DLSU Business & Economics Review 28(2) 2019, pp. 10–25

RESEARCH ARTICLE

Are Filipino Smokers More Sensitive to Cigarette Prices due to the Sin Tax Reform Law?: A Difference-in-difference Analysis

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Abstract: Employing a two-part estimation model using the Family Income Expenditure Survey before (2009) and after (2015) the tax reform, our study assessed the impact of the Philippine Sin Tax Reform Act (2012) on cigarette consumption and the responsiveness of cigarette consumption to price changes. The results are consistent with existing studies that cigarette consumption is price inelastic. The demand, however, has become less inelastic in the Philippines over the period 2009 to 2015, indicating a more responsive cigarette demand to price increases. Of the total effect of cigarette price increase on demand, the decrease in consumption by smokers (smoking intensity) accounts for much of the decline in cigarette consumption, rather than the decrease in the number of cigarette users (smoking prevalence). The increase in excise tax due to the tax reform has been effective on lowering cigarette consumption in the country and in making cigarette demand more responsive to price increases. Specifically, the tax reform has reduced the number of cigarettes purchased by smokers more than the number of cigarette users.

***Keywords*:** excise tax, elasticities, smoking prevalence and intensity, difference-in-difference analysis

JEL Classifications: D120, H200

One of the significant legislation during the Aquino Administration was the Sin Tax Reform Act of 2012 (Republic Act No. 10351, 2012). The tax reform is primarily a health measure as well as a governance measure. It addresses public health issues related to alcohol and tobacco consumption along with the structural weaknesses of the country's tax system on alcohol and tobacco products.

For tobacco, the law significantly increased the excise tax on tobacco and tobacco products, simplified the tax structure, and removed the price classification freeze. Prior to the reform, tobacco taxation in the country followed a complex four-tiered tax system using a tax base freeze at 1996 price levels. Since the excise tax was not indexed to inflation, prices of tobacco products in the country were among the cheapest in the world despite the increases in excise tax over the years (Quimbo et al., 2012). In contrast, the tax reform provides a two-tiered system effective January 2013 with a gradual shift to single and uniform

rate taxation starting 2017, after which the rate will be increased by 4% every year effective January 2018. The current system is considered simpler and more efficient in raising tobacco taxes.

Depending on the cigarette classification, the increase in excise tax varies from 108% to as high as 341%. Given the significant increase, the price of cigarettes also substantially went up. After almost six years of implementation, what has been the impact of the Sin Tax Reform on the demand for cigarettes? This study aims to: (i) estimate the price and income elasticities of the demand for cigarettes after the tax reform; (ii) determine the impact of the tax reform on cigarette consumption; (iii) determine the impact of the tax reform on the price responsiveness of the demand for cigarettes; and (iv) recommend policies for future tax reform in the country.

This empirical study offers two major contributions on tobacco economics and taxation. First, this is the first analysis that evaluate empirically the impact of the tax reform on cigarette demand in the Philippines after it was implemented starting 2013. The most recent study on the demand for cigarettes in the country was done in 2012 by Quimbo et al. Second, this is the first study on the demand for cigarettes in the country that used a two-part estimation strategy, estimating separately the components of the total price elasticities, namely the price elasticity of smoking prevalence and the price elasticity of smoking intensity, both of which are key parameters in assessing the impact of the policy reform. The findings and recommendations of the study will be of invaluable help to the government in designing the next sin tax policy reform.

The paper is structured as follows. The next section reviews the literature on tobacco demand and taxation. It is followed by a discussion of the data and methodology, after which the results are presented and discussed. The final section presents the conclusion and recommendations.

Literature Review

Due to the adverse health and economic consequences of tobacco consumption, several studies both in developed and developing economies have examined empirically the extent of the impact of tobacco price increases on smoking, including the effectiveness of raising tobacco taxes as part of tobacco control strategy. Although demand for tobacco products is not as elastic as the demand for other consumer goods (Tennant, 1950), there is a consensus in the empirical literature that tobacco consumption falls in response to an increase in the price of tobacco because of a decrease in smoking prevalence (i.e., decrease in the number of individuals who smoke), because of a decrease in smoking intensity (i.e., decrease in the consumption by those who use the tobacco products), or because of a combination of the two possible outcomes (IARC, 2011; World Bank,1999).

There were almost no micro-level studies on the impact of tax and price on tobacco consumption in low- and middle-income countries up until the publication of the World Bank's (1999) *Curbing the Epidemic* report. Since then, however, there has been a growing body of tobacco demand studies for developing countries (IARC, 2011). The World Bank review revealed that, ceteris paribus, a 10% price increase would reduce tobacco consumption by about 8% in less-developed countriesand about 4% in advanced economies (Jha & Chaloupka, 2000).The thorough synthesis in IARC (2011)concluded that price elasticity of demand for tobacco products for low- and middle-income countries varies over a wide range between -0.2 and -1.0.

In the Philippines, there is a dearth of empirical evidence on tobacco demand elasticities either using individual- and household-level data or even aggregate data. The most recent is the study by Quimbo et al. (2012), which used cross-sectional household survey data taken from the nationally representative 2003 FIES. The study found that cigarette price has a negative and statistically significant impact on household cigarette consumption, both for the overall sample and across income groups. The estimated price elasticity for the full sample is -0.87, which is close to the upper bound of the range obtained in studies based from low- and middle-income countries (Chaloupka,Hu, Warner, Jacobs, & Yurekli, 2000; Guindon, Perucic, & Boisclair, 2003; IARC, 2011).

