Assessing the Impact of the Philippine Sin Tax Reform Law on the Demand for Cigarettes

Working Paper Series 2018-03-051

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I. Introduction

One of the significant legislations during the Aquino Administration was Republic Act 10351, otherwise known as the *Sin Tax Reform Act of 2012*. Considered a landmark legislation, the law addressed the long-standing structural weaknesses of the country's tobacco tax system. It considerably increased the specific excise tax on tobacco and tobacco products, simplified the tax structure, removed the price classification freeze and indexed the tax rates to address inflation. 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. And 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 current law provides a two-tiered system effective January 2013 with a gradual shift to a 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.

The law is aligned with the country's commitments under the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) along with other tobacco control measures that the government has been implementing such as the ban of smoking in public places, ban in tobacco advertising, promotion and sponsorship of public events by tobacco companies, regulation on packaging and labeling of tobacco products, and health warnings including graphic images. The tobacco control measures were designed to curb smoking and other forms of tobacco use due to their health and economic consequences. According to the comprehensive review conducted by the International Agency for Research on Cancer (IARC) in 2011, several studies have shown that the economic costs of tobacco use are undoubtedly substantial (IARC, 2011; Quimbo et al., 2012). These include the health care expenses for treatment of diseases caused by tobacco (such as tuberculosis, lung cancer, cardiovascular diseases, etc.) and the loss in productivity due to tobacco-related diseases and premature deaths. However, among the tobacco control measures, "raising tobacco taxes is the most effective and cost-effective strategy for reducing tobacco use" (WHO, 2015:26). Higher tobacco taxes translate to higher prices which in turn reduce the demand for tobacco products and promote quitting (IARC, 2011).

The health and economic consequences of tobacco use is a long-standing policy concern in the Philippines because the country is one of the largest tobacco consuming countries in the Western Pacific region (Quimbo et al, 2012). Based on the 2015 Global Adult Tobacco Survey (GATS), 23. 8 percent of adults ages 15 and above or 16.6 million adults use tobacco.

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As a consequence of the significant increase in excise tax, the price of tobacco products has substantially gone up. After almost five (5) years of implementation, what has been the impact of the *Sin Tax Reform Law* on the demand for cigarettes? This study aims to: (i) to analyze the regulatory environment affecting demand for and supply of tobacco products in the country; (ii) to estimate the price and income elasticities of the demand for cigarettes after the tax reform; (iii) to determine the impact of the tax reform on cigarette consumption; (iv) to determine the impact of the tax reform on the price responsiveness of the demand for cigarettes; and, (v) to make policy recommendations for future tax reform in the country.

This empirical study offers two (2) major contributions on tobacco economics and taxation. *First*, to our knowledge, this is the first analysis to evaluate empirically the impact of the tax reform on cigarette demand in the Philippines after the policy reform was implemented starting 2013. The most recent study on the demand for cigarettes in the country was done in 2012 by Quimbo et al. (2012) using the 2003 Family Income and Expenditure Survey (FIES). *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 for the government in designing the next sin tax policy reform. The current administration of President Duterte is proposing a tax policy reform package, one component of which is a health tax package aimed at increasing taxes on sweetened beverages and the sin tax rates on cigarettes and alcoholic drinks.

The paper is organized as follows. Section II discusses the regulatory environment to control tobacco use in the country. Section III reviews existing studies on tobacco demand in the Philippines and other low- and middle-income countries. Section IV and Section V present the theoretical framework, and the data and methodology, respectively. In Section VI, we discuss the results of our empirical analyses, while the last section (Section VII) concludes and offers policy recommendations.

II. The Regulatory Environment: Tobacco Control Measures

This section discusses the measures implemented by the government to reduce the demand for and supply of tobacco products in the country. These are measures aimed at eliminating or reducing tobacco use and restricting the availability of cigarettes and other tobacco products. The control measures come in various forms supported by legislations, executive orders (EO) and administrative orders (AO). The commitment of the government to protect its people from tobacco-related diseases was strengthened with the ratification by the Senate of the WHO FCTC in June 2005[2]. The Convention provides the framework for measures

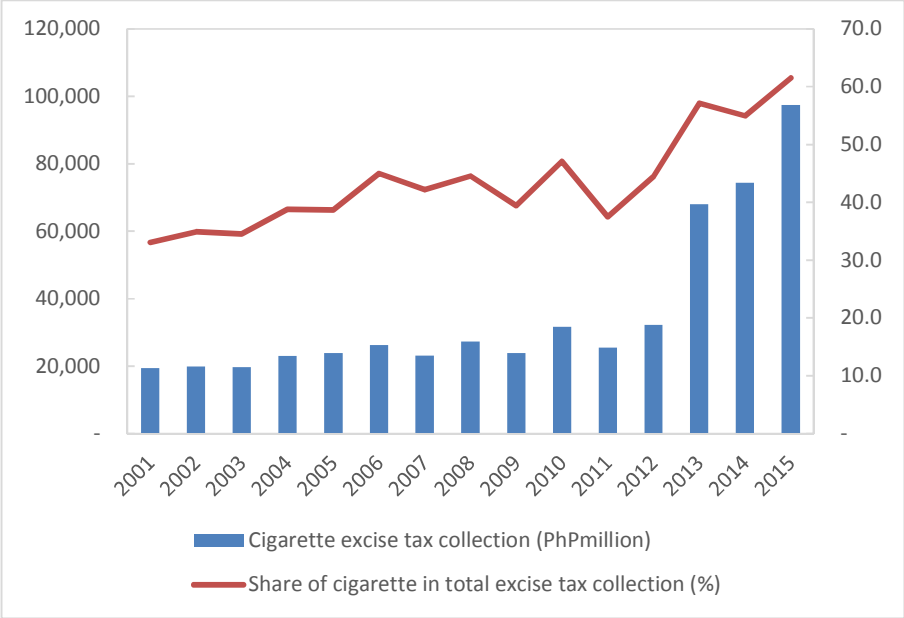
[2] The WHO FCTC is an evidence-based treaty, the primary objective of which is "to protect present and future generations from the devastating health, social, environmental and economic consequences of tobacco consumption and exposure to tobacco smoke" (WHO, 2005).

to control tobacco use that will be implemented by the country signatories to the convention (WHO, 2005).

Measures to lower demand for tobacco products

Price and tax measures. Excise taxes, either ad valorem or specific, are considered the most effective measure to reduce the demand for tobacco products because of their effects in increasing the price (WHO, 2015). The country's tobacco tax system has been considered complicated until Republic Act No.10351 or the Sin Tax Reform Act was passed into law in July 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. That it generates extra revenues for the government is a secondary objective. The excise tax collection from locally manufactured cigarettes went up from PhP32,163 million in 2012 to PhP67,941 million in 2013 or an increase of 111.2% (Figure 1). By 2015, locally manufactured cigarettes accounted for 61.5% of the total excise tax collection in the country. The revenues are used to finance the government's universal health care program.

Figure 1. Excise tax collections from locally manufactured cigarettes, 2001-2015



Source: Large Taxpayers Service, Bureau of Internal Revenue (BIR)

For tobacco, the excise tax applies to imports and locally manufactured cigarettes, either for the domestic market or for exports. This is in addition to the value added tax (12%) for locally manufactured cigarettes and tariffs for imported cigarettes.

As shown in Table 1, the tax reform increased the tax rates. It also simplified the tax structure by gradually shifting from the four-tier system implemented in 1997 - 2012 to a two-tier system in 2013 - 2016 and then to a unitary tax system effective 2017 (Figure 2).

The tax reform also removed the price classification freeze. Under the law's predecessors (RA 8424 for 1997-2003 and RA 9334 for 2004 -2012), the four-tier system followed a scheme where each cigarette brand was classified based on its average net retail price in October 1996[3]. The lower the net retail price, the lower is the excise tax. Section 145 of RA 9334 provided that the classification remains in force until revised by Congress. However, the Congress never revised the classification scheme; thus, the classification remained the same despite the increase in the net retail price of brands over 15 years from 1997 to 2012.

Furthermore, the current tax system is sound, unlike its predecessors, as the tax rate is mandated to increase by 4% every year effective 2018. The rate is in fact higher than the current inflation rate of less than 3%.

The current tax system is considered simpler, easier to administer, and effective in reducing tax evasion. The uniform tax rate, regardless of the brand and net retail price, removes the incentive to misclassify brands or under-declare cigarette products for tax purposes. But most importantly, it prevents smokers from shifting to cheaper brands whenever there is an increase in price arising from a tax increase.

Non-price measures. Non-price measures are also recognized as effective in reducing tobacco use.

a. *Ban on smoking in public places.* To protect the public from exposure to tobacco smoke, several legislations banned smoking in public places. These include RA No. 8749, otherwise known as the "Philippine Clear Act of 1999", RA No. 9211 known as "Tobacco Regulation Act of 2003", and Executive Order No. No. 26 signed in March 2016 and enforced effective July 2017. Public places include "all places, fixed or mobile, that are accessible or open to the public or places for collective use, regardless of ownership or right to access" (Section 1 of EO No. 26). Only in designated areas is smoking allowed. "No Smoking" signs are required to be posted in noticeable locations within the public places.

   Smoking in public utility vehicles and public transport terminals is also prohibited by virtue of Land Transportation Franchise Regulatory Board (LTFRB) Memorandum Circular No. 36, s. 2009. Smoking is also prohibited in government premises, buildings and grounds through the Civil Service Commission Memorandum Circular No. 17, s.2009.

b. *Ban on tobacco advertisement, promotion and sponsorship.* Under RA No.9211, all forms of tobacco advertisement and promotion in mass media were banned effective

[3] Section 145 of RA9334 defines net retail price as "the price at which the cigarette is sold on retail in at least twenty (20) major supermarkets in Metro Manila (for brands of cigarettes marketed nationally), excluding the amount intended to cover the applicable excise tax and the value-added tax. For brands which are marketed only outside Metro Manila, the 'net retail price' shall mean the price at which the cigarette is sold in at least five (5) major supermarkets in the region excluding the amount intended to cover the applicable excise tax and the value-added tax". The net retail price is determined by the Bureau of Internal Revenue (BIR) through a price survey conducted by BIT or the National Statistics Office, if deputized by the BIR.

