lower) since the maturation period is shorter, and therefore, more harvesting could be done in the same period as in the organic method.

Table 5. The Mean Weight of Lettuce Harvested Using Different Farming Methods, Media, and Containers

	Medium	Container Used	Plant Age at Harvest (days)	Mean Weight (g) [Sample Size]
1	Hydroponics solution	Hydroponics set up	21	5.2 [100]
2	Hydroponics solution	Hydroponics set up	21	5.5 [100]
3	Hydroponics solution	Hydroponics setup	21	7.5 [100]
4	Pure garden soil	Garden plot	52	10.6 [26]
5	75% Garden soil: 25% vermicast	Garden plot	52	9.1 [22]
6	50% Garden soil: 50% vermicast	Garden plot	52	6.8 [33]
7	50% Garden soil: 50% vermicast	Small container	52	6.8 [28]
8	50% Garden soil: 50% vermicast	Medium container	52	10.2 [22]
9	50% Garden soil: 50% vermicast	Large container	52	11.9 [21]
10	50% Garden soil: 50% vermicast	Halved bamboo shoot	52	8.3 [15]

Comparison of Nutrient Value in Terms of Vitamin and Mineral Content

To be hale and hearty, we need proper nutrition, exercise, and a healthy lifestyle. Proper nutrition is an essential part of this regiment, and vitamins and minerals are essentials that we get from our food. The US Food and Drug Administration (USFDA) lists 13 vitamins that are recommended to be taken daily. As vegetables including lettuce have to be transported across large distances before they reach the consumer, we limited the monitoring of the vitamin content of lettuce in this study to the vitamins that remain stable during storage. These are vitamins A, D, and E. Copper was also monitored because it has served as an essential mineral for biochemical reactions at low quantities but could have toxic effects at large concentrations.

Vitamin A plays a role in a variety of functions throughout the body including vision, gene transcription, immune function, embryonic development and reproduction, bone metabolism, blood cell formation and maturation, skin and cellular health, and antioxidant activity. Derivatives of vitamin A are also currently in use for cancer, HIV, and dermatological purposes (Sommer, 1995; WHO, 2014). The most prominent symptom of vitamin A deficiency is impaired vision. An overdose of vitamin A is also not healthy. The symptoms of overdosage of vitamin A are given in Table 6.

Table 6. The Mean Vitamins and Mineral Content of Lettuce Grown Using Two Different Methods

Nutrient	Hydroponics Levels (μg/g)	Organic Method Levels (μg/g)	Recommended daily intake	Vitamin or Mineral Information	Overdosage (mg or μg/d) (Primary Reference Is USEPA or USDFA)
Vitamin A	60–83	58.6–69.4	600 μg	Vitamin A in food and as a supplement	Extremely high doses (>9,000 mg) can cause dry, scaly skin; fatigue; nausea; loss of appetite; bone and joint pains; and headaches.
Vitamin D (cholecalciferol)	0.0–44.6	5.9–6.1	5 μg	Vitamin D in food and as a supplement	Large doses (>50 μg) obtained from food can cause eating problems and ultimately disorientation, coma, and death.
Vitamin E (tocopherol)	2.43–23.58	8.29–8.82	10 mg	Vitamin E in food and as a supplement	Doses larger than 1,000 mg cause blood clotting, which results in increased likelihood of hemorrhage in some individuals.
Copper	0.23–0.63	0.63–95.9	2 mg	Copper in food and as a supplement	As little as 10-mg copper can have a toxic effect and gram quantities are potentially lethal.

Results of this study indicated that the vitamin content of lettuce in both agricultural methods used is at the same level as shown in Table 6. If we consider that the average amount of lettuce intake in a meal is from 50 to 100 g, the amount of Vitamin A from lettuce already satisfies the recommended daily intake of 600 µg.

Vitamin D (the form we detected is cholecalciferol) is responsible for enhancing intestinal absorption of calcium and phosphate. We can get vitamin D from diet, but we can also synthesize vitamin D (specifically cholecalciferol) in the skin, from cholesterol, when sun exposure is adequate. Thus, this makes the practice of exposing infants to early morning sun for the purpose of strengthening the bones. Vitamin D deficiency is known to cause bone diseases including rickets, osteomalacia, and osteoporosis and muscle aches and weaknesses and muscle twitching (Heaney, 2004; Holick, 2007).

