CROWDING-OUT OF HOUSEHOLD EXPENDITURE BY TOBACCO IN GHANA

By

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Abstract

This paper examines whether other expenditure in Ghanaian households is crowded out by expenditure on tobacco over the period under study (2005/2006 and 2012/2013) and whether the magnitude of crowding-out over the period has been changed by the introduction of the tobacco control law in July, 2012. The paper uses household survey data from the Ghana Living Standards Survey in the years 2005/2006 and 2012/2013. A system of quadratic conditional Engel curves was estimated for a set of eleven groups of commodities for both periods. The results show a crowding-out of food, alcohol, clothing and transport and a crowding-in of furnishings, health and communication expenditure by tobacco. The magnitude of crowding-in and crowding-out declined over the period under study. The tobacco control law of 2012 was positively associated with a reduction in the prevalence rate of tobacco use among households, and a reduction in household budget share allocation to tobacco.

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1. INTRODUCTION

Tobacco is known to be responsible for an increased mortality and morbidity of tobacco consumers and persons exposed to tobacco smoke (WHO, 2005; WHO, 2010; NCI, 2017). The number of tobacco related deaths is estimated at 7 million annually globally (WHO, 2018); it is expected to rise to 8 million annually by the year 2030. Most of these deaths are forecasted to occur in low and middle income countries since the prevalence rate of smoking has been on the rise in these countries as a result of rising incomes (NCI, 2017).

Apart from the negative effects of tobacco use in terms of morbidity and mortality, there is a crowding-out and crowding-in effect on other household expenditure. Crowding-out of household expenditure occurs when household income which could have been channeled into the provision of basic necessities, such as food, education, health care, and housing is allocated to tobacco use. This phenomenon affects the physical well-being of household members as well as their future prospects. For instance, lower allocations of household income to food, health care, and housing could have an adverse impact on the physical wellbeing of children. Lower allocations of household income to education could negatively shape the prospects of children. Crowding-in occurs where a positive relationship is found between tobacco and another category of household expenditure.

This study will estimate Engel curves using cross sectional data in the first survey (2005/2006) and the second survey (2012/2013) to ascertain the crowding-out effect of tobacco on other household expenditure. It will also seek to establish if the magnitude of crowding-out of other household expenditure by tobacco has changed during the period due to the introduction of the tobacco control law in 2012.

The study found a crowding-out of food, alcohol, clothing and transport, and a crowding-in of furnishings, health and communication expenditure by tobacco. The magnitude of crowding-in and crowding-out however declined over the period under study. The tobacco control law of 2012 was positively associated with a reduction in the prevalence rate of tobacco use and a reduction in household budget share allocation to tobacco.

Ghana attained lower-middle income status in 2010 (World Bank, 2018). As incomes of the general population rise over the period, it is estimated that consumption of tobacco products will also increase (WHO, 2010). The World Health Organization projects an increase in the prevalence rate of tobacco use in Ghana from 2000 to 2025 (WHO, 2015). This trend is largely expected to originate with males; the prevalence rate among males is expected to increase from 8.4% to 15.9% from 2000 to 2025. The prevalence rate for females is expected to decline gradually over the same period.

It is predicted that developing countries will experience an increasing trend in the prevalence rate of current tobacco smoking over the period of this study, owing to anticipated rise in household incomes (Mendez et al., 2013; Blecher & Ross, 2013). The rest of this paper is structured as follows: Section 2 gives a summary of the relevant literature. Section 3 provides an overview of the background to tobacco control in Ghana. Section 4 discusses the methodology. Section 5 explains the data. Section 6 presents the main results and discussion. Section 7 presents the conclusions.

2. LITERATURE REVIEW

The earliest study to estimate the crowding-out of other household expenditure by tobacco, and ascertain welfare implications of tobacco expenditure on the household, was conducted by Efroymson et al. (2001), who estimated household expenditure patterns in Bangladesh. Some of the much earlier studies such as Barraclough (1999), pointed out the potential crowding-out of other household expenditure by tobacco and possible welfare implications on the household, but did not discuss this in detail. The earliest studies on the crowding-out of other household expenditure by tobacco were based on simple descriptive statistics of household data (Barraclough, 1999; Efroymson et al., 2001; Thomson et al., 2002). They observed that expenditure on tobacco by poor households led to a deterioration in living standards. The findings revealed that food, health, housing, and education expenditure were displaced by tobacco (Barraclough, 1999; Efroymson et al., 2001).