January 2008. Similarly, sponsorships by cigarette companies of any sport, concert, cultural or art event were prohibited effective January 2008.

c. *Health warnings on cigarette packages.* Warnings on the adverse health consequences of tobacco consumption have gradually evolved over the years from text warnings on cigarette packages under RA No. 9211 effective January 1, 2004 to graphic warnings under RA No. 10643 effective March 3, 2016. An example of text warning is "Government warning: cigarette smoking is dangerous to your health".

Text warnings are considered insufficient in conveying the dangers of smoking while graphic health warnings are considered more effective in instilling in the minds of the public the truth about the dangers of smoking and exposure to tobacco smoke. Section 4 of RA 10643 defines graphic health warnings as "the photographic image printed on the tobacco product package which accurately depicts the hazards of tobacco use and is accompanied by textual warning related to the picture". The law provides guidelines and specifications on the printing of the graphic warnings. Sale of cigarettes without the graphic warning is prohibited. Also prohibited are descriptors in cigarette or tobacco packs that may lead consumers to believe that a particular cigarette brand is safer or less harmful.

d. *Public awareness against smoking* – The Department of Health implemented "Yosi Kadiri" in 1994. Translated "Cigarette, Filthy", the campaign specifically targeted the youth (7-19 years old) and aimed at discouraging them to start smoking. The campaign was considered the most successful anti-smoking drive of the government so far. The program's mascot became the face of smoking and its harmful effects in the 1990s.

Measures to lower supply of tobacco

a. *Ban on the sale to and by minors of tobacco products*. Minors are not allowed access to cigarettes and tobacco products. This means that minors are not allowed to buy or sell or smoke cigarettes and any tobacco product. Minors include those members of the population below 18 years old.

b. *Internal revenue tax stamps* – Effective November 2014, imported and locally manufactured cigarettes, whether for domestic sale or for exports, are affixed with internal revenue tax stamps[4]. The stamps serve as a measure to ensure that payment of the correct excise tax has been done by the importer or local manufacturer prior to withdrawal of the cigarettes from the production or importation site. Cigarettes found without the tax stamps are confiscated and subject to penalties. Thus, the measure also functions to combat smuggling and other forms of illicit cigarette trade. The

[4] Internal revenue stamp refers to the "BIR-issued stamp with a dimensional size of 23 millimeters (mm) by 43 mm containing multi-layered security features and an IRSIS-assigned Unique Identifier Code and a Quick Reference Code containing information pertinent only to the cigarette container (e.g. pack) to which the internal revenue stamp is affixed" (Revenue Regulation No. 7-2014).

volume of removal substantially went down after 2012 although an increase was registered in 2015 (Figure 3).

To ensure the authenticity of the revenue stamps, the ordering and distribution of the stamps is done through the Internal Revenue Stamp Integrated System (IRSIS) while payment is done only through the Electronic Filing and Payment System (eFPS) of the BIR[5]. Furthermore, on–the-spot surveillance is done in the cigarette factory, the manufacturer's storage facilities, or in the local market.

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c. *Assistance to displaced tobacco farmers*. Tobacco production in the country is expected to decrease as a result of the tax reform. To assist the affected farmers, 15 percent of the increase in total revenue collected from the tobacco excise tax under RA No. 8240 will be given to the farmers. According to the law, the fund is intended solely to help displaced farmers and workers find alternative economic activities.

[5] IRSIS refers to the "web-based application system for ordering and distribution of internal revenue stamps, as well as, for real-time monitoring of the said stamps upon its affixture on the cigarette products, and for generating the required reports" (Revenue Regulation No. 7-2014).

Table 1: Tobacco Tax Regulations

	R.A. 8424 (1997)	R.A. 9334 (2004)	R.A. 10351 (2012)
A. Tobacco Products			
a. Tobacco twisted by hand or reduced into a condition to be consumed in any manner other than the ordinary mode of drying and curing. b. Tobacco prepared or partially prepared with or without the use of any machine or instruments or without being pressed or sweetened. c. Fine-cut shorts and refuse, scraps, clippings, stems, and sweepings of tobacco	P0.75 per kilogram	P1 per kilogram	P1.75 per kilogram effective January 2013
d. Tobacco specially prepared for chewing so as to be unsuitable for use in any other manner	P0.60 per kilogram	P0.79 per kilogram	P1.50 per kilogram effective January 2013.
		The tax rates on tobacco products shall be increased by 6% every 2 years starting January 2007 until January 2011.	The tax rates on tobacco products shall be increased by 4% every year thereafter effective January 2014.
B. Cigars & Cigarettes			
a. Cigars	P1 per cigar	10% ad valorem tax if net retail price per cigar is P500 or less.	Effective January 2013: - Ad valorem tax of 20% of net retail price per cigar. - Specific tax of P5.00 per cigar.
		P50 + 15% of net retail price in excess of P500 if net retail price per cigar is more than P500	Effective January 2014: - Ad valorem tax of 20% of net retail price per cigar.

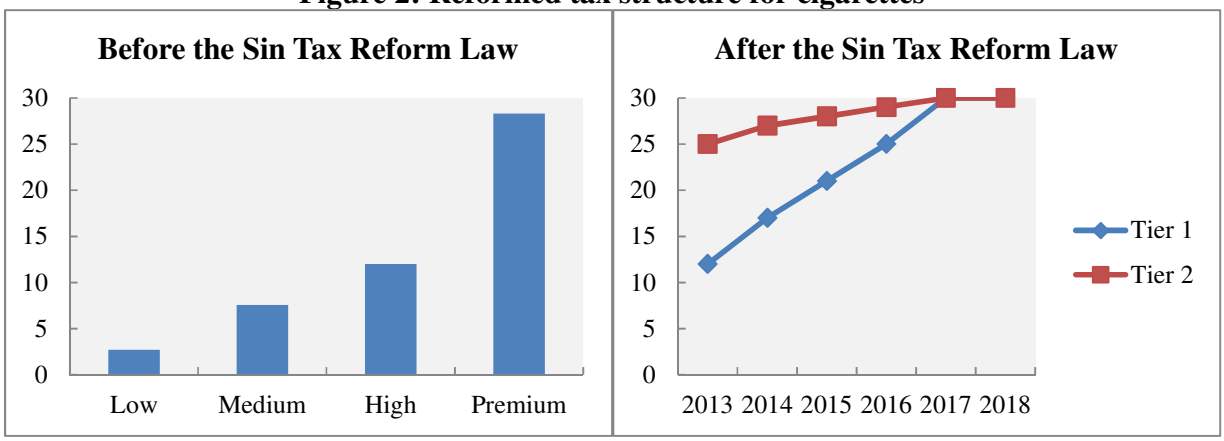
	R.A. 8424 (1997)	R.A. 9334 (2004)	R.A. 10351 (2012)
			- Specific tax of P5.00 per cigar shall be increased by 4%.
b. Cigarettes packed by hand	P0.40 per pack	- P2 per pack effective January 2005 - P2.23 per pack effective January 2007 - P2.47 per pack effective January 2009 - P2.72 per pack effective January 2011	- P12 per pack effective January 2013 - P15 per pack effective January 2014 - P18 per pack effective January 2015 - P21 per pack effective January 2016 - P30 per pack effective January 2017 - The rates shall be increased by 4% every year effective Jan. 2018.
c. Cigarettes packed by machine	If net retail price is below P5 per pack P1 per pack	If net retail price is below P5 per pack: - P2 per pack effective January 2005 - P2.23 per pack effective January 2007 - P2.47 per pack effective January 2009 - P2.72 per pack effective January 2011	If net retail price is P11.50 & below per pack: - P12 per pack effective January 2013 - P17 per pack effective January 2014 - P21 per pack effective January 2015 - P25 per pack effective January 2016 - P30 per pack effective January 2017 The rate shall be increased by 4% every year thereafter effective January 2018.
	If net retail price is P5 to 6.50 per pack: P5 per pack	If net retail price is P5 to 6.50 per pack: - P6.35 per pack effective January 2005 - P6.74 per pack effective January 2007 - P7.14 per pack effective January 2009 - P7.56 per pack effective January 2011	If net retail price is more than P11.50 per pack: - P25 per pack effective January 2013 - P27 per pack effective January 2014 - P28 per pack effective January 2015 - P29 per pack effective January 2016 - P30 per pack effective January 2017 The rate shall be increased by 4% every year thereafter effective January 2018.

	R.A. 8424 (1997)	R.A. 9334 (2004)	R.A. 10351 (2012)
	If net retail price is P6.50 to P10 per pack: P8 per pack	If net retail price is P6.50 to P10 per pack: - P10.35 per pack effective January 2005 - P10.88 per pack effective January 2007 - P11.43 per pack effective January 2009 - P12.00 per pack effective January 2011	
	If net retail price is above P10 per pack: P12 per pack	If net retail price is above P10 per pack: - P25 per pack effective January 2005 - P25.06 per pack effective January 2007 - P27.16 per pack effective January 2009 - P28.39 per pack effective January 2011	

Notes: (a) Net retail price excludes the excise tax and value added tax. For Definition, refer to RA relevant section.
(b) Imported cigarettes and cigarettes for exports are subject to the same rates and basis of excise taxes applicable to locally manufactured articles.

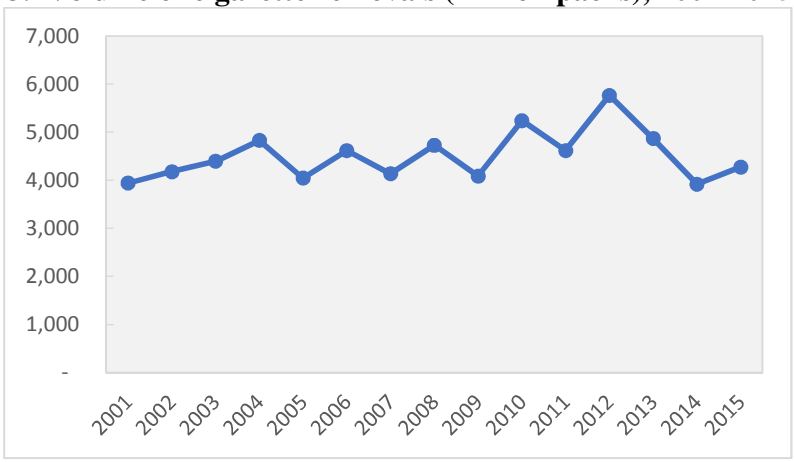
Sources: RA No. 9334; RA No. 10351.