As with vitamin A, the results of the study showed that the levels of vitamin D in lettuce harvested from both agricultural methods are in the same dimensions. Furthermore, the vitamin D levels from the lettuce that were harvested from both setups are high and can even be toxic when lettuce is eaten in large quantities. As shown in Table 6, vitamin D obtained from food in concentrations greater than 50 µg can already cause eating disorders and in extreme concentration even coma and death. This should not be surprising since wild lettuce had been reported previously to be toxic (Besharat et al., 2009).

Vitamin E (tocopherol) is a fat-soluble antioxidant that stops the production of reactive oxygen species formed when fat undergoes oxidation (Brigelius-Flohé & Traber, 1999). However, more recent studies have suggested that its cell-signalling function is its main role and that it may not have a significant role in antioxidant metabolism (Zingg & Azzi, 2004; Azzi, 2007). Other functions of tocopherol include enzymatic activities, gene expression, and neurological functions. Vitamin E deficiency can cause spinocerebelar ataxia, myopathies, peripheral neuropathy, ataxia, skeletal myopathy, retinopathy, impairment of the immune response, and red-blood-cell destruction (Tanyel & Mancano, 1997; Hathcock, 1997; Fuller et al., 1998; Traber et al., 2008; Steinraths et al., 2008; Pekmezci, 2011; Traber & Stevens, 2011; Bromley et al., 2013).

Copper is an essential nutrient involved in the function of several enzymes. Copper is required for infant growth, host defense mechanisms, bone strength, red- and white-blood-cell maturation, iron transport, cholesterol and glucose metabolism, myocardial contractility, and brain development. Copper deficiency can result in the expression of an inherited defect such as Menkes syndrome or in an acquired condition (Olivares & Uauy, 1996).

Comparatively, both treatment groups have high levels of copper in relation to the recommended daily intake for this essential nutrient, but the copper levels of lettuce cultured using the organic method are higher than the hydroponically grown group. This should be a positive character for the plant, but the high levels of copper in lettuce also support the allegation that lettuce can be toxic. According to the United States Environmental Protection Agency (USEPA), 10 mg in the diet can already be toxic, and gram quantities can be lethal.

A potential source for the high copper levels observed in the two setups is the copper in the floral foam used in the hydroponics setup and in the vermicast in the organic farming setup. Floral foams are used to improve water absorption by plants in a controlled amount (Landrock, 1995). However, the copper content in the medium of both setups was in the low milligram-per-gram levels or parts per thousand. The level of copper in the floral foam is about 25% of that found in the vermicast. Floral foams can also contain resins, the components of which include phenol and formaldehyde.

Comparison of the Level of Contaminants

Plants can take up chemical contaminants from the soil or other media. Contaminants from the soil tend to travel through the plant via absorption of the roots and adsorption on the surface of plant organs. Although plants readily contain minerals in their different compartments, they could accumulate additional metals depending on their physiological capacity (Peralta-Videa et. al, 2009; Tomas et. al., 2012). Containers used in planting crops could also affect chemical contaminant uptake. Containers used in planting vary from woods, tires, metals, plastics, and clay pots (Vick & Poe, 2011). The use of wood does not affect heavy metal consumption by plants until 1994, when lumber was treated with chromium, copper, and arsenic. Studies found that these metals could be deposited into the soil and absorbed easily by plants (Rahman et al., 2004). Plastics are generally used in planting and have been found to have no effect on metal absorption. However, plastics that are made of polyvinylchloride may contain metal residues such as lead, zinc, cadmium, and copper, which are absorbed by the soil and the plant (Mathe-Gaspar & Anton, 2005).

Some of these contaminants like heavy metals are considered to be toxic to humans. Copper, cadmium, and lead are the most common heavy-metal contaminants found in the soil that could be transferred to plants. Copper though is essential for plants' cellular processes, but relatively high amounts may be detrimental to the plant and to those who consume these plants. Cadmium and lead are found to be more toxic than copper. Nevertheless plants do not accumulate or absorb a substantial amount of lead due to its ability to bind tightly with the soil particles. This is even if lead is found mostly on the surface of the leaves or the roots (Angima, 2010). Cadmium on the other hand is found to be mobile in soil and could be readily absorbed by plants at neutral and alkaline pH (Vick & Poe, 2011). High amounts of copper could generate free radicals leading to cancer as well as damage of proteins, lipids, and DNA (Brewer, 2010). Cadmium poisoning targets the liver, placenta, kidneys, lungs, brain, and bones, while lead poisoning could trigger birth defects, retardation, vertigo, seizures, weakness, and paralysis (Roberts, 1999; Ferner, 2001).