There is a consensus among policymakers that raising tobacco taxes reduces cigarette consumption. In fact, among the tobacco control measures, "raising tobacco taxes is the most effective and cost-effective strategy for reducing tobacco use" (World Health Organization, 2015, p. 26). This has led to a number of empirical studies which examined the effectiveness of tobacco taxation in cutting cigarette use, one of which is by Kevin Callison and Robert Kaestner(2013). Using data from the U.S. Current Population Survey Tobacco

Use Supplements, the study employed a novel paired difference-in-difference (DID) technique to estimate the association between recent large tax increases and cigarette consumption. Results reveal that increases in cigarette taxes are associated with small decreases in cigarette consumption and that it will take sizable tax increases, on the order of 100%, to decrease adult smoking by as much as 5%.

Data and Methodology

Our primary data source is the 2015 and 2009 Family Income and Expenditure Survey (FIES) provided by the Philippine Statistics Authority (2011, 2017). As in Quimbo et al. (2012), the demand analysis is subject to a number of limitations. First, the unit of analysis is the household. While it can be argued that demand for cigarettes is an individual and not a household choice, the lack of availability of individual-level data on cigarette consumption constrains us to use data at the household level. Hence, we followed similar approaches undertaken by various studies in the tobacco taxation literature such as those mentioned in the preceding section, and in particular,Bishop, Liu, and Meng (2007) and John (2008).Likewise, the households in the two periods (2015 and 2009) in the FIES data are not identical. The paucity of a longitudinal dataset which could have tracked the cigarette consumption patterns of households before and after the sin tax reform is another constraint. As we argue in this study, in the absence of panel data, pooled cross sections can be very useful for evaluating the impact of a certain event or policy (Wooldridge, 2009). Lastly, there is no available household-level data on cigarette prices. Instead, we used province-wide average prices of cigarettes taken from the Survey of Retail Prices for the Monthly Consumer Price Index (CPI) produced by the PSA. This may give rise to potential endogeneity of the price variable due to the self-reported nature of the price data from the survey. If not accounted for, the endogeneity in self-reported price data may introduce considerable bias in the price elasticity estimates. These measures may also be subject to measurement/reporting errors since in these household expenditure surveys, it is typical that one family member reports total household expenditures on tobacco and quantity purchased. We addressed the endogeneity issue by employing two-stage least squares (2SLS) and two-step efficient generalized method of moments (GMM) estimators.

New Estimates Using the 2015 FIES

For the baseline model using the 2015 FIES, we estimated the following cross-sectional model:

$$\log(Q_i) = \beta_0 + \beta_1 \log(P_i) + \beta_2 \log(Y_i) + \sum_j \gamma_j X_{ji} + u_i \quad (1)$$

where Q_i denotes the quantity of cigarettes consumed by household , measured as the number of packs (20 sticks per pack); P_i is the average price of cigarettes in household i's region; Y_i is the annual household income; X_i is a vector of control variables consisted of household and household head's characteristics; and $u_i \sim iid(0, \sigma^2)$ is a normally distributed disturbance term with constant mean and variance.

The vector *X* consists of variables that control for the household as well as household head's characteristics correlated with cigarette consumption such as age, sex, educational attainment, and employment status, which are all categorical variables. The age of the household head is coded into four categories (18–29, 30–45, 46–59, and 60 and above, for which we chose the last category as the base group) and education into three categories (none/primary, secondary, tertiary, for which we chose the latter as the base group). Sex and employment status are both dummies indicating whether the household head is male and has a job, respectively. To account for households' risk attitude, we included a dummy variable indicating the positive expenditure on any form of insurance. We also control the household's family size and urbanicity of the household's regional location.

To account for the potential endogeneity of the price variable arising from the self-reported nature of the price data as well as measurement/reporting errors, we employed 2SLS and two-step efficient GMM estimation with regional fixed effects as the instruments. The disturbance terms of different individuals within the same region are likely to be correlated. The two-step efficient GMM estimator generates estimates of coefficients as well as standard errors which are robust to both serial correlation and cluster-specific heteroscedasticity (Hayashi, 2000). There are efficiency gains in using the two-step GMM estimator relative to the conventional 2SLS estimator, and this lies from the use of the optimal weighing

matrix, the overidentifying restrictions of the model, and the relaxation of the i.i.d. assumption (Baum, Schaffer, & Stillman 2010).

Elasticities of Smoking Prevalence and Intensity

There has been a long tradition of using two-part econometric models of cigarette demand developed by Cragg (1971) when using individual-level data (IARC, 2011). This framework is designed to model smoking prevalence and smoking intensity separately. The two stages represent the two sequential decisions an individual faces in consuming tobacco products, namely the decision to whether consume or not, and among those who have decided to consume tobacco, the decision on how much to consume. The first step is usually modeled using nonlinear probability models such as logit and probit specifications due to the binary nature of the first decision. The second step, meanwhile, is modeled using ordinary least squares (OLS) techniques. The resulting price elasticity from the first stage is known as the price elasticity of prevalence, while the resulting elasticity from the second stage is known as the price elasticity of intensity. The total price elasticity of tobacco demand is derived by combining the two price elasticities. Other studies have employed sample selection models such as Heckman's (1979) two-step sample selection correction model. Known as the Heckit model, this approach corrects the self-selection problem in the second stage of the two-part model by including the inverse mills ratio as an additional variable in the second equation. We employed these two-part econometric techniques to generate the estimates for smoking prevalence and intensity elasticities.