Figure 2: Reformed tax structure for cigarettes



Notes: Prior to the Sin Tax Reform Law, the cigarette tax scheme was complicated and was divided into four tiers depending on the net retail price of cigarettes: low=below P5 per pack; medium=P5 to P6.50 per pack; high=P6.50 to P10 per pack; and premium=above P10 per pack.
Source: RA No. 9334; RA No. 10351.

Figure 3. Volume of cigarette removals (million packs), 2001-2015



Source: Bureau of Internal Revenue

III. Existing Studies on Tobacco Demand and Taxation

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 increases in the price of tobacco products 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 demand for other consumer goods (Tennant, 1950), it is a consensus in the 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]).

Existing elasticity estimates

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 *Curbing the Epidemic* report (1999). 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 countries and about 4% in advanced economies (Jha and Chaloupka, 2000). The thorough synthesis by the 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, empirical evidence on tobacco demand elasticities either using individual- and household-level data or even aggregate data is unfortunately sparse. 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 et al, 2000; Guindon et al, 2003; IARC, 2011). The estimated income elasticity is 0.66 for the full sample. Consistent with economic theory, lower income households are more responsive to changes in both price and income relative to higher income households, with estimated price and income elasticities for the lowest income group at -1.09 and 1.03, respectively.[6]

[6] Prior to the Quimbo study, in Leonel et al (2010), the authors performed simulations to estimate the impact of tax increases on cigarette consumption and smoking prevalence, economic costs due to smoking-related diseases, and government revenue. The study made use of estimated price elasticities ranging from -0.235, which is taken from the Department of Finance (DOF) study on excise tax reform, to -0.149, which is taken from the estimates of the Tobacco and Poverty Project, a collaborative project of the National Tobacco Control Team of the Department of Health (DOH), the College of Public Health of the University of the Philippines-Manila, the Philippine College of Medical Researchers Foundation, Inc., and the Tobacco Free Initiative of the World Health Organization (TFI-WHO) conducted in 2008. The Tobacco and Poverty project reported estimates on the impact of price on the demand for cigarettes using annual data for the period 1970-2004. The study found that the price elasticity of demand for cigarettes range from -0.15 to -0.20, which is generally lower than the estimates found for other

Several studies have also estimated price elasticities for other developing countries in Asia. Bishop et al (2007) used data on urban adult males in ten provinces in China taken from the 1995 Chinese Household Income Project. Employing a two-part model, the study found the estimated price elasticities of smoking prevalence and smoking intensity are -0.213 and -0.250, respectively, with estimated total price elasticity of demand at -0.463. Mao et al (2007) used data taken from the National Smoking Prevalence Survey 2002 and found that lower income Chinese households are more responsive to price changes, with estimated price elasticities of smoking prevalence and smoking intensity for the poor income group at -0.478 and -0.111, respectively.

For India, John (2008) used cross-sectional data taken from the 55th round of National Sample Survey Organization survey conducted from July 1999 through June 2000. He examined the effect of price on demand for cigarettes, bidis, and leaf tobacco separately for urban and rural populations among those households that consumed tobacco products (i.e. price elasticity of smoking intensity). The estimated price elasticities are in line with the findings in the literature: own-price elasticities of demand for each of the three tobacco products are negative and statistically significant, with demand for bidis and leaf tobacco being less inelastic (estimates ranging from -0.92 to -0.86 and -0.88 to -0.87, respectively, depending on rural/urban populations). Demand for cigarettes are found to be relatively inelastic, ranging from -0.34 to -0.18.

A study by Adioetomo et al. (2005) assessed cigarette demand in Indonesia using data taken from the 1999 National Socioeconomic Survey collected by the Central Bureau of Statistics. Using two-stage least squares (TSLS) regression to account for the potential endogeneity of the price variable, the results revealed that price has limited impact on smoking prevalence and more pronounced effect on smoking intensity, with overall price elasticity at -0.61. Consistent with economic theory, cigarette demand of lower income Indonesian households is more responsive relative to demand of higher income households, with price elasticities at -0.67 and -0.31, respectively.

Impact of tobacco taxation

There is a general 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" (WHO, 2015:26). This has led to a number of empirical studies which examined the effectiveness of tobacco taxation including reforms in cutting cigarette use. In Japan, a special tobacco tax was imposed in 1998 which led to dramatic increases in the real price of tobacco, the most pronounced of which was in 2010 when the price of a pack of Mild Seven—the most popular brand in the country—rose by as much as 37% (Ito and Nakamura, 2013). Using data from a nationally representative longitudinal study of 30,773 individuals aged 50-59 years, Tabuchi et al. (2017) revealed that the tax-induced price uptake in 2010 led to subdued smoking prevalence from 30.5% to 24.3% in 2012. The dramatic price shift affected both cessation among smokers and prevention of relapse

developing countries. The authors performed simulations of the impact of a tax increase on price and total tax revenues using price elasticities derived from the estimations as well as calibrated elasticities from estimates for other developing countries. The simulation exercise revealed that tax revenues are projected to increase by 17.0 to 85.0 percent with tax increases by 20.0 to 100.0 percent and a price elasticity of -0.20.

among quitters. A study by Kim et al. (2006) examined the impact of an average 29% tax-induced tobacco price increase in Korea in 2004 on teenage students, and found that 11.7% quit smoking while 20.5% reduced consumption.

The National Tobacco Campaign (NTC) which commenced in June 1997 is "the most intense and longest running anti-tobacco campaign ever seen" in Australia (Hill and Carroll, 2003, p.ii9). Among other things, the NTC introduced major shifts in the country's tobacco taxation scheme, including (i) the end of State franchise fees which consequently eradicated the opportunity for cross-border and "between state" cigarette tax evasion; (ii) the shift from a weight- to a stick-based system of levying excise taxes on cigarettes, and (iii) the imposition of a Goods and Services Tax (GST) on all tobacco products. Using survey data and logistic regression analysis, Scollo et al. (2003) found that in the 2.4% decrease in smoking prevalence over the period of the NTC, at least two-thirds was due to the impact of the tax reform.

A 2012 National Bureau of Economic Research (NBER) Working Paper by Kevin Callison and Robert Kaestner entitled "Do higher tobacco taxes reduce adult smoking? New evidence of the effect of recent cigarette tax increases on adult smoking" is one of the recent empirical studies which examined the impact of cigarette taxation. 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% (Callison and Kaestner, 2012).

With the solid empirical support on the effectiveness of taxation as part of tobacco control strategy, WHO has published the Technical Manual on Tobacco Tax Administration which synthesizes several 'best practices' in tobacco taxation. These best practices focus on the health benefits of tobacco taxation as well as its role in government revenue generation and thus represents a roadmap for policymakers (WHO, 2010; Chaloupka, Yurekli, and Fong, 2012). Among others, best practices in tobacco taxation include the following: (i) setting tobacco excise tax levels so that they account for at least 70% of the retail prices for tobacco products; (ii) adopting comparable taxes and tax increases on all tobacco products; (iii) automatically adjusting specific tobacco taxes for inflation; (iv) increasing tobacco taxes by enough to reduce the affordability of tobacco products; and (v) including tobacco excise tax increases as part of a comprehensive strategy to reduce tobacco use.

IV. Theoretical Framework

Before the 1990s, tobacco demand was modelled not much differently from the theoretical specification of the demand for other consumer products. Broadly speaking, in most empirical studies, determinants of tobacco consumption included the price of the tobacco product as well as its substitutes and complements, an income variable, an advertising variable, and often some dummy variables intended to the capture the impact of tobacco control measures (IARC, 2011).

Some early economists theorized that demand for tobacco products was irrational due to addictive nature of nicotine and hence postulated that it was not suitable for conventional economic analysis (Chaloupka, 1991). The irrationality is underpinned by the fact that the addictiveness of tobacco "forces" one to consume a product that he might not have bought had he not been addicted to it. This also implies that demand for tobacco products does not respond to changes in the price, hence perfectly price-inelastic (U.S. Department of Health and Human Services, 2000). With perfectly price-inelastic cigarette demand, increases in excise tax is futile in so far as attempting to curb cigarette consumption is concerned.

However, this view is not supported by empirical studies. In the past two decades, developments in modelling tobacco consumption based on economic models of choice have emerged as a result of new insights into addictive behavior, and thus have stirred up a lively methodological debate (IARC, 2011). Initially, tobacco demand was modelled as a contemporaneous function of prices and values of all other controls. Addictive behavior was initially captured through backward-looking "myopic" demand models where current consumption is affected by previous consumption (and hence previous prices). In the late 1980s, however, forward-looking rational addiction models emerged as an improvement on backward-looking models. These were subsequently revised by addiction models that accounted for the time-inconsistent demand behavior of smokers (Chaloupka and Warner, 2000). In this section, we review this progression.

Backward-looking "myopic" addiction models

The central assumption in myopic models lies in the argument that addicted smokers are near-sighted. That is, a myopically addicted person's current consumption is determined by his past consumption. This implies that price as well as income still affects the decision of smokers on how much tobacco products to consume, but once they become addicted to it, individuals tend to ignore or discount the future costs of tobacco use. Under the myopic tobacco demand models, although the conventional law of demand holds—that is, an increase (decrease) in price will decrease (increase) consumption, holding all else constant—the effect of price uptake will be much smaller than the effect of any price decrease (Scollo and Winstanley, 2017).

Forward-looking rational addiction models

The rational addiction framework formally developed by Gary Becker and Kevin Murphy in 1988 is arguably the most influential model of addictive behavior especially in the late 1980s and 1990s (IARC, 2011). The framework has supported the theoretical foundation of many empirical tobacco demand studies (such as Chaloupka [1991] and Becker et al. [1994]) and has also become the standard approach to modelling demand for other addictive consumer products such as coffee (Olekains and Bardsley, 1996) and alcohol (Waters and Sloan, 1995; Grossman et al., 1998). Under the rational addiction framework, individuals are assumed to have stable preferences and may rationally decide to be involved in an addictive behavior such as smoking since this maximizes their lifetime utility (Becker and Murphy, 1988).