Crowding-out of food, education, health, and housing expenditure by tobacco has implications for the welfare of members of the household especially children. Efroymson et al. (2001) found that the poorest tobacco-consuming households could meet the calorie intake of one or two children if the household's tobacco budget was allocated to food. Tobacco consumption contributed to malnourishment among children in such households (Efroymson et al., 2001; Thomson et al., 2002).

The problem with inferring differences from the expenditure patterns of households through descriptive statistics is, the results do not take into consideration the difference in socio-economic factors between the two groups. Taking these factors into consideration would explain some of the difference in the expenditure patterns of the two groups which have nothing to do with expenditure on tobacco. Failure to consider the difference in socio-economic factors would attribute all the difference in expenditure patterns between the two groups to tobacco, thus overestimating the impact of tobacco consumption on household expenditure patterns.

Subsequently, the methodology evolved to the use of simple econometric models which took socio-economic factors into consideration when estimating differences in the expenditure patterns of households. This new methodology explained some of the difference between the two groups that were caused by difference in socio-economic factors, thus addressing the problem of overestimating the impact of tobacco on other household expenditure. These studies were mainly conducted in China (Wang et al., 2006; Liu et al., 2006), Cambodia (John et al., 2012a), Indonesia (Block & Webb, 2009) and the United States of America (Busch et al., 2004).

Econometric functions that were estimated took into consideration household characteristics and demographic features (Busch et al., 2004; Hu et al., 2005; Wang et al., 2006; Liu et al., 2006; Block & Webb, 2009; John et al., 2012a). Some of these econometric specifications took the form of simultaneous equations where the dependent variable, often household expenditure, was

explained by one or two explanatory variables with a set of controls for socio-economic variables (Busch et al., 2004; Wang et al., 2006; John et al., 2012a).

Other econometric specifications used simple regression models to estimate household or medical expenditure. The dependent variables were explained by one or two explanatory variables with a set of controls for socio-economic factors (Hu et al., 2005; Liu et al., 2006). These studies pointed out that expenditure on food was consistently displaced by tobacco. Other expenditure categories such as education, health, housing, savings, insurance, and farm productivity were also found to be displaced by tobacco; while tobacco and alcohol were complements (Busch et al., 2004; Wang et al., 2006).

In relation to economic welfare, Liu et al. (2006) estimated the impact of smoking related expenses on poverty in China using a simple regression model that controlled for socio-economic factors. They took into consideration cigarette purchases and medical expenses due to smoking. The effect on poverty was measured by changes in the poverty head count after annual smoking related expenses (i.e. expenditure on cigarettes and medical expenses incurred due to smoking) were deducted from annual income. They found that smoking was responsible for increasing the poverty headcount in urban areas by 6.4% and by 1.9% in rural areas, resulting in the impoverishment of 30.5 million urban and 23.7 million rural residents in China. In a similar study by John et al. (2011) on India, monthly tobacco expenditure and medical expenditure due to tobacco consumption were estimated. Tobacco was found to be responsible for increasing rural poverty rates by 1.5% and urban poverty rates by 0.72%. This meant that 15 million people in India were pushed below the poverty line due to expenditure on tobacco.

The study by Wang et al. (2006) of rural China also suggests that smoking could affect the economic prospects of a household. Wang et al. (2006) used fractional logit models to estimate the relationship between spending on tobacco and other categories of household expenditure while controlling for socio-economic and demographic characteristics. They found that smoking displaced expenditure on farming equipment and seeds, savings and insurance, future farming productivity, and human capital investment. These categories of expenditure are usually positively associated with the economic prospects of a household. Sachs et al. (2004) explains that lower investments in food production, infrastructure, health and education are the main factors that keep low income countries in a cycle of poverty.