Measuring the Causal Impact of the 2012 Sin Tax Reform Law on Cigarette Consumption: Difference-in-Difference (DID) Analysis

Both theoretical and empirical evidence suggest that tax-induced price increase would decrease the demand for cigarettes. Hence, we attempted to test the hypothesis that the tax-induced price increase after the 2012 Sin Tax Reform Act has a negative effect on cigarette consumption. Towards this end, we constructed a two-year independently pooled cross section by pooling the 2009 and 2015 FIES, which are collected before and after, respectively, the Sin Tax Reform Act (2012) was enacted. Pooled cross sections can be very useful for evaluating the impact of a certain event or policy (Wooldridge, 2009). By pooling random samples drawn from the same population but at different points in time, the sample size is increased which results in more precise estimators and test statistics with more power. Under impact evaluation studies, typically, two cross-sectional data sets, collected before and after the occurrence of the event, are used to determine the effect on economic outcomes. The common technique applied to such impact evaluation analyses is the difference-in-difference (DID) framework, which systematically measures the difference in the outcome variable of interest across groups before and after the occurrence of an event. For instance, a study by Kiel and McClain (1995) estimated the impact that a new garbage incinerator had on housing values in North And over, Massachusetts using a DID analysis for cross sections pooled across various years.

Similar to the approach of Callison and Kaestner (2013) and Kiel and McClain (1995), we constructed a two-year independently pooled cross-section of the 2009 and 2015 FIES. The equation of interest in measuring the causal impact of the Sin Tax Reform Act in 2012 is given by

$$\begin{aligned}\log(Q_i) = {} & \beta_0 + \delta_0 d15 + \beta_1 dT + \delta_1 d15 \cdot dT \\ & + \beta_2 \log(P_i) + \beta_3 d15 \cdot \log(P_i) + \beta_4 \log(Y_i) \\ & + \beta_5 d15 \cdot \log(Y_i) + \sum_j \gamma_j X_{ji} + u_i \end{aligned} \quad (2)$$

In Equation(2), the parameter of interest is δ_1, the coefficient of the interaction between the year dummy variable $d15$ and the treatment variable dT. This is the DID estimator, which measures the causal impact of the Sin Tax Reform Act (2012)on cigarette consumption. In the natural experiment literature, the parameter δ_1 is often called the *average treatment effect* because it measures the effect of the treatment or policy on average outcomes.

Has Responsiveness of Cigarette Demand to Price Increases Changed After the 2012 Sin Tax Reform Act?: A Chow's Test Approach

Another important question that we uncovered in our empirical analysis involves the impact of the 2012 Sin Tax Reform Act on the responsiveness of cigarette consumption to changes in cigarette prices. Accordingly, we constructed a two-year independently pooled cross section by pooling the 2009 and 2015

FIES. To determine whether the total price elasticity of demand has changed due to the sin tax reform law, we estimated the following model:

$$\log(Q_i) = \beta_0 + \delta_0 d15 + \beta_1 \log(P_i) + \delta_1 d15 \cdot \log(P_i) + \beta_2 \log(Y_i) + \delta_2 d15 \cdot \log(Y_i) + \sum_j \gamma_j X_{ji} + u_i \quad (3)$$

where the variables are as defined above. In Equation (3), δ_0 measures the difference between average cigarette consumption of households in 2009 and 2015 for reasons other than changes in price, income, and other factors. The year dummy variable $d15$ captures tobacco control measures other than the Sin Tax Reform Act (2012) that has been implemented over the seven-year period. This is a necessary step in singling out the impact of the reform. The parameter of interest is δ_1, the coefficient of the interaction between the year dummy and the price variable log(P). This parameter measures the change in the price elasticity of demand from 2009 before the tax reform to 2015 post-tax reform. We hypothesized that $\hat{\delta}_1$ is negative and statistically significant, that is, cigarette consumption of households has become more responsive to price increases after the reform. To determine the statistical significance of $\hat{\delta}_1$, we used Chow's test, which is primarily designed to capture the structural change in the parameter of interest.

Results and Discussion

Descriptive Statistics

The key descriptive statistics for our samples are presented in Table 1. There were 38,400 and 41,544 households independently sampled in the FIES 2009 and 2015, respectively. There are recognizably significant changes in household income and tobacco consumption over the seven-year period. In 2015, fewer households had tobacco expenditures than in 2009; the proportion of tobacco-consuming households declined by 12 percentage points from 65% to 53%. Notwithstanding this sizeable decline, household expenditures on tobacco and, specifically, on cigarettes, picked up considerably by 62% and 53%, respectively, after adjusting for inflation. Tobacco expenditures as a proportion of total household expenditures also rose by a percentage point in 2015 from its value in 2009. Consequently, household income expanded by nearly 4%. Tobacco expenditures accounted for 1% and 2% of the household's annual income in 2009 and 2015, respectively. Our demand analysis focuses on cigarettes as they account for more than 90% of households' expenditures on tobacco products.

Table 1
Mean Household Income and Expenditures on Tobacco Products (PhP)

Variable	Mean			
	2009	N	2015	N
Annual household income	195,811.50	38,400	247,555.60	41,544
Proportion of households with tobacco expenditures (%)	65.00	38,400	53.00	41,544
Household expenditures on tobacco products	2,180.08	24,962	4,314.67	22,095
Share of household expenditures on tobacco products in overall expenditures (%)	1.87	24,962	2.88	22,095
Household expenditures on cigarettes	2,106.21	24,962	3,927.89	22,095
Household expenditures on cigars	9.95	24,962	311.98	22,095
Household expenditures on chewing tobacco			33.59	22,095
Household expenditures on other tobacco products	63.91	24,962	41.20	22,095

Note: All figures are reported in nominal terms. The mean expenditures are calculated for the subsamples for which household expenditures on tobacco is nonzero.
Source: Authors' calculations using data from the Family Income and Expenditure Survey (FIES) provided by the Philippine Statistics Authority (PSA).