A rationally addicted person weighs up on the one hand the satisfaction from current consumption and the dissatisfaction of withdrawal associated with quitting smoking, and the

cost of current and continued smoking and the long-term health effects on the other (Scollo and Winstanley, 2017). Becker and Murphy's framework assumes perfect information in that the full price of the product—which includes not only the monetary price but also the negative health effects and the legal sanctions associated with consumption—is known to individuals.

The rational addiction model bares important implications, which also provide theoretical support for our model specification. The model suggests that more educated and older people will be responsive to both price uptake and expectations on future price increases, and that less-educated and younger individuals will be much less sensitive to information about long-term effects and relatively more responsive to immediate changes in price.

Imperfectly rational addiction models

Although it has been tested and supported by many empirical studies, the Becker-Murphy framework has been criticized severely in some respects (Scollo and Winstanley, 2017). First, the model assumes perfect foresight (Chaloupka and Warner, 1999)—that is, individuals have a very accurate picture of what the future is going to be like and that they fully appreciate the nature and extent of health risks and may perfectly imagine how life would be like if they became ill due to smoking. Second, according to Akerlof (Chaloupka et al., 2000), the model does not allow the possibility that people regret that they ever started smoking given their assumed perfect foresight. Results of surveys indicate that most smokers wish to quit smoking and regret that they started the habit (Fong et al., 2004; Gruber and Köszegi, 2001), hence rendering the framework unrealistic.

Another drawback of the rational addiction framework, which gave rise to imperfectly rational addiction models, is that it uses exponential discounting to capture the fact that smokers value present consumption more than future consumption. Exponential discounting, however, implies that individuals are time-consistent, that is, they have stable preferences (IARC, 2011). In 2001, Gruber and Köszegi argued that consumer preferences are not stable over time: people display different relative preferences when asked on different occasions. This argument underpins imperfectly rational addiction models. Under this strand, the rational, far-sighted part of a person values good health and a long life but efforts to kick the habit are repeatedly squared off by the 'wayward' part of his personality that simply 'adores' smoking (Scollo and Winstanley, 2017). Hence, consumption will fall sharply in response to price uptake, but will then drift back again with time.

V. Data and Methodology

Our primary data source is the 2015 and 2009 Family Income and Expenditure Survey (FIES) provided by the Philippine Statistics Authority (PSA). 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 follow similar approach undertaken by various studies in the tobacco taxation literature such as those mentioned in Section III (e.g. Bishop et al (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 below, in the absence of panel data, pooled cross sections can be very useful for evaluating the impact of a certain event or policy (Wooldridge, 2010). Lastly, there is no available household-level data on cigarette prices. Instead, we use province-wide average prices of cigarettes taken from the Survey of Retail Prices for the Monthly Consumer Price Index (CPI) produced by the PSA.[7] This may give rise to potential endogeneity of the price variable due to the self-reported nature of the price data from the survey.[8] 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. As in below, we address the endogeneity issue by employing of 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 estimate 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: quantity of cigarettes consumed by household i, measured as the number of packs (20 sticks per pack)
P_i: average price of cigarettes in household i's region, in PhP
Y_i: annual household income, in PhP
X_i: a vector of control variables consisted of household and household head's characteristics; and
$u_i \sim iid(0, \sigma^2)$: normally distributed disturbance term with constant mean and variance.

The vector X consists of variables that control for household as well as household head's characteristics which affect 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 last category as the base group) and education into three categories (none/primary, secondary, tertiary, for which

[7] While it is ideal for granularity purposes to use province-wide cigarette price data for our price variable, we use regional prices calculated as the average of provincial prices to match the sampling design of the FIES from which we take our data for our cigarette consumption and the rest of our independent variables. In the FIES, the country's administrative regions constitute the sampling domains, which are defined as subdivisions of the country for which estimates with adequate level of precision are generated.

[8] That is, holding other factors constant, households who are heavy smokers may be more likely to consume cheaper brands of cigarettes and purchase cigarettes in greater quantities than households who smoke fewer cigarettes (IARC, 2011)

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.[9] To account for households' risk attitude, we include a dummy variable indicating the positive expenditure on any form of insurance. We also control for 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 employ 2SLS and two-step efficient GMM estimation with regional fixed effects as the instruments. The first-stage regression, also called the reduced-form equation, is given by

$$\log(P_i) = \pi_0 + \sum_j \rho_j z_{ji} + \pi_1 \log(Y_i) + \sum_j \theta_j X_{ji} + e_i \tag{2}$$

where z_{ji}'s are the regional fixed effects and all other variables are as defined above. The second-stage equation, which is the structural equation, is expressed as

$$\log(Q_i) = \beta_0 + \beta_1 \widehat{\log(P_i)} + \beta_2 \log(Y_i) + \sum_j \gamma_j X_{ji} + u_i \tag{3}$$

where $\widehat{\log(P_i)}$ denotes the fitted values of the first-stage regression. Accordingly, we perform econometric tests such as Sargan and Hausman tests of instrument exogeneity and other tests for overidentifying restrictions to ascertain the validity of our instruments.[10]

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 and Schaffer, 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

[9] An area for improvement is to control for the household head's nature of work, i.e. white-collar versus blue-collar, and investigate whether the cigarette consumption patterns vary across the two classifications as well as relative to unemployed household heads.

[10] 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. The results of our endogeneity and instruments validity tests are available upon request.

tobacco, the decision on how much to consume. The first step is usually modelled using nonlinear probability models such as logit and probit specifications due to the binary nature of the first decision. The second step, meanwhile, is modelled 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 for 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 exploit a two-part estimation strategy to estimate separately the price elasticities of smoking prevalence and smoking intensity. Following Wooldridge (2009), the two-part model expresses the observed response, $\log(Q_i)$, in terms of an underlying latent variable:

$$y^* = \beta_0 + \boldsymbol{x\beta} + u, \;\; u|\boldsymbol{x} \sim Normal(0, \sigma^2) \tag{4}$$

$$\log(Q_i) = \max(0, y^*), \tag{5}$$

where we use $\boldsymbol{x\beta}$ as shorthand for $\beta_1 \log(P_i) + \beta_2 \log(Y_i) + \sum_j \gamma_j X_{ji}$. The latent variable y^* satisfies the classical linear model assumptions (i.e. normal, homoskedastic distribution with a linear conditional mean). Equation (5) implies that $\log(Q_i) = y^*$ when $y^* \geq 0$, but $\log(Q_i) = 0$ when $y^* < 0$. This formulation allows us to estimate separately the price elasticity of smoking prevalence which is the elasticity estimated in the unconditional expectation

$$\begin{aligned} E(\log(Q)\,|\boldsymbol{x}) &= P(y > 0|\boldsymbol{x}) \cdot E(\log(Q)\,|\,\log(Q) > 0, \boldsymbol{x}) \\ &= \boldsymbol{\Phi}(\boldsymbol{x\beta}/\sigma) \cdot E(\log(Q)\,|\,\log(Q) > 0, \boldsymbol{x}) \end{aligned} \tag{6}$$

where $\boldsymbol{\Phi}(\boldsymbol{x\beta}/\sigma)$ is the standard normal cumulative distribution function, and the price elasticity of smoking intensity which is the elasticity estimated in the conditional expectation

$$E(\log(Q)\,|\,\log(Q) > 0, \boldsymbol{x}) = \boldsymbol{x\beta} + \sigma\lambda(\boldsymbol{x\beta}/\sigma)\,, \tag{7}$$

where $\lambda(c) = \phi(c)/\,\Phi\,(c)$ is called the inverse Mills ratio; it is the ratio between the standard normal probability density function $\phi(c)$ and the standard normal cumulative distribution function $\Phi\,(c)$, each evaluated at c.

To correct for sample selection bias, we employ the Heckman correction method. Let the population model be characterized Equation (4). It is useful to write the population model for a random draw as

$$y_i = \boldsymbol{x}_i\boldsymbol{\beta} + u_i \tag{8}$$

where we use y_i as shorthand for $\log(Q_i)$ and $\boldsymbol{x}_i\boldsymbol{\beta}$ for $\beta_0 + \beta_1 \log(P_i) + \beta_2 \log(Y_i) + \sum_j \gamma_j X_{ji}$. Let s_i be a selection indicator for each i such that $s_i = 1$ if we observe all of $(y_i, \boldsymbol{x}_i)$, i.e. household i has nonzero cigarette consumption, and $s_i = 0$ otherwise. The Heckman approach,

also known as the Heckit model, adds an explicit selection equation to the population model of interest:

$$y = \boldsymbol{x\beta} + u, \;\; E(u|\boldsymbol{x}) = 0 \tag{9}$$

$$s = 1[\boldsymbol{z\gamma} + v \geq 0], \tag{10}$$

where $s = 1$ if we observe y, zero otherwise.

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 demand for cigarettes. Hence, we attempt to test the hypothesis that the tax-induced price increase after the 2012 sin tax reform law has a negative effect on cigarette consumption. Towards this end, we construct 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 law was enacted. Pooled cross sections can be very useful for evaluating the impact of a certain event or policy (Wooldridge, 2010). By pooling random samples drawn from the same population but at different points in time, the sample size is increased which results to 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 Andover, Massachusetts using a DID analysis for cross sections pooled across various years.

The implementation of the tax reform in 2012 allows us to exploit a natural experiment approach in measuring the causal impact of the law on tobacco demand. A natural experiment occurs when some exogenous event such as a change in government policy alters the environment in which individuals, families, firms, or cities operate (Wooldridge, 2010). In a natural experiment, the sample is divided into two groups, namely the control group, which is not affected by the policy change, and the treatment group, which is thought to be affected by the policy change. In our natural experiment exercise, we assume that the treatment group consists of low-income individuals who are the most responsive to cigarette price increases while the control group is composed of high-income households who have generally inelastic demand for cigarettes (as shown in our estimates of elasticities across income groupings below). The assignment of control and treatment groups follows Meyer, Viscusi, and Durbin (1995) who studied the length of time (in weeks) that an injured worker receives workers' compensation. On July 15, 1980, Kentucky raised the cap on weekly earnings that were covered by worker's compensation. The control group consists of low-income workers since the increase in the cap has no effect on the benefit for low-income workers, while the treatment group is composed of

high-income workers since the cap increase makes it less costly for a high-income worker to stay on worker's compensation.