In relation to health, Block and Webb (2009) corroborated the findings of Efroymson et al. (2001) that tobacco consumption contributed to the malnourishment of children in poor households. To ascertain the extent of malnutrition due to tobacco use, Best et al. (2007) used multivariate logistic models to estimate the association between tobacco use and the health of children in Bangladesh. They found that parental tobacco use was associated with an increased risk of stunting, underweight, wasting, severe stunting, severely underweight, and severe wasting.

To mitigate the crowding-out effect of tobacco on other household expenditure, researchers recommended an increase in taxes to raise the price of tobacco products (Efroymson et al., 2001; Hu et al., 2005; John, 2008). They argued that when tobacco expenditure is curtailed through taxes that raise the price of tobacco products, households will have an improved standard of living because tobacco consumers will more likely reduce tobacco expenditure and channel the surplus resources into acquiring necessities such as food, health care, and education. A study by Busch et al. (2004) tested this hypothesis by studying households across the United States of America. Busch et al. (2004) estimated own and cross-price elasticities for cigarettes and other expenditure. They found that tobacco and food were substitutes; that is, when cigarette prices increased individuals reduced tobacco purchases and increased expenditure on food. This observation corroborated the hypothesis that it is possible to improve the welfare of tobacco consumers by increasing the price of tobacco products through taxation.

A new wave of studies controlled for possible endogeneity in the demand functions used in estimating the expenditure patterns of households. This was necessary as many studies found the variables 'tobacco expenditure' and 'net-of-tobacco household expenditure' were endogenous in the specification of the demand functions (John, 2008; Pu et al., 2008; Koch & Tshiswaka-Kashalala, 2008).

Failure to control for endogeneity could lead to the incorrect estimation of the impact of tobacco on other household expenditure. Chelwa and van Walbeek (2014) in a study on Zambia estimated ordinary-least-squares estimates with no controls for endogeneity and three-stage-least-squares with instrumental variables to control for endogeneity. They observed that out of seventeen expenditure categories in the full sample, the three-stage-least-squares estimates were larger in eleven expenditure categories, smaller in one category, and had opposite results in five categories to those of the ordinary-least-squares estimates.

In order to address possible endogeneity in the econometric functions, subsequent studies used instrumental variables in estimating the demand functions (John, 2008; Pu et al., 2008; Koch & Tshiswaka-Kashalala, 2008; Chelwa & van Walbeek, 2014; San & Chaloupka, 2015; Jumrani & Birthal, 2017). John (2008) in a study on India, used household expenditure as an instrument for net-of-tobacco household expenditure following Keen (1986) and Vermeulen (2003). He also used the adult sex ratio, ratio of adult males to number of adults in the household as an instrument for tobacco expenditure. He explained that the adult sex ratio is positively correlated to tobacco expenditure (owing to the higher prevalence rate of tobacco use among males than females in India) but uncorrelated to the error term.

The problem with using the adult sex ratio as an instrument is that the proportion of adult males in a household may be more associated with certain types of expenditure such as tobacco, alcohol and entertainment (Busch et al., 2004; Wang et al., 2006; Koch & Tshiswaka-Kashalala, 2008) but less associated with other types of expenditure, such as those related to clean cooking fuels and the welfare of children (Efroymson et al., 2001; John, 2008). Thus the adult sex ratio

may be partially correlated with the error term, and would therefore be an imperfect instrument (Chelwa & van Walbeek, 2014). Subsequently, Chelwa and van Walbeek (2014) allowed for the exclusion restriction on the adult sex ratio to be violated, and the instrument to be correlated with the error term. Relying on the Nevo and Rosen (2012) method, they estimated the coefficients of the demand functions using the Quadratic Almost Ideal Demand System. Nevo and Rosen's (2012) method relied on two main assumptions. The first was that the direction of correlation between the imperfect instrument and the error term had to be same. The second required the correlation between the error term and the endogenous variable to be greater than the correlation between the imperfect instrument and the error term. The coefficients of the Quadratic Almost Ideal Demand System's estimates under the condition of the exclusion restriction and when it was violated were similar in thirteen expenditure categories out of a total of seventeen. However, the remaining four categories of expenditure had opposite results. This shows that although the adult sex ratio is an imperfect instrument, it is nevertheless a valid instrument.