Table 7. The Mean Content Chemical Contaminants Detected in Lettuce Grown Using Two Different Methods

Contaminant	Category	Hydroponics Levels (µg/g)	Organic Method Levels (µg/g)	LD50 (Human)	Reference
Cadmium	Heavy metal	6.9–11	7.5–11	20–130 mg/kg	United States Food and Drug Administration
Lead	Heavy metal	0.22	0.19–0.31	714 mg/kg	United States Center for Disease Control
Copper	As heavy metal	0.23–0.63	0.63–95.9	Gram quantities (adult individual)	United States Environmental Protection Agency
Oxirane, tetradecyl	Bioactive compound or sterilant	6.9–11	7.5–11	100–200 mg/kg	United States Public Health Service
1,2 Dithiane	Bioactive compound or pesticide	94	13	410 mg/kg (in rodents)	America Chemical Society
Endosulfan	Insecticide	0.74–1.46	0.48–1.34	35 mg/kg	United States Environmental Protection Agency
Dieldrin	Termicide	—	—	5 mg per adult individual	United States Center for Disease Control

The heavy-metal contaminants of the two setups (hydroponics and organic farming) were at the same levels with one another (Table 7). As was mentioned above for copper contamination, the heavy-metal content of the floral foam and the vermicast can be potential sources of the heavy metals analyzed from the harvested lettuce leaves. In terms of heavy-metal contamination, the measured levels in the leaves are not yet at hazardous levels.

Four other chemical contaminants were identified in the GC–MS assay, namely, oxirane, dithiane, dieldrin, and endosulfan. These compounds were consistently present in all of the chromatograms and were selected to be monitored due to their potential adverse effects on humans, vegetation, and the environment. The four compounds are found to be components of insecticides or pesticides.

Oxirane or ethylene oxide is commonly used as an intermediate in producing industrial chemicals (e.g., ethylene glycol and acrylonitrile) and used in the formulation of products such as soap, detergent, adhesives, antifreeze, and pesticides such as thiiranes (Surendra et al., 2004). Oxirane, tetradecyl has also been identified as a type of additive in plastic production (Saker & Rashid, 2013). Oxirane is also a bioactive compound produced by algae; it has been isolated from *Laurencia brandenii.* Aside from the antimicrobial activity, the extracts also have termicidal effects (Manilal et al., 2011). In addition, oxirane is also a known fumigant or sterilant used in fumigating heat-sensitive hospital equipment, medical products, cosmetics, and food such as spices, grains, dates, walnuts, copra, and peas. (NTP, 2011) Oxirane was found to be a harmful substance and may cause numerous effects on humans such as sore throat, vomiting, nausea, dizziness, blurred vision, and convulsions. Moreover, epidemiological studies on both humans and animals revealed the potential carcinogenic properties of oxirane (OSHA, 2002). Occupational, consumer (foodstuff), and environmental (air, water, soil) contact are the main exposure routes for oxirane in humans. From a toxicological study, the minimum risk level (MRL) for long-term exposure of humans to breathing oxirane is 0.09 ppm for about 14 weeks and that 5 to 20 years of exposure (3–430 ppm levels in air) could cause serious problems in hand and eye coordination. Longer exposure and higher concentrations of oxirane could lead to more serious effects. Human effects from eating or drinking oxirane are not known; however, it could cause immediate death in rats (ATSDR, 1990). Plant employees exposed to oxirane are limited to 1.0-ppm aerial exposure in an 8-hr time-weighted average (OSHA, 2002). Minimum toxic levels (MTL) and minimum effective levels (MEL) of oxirane as fumigants in plants and vegetables are not known.

The oxirane content of both hydroponically and organically grown lettuce is of the same levels (see Table 7 above). For the hydroponically grown lettuce, the heavy traffic at Taft Avenue and even the floral foam used as a medium are a potential source of the oxirane. This is apparently the same situation in the organic method setup. The vermicast and heavy traffic in the vicinity contributed to the oxirane contamination of the lettuce harvested.

Dithianes are white crystalline organosulfur compounds that are used in the formulation of certain pesticides and insecticides. There are very few researches and studies done on the adverse effects to humans, animals, and plants and the exposure route of this compound (IRIS, 2012). Also, the absorption, distribution, metabolism, and excretion in living organisms are not well known (Schieferstein et al., 1988). However, dithiane is a novel inducer of ER stress proteins (Asmellash et al., 2005). For both setups, dithiane did not come from the medium but most likely from other plants in the vicinity (see Table 7 above).