One notable study that adopted the DID approach in cigarette taxation is the 2012 National Bureau of Economic Research (NBER) Working Paper by Kevin Callison and Robert Kaestner entitled "Do higher tobacco taxes reduce adult smoking? New evidence of the effect of recent cigarette tax increases on adult smoking". Using data from the U.S. Current Population Survey Tobacco Use Supplements, the study employed a novel paired 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% (Callison and Kaestner, 2012).

Similar to the approach of Callison and Kaestner (2012) and Kiel and McClain (1995), we construct 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 law in 2012 is given by

$$\log(Q_i) = \beta_0 + \delta_0 d15 + \beta_1 dT + \delta_1 d15 \cdot dT + \beta_2 \log(P_i) + \beta_3 d15 \cdot \log(P_i) + \beta_4 \log(Y_i) + \beta_5 d15 \cdot \log(Y_i) + \sum_j \gamma_j X_{ji} + u_i \quad (11)$$

In Equation (11), 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 law reform 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. The DID estimator is characterized by the following equation:

$$\hat{\delta}_1 = \left[\overline{\log(Q)}_{15,T} - \overline{\log(Q)}_{15,C}\right] - \left(\overline{\log(Q)}_{09,T} - \overline{\log(Q)}_{09,C}\right) \quad (12)$$

where the bar denotes the average, the first subscript denotes the year, and the second subscript denotes the group.

This policy parameter plays the key role in determining the effectiveness of the sin tax law reform in 2012 as far as lowering household cigarette consumption is concerned. In particular, if the estimated model reveals that $\hat{\delta}_1$ is negative and statistically significant, then it implies that the tax reform achieved its goal to subdue purchase and use of cigarettes. Otherwise, a statistically insignificant estimate of this parameter would suggest that the tax reform law had limited, if at all, impact on cigarette consumption after controlling for other factors.

Has responsiveness of cigarette demand to price increases changed after the 2012 Sin Tax Reform Law?: A Chow's test approach

Another important question that we uncover in our empirical analysis involves the impact of the 2012 sin tax law reform on the responsiveness of cigarette consumption to changes in cigarette prices. Accordingly, we construct 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 law reform in 2012, we estimate the following model:

$$\log(Q_i) = \beta_0 + \delta_0 d15 + \beta_1 \log(P_i) + \delta_1 d15 \cdot \log(P_i) + \beta_2 \log(Y_i) + \delta_2 d15 \cdot \log(Y_i) + \sum_j \gamma_j X_{ji} + u_i \quad (13)$$

where the variables are as defined above. In this equation, 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 that have been implemented over the seven-year period.[11] 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 $d15$ 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.[12] We hypothesize 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 use Chow's test, which is primarily designed to capture the structural change in the parameter of interest.

VI. Results and Discussion

Descriptive statistics

We present key descriptive statistics for our samples in both 2009 and 2015 in Table 2. 38,400 and 41,544 households were 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, less 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.[13] 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 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 (Figure 4).

[11] Appendix Table 3 provides a comprehensive list of non-price tobacco measures implemented effective 2006-2015.

[12] To see why, the intercept is β_0 for 2009 and $\beta_0 + \delta_0$ for 2015. The price elasticity of demand is β_1 for 2009 and $\beta_1 + \delta_1$ for 2015. Thus, δ_1, measures the difference between the elasticities from 2009 to 2015.

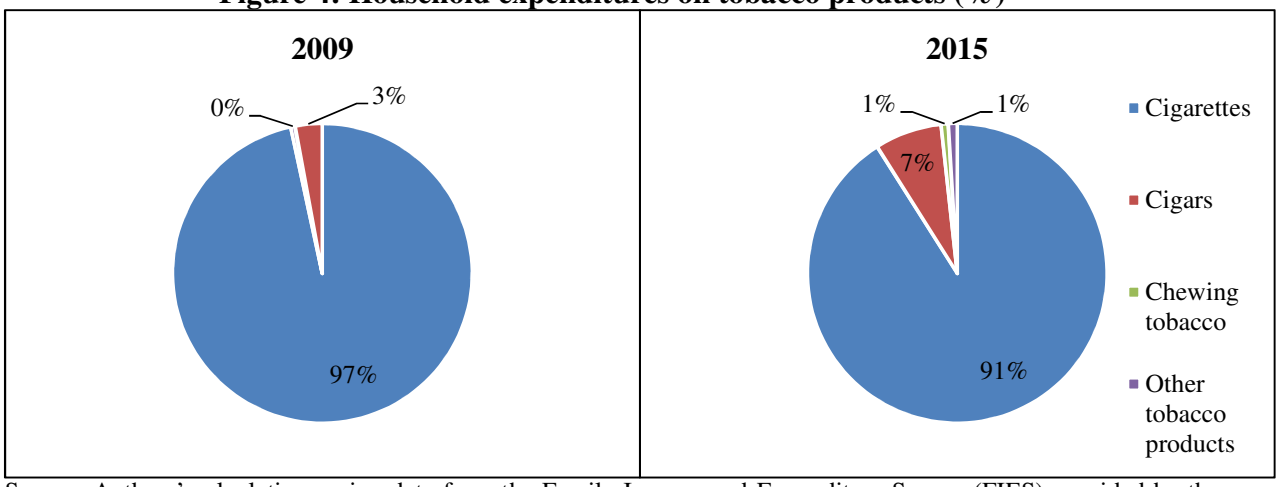
[13] The consumer price index (CPI) (2010=100) is 96.349 and 117.427 for 2009 and 2015, respectively. Source: World Development Indicators, The World Bank.

Table 2: 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).

Figure 4: Household expenditures on tobacco products (%)



Source: Authors' calculations using data from the Family Income and Expenditure Survey (FIES) provided by the Philippine Statistics Authority (PSA).

That there are nontrivial differences between tobacco-consuming and non-tobacco-consuming households is revealed by the comparison-of-means test in Table 3. Households with tobacco expenditures have household heads who are slightly younger, more likely to be male and employed but less likely to have completed college education. Consistent with our a-priori expectation, households who spend on any form of insurance are more likely without expenditures on tobacco than those who do not, reflecting the fact that they are more risk averse relative to tobacco-consuming households. The important differences between the socioeconomic characteristics of households with and without tobacco expenditures raise the need to control for such factors in our estimation exercises.

Table 3: Socioeconomic Characteristics: Households With vs Without Tobacco Expenditures

Socioeconomic Characteristic	Mean					
	2009			2015		
	With	Without	Difference	With	Without	Difference
Age of household head	49.70	50.71	1.01***	50.50	52.39	1.89***
Household head is (probability):						
Male	0.85	0.70	0.15***	0.85	0.70	0.15***
College graduate	0.07	0.18	0.11***	0.15	0.29	0.14***
Employed	0.86	0.78	0.08***	0.86	0.78	0.08***
Household has insurance (any form)	0.28	0.39	0.11***	0.36	0.45	0.09***

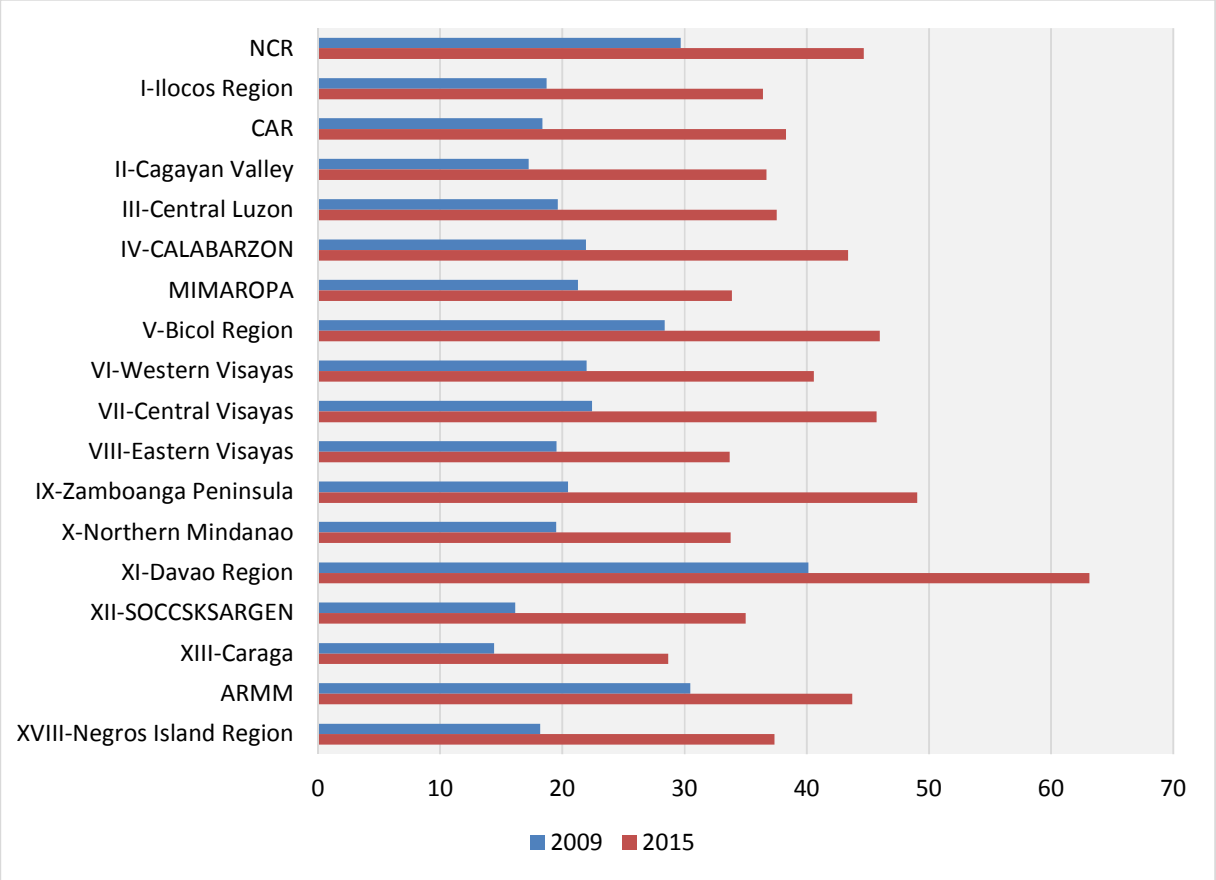
***=significant at 0.1%, **=significant at 1%, *=significant at 5%

Source: Authors' calculations using data from the Family Income and Expenditure Survey (FIES) provided by the Philippine Statistics Authority (PSA).