Pu et al. (2008) treated alcohol and tobacco as separate variables in the specification of the demand functions for Taiwan. Following John (2006), Pu et al. (2008) decided to use adult sex ratio as an instrument for tobacco expenditure, and adult ratio (the ratio of adults to the size of the household) as an instrument for alcohol expenditure. They explained that alcohol consumption was an adult phenomenon in Taiwan, as the law prevents persons under18 years from consuming alcohol. The number of adults in a household is therefore positively correlated to alcohol expenditure but uncorrelated to the error term. Pu et al (2008) also explained that the reason for using adult sex ratio as an instrument for tobacco expenditure was that smoking was especially prevalent among adult males in Taiwan. Following Banks et al. (1997), Pu et al. (2008) also used household income as an instrument for net-of-tobacco household expenditure. Pu et al. (2008) explained that as the income of a household increased, the share of a given expenditure category to the household expenditure will remain same if the household saves the additional income, and household expenditure will remain unchanged.

Koch & Tshiswaka-Kashalala (2008) using a modified version of the Quadratic Almost Demand System developed by Banks et al. (1997) estimated the expenditure patterns of tobacco-consuming households in South Africa. They identified two endogenous variables 'per adult equivalent net expenditure' and 'tobacco expenditure' in the specification of the demand functions. These were instrumented with per adult equivalent income and a composite smoking prevalence rate respectively. Per adult equivalent net expenditure is the level of expenditure, less tobacco expenditure, needed by a single adult in a household to enjoy the same standard of living as another single adult in an alternative household, taking into consideration differences in household composition and demographic features. Per adult equivalent income is the amount of income a single adult needs to enjoy same standard of living as another single adult in an alternative household, taking into account difference in household composition and demographic characteristics.

The choice of instrument for tobacco expenditure, the composite smoking prevalence rate, is imperfect. Koch and Tshiswaka-Kashalala (2008) constructed the composite smoking prevalence rate based on the work of van Walbeek (2002), in which he estimated smoking prevalence rates in South Africa. The composite smoking prevalence rate was based on the demographic features of the population. The degree to which demographic features can predict the likelihood that a household will smoke is not comprehensive. There is evidence that socio-economic factors also influence a person's decision to smoke (Laaksonen et al., 2005; Doku et al., 2010; Gilman et al., 2008). Therefore, relying on only demographic characteristics will make the instrument imperfect. To address the issue of imperfection, the composite smoking prevalence rate should take into consideration both demographic and socio-economic factors.

In a study on Zambia, Chelwa and van Walbeek (2014) estimated Engel curves to ascertain if expenditure patterns of tobacco-consuming and non-tobacco-consuming households were significantly different. Following John (2008) and Pu et al. (2008), they used the adult sex ratio as an instrument for tobacco expenditure. They also instrumented net-of-tobacco household expenditure with the value of household assets.

San and Chaloupka (2015) investigated the difference in the expenditure patterns of households in Turkey by estimating Quadratic Conditional Engel curves. Net-of-tobacco household expenditure was instrumented with household expenditure following Keen (1986) and Vermeulen (2003). Tobacco expenditure was instrumented with the adult female ratio. The adult female ratio is the opposite of the adult sex ratio. The adult female ratio is the ratio of adult females to number of adults in the household. San and Chaloupka (2015) explained that the adult female ratio will be negatively correlated to tobacco expenditure but unrelated to the error term, since the female smoking prevalence rate was lower than the male smoking prevalence rate in Turkey.

Jumrani and Birthal (2017) used peer-effect measures as an instrument for tobacco, and alcohol expenditure in the demand function. They assumed that there was no information asymmetry in a peer network and peer groups were not totally overlapped. The peer-effect measure is the average spending on tobacco or alcohol of a given household's peer group (its village) net of the household's own spending on that good. They argued that social interactions were important determinants of many youths' behavioral outcomes such as substance abuse, teenage pregnancy, and educational outcomes.