Price Elasticity of Demand for Cigarettes—New Evidence

We presented novel elasticity estimates in Table 2 and Table 3 using the 2015 and 2009 FIES, respectively. Our elasticity estimates provide support to the theoretical and empirical consensus that cigarette consumption declines when cigarette price increases. We found a negative and statistically significant impact of cigarette price on consumption, with the estimated overall price elasticity equal to -0.93, suggesting that cigarette consumption is price inelastic. Hence, given a 10%-increase in average cigarette prices, demand declines by 9.3%, everything else constant. Historically, tobacco products typically exhibit relatively inelastic demand due to their addictive nature and the unavailability of close substitutes. For many low- and middle-income countries where cigarettes are generally less affordable than in advanced countries, elasticity estimates lie between -0.2 and -0.8(see Warner,1990; Blecher & van Walbeek, 2004, 2009).

A comparison with the estimates for 2009 shows that cigarette demand has become more responsive to price increases. This increase in cigarette demand elasticity could be attributed to various factors such as the permanent increase in cigarette prices brought about by the significant rise in excise taxes from the reform as well as the increasing presence of close substitutes such as electronic (e-) cigarettes.

Our estimated income elasticities, meanwhile, fall in the lower estimate at 0.56, indicating the positive and statistically significant relationship between income and cigarette consumption. Hence, a 10%-increase in average income will yield a 5.6% increase in cigarette demand, everything else constant. Compared to 2009, the estimates show that the responsiveness of cigarette demand to income increases significantly went up after the reform. Consistent with the findings of Ulep (2015), cigarettes in the Philippines became less affordable after the reform as shown by the increase in relative income prices (RIP). This means that the proportion of income required to purchase cigarettes rose, making demand more responsive to income increases.

Our estimated income correlates suggest that households with household heads who have jobs but did not finish college are more likely to consume cigarettes. Our estimates also confirm the hypothesis that risk-averse households—those with expenditures on any form of insurance—are less likely to have expenditures on cigarettes.

Consistent with economic theory and studies in the literature, poor households are relatively more responsive to cigarette price increases than richer households (see, for instance, Barkat, Chowdhury, Nargis, Khan, & Kumar, 2012; Townsend, Roderick, & Cooper,1994). Cigarette demand is price elastic for households in the lowest income group (-1.254) and inelastic for the relatively richer households (-0.968, -0.869, and -0.598).Consequently, deprived households are more responsive to income increases than the well-off. Estimated income elasticities decline as income increases. The increasing trend in income elasticities is also reflected across income groupings.

Using two-part econometric techniques, we estimated separately the two components of price elasticity of demand for cigarettes, that is, price elasticities of smoking prevalence and intensity. A key step in this exercise is to check whether selecting only households with positive cigarette consumption in the regressions introduces sample selection bias. Table 4 presents the estimates of the Heckman model, indicating that the estimated inverse mills ratio in column (1) is statistically significant and positive. Therefore, selecting only smoker households to be included in the regressions and, to the same effect, ignoring those households with zero cigarette consumption, would result to sample selection bias. Thus, to avoid sample selection bias, we included also the small proportion of the sample with zero cigarette consumption. Since we log-transformed the cigarette consumption variable as the dependent variable, all zero-valued observations will be missing values. We resolved this issue in two ways: (i) setting these observations equal to zero; and (ii) employing the Heckman sample selection correction method. The estimates are robust across the two approaches.

In Table 5,we present the estimates of prevalence and intensity elasticities as the average marginal effects of the two-part estimation technique. The results reveal that the elasticity of smoking intensity dominates the elasticity of smoking prevalence, suggesting that of the total effect of cigarette price increase on demand, it is the decrease in consumption by smokers (smoking intensity) that account for much of the decline in cigarette consumption rather than the deterioration in

Table 2
Estimates of Overall Price Elasticity of Demand for Cigarettes - 2015

	(1)	(2)	(3)	(4)	(5)
			Income Deciles		
VARIABLES	**Overall**	**1st-3rd**	**4th-6th**	**7th-9th**	**10th**
ln(cigarette price)	-0.927***	-1.254***	-0.968***	-0.869***	-0.598***
	(0.0406)	(0.0623)	(0.0800)	(0.0953)	(0.189)
ln(HH income)	0.557***	0.742***	0.656***	0.538***	0.362***
	(0.0136)	(0.0293)	(0.0294)	(0.0354)	(0.0674)
HH age 18-29	0.0322	0.143**	0.104	-0.0902	0.253
	(0.0449)	(0.0629)	(0.0835)	(0.101)	(0.280)
HH age 30-45	0.0498*	0.198***	0.0936**	-0.0132	-0.121
	(0.0262)	(0.0464)	(0.0445)	(0.0488)	(0.116)
HH age 46-59	0.0802***	0.117**	0.120***	0.0967**	-0.0361
	(0.0243)	(0.0460)	(0.0430)	(0.0419)	(0.0764)
dummy HH is male	0.128***	0.111**	0.0743	0.113***	0.113
	(0.0254)	(0.0486)	(0.0454)	(0.0427)	(0.0792)
HH education: none to primary	0.246***	0.217***	0.218***	0.199***	0.229**
	(0.0282)	(0.0670)	(0.0488)	(0.0467)	(0.101)
HH education: secondary	0.207***	0.164**	0.147***	0.110***	0.250***
	(0.0265)	(0.0677)	(0.0481)	(0.0405)	(0.0752)
dummy HH has a job	0.0313	0.0988*	-0.00820	0.0341	0.0877
	(0.0281)	(0.0571)	(0.0515)	(0.0454)	(0.0834)
dummy household has insurance	-0.0266	0.110**	-0.0709**	-0.0521	-0.00908
	(0.0207)	(0.0460)	(0.0310)	(0.0350)	(0.114)
ln(family size)	-0.106***	-0.426***	-0.161***	0.00656	0.261***
	(0.0197)	(0.0319)	(0.0343)	(0.0402)	(0.0740)
dummy household from urban	0.0606***	0.0177	0.0207	0.169***	-0.0748
	(0.0197)	(0.0374)	(0.0316)	(0.0348)	(0.0683)
Constant	1.805***	-0.0650	0.155	5.826***	8.656***
	(0.248)	(0.655)	(1.125)	(0.967)	(1.508)
Observations	19,662	6,478	6,591	5,242	1,351
R-squared	0.083	0.108	0.035	0.041	0.063