Dieldrin is a white to tan crystalline solid that is mainly used to control termites. Dieldrin is used and applied to soil and seed dressing applications as well as to crops and foliage such as cotton (Zitko, 2003). Dieldrin was found to be a nervous-system poison and a potential carcinogen. Also, epidemiological studies revealed that the long-term exposure to dieldrin increases risk and susceptibility to breast cancer, and this is correlated to the estrogenicity of the compound (Snedeker, 2001). Exposure to dieldrin may be occupational, consumer, and environmental.

Apparently, lettuce does not take up dieldrin from the medium (see Table 7 above). The undetectable levels of dieldrin in the leaves of lettuce analyzed may be related to the relative low solubility and stability of dieldrin (it is also slowly metabolized by organisms).

In humans, exposure to dieldrin may be due to inhalation of dieldrin in workplace and the ingestion of foodstuff contaminated with dieldrin. In the United States, it was detected in foods analyzed from markets such as dairy and poultry products, egg, legumes, root, and leafy vegetables, and this was associated with the absorption of dieldrin from the soil. Intermediate- and chronic-duration oral MRLs of dieldrin were found to be 0.0001 mg/kg/day (15–364 days of oral exposure) and 0.00007 mg/kg/day (365 days or more), respectively. MTL and MEL to plants and vegetables were not determined (ATSDR, 2002). Dieldrin was not detected in the plant samples analyzed but were detected in the floral foam and the vermicast used as medium.

Endosulfan is a restrictedly used insecticide with a cream to beige crystalline solid appearance. This chlorinated hydrocarbon is widely used against the proliferation of aphids, fruit worms, beetles, termites, moth larvae, and white flies, and it is applied directly on crops and soil. It is released in the environment and consumed by living organisms through several routes: air, water, soil, and food. This pesticide is subjected to long-range aerial transport, and it could be detected at remote locations from sources and to where it was used. In water, endosulfan may be oxidized and undergo biotransformations to produce endosulfan sulfate and endosulfan diol, the former being more toxic and the latter being less toxic than the parent compound. (Vivekanandhan et al., 2012). As an insecticide, endosulfan is directly applied to soil and crops, and it is chiefly converted to the sulfate form and could penetrate into plants.

Dietary intake (as residue in foodstuff such as fruits and vegetables) is the main exposure route of endosulfan. However, the endosulfan levels from both setups were low in comparison to the lethal doses (LD_{50}) prescribed for humans (see Table 7 above) and at the same levels with one another. Generally, endosulfan targets the nervous system of both humans and animals. Exposure to high concentrations of endosulfan could result to hyperactivity, tremors, decreased respiration, dyspnea, salivation, tonic-clonic convulsions, and death to humans. The acute and intermediate oral MRL of endosulfan to humans and animals are 0.007 mg/kg/day and 0.005 mg/kg/day, respectively (ATSDR, 2013).

The floral foam used in the hydroponics setup contains endosulfan. As floral foams are used for increasing the "shelf life" of cut flowers, endosulfan could be used by the suppliers of floral foam as an insecticide to get rid of aphids that may spoil the presentation of the bouquet. The endosulfan contamination in the hydroponics may have been from the floral foam. As an insecticide, endosulfan is directly applied to soil and crops, and it is chiefly converted to the sulfate form and could be taken up by plants. The situation in the organic farming setup is different. There is no endosulfan detected in the vermicast. The possible sources of endosulfan in this case are the surrounding farms and gardens in the vicinity. As mentioned above, endosulfan can travel distances as wind-borne particles.

Conclusion

The results of the present study indicate that the hydroponics method shortens the growth period although the yield of the organically grown lettuce is larger and heavier. However, the shortened maturation period can be translated to more planting seasons and therefore a higher yield. In terms of nutrient value, there is little or no difference between the lettuce leaves from both setups. This is also the same observation regarding the contaminants found in plants from both setups. Overall, data gathered from these experiments suggest that lettuce plants grown using the hydroponics method is in fact comparable to organically grown plants in terms of nutrient content. These findings add value to urban agriculture in the form of hydroponics because the yield is not only higher but also is comparatively speaking as nutritious as organically grown plants. The question of whether hydroponically grown lettuce is safer to eat than organically grown lettuce is not easy to answer. Apparently, the contaminants found in the lettuce are a factor of where they are grown and what materials have been used in the cultivation process. Interestingly, our observations also suggest that plants are able to pick up chemicals from the environment, so one should be more aware of his/her surroundings when cultivating plants most especially in the urban environment.

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