To investigate whether the type of tobacco consumed (i. e., smokeless tobacco or smoking tobacco) had an impact on the crowding-out effect of tobacco on other household expenditure, Husain et al. (2018) further segregated tobacco-consuming households into smoking-only and smokeless-only samples. They found that the segregation of tobacco into categories of smokeless-only and smoking-only did not change the effect of tobacco on household expenditure patterns, except for difference in magnitudes. They observed that tobacco use crowded out expenditure on clothing, housing, education, energy, transportation, and communications in

Bangladesh. Husain et al. (2018) followed previous studies by using household income as an instrument for household expenditure, and adult sex ratio as an instrument for tobacco expenditure.

The findings of the later studies that used instrumental variables to control for endogeneity revealed that tobacco expenditure crowded out food, health care, and education expenditure among other things (John, 2008; Pu et al., 2008; Koch & Tshiswaka-Kashalala, 2008; Chelwa & van Walbeek, 2014; Jumrani & Birthal, 2017). These findings were similar to earlier findings that used simple descriptive statistics and simple econometric models.

The problem with the studies using instrumental variables to control for endogeneity is that all used a just-identified case (John, 2008; Pu et al., 2008; Koch & Tshiswaka-Kashalala, 2008; Chelwa & van Walbeek, 2014; San & Chaloupka, 2015; Jumrani & Birthal, 2017). A just-identified case is a situation where each endogenous variable is corrected using one instrumental variable. The problem is that, it is difficult to validate whether the exclusion restriction has not been violated in these studies (Chelwa & van Walbeek, 2014; San & Chaloupka, 2015; Jumrani & Birthal, 2017). As the work of Chelwa and van Walbeek (2014) revealed, the exclusion restriction could be violated when some instruments are used. The way to address this is to have an over-identified case, a situation where each endogenous variable is corrected using two or more instruments, so that a test of over-identifying restrictions can be conducted to ascertain whether the exclusion restriction is not violated. This is not possible because of limitations in the datasets. It is difficult to find a dataset that is adequate enough for more than one instrument to be constructed for each endogenous variable.

3. BACKGROUND TO TOBACCO CONTROL IN GHANA

Globally, the prevalence rate of tobacco consumption was estimated at 23.7% in 2010 (Mendez et al., 2013). The prevalence rate for Africa was estimated at 15.8% in 2010 (Mendez et al., 2013). Ghana's estimated current tobacco smoking prevalence rate of 5.3% in 2010 is not alarming compared to the global prevalence rate however, the projected upward trend in the prevalence rate is worrying. Ghana's current tobacco smoking prevalence rate is projected to increase to 8% nationally by 2025 (WHO, 2015).

Annually, tobacco is estimated to result in the death of 5,000 Ghanaians (Tobacco Atlas, n.d). It is estimated that around 3,900 males and 1,092 females died from smoking related diseases in 2016 (Tobacco Atlas, n. d.). The estimates indicate that 3.95% of male and 1.23% of female deaths was attributable to tobacco use in 2016 (Tobacco Atlas, n. d.). Below is a table of estimated (2000 to 2010) and projected (2015 to 2025) prevalence rate of current tobacco smoking among adults in Ghana[1]. Table 1 indicates an anticipated upward trend in the prevalence rate of current tobacco smoking among adults during the period under study from an estimated 4.9% in 2005 to 6.1% in 2015. Tobacco consumption is predominantly a male phenomenon in Ghana (John et al., 2012b; WHO, 2015).

The continent of Africa currently has the lowest tobacco consumption prevalence rate (Mendez et al., 2013). In the absence of the implementation of additional tobacco control policies, the tobacco consumption prevalence rate is expected to increase to 21.9% by 2030 (Mendez et al., 2013). Africa is expected to undergo considerable population growth, from its current 12%, to 30% of world population by 2100 (Blecher & Ross, 2013). In addition, Africans are experiencing rising incomes as a result of higher economic growth. These factors make Africa a valuable market for tobacco firms to offset decreasing sales elsewhere (Blecher & Ross, 2013).