*** = significant at 0.1%, ** = significant at 1%, * = significant at 5%. Robust standard errors in parentheses. Dependent Variable: ln(number of pack of cigarettes consumed). HH is household head.

Notes: We test for endogeneity of the cigarette price variable for the overall sample and each four subsamples, and find that the null of exogeneity is rejected. Hence, generalized method of moments (GMM) estimation is used where the instruments employed are regional fixed effects.

Sources: Authors' calculations using data from the Survey of Retail Prices of Commodities for the Generation of CPI and Family Income Expenditure Survey (FIES), both provided by the Philippine Statistics Authority (PSA).

Table 3
Estimates of Overall Price Elasticity of Demand for Cigarettes – 2009

	(1)	(2)	(3)	(4)	(5)
			Income Deciles		
VARIABLES	**Overall**	**1st-3rd**	**4th-6th**	**7th-9th**	**10th**
ln(cigarette price)	-0.795***	-0.916***	-0.701***	-0.566***	-0.465***
	(0.0352)	(0.0534)	(0.0431)	(0.0550)	(0.105)
ln(HH income)	0.526***	0.592***	0.467***	0.427***	0.328***
	(0.0124)	(0.0255)	(0.0298)	(0.0331)	(0.0607)
HH age 18-29	0.257***	0.228***	0.251***	0.181*	-0.0806
	(0.0445)	(0.0686)	(0.0776)	(0.0967)	(0.253)
HH age 30-45	0.0975***	0.116**	0.0252	0.0403	0.0855
	(0.0300)	(0.0500)	(0.0550)	(0.0580)	(0.119)
HH age 46-59	0.179***	0.180***	0.139***	0.141***	0.183*
	(0.0284)	(0.0486)	(0.0525)	(0.0521)	(0.0969)
dummy HH is male	0.469***	0.591***	0.456***	0.379***	0.446***
	(0.0317)	(0.0598)	(0.0596)	(0.0531)	(0.0967)
HH education: none to primary	0.419***	0.359***	0.399***	0.353***	0.330**
	(0.0334)	(0.0855)	(0.0592)	(0.0545)	(0.131)
HH education: secondary	0.254***	0.157*	0.214***	0.121**	0.326***
	(0.0311)	(0.0885)	(0.0579)	(0.0474)	(0.0894)
dummy HH has a job	0.147***	0.300***	0.0894	0.148***	-0.00724
	(0.0330)	(0.0696)	(0.0625)	(0.0528)	(0.0927)
dummy household has insurance	-0.165***	-0.144*	-0.144***	-0.143***	-0.231**
	(0.0257)	(0.0755)	(0.0429)	(0.0379)	(0.101)
ln(family size)	0.134***	-0.0882**	0.0847**	0.245***	0.454***
	(0.0227)	(0.0377)	(0.0412)	(0.0463)	(0.0946)
dummy household from urban	0.276***	0.0559	0.206***	0.325***	0.471***
	(0.0222)	(0.0406)	(0.0355)	(0.0441)	(0.113)
Constant	-0.723***	-5.694***	0.0638	0.481	0.691
	(0.244)	(0.679)	(1.115)	(0.967)	(1.214)
Observations	23,639	8,123	7,686	6,156	1,674
R-squared	0.100	0.114	0.054	0.053	0.063

*** = significant at 0.1%, ** = significant at 1%, * = significant at 5%. Robust standard errors in parentheses. Dependent Variable: ln(number of pack of cigarettes consumed). HH is household head.

Notes: We test for endogeneity of the cigarette price variable for the overall sample and each four subsamples, and find that the null of exogeneity is rejected. Hence, generalized method of moments (GMM) estimation is used where the instruments employed are regional fixed effects.

Sources: Same as Table 2.

Table 4
Heckman Model of Sample Selection

VARIABLES	(1)	(2)	(3)
mills	-0.945***		
	(0.339)		
ln(cigarette price)		-0.896***	-0.173***
		(0.0452)	(0.0266)
ln(HH income)		0.607***	-0.128***
		(0.0192)	(0.00894)
HH age 18-29		0.116***	0.0915***
		(0.0416)	(0.0315)
HH age 30-45		0.0888***	0.0102
		(0.0245)	(0.0186)
HH age 46-59		0.0983***	0.104***
		(0.0246)	(0.0175)
dummy HH is male		0.170***	0.357***
		(0.0388)	(0.0167)
HH education: none to primary		0.356***	0.284***
		(0.0317)	(0.0192)
HH education: secondary		0.304***	0.274***
		(0.0323)	(0.0179)
dummy HH has a job		0.0376	0.0790***
		(0.0266)	(0.0187)
dummy household has insurance		-0.0530***	-0.0165
		(0.0193)	(0.0149)
ln(family size)		-0.124***	0.392***
		(0.0373)	(0.0137)
dummy household from urban			0.165***
			(0.0141)

*** = significant at 0.1%, ** = significant at 1%, * = significant at 5%. Robust standard errors in parentheses. Dependent Variable: ln(number of pack of cigarettes consumed). HH is household head.