Cigarette price and consumption

Despite a uniform nationwide cigarette tax scheme, cigarette prices vary by a large extent across the country, ranging from 14 to 40 pesos per pack using 2009 data. The wide variability in cigarette prices barely assuaged even after the sin tax reform law which stipulates the gradual simplification of the tax structure to a unitary excise tax of 30 pesos per pack, with average prices ranging from 29 to 63 pesos per pack in 2015 (Figure 5). Quimbo et al. (2012) attributed the large cross-regional differences in cigarette prices to demand factors such as household incomes and the availability of substitutes to cigarettes as well as supply determinants such as differences in transportation and distribution costs including regional wages.

Figure 5: Average selling prices of cigarettes (pack of 20 sticks, php) by province



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

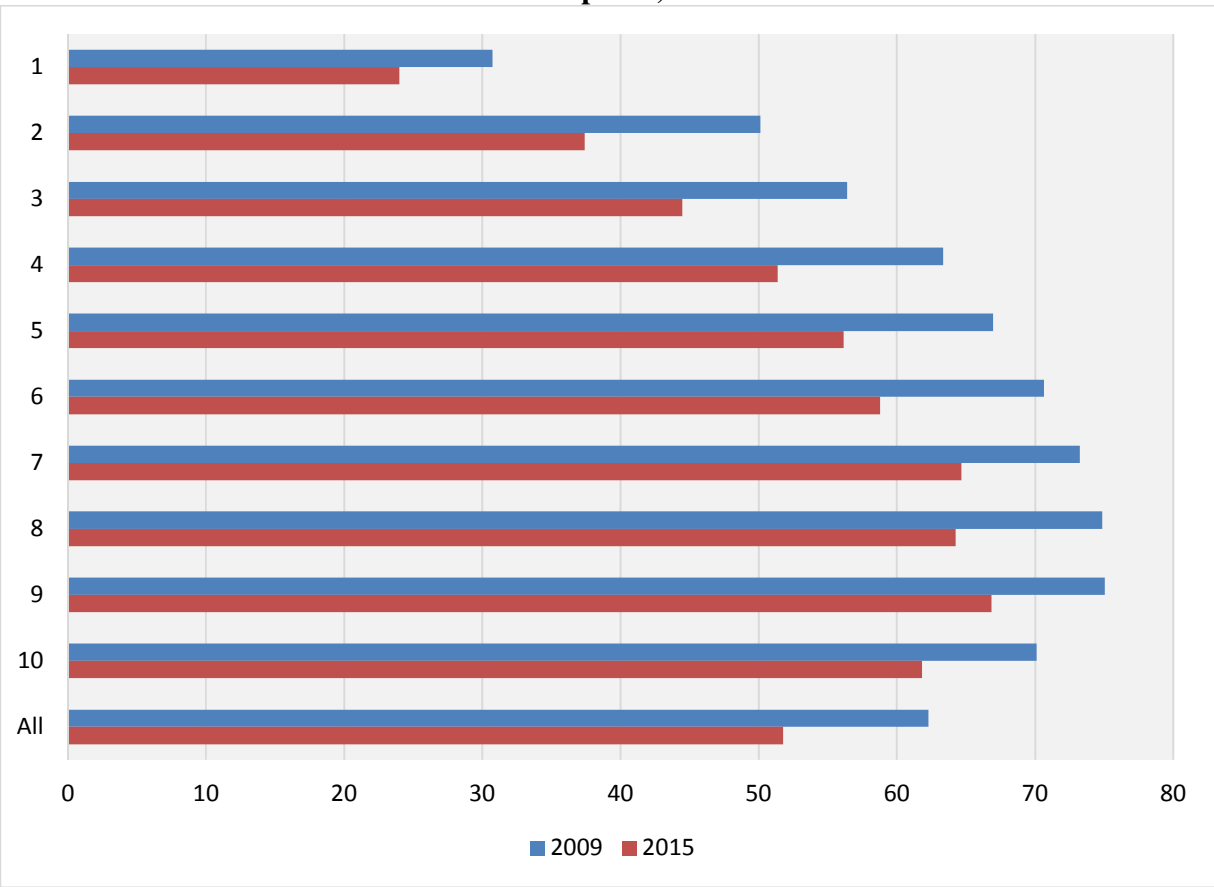
Overall, households consumed an average of 62 packs of cigarettes in 2009 and purchased less in 2015 at 52 packs (Figure 6). In general, cigarette consumption increases with income, with the poorest having average consumption of 24 packs and the richest 62 packs in 2015. The figures are much higher in 2003, in which it was reported that smoker households consumed an average of 175 packs of cigarettes, the poorest consuming almost 80 packs and the richest almost 300 packs (Quimbo et al., 2012).

Price elasticity of demand for cigarettes—New evidence

We present novel elasticity estimates in Table 4 using latest available data that is 2015 FIES and cigarette prices, while Tables 5 and 6 report the estimates for 2009 and 2012, respectively. Our elasticity estimates provide support to the theoretical and empirical consensus that cigarette consumption declines when cigarette price increases. We find 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.

Figure 6: Average annual cigarette consumption of households by income decile (number of packs)



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

Historically, tobacco products typically exhibit relatively inelastic demand due to their addictive nature and the unavailability of close substitutes.[14] 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) and Blecher and van Walbeek (2004, 2009)]. Our estimates suggests that cigarette demand has become more responsive to price increases since 2009 (Figure 5-6). 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 (we formally evaluate the impact of the sin tax

[14] About 75% of tobacco leaves grown globally are used for cigarettes. There is relatively small variety of tobacco products either smoked (such as cigarettes, cigars, and bidis) or smokeless (such as chewing tobacco and snuff) (WHO, 2012).

reform law on price elasticities in the next subsection) as well as the increasing presence of close substitutes such as electronic- (e-) cigarettes.[15]

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. Looking at the trend of income elasticities over time, we find that responsiveness of cigarette demand to income increases slightly decreased from 2009 to 2012 and picked up noticeably after the reform (Figure 7). Consistent with the findings of Ulep (2015), cigarettes in the Philippines became more affordable as shown by the annual decrease in relative income prices (RIP), hence the proportion of income required to purchase cigarettes fell making demand less responsive to income increases. After the sin tax reform law took effect, however, RIP increased, thus making cigarettes less affordable.

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.[16] 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 (Figure 8).

[15] Aside from higher excise taxes on tobacco products, e-cigarettes have become increasingly popular among Filipinos, particularly the youth, due to the rising number of public places that prohibit smoking. The Metro Manila Development Authority (MMDA) has urged local government units (LGUs) to regulate the sale and use of e-cigarettes in respective localities.

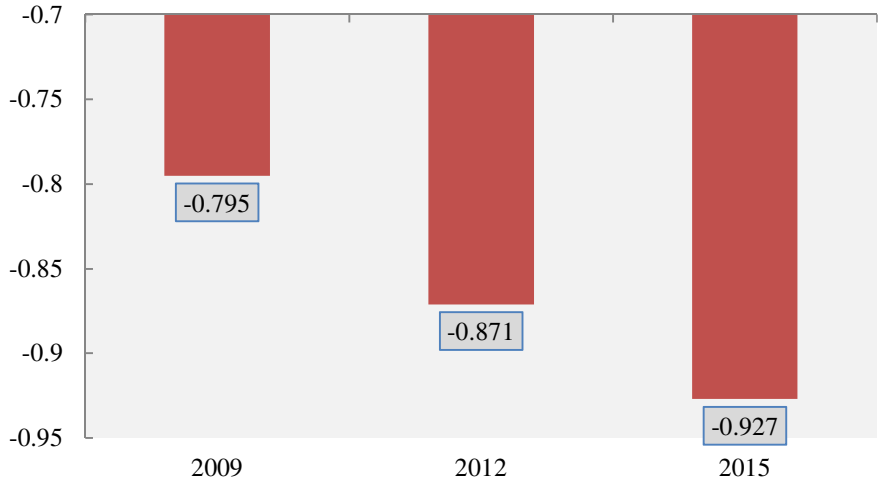
[16] See, for instance, Barkat et al. (2012) and Townsend (1994).

Table 4: 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

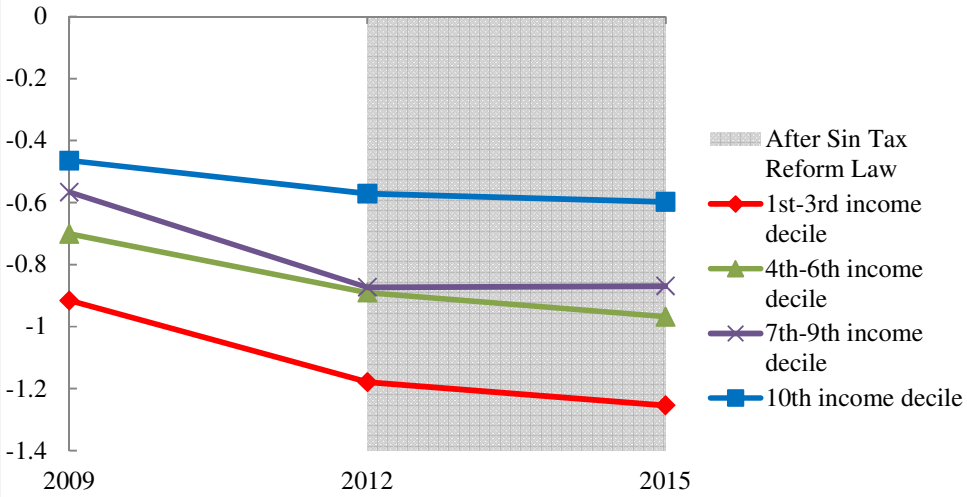
***=significant at 0.1%, **=significant at 1%, *=significant at 5%. Robust standard errors in parentheses.
Dependent Variable: ln(number of pack of cigarettes consumed). HH is household head.
Notes: We test for endogeneity of the cigarette price variable for the overall sample and each four subsamples, 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 and Expenditure Survey (FIES) both provided by the Philippine Statistics Authority (PSA).