Trends In Current Tobacco Smoking Among Persons Aged 15 Years And Over

Table 1. Current Tobacco Smoking (%)

Year	Men	Women	Both Sexes
2000	8.4	0.7	4.6
2005	9.4	0.6	4.9
2010	10.5	0.5	5.3
2015	12.0	0.4	6.1
2020	13.7	0.3	6.9
2025	15.9	0.3	8.0

Source: WHO, 2015

[1] Tobacco smoking is said to be current if a person smoked at least once in the 30 days prior to the survey.

3.1 Taxation of Tobacco Products

In Ghana, the excise tax constitutes the major part of total taxes levied on tobacco products. Value Added Tax (VAT), import duty, and the National Health Insurance levy form a smaller part of the total taxes on cigarette. Ghana has witnessed a degree of stability in all taxes over the period from 2004 to 2014, except in the excise tax rate, which has been through considerable changes during the period.

The government of Ghana levied a 140% ad valorem excise tax on the CIF (cost, insurance and freight value) of cigarettes from 2000 to 2006 (Ghana Health Service, 2010; Ministry of Finance and Economic Planning, 2000). In June 2007, it changed the ad valorem excise tax on cigarettes to a specific excise tax on cigarettes ranging from 0.01 cedi to 0.0275 cedi[2] per stick on selected brands, while non-listed brands maintained the 140% ad valorem excise tax (Ministry of Finance and Economic Planning, 2007; Customs and Excise Act, 2007). The specific excise tax represented only 13% of the retail price of cigarettes in 2008 (WHO, 2010). The World Health Organization recommends a total excise tax burden of 70% (WHO, 2010). In 2010, Ghana again reverted back to an ad valorem excise tax system. It charged 140% on the CIF value of cigarette products. The ad valorem tax of 140% represented an excise tax burden of 22% (Ghana Health Service, 2010). Ghana subsequently increased the ad valorem excise tax on all tobacco products to 150% of the CIF value in 2012 (Ministry of Finance and Economic Planning, 2012). Van Walbeek (2015) observed that the CIF value of cigarettes represented 11% of the retail price of cigarettes. In 2015, the excise tax was again increased, to 175% of CIF value. Van Walbeek (2015) found that the CIF value of cigarettes was 7% of the retail price.

Since these increments in ad valorem excise taxes were based on the CIF value, they have been largely ineffective in raising the retail price of tobacco products. Most importantly, an ad valorem excise tax could easily be subject to transfer pricing, a phenomenon where the tobacco industry manipulates the CIF value so that the amount paid as tax remains unchanged. Prior to Ghana's independence in 1957, cigarettes were manufactured locally by British American Tobacco (BAT). BAT Ghana enjoyed a near-monopoly status in the production and distribution of cigarettes after independence (Owusu-Dabo et al., 2009). In 2006, however, BAT Ghana closed down local manufacturing because of losses and relocated manufacturing operations to Nigeria from which it currently imports to Ghana (Owusu-Dabo et al., 2009). Both Ghana BAT and Nigeria BAT report to BAT plc in the United Kingdom. This arrangement is perfect for transfer pricing.

The National Cancer Institute (2017) explains that it is changes in the retail price, not the level of the retail price, that lead to changes in the consumption of cigarettes. Increases in the retail price of tobacco products need to be sustained over time to mitigate the effects of inflation. The literature confirms that tobacco consumers in low and middle income countries are sensitive to

[2] The redenominated Ghana cedi value was used

increments in the prices of cigarettes (NCI, 2017). Nana (2014) proposed a mixed excise tax system, comprising both an ad valorem and a specific component, for West African countries to accommodate the difference in markets. A merit of Nana's proposal is that the specific excise tax component would lead to relatively higher excise tax burdens. In addition, a specific excise tax component would take care of the problem of transfer pricing, because excise taxes will not be calculated solely on the CIF value. An ad valorem excise tax component will help to adjust cigarette prices and take care of inflation (WHO, 2010).