Notes: Column (1) shows the mills ratio., while Columns (2) and (3) present the estimates of the structural and selection equations, respectively.

Sources: Same as Table 2.

Table 5
Estimates of Smoking Prevalence and Smoking Intensity

VARIABLES	(1) Prevalence	(2) Intensity
ln(cigarette price)	-0.130***	-0.841***
	(0.00934)	(0.0434)
ln(HH income)	-0.0198***	0.557***
	(0.00314)	(0.0144)
HH age 18-29	0.0330***	0.129***
	(0.0110)	(0.0419)
HH age 30-45	0.00488	0.0186
	(0.00649)	(0.0248)
HH age 46-59	0.0390***	0.150***
	(0.00610)	(0.0233)
dummy HH is male	0.135***	0.491***
	(0.00600)	(0.0229)
HH education: none to primary	0.116***	0.451***
	(0.00676)	(0.0258)
HH education: secondary	0.111***	0.439***
	(0.00633)	(0.0241)
dummy HH has a job	0.0288***	0.108***
	(0.00665)	(0.0254)
dummy household has insurance	-0.00333	-0.0127
	(0.00517)	(0.0197)
ln(family size)	0.131***	0.499***
	(0.00479)	(0.0183)
dummy household from urban	0.0628***	0.243***
	(0.00488)	(0.0186)
Observations	41,544	41,544

*** = significant at 0.1%, ** = significant at 1%, * = significant at 5%. Robust standard errors in parentheses. Dependent Variable: ln(number of pack of cigarettes consumed). HH is household head.

Sources: Same as Table 2.

the number of cigarette users (smoking prevalence). Our estimated price elasticities of smoking intensity and prevalence fall at -0.841 and -0.130, respectively. Adding the two estimates gives us the overall price elasticity which is approximately equal to our estimate in Table 2. This finding is consistent with household-level cigarette demand analysis in developing countries such as Lance,Akin, Dow, and Loh (2004), Bishop et al. (2007), and Mao, Sung, Hu, and Yang (2007) for China, Jimenez-Ruiz, Sáenz de Miera, Reynales-Shigematsu, Waters, and Hernández-Ávila (2008) for Mexico, and Onder (2002) for Turkey.

Impact of the 2012 Sin Tax Reform Act

To quantitatively assess the impact of the Sin Tax Reform Act (2012) on cigarette demand, we constructed an independently pooled cross-sectional data set which covers the period before and after the Sin Tax Reform law. In Tables 6–8, we present the results of the impact of the sin tax law reform on cigarette consumption and cigarette demand elasticities. We found the following interesting insights. Our estimates provide empirical evidence to the observation that household-level cigarette consumption contracted in the post-reform period in 2015. The actual decline is from an average of 62 packs to 52 in 2015. In our DID model, the DID parameter (dummy 2015 X dummy treat in Table 6) is statistically significant and negative, providing strong evidence that the reform has been effective in reducing household cigarette consumption, accounting for as much as 70% of the actual decline in cigarette consumption from 2009 to 2015.

Moreover, the enormous increase in excise taxes from 2009 to 2015 has shifted upwards the sensitivity of cigarette demand to price increases, making demand less inelastic,thereby eliciting sizeable contractions in cigarette consumption (Table 7). Decomposing the impact of the Sin Tax Reform Act (2012)into its effect on smoking prevalence and intensity, our empirical exercise reveals that the impact on smoking intensity is significantly higher than on smoking prevalence (Table 8). The Sin Tax Reform Act (2012)has reduced the number of cigarettes purchased by smokers more than the number of cigarette users over the period 2009 to 2015. This is expected due to the addictive nature of cigarettes which attenuates the impact of the reform on the decision of smokers to quit. Although tobacco use prevalence in general significantly decreased among adults from 29.7% in 2009 to 23.8% in 2015, the proportion of current smokers who were advised to quit by health care providers and the proportion of smokers who successfully quit in the past 12 months remained level from 2009 to 2015 (Global Adult Tobacco Survey[GATS], 2017).

Conclusions and Recommendations

This paper supports earlier studies that cigarette consumption is price inelastic. Nevertheless, demand has become less inelastic in the Philippines over the period 2009 to 2015, indicating a more responsive cigarette demand to price increases. More interesting is the result that of the total effect of cigarette price increase on demand, the decrease in consumption by smokers (smoking intensity) accounts for much of the decline in cigarette consumption, rather than the decrease in the number of cigarette users (smoking prevalence).

The findings are also consistent with other studies that reveal that a rise in income increases the demand for cigarettes; college graduates are more likely to consume fewer cigarettes; poor households are relatively more responsive to increases in cigarette price than rich households.

The major contribution of the study is our analysis of the impact of the Sin Tax Reform Act (2012). The results show that the increase in excise tax has been effective in reducing cigarette consumption in the country and in making cigarette demand more responsive to price increases. Specifically, the tax reform has reduced the number of cigarettes purchased by smokers more than the number of cigarette users.