Figure 7. **Estimates of overall price elasticity of demand for cigarettes, 2009-2015.**



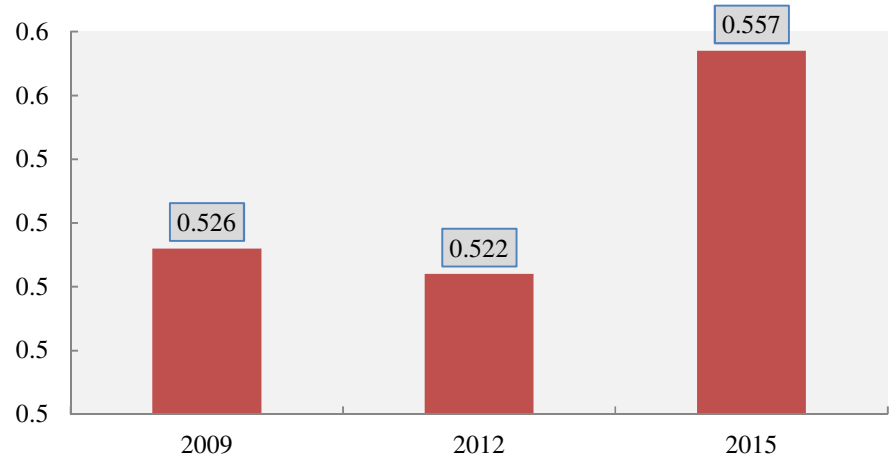
Sources: Authors' calculations using data from the Survey of Retail Prices of Commodities for the Generation of CPI and Family Income and Expenditure Survey (FIES) both provided by the Philippine Statistics Authority (PSA).

Figure 8. **Estimates of price elasticity of demand for cigarettes by income groupings, 2009-2015.**



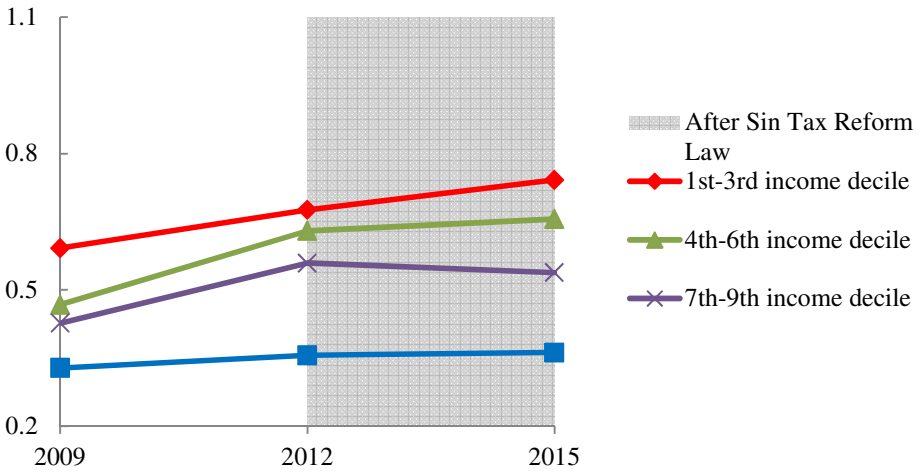
Sources: Authors' calculations using data from the Survey of Retail Prices of Commodities for the Generation of CPI and Family Income and Expenditure Survey (FIES) both provided by the Philippine Statistics Authority (PSA).

Figure 9. **Estimates of overall income elasticity of demand for cigarettes, 2009-2015.**



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

Figure 10. **Estimates of income elasticity of demand for cigarettes by income groupings, 2009-2015.**



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

Table 5: 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: Authors' calculations using data from the Survey of Retail Prices of Commodities for the Generation of CPI and Family Income and Expenditure Survey (FIES) both provided by the Philippine Statistics Authority (PSA).

Table 6: Estimates of Overall Price Elasticity of Demand for Cigarettes - 2012

	(1)	(2)	(3)	(4)	(5)
		Income Deciles			
VARIABLES	Overall	1st-3rd	4th-6th	7th-9th	10th
ln(cigarette price)	-0.871***	-1.179***	-0.890***	-0.873***	-0.571***
	(0.0272)	(0.0443)	(0.0538)	(0.0619)	(0.114)
ln(HH income)	0.522***	0.676***	0.630***	0.559***	0.356***
	(0.0110)	(0.0210)	(0.0239)	(0.0270)	(0.0533)
HH age 18-29	0.0503	0.0932	0.0295	0.0430	0.182
	(0.0408)	(0.0573)	(0.0726)	(0.0976)	(0.261)
HH age 30-45	0.0781***	0.140***	0.0762*	0.0889*	-0.0812
	(0.0258)	(0.0412)	(0.0439)	(0.0530)	(0.104)
HH age 46-59	0.0922***	0.0953**	0.0531	0.118***	0.0810
	(0.0239)	(0.0417)	(0.0411)	(0.0444)	(0.0856)
dummy HH is male	0.170***	0.185***	0.143***	0.203***	0.0698
	(0.0258)	(0.0472)	(0.0433)	(0.0460)	(0.0834)
HH education: none to primary	0.194***	0.138**	0.163***	0.135***	0.108
	(0.0276)	(0.0660)	(0.0484)	(0.0455)	(0.129)
HH education: secondary	0.167***	0.0472	0.100**	0.100**	0.129
	(0.0262)	(0.0676)	(0.0475)	(0.0404)	(0.0824)
dummy HH has a job	0.0515*	0.128**	0.0567	0.0129	0.0714
	(0.0270)	(0.0512)	(0.0485)	(0.0470)	(0.0829)
dummy household has insurance	-0.0805***	-0.117**	-0.0492	-0.105***	0.0510
	(0.0205)	(0.0470)	(0.0306)	(0.0349)	(0.101)
ln(family size)	-0.0488**	-0.256***	-0.153***	0.123***	0.207**
	(0.0190)	(0.0286)	(0.0326)	(0.0405)	(0.0908)
dummy household from urban	0.106***	0.0696**	0.0753**	0.159***	-0.00192
	(0.0188)	(0.0348)	(0.0293)	(0.0369)	(0.0777)
Constant	0.954***	-2.053***	-1.262	2.193***	3.298***
	(0.214)	(0.571)	(0.982)	(0.850)	(1.266)
Observations	20,778	6,959	6,951	5,479	1,389
R-squared	0.113	0.143	0.061	0.066	0.035

***=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 and Expenditure Survey (FIES) both provided by the Philippine Statistics Authority (PSA).

Using two-part econometric techniques, we estimate 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.[17] Table 7 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.

In Table 8, 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 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 4. This finding is consistent with household-level cigarette demand analysis in developing countries such as Lance et al. (2004), Bishop et al. (2007), and Mao et al. (2007) for China, Jimenez-Ruiz et al. (2008) for Mexico, and Onder (2002) for Turkey.

[17] In all the estimations thus far, the sample consists of only those households with positive cigarette expenditures. The dependent variable is expressed in natural logarithm, hence observations for which household cigarette consumption is zero will be missing values. These observations will be dropped in the estimation process.

Table 7: 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: Authors' calculations using data from the Survey of Retail Prices of Commodities for the Generation of CPI and Family Income and Expenditure Survey (FIES) both provided by the Philippine Statistics Authority (PSA).

Table 8: 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: Authors' calculations using data from the Survey of Retail Prices of Commodities for the Generation of CPI and Family Income and Expenditure Survey (FIES) both provided by the Philippine Statistics Authority (PSA).

Impact of the 2012 Sin Tax Reform Law

To quantitatively assess the impact of the sin tax law reform on cigarette demand, we construct an independently pooled cross sectional data set which covers the period before and after the sin tax reform law. In Tables 9-11, we present the results of the impact of the sin tax law reform on cigarette consumption and cigarette demand elasticities. We find 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 $\hat{\delta}_1$ (dummy 2015 X dummy treat in Table 9) 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 10). Decomposing the impact of the sin tax reform law into its effect on smoking prevalence and intensity, our empirical exercise reveals the impact on smoking intensity is significantly higher than on smoking prevalence (Table 11). The sin tax reform law 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 (GATS, 2017).

Table 9: The Sin Tax Reform Law 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 intruments for ln(cigarette price).
Sources: Authors' calculations using data from the Survey of Retail Prices of Commodities for the Generation of CPI and Family Income and Expenditure Survey (FIES) both provided by the Philippine Statistics Authority (PSA).

Table 10: The Sin Tax Reform Law 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 intruments for ln(cigarette price).

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

VII. Conclusions and Recommendations

This study lends support to 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 the decline in cigarette consumption by smokers contributed more to the total effect of a cigarette price increase on demand than the decline in the number of smokers. This was shown by the elasticity of smoking intensity which is larger than the elasticity of smoking prevalence.

Our findings are also consistent with other studies that reveal that an increase in income increases the demand for cigarettes; college graduates are more likely to consume less cigarettes; and poor households are relatively more responsive to increases in cigarette price than rich households.

The major contribution of our study is our analysis of the impact of the sin tax reform. 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 contributed more in reducing the cigarette consumption of smokers than in reducing the number of smokers.

The above findings have major policy implications for the country. One, 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% (Refer to Box A). To determine the increase in excise tax, two important factors should be considered namely, inflation rate and the increase in per capita income. The increasing per capita income in the country will increase tobacco consumption in the coming years. To guarantee that cigarettes will continue to be less affordable since the sin tax reform, the policy goal is to ensure that the relative increase in price due to an increase in excise tax should be higher than the increase in per capita income.

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

Two, 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 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.