3.2 Tobacco Control Laws In Ghana

On 11 July 2012, Ghana passed the Public Health Act into law. The date of gazette notification was 16th October, 2012. However, the Campaign for Tobacco-Free kids (2019) explained that the effective date of the law was 9th October, 2012. The requirements (Food and Drugs Authority guidelines) for the packaging and labeling of tobacco products component of the Public Health Act were effective on 1st March, 2013. Part 6 of the Act relates to policies aimed at achieving Articles 7, 8, 11, 12, 13, 14 and 16 of the WHO Framework Convention for Tobacco Control. These provisions largely consist of measures aimed at reducing the demand for tobacco products (Articles 7, 8, 11, 12, 13 and 14) and controlling the supply of tobacco products (Article 16). The Framework Convention for Tobacco Control is a treaty of 181 member countries. Article 7 proposes the enactment of legislative, executive, administrative, or any other measures deemed pertinent to forestall or gradually curb the use of tobacco products. These measures are spelt out in Articles 8 to 14 of the WHO Framework Convention for Tobacco Control.

Article 8. Protection from exposure to tobacco smoke;
Article 9. Regulation of the contents of tobacco products;
Article 10. Regulation of tobacco product disclosures;
Article 11. Packaging and labeling of tobacco products;
Article 12. Education, communications, training, and public awareness;
Article 13. Tobacco advertising, promotion, and sponsorship;
Article 14. Demand reduction measures concerning tobacco dependence and cessation;

WHO, 2005

Part 6 of the Public Health Act consists of the following provisions:

1. Prohibition of smoking in public places;
2. A ban on the Promotion, Advertising, and Sponsorship of tobacco and tobacco products;
3. Guidelines on the labeling and packaging of tobacco and tobacco products;
4. A display of health warnings at the point of sale of tobacco products;
5. Prohibition of sale of tobacco products to persons below 18 years;
6. Public education against tobacco use;
7. Treatment of tobacco addiction;
8. Prohibition of sale of tobacco products at designated public places or through unapproved channels.

Public Health Act, 2012

Ghana has implemented measures relating to the Protection from exposure to tobacco smoke (Article 8), Regulating tobacco product disclosures (Article 10), Packaging and labeling of tobacco products (Article 11), Education, communications, training and public awareness (Article 12), Tobacco advertising, promotion and sponsorship (Article 13), Demand reduction measures concerning tobacco dependence and cessation (Article 14), and Measures relating to the reduction of the supply of tobacco such as the prohibition of the sale of tobacco products to persons below 18 years (Article 16); measures relating to Regulation of the contents of tobacco products (Article 9) have not yet been implemented (Kyei-Faried, 2014).

On 19th September, 2016 Ghana introduced additional tobacco control regulations under the Tobacco Control Regulations 2016 (Legislative Instrument 2247) in furtherance of Part 6 of the Public Health Act. The effective date of this law was 4th January, 2017. The Tobacco Control Regulations provided specific measures aimed at achieving the provisions in Part 6 of the Public Health Act.

4. CONCEPTUAL FRAMEWORK

Conditional Demand Functions

Following John (2008), and Chelwa and van Walbeek (2014), this study assumes that households maximize a single utility function and seek to maximize their utility subject to income constraint. This assumption is made because of limitations in the dataset, which does not allow for intra-household interactions to be observed. The household utility-maximization problem results in a set of Marshallian demand functions of the form

$x_i\,(p_i...., pn; Y ;a)$

where $\mathbf{x_i}$ is the quantity purchased of the ***i*th** commodity, $\mathbf{p_i}$ is the price of the ***i*th** commodity, **a** is a vector of household characteristics and **Y** is household income.

Following Pollak (1969), the consumption of tobacco products is assumed to be pre-allocated by the household. The household first spends on tobacco then allocates the remainder of its income to other goods and services. The household's utility-maximization problem will therefore result in a set of conditional demand functions of the form

$x_i = g_i\,(p_i....,p_n; M; a; d),$

where **d** is a variable that shows whether the household spends on tobacco or not. **M** is net-of-tobacco household income.

4.1 Methodology

Two methods were used in this study. Following John (2008), and San and Chaloupka (2015) this paper will first conduct a test on the difference in mean expenditure share (weighted budget share averages) of tobacco-consuming and non-tobacco-consuming households to ascertain differences in household expenditure patterns.