The findings have major policy implications for the country. First, the implementation of the annual increase in excise tax should be continued. In 2015 and 2016, excise taxes as a percentage of cigarette retail prices fell short below the international threshold of 70%. To determine the increase in excise tax, two important factors should be considered, namely, inflation rate and the increase in per capita income. The rising per capita income in the country will increase tobacco consumption in the coming years. To guarantee that cigarettes will continue to be less affordable, the policy goal is to ensure that the relative increase in price due to an increase in excise tax should be higher than the rise in per capita income.

On inflation rate, at the very least, the increase in excise tax should be either 4% as mandated by the law

Table 6
The Sin Tax Reform Act and the Cigarette Consumption - DID Approach

VARIABLES	(1) OLS	(2) 2SLS	(3) GMM
dummy 2015	-16.97***	-53.37***	-63.22***
	(3.810)	(4.901)	(4.734)
dummy treat	-19.22***	-11.16***	-10.29***
	(1.321)	(1.516)	(1.284)
dummy 2015 X dummy treat	-2.339	-7.248***	-4.311**
	(1.854)	(2.244)	(1.931)
cigarette price	-0.682***	-2.135***	-1.765***
	(0.0773)	(0.0951)	(0.0742)
dummy 2015 X cigarette price	-0.560***	0.802***	0.866***
	(0.0956)	(0.114)	(0.0980)
HH income	1.67e-05**	2.76e-05**	4.34e-06
	(7.27e-06)	(1.09e-05)	(8.78e-06)
dummy 2015 X HH income	-4.87e-06	-1.54e-05	2.63e-06
	(7.36e-06)	(1.06e-05)	(8.74e-06)
HH age 18-29	5.917***	10.76***	10.48***
	(1.745)	(1.762)	(1.752)
HH age 30-45	-1.794	0.771	2.127*
	(1.120)	(1.137)	(1.119)
HH age 46-59	8.312***	10.68***	10.38***
	(1.105)	(1.112)	(1.109)
dummy HH is male	23.10***	25.82***	24.60***
	(0.919)	(0.949)	(0.944)
HH education: none to primary	26.34***	34.23***	29.45***
	(1.282)	(1.325)	(1.233)
HH education: secondary	19.18***	25.29***	22.38***
	(1.173)	(1.204)	(1.132)
dummy HH has a job	6.911***	11.37***	9.687***
	(1.089)	(1.131)	(1.125)
dummy household has insurance	-0.712	2.710**	4.891***
	(1.050)	(1.228)	(1.177)
ln(family size)	21.44***	27.38***	25.15***
	(0.856)	(1.083)	(1.037)
dummy household from urban	11.06***	17.18***	16.89***
	(0.895)	(1.056)	(1.037)
Observations	79,944	79,944	79,944
R-squared	0.292	0.287	0.286

*** = significant at 0.1%, ** = significant at 1%, * = significant at 5%. Robust standard errors in parentheses. Dependent Variable: number of pack of cigarettes consumed. DID = difference-in-difference; OLS = ordinary least squares; 2SLS = two-stage least squares; GMM = generalized method of moments; HH = household head.

Notes: For the 2SLS and GMM estimations, we used regional fixed effects as instruments for ln(cigarette price).

Sources: Same as Table 2.

Table 7
The Sin Tax Reform Act and the Overall Price Elasticity of Demand for Cigarettes

VARIABLES	(1) OLS	(2) 2SLS	(3) GMM
dummy 2015	1.244***	0.942***	0.995***
	(0.256)	(0.258)	(0.256)
ln(cigarette price)	-0.660***	-0.815***	-0.808***
	(0.0270)	(0.0318)	(0.0305)
dummy 2015 X ln(cigarette price)	-0.319***	-0.174***	-0.131***
	(0.0472)	(0.0502)	(0.0497)
ln(HH income)	0.452***	0.462***	0.485***
	(0.0165)	(0.0165)	(0.0163)
dummy 2015 X ln(HH income)	0.0305	0.0196	0.00217
	(0.0189)	(0.0190)	(0.0189)
HH age 18-29	0.140***	0.148***	0.139***
	(0.0318)	(0.0318)	(0.0318)
HH age 30-45	0.0638***	0.0692***	0.0597***
	(0.0200)	(0.0200)	(0.0200)
HH age 46-59	0.126***	0.129***	0.129***
	(0.0187)	(0.0187)	(0.0187)
dummy HH is male	0.297***	0.297***	0.303***
	(0.0206)	(0.0206)	(0.0206)
HH education: none to primary	0.341***	0.343***	0.335***
	(0.0220)	(0.0220)	(0.0219)
HH education: secondary	0.238***	0.239***	0.238***
	(0.0205)	(0.0205)	(0.0205)
dummy HH has a job	0.0792***	0.0783***	0.0946***
	(0.0218)	(0.0218)	(0.0218)
dummy household has insurance	-0.0912***	-0.0901***	-0.0855***
	(0.0163)	(0.0163)	(0.0163)
ln(family size)	0.0365**	0.0344**	0.0221
	(0.0152)	(0.0152)	(0.0151)
dummy household from urban	0.167***	0.177***	0.158***
	(0.0152)	(0.0153)	(0.0151)
Constant	-0.0487	0.298	0.0223
	(0.197)	(0.201)	(0.199)
Observations	43,301	43,301	43,301
R-squared	0.083	0.083	0.083

*** = significant at 0.1%, ** = significant at 1%, * = significant at 5%. Robust standard errors in parentheses. Dependent Variable: ln(number of pack of cigarettes consumed). OLS = ordinary least squares; 2SLS = two-stage least squares; GMM = generalized method of moments; HH = household head.