Three, our analysis support 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 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 our findings, a periodic review of the implementation of the non-price tobacco control measures should be undertaken in order to increase their effectiveness in reducing tobacco consumption in the country. For example, according to the 2015 GATS, 58.6 percent of survey respondents noticed tobacco promotion, advertisement and sponsorship in the past 30 days while 40.5 percent 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 complete ban in tobacco advertisements and promotions. Also, despite the complete ban of 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 our work. The FIES, which is our primary 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, our 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.

Table 11: The Sin Tax Reform Law 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

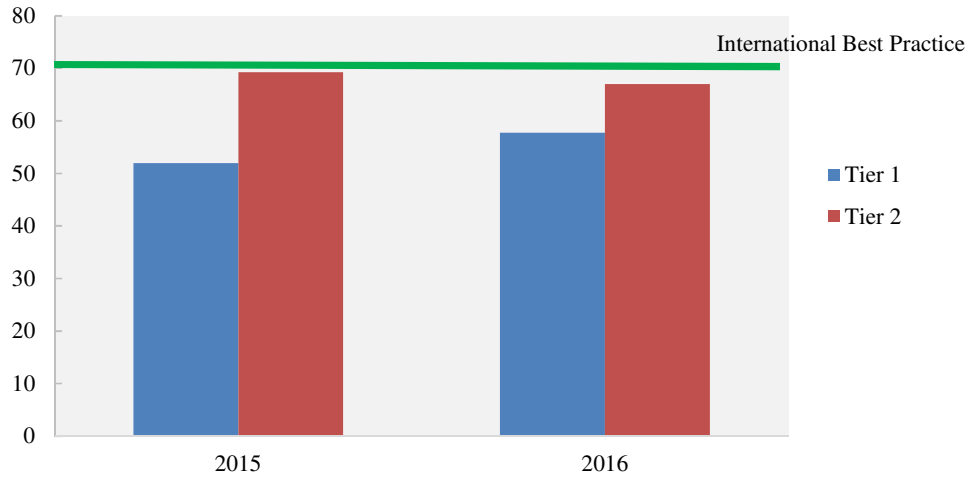
***=significant at 0.1%, **=significant at 1%, *=significant at 5%. Robust standard errors in parentheses. Dependent Variable: ln(number of pack of cigarettes consumed). HH=household head.
Sources: Authors' calculations using data from the Survey of Retail Prices of Commodities for the Generation of CPI and Family Income and Expenditure Survey (FIES) both provided by the Philippine Statistics Authority (PSA).

Box A: Cigarette Excise Tax Share on Retail Price

Using cigarette price data taken from the Survey of Retail Prices of Commodities for the Generation of CPI provided by the Philippine Statistics Authority (PSA), we calculate the share of excise tax on retail price for both cigarette tiers available for sale in the Philippines. As mandated in the sin tax reform law, excise taxes for the Tier 1 cigarettes were PhP 21 per pack and PhP 25 per pack in 2015 and 2016, respectively, and PhP 28 per pack and PhP 29 per pack for Tier 2 cigarettes in the same years. In these years, cigarette prices averaged PhP 40 and PhP 43.

In both years, excise taxes as a percentage of cigarette retail prices across the two tiers fell short below the international threshold of 70%. Excise taxes for the lower tier cigarettes were just below 60% of retail prices in both years. For higher tier cigarettes, excise tax accounted for almost 70% of price in 2015 but slightly dropped in the following year. Raising excise taxes so that they account for at least 70% of retail prices would significantly increase prices, force current users to kick the habit, and dissuade young people to smoke, thereby leading to large reductions in both smoking intensity and prevalence (Chaloupka, Yurekli, and Fong, 2012).

Figure A. **Cigarette excise tax share in retail price (%) - 2015-2016**



Source: Authors' calculations using data from the Survey of Retail Prices of Commodities for the Generation of CPI provided by the Philippine Statistics Authority (PSA) and Euromonitor International.

Appendix Table 1. Average Retail Prices of Cigarettes, by Region (pack of 20 sticks, PhP).

Region	2009				2015			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
NCR	29.67	33.02	28.55	29.67	44.68	50.67	42.69	44.68
I-Ilocos Region	18.72	16.75	20.41	19.54	36.42	35.31	37.37	38.15
CAR	18.36	11.94	20.70	17.19	38.29	30.11	41.26	36.11
II-Cagayan Valley	17.24	16.47	19.18	14.97	36.68	36.20	37.90	35.16
III-Central Luzon	19.63	19.19	20.07	16.57	37.54	38.65	36.43	33.51
IV-CALABARZON	21.93	22.26	21.60	21.14	43.38	44.74	42.02	42.52
MIMAROPA	21.26	13.67	28.85	18.07	33.88	23.27	44.50	30.97
V-Bicol Region	28.37	11.06	34.14	15.78	45.97	27.80	52.02	32.23
VI-Western Visayas	21.98	15.55	29.47	18.74	40.58	34.37	47.83	37.04
VII-Central Visayas	22.45	23.67	17.58	19.85	45.73	45.80	45.43	42.24
VIII-Eastern Visayas	19.53	21.31	18.34	20.85	33.68	32.04	34.77	35.71
IX-Zamboanga Peninsula	20.46	19.44	27.59	16.50	49.03	47.64	58.77	42.21
X-Northern Mindanao	19.47	20.98	17.96	14.63	33.75	34.46	33.04	31.71
XI-Davao Region	40.13	37.97	40.94	28.93	63.13	51.72	67.41	44.31
XII-SOCCSKSARGEN	16.13	24.00	14.56	15.87	35.02	55.17	30.98	35.02
XIII-Caraga	14.40	13.44	15.15	13.71	28.65	29.47	28.49	28.60
ARMM	30.46	35.08	21.23	37.84	43.73	48.93	33.32	51.63
XVIII-Negros Island Region	18.18	20.12	16.23	16.14	37.35	42.47	32.23	33.77

Notes: 1=simple average of province-wide cigarette prices; 2=simple average of province-wide prices of short cigarettes; 3=simple average of province-wide prices of long cigarettes; 4=weighted average of province-wide cigarette prices with cigarette brand shares as weights.

Source: Authors' calculations using data from the Survey of Retail Prices of Commodities for the Generation of CPI provided by the Philippine Statistics Authority (PSA) and Euromonitor International.

Appendix Table 2. Average Annual Cigarette Consumption of Households by Income Decile

Income Decile	Average Number of Packs Consumed by Households							
	2009				2015			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1	30.74	34.07	29.91	35.31	23.99	24.10	24.11	25.32
2	50.12	56.98	49.09	56.78	37.40	38.93	37.48	39.75
3	56.40	63.74	55.50	63.93	44.46	46.46	44.64	47.47
4	63.35	72.70	62.64	71.89	51.36	54.06	51.26	55.44
5	66.97	74.28	65.45	75.33	56.13	58.04	55.76	60.23
6	70.63	78.51	69.04	79.44	58.79	60.79	58.23	63.17
7	73.24	79.19	71.59	81.78	64.67	66.13	64.20	69.05
8	74.86	80.06	73.58	83.41	64.26	65.16	64.29	68.73
9	75.04	79.52	74.17	83.17	66.85	66.83	67.10	71.11
10	70.12	73.49	69.35	77.04	61.83	61.50	62.16	65.44
Overall	62.29	68.43	61.17	69.89	51.78	53.05	51.73	55.30

Notes: 1=calculated using simple average of province-wide cigarette prices; 2=simple average of province-wide prices of short cigarettes; 3=simple average of province-wide prices of long cigarettes; 4=weighted average of province-wide cigarette prices with cigarette brand shares as weights.

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

Appendix Table 3. Non-price Tobacco Measures Implemented Effective 2006 – 2015

Effectivity of Implementation	Laws, regulations and policies	Non-price tobacco measures
1 January 2007	*IAC-Tobacco Memorandum Circular No. 1 Series of 2004* Rules and Regulations Implementing Republic Act No. 9211, Otherwise Known as the Tobacco Regulation Act of 2003	Ban on tobacco advertising on TV and radio
1 July 2007	*IAC-Tobacco Memorandum Circular No. 1 Series of 2004* Rules and Regulations Implementing Republic Act No. 9211, Otherwise Known as the Tobacco Regulation Act of 2003	Ban on cinema and outdoor tobacco advertising
1 July 2008	*IAC-Tobacco Memorandum Circular No. 1 Series of 2004* Rules and Regulations Implementing Republic Act No. 9211, Otherwise Known as the Tobacco Regulation Act of 2003	Ban on all forms of tobacco advertising in mass media, except tobacco advertisements placed inside the premises of point-of-sale retail establishments
29 May 2009	*Civil Service Commission Memorandum Circular No. 17, s.2009* Smoking Prohibition based on 100%	Ban on smoking in government premises, buildings and grounds

Effectivity of Implementation	**Laws, regulations and policies**	**Non-price tobacco measures**
	Smoke-Free Environment Policy	
7 January 2010	*Land Transportation Franchise Regulatory Board (LTFRB) Memorandum Circular No. 36, s. 2009*: 100 % Smoke-Free Public Utility Vehicles (PUVs) and Public Transportation Terminals	Ban on smoking in public utility vehicles and public transport terminals
7 August 2014	*Republic Act No. 10643 (RA 10643)* An Act to Effectively Instill Health Consciousness Through Graphic Health Warnings on Tobacco Products	Graphic health warnings on cigarette packages
March 3, 2016	Implementing Rules and Regulations of RA 10643	Graphic health warnings on cigarette packages
1 December 2014 (for locally manufactured cigarettes) 1 April 2015 (for imported cigarettes)	*Revenue Regulations No. 9-2014* Further Amending the Provisions of Revenue Regulations No. 7-2014, Specifically the Deadlines Prescribed Under Section 13 Thereof *Revenue Regulations No. 7-2014:* Prescribing the Affixture of Internal Revenue Stamps on Imported and Locally Manufactured Cigarettes and the Use of the Internal Revenue Stamp	Excise tax stamps on locally manufactured and imported cigarettes

Effectivity of Implementation	Laws, regulations and policies	Non-price tobacco measures
	Integrated System (IRSIS) for the Ordering, Distribution and Monitoring Thereof	

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