Notes: For 2SLS and GMM estimations, we used regional fixed effects as instruments for ln(cigarette price).

Sources: Same as Table 2.

Table 8
The Sin Tax Reform Act and the Price Elasticities of Smoking Prevalence and Smoking Intensity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						Income Deciles				
VARIABLES	**Overall**		**1st to 3rd**		**4th to 6th**		**7th to 9th**		**10th**	
	Prevalence	**Intensity**	**Prevalence**	**Intensity**	**Prevalence**	**Intensity**	**Prevalence**	**Intensity**	**Prevalence**	**Intensity**
dummy 2015	0.00469***	1.499***	0.0193***	2.287***	-0.000583	-0.347	0.0193***	2.287***	0.376***	7.893***
	(0.000622)	(0.264)	(0.00336)	(0.673)	(0.00185)	(1.176)	(0.00336)	(0.673)	(0.00415)	(1.716)
ln (cigarette price)	-0.00132***	-0.559***	-0.00427***	-0.855***	-0.000941***	-0.598***	-0.00427***	-0.855***	-0.000205	-0.0849
	(6.99e-05)	(0.0297)	(0.000263)	(0.0526)	(9.02e-05)	(0.0573)	(0.000263)	(0.0526)	(0.000343)	(0.142)
dummy 2015 X ln (cigarette price)	-0.00131***	-0.558***	-0.00260** *	-0.520***	-0.000544***	-0.346***	-0.00260***	-0.520***	-0.00287***	-1.188***
	(0.000146)	(0.0620)	(0.000508)	(0.102)	(0.000167)	(0.106)	(0.000508)	(0.102)	(0.000709)	(0.293)
ln(HH income)	0.00111***	0.470***	0.00287***	0.574***	0.000760***	0.483***	0.00287***	0.574***	0.000741***	0.306***
	(2.25e-05)	(0.00954)	(9.72e-05)	(0.0195)	(3.44e-05)	(0.0219)	(9.72e-05)	(0.0195)	(0.000115)	(0.0476)
dummy 2015 X ln (HH income)	0.000200***	0.0849***	5.80e-05	0.0116	0.000271*	0.172*	5.80e-05	0.0116	-0.000680***	-0.281***
	(3.73e-05)	(0.0158)	(0.000279)	(0.0559)	(0.000150)	(0.0953)	(0.000279)	(0.0559)	(0.000263)	(0.109)
Full set of controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43,301	43,301	14,601	14,601	14,277	14,277	14,601	14,601	3,025	3,025

*** = significant at 0.1%, ** = significant at 1%, * = significant at 5%. Robust standard errors in parentheses. Dependent Variable: ln (number of pack of cigarettes consumed).
HH = household head.

Sources: Same as Table 2.

or indexed to the current inflation rate, whichever is higher. Since the law pegged the increase at 4% per year, this particular provision of the law requires an amendment to ensure that the increase in excise tax will not be lower than the current inflation rate. On the other hand, to help counteract the effect of the rising per capita income on cigarette consumption, an effective anti-smoking drive is needed to enhance public awareness of the adverse health consequences of smoking.

Second, the relatively inelastic demand for cigarettes and the dominance of the elasticity of smoking intensity over the elasticity of smoking prevalence support the evidence to the addictive nature of cigarette smoking. Smokers attempting to quit smoking struggle with nicotine addiction, thus, requiring professional support and guidance. The results of the 2015 GATS show that the percentage of smokers in the country who successfully quit smoking remained small and in fact went down between 2009 (4.5%) and 2015 (4.0%). Thus, the tobacco treatment or rehabilitation program of the government should be reviewed to make it more effective in increasing the proportion of smokers who successfully kick the habit.

Third, the finding supports the positive effect of higher education in lowering cigarette consumption. This could be attributed to greater awareness by more educated people on the health consequences of smoking than by those with less education. Making education more accessible and affordable to the poor will help reduce tobacco use in the country. The implementation of the Universal Access to Quality Tertiary Education Act (Republic Act No. 10931, 2016)may help address the problem. In addition, the proportion of tobacco tax revenues earmarked for displaced tobacco farmers in tobacco-growing provinces may be directed for the educational program of children of these farmers.

Finally, while not directly related to the paper's findings, a periodic review of the implementation of the non-price tobacco control measures should be undertaken to increase their effectiveness in reducing tobacco consumption in the country. For example, according to the 2015 GATS, 58.6% of survey respondents noticed tobacco promotion, advertisement, and sponsorship in the past 30 days while 40.5% noticed tobacco advertisements in stores where cigarettes are sold. While the proportions are lower compared to the results of the 2009 GATS, the percentage is still high considering that existing laws require a complete ban in tobacco advertisements and promotions. Also, despite the complete ban on smoking in public places, it is common to see smokers in public utility vehicles and public transport terminals. It is also common to see youth smoking cigarette in public places despite the ban on the sale of cigarettes to minors.

Future research may consider the following limitations of the paper. The FIES, which is the source of data, did not consider the type or brand of cigarettes consumed by the households. Thus, the higher household expenditures on tobacco products in 2015 compared to 2009 could be attributed to a shift in preference for high quality and more expensive cigarettes, given the increase in household income during the period, than to increases in quantity of cigarettes consumed. Also, other important determinants of cigarette consumption were not considered such as the presence of children in the household, family history of dreadful diseases associated with smoking, or working hours of household members. In terms of assessing the impact of the sin tax reform, the empirical exercise has yet to take into account the change in the affordability of cigarettes over the period. A more nuanced analysis would involve simultaneously evaluating the impact of the reform on cigarette consumption and cigarette affordability.

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