The analysis will further estimate Engel curves using the Quadratic Almost Ideal Demand System developed by Banks et al. (1997). Engel curves will be estimated for the two cross sections of data. The Quadratic Almost Ideal Demand System consistent with consumer theory allows goods to be modeled as luxuries or necessities at certain income levels. Thus, it provides a more accurate representation of consumer behavior across income groups. This method will take into account socio-economic differences between tobacco-consuming and non-tobacco-consuming households. The quadratic conditional Engel curves will be estimated using the Generalized Method of Moment Three-Stage-Least-Squares (GMM 3SLS) with instrumental variables.

The functional form below is implemented to estimate Engel curves for the various categories of expenditure

$$w_i = \alpha_{1i} + \alpha_{3i}q + \alpha_{4i}a + \beta_{1i} \ln M + \delta_{1i} (\ln M)^2 + U_{ij}$$

w_i represents the net-of-tobacco budget share (in percentages) of **i** commodity group;

q is the expenditure on tobacco by a household;

a is a vector of household characteristics, which include age of household heads, adult ratio, and the logarithm of household size;

M is net-of-tobacco household expenditure

Previous studies in different countries found the variables **q** and **M** to be endogenous (John, 2008; Chelwa & van Walbeek, 2014; San & Chaloupka, 2015). The Durbin-Wu-Hausmann test of the explanatory variables **q** and **M** in this study revealed that they were endogenous. Instrumental variables were used to correct for endogenous variables. For lack of a better instrument this study followed the literature (Keen, 1986; Vermeulen, 2003; John, 2008; San & Chaloupka, 2015) and used household expenditure as an instrument for **M**. The instrument for **q** was the adult sex ratio following the literature (John, 2008; Pu et al., 2008; Chelwa & van Walbeek, 2014). Adults are defined as persons aged above 17 years. The prevalence rate of tobacco use is higher among adults than non adults (Tobacco Atlas, n.d.; John et al. 2012b; WHO, 2015) and higher among male adults than female adults in Ghana (Tobacco Atlas, n.d.;

John et al. 2012b; WHO, 2015). Since more males than females smoke, the adult sex ratio is expected to be highly correlated with tobacco expenditure but unrelated to the error term.

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity revealed the presence of heteroskedastic errors. According to Wooldridge (2010) the GMM 3SLS is more efficient than the traditional 3SLS in the presence of heteroskedastic errors because it produces more efficient parameter estimates.

The inclusion restriction test on the instruments revealed that household expenditure and adult sex ratio are valid and strong instruments for **M** and **q** respectively**.** This study did not allow for the exclusion restriction to be violated in either of the instruments. In the case of the adult sex ratio I acknowledge that this may not influence the results significantly as shown by Chelwa and van Walbeek (2014). In the case of the household expenditure this may adversely affect the results because household expenditure seems to violate the exclusion restriction.

5. DATA

This study uses data from rounds 5 and 6 of the Ghana Living Standards Survey conducted by the Ghana Statistical Service. The Ghana Living Standards Surveys are nationally representative surveys that consist of data at the individual, household, and community levels. Of interest to this paper is the household section which comprises data on housing characteristics, agricultural inputs, crop production, and expenditure on food items, assets, savings, and loans.

The Ghana Statistical Service has a complete list of enumeration areas based on previous censuses. The enumeration areas serve as the primary sampling units while households within each enumeration area serve as the secondary sampling units. A two-stage stratified random sampling design was employed. Enumeration areas were first stratified according to the ten administrative regions of the country and then according to rural and urban areas of location for both datasets. The distribution of the selected enumeration areas in the ten regions was based on probability proportionate allocation using the population size.

The Ghana Living Standards Survey Round 5 enumeration exercise spanned one year, from September 2005 to September 2006. Five hundred and fifty enumerative areas were considered during the first stage of sampling; 15 households were subsequently selected from each enumerative area. At least 400 households were selected from each of the ten regions. 8,688 households were surveyed overall, of which 7,867households (91.10%) did not consume any tobacco. 52 households were deleted from the dataset for having missing or zero value for annual household expenditure. An enumerator visited each household in the enumeration area every third day in a 33 day cycle.

The Ghana Living Standards Survey Round 6 enumeration exercise also spanned one year from October 2012 to October 2013. 1,200 enumerative areas were considered at the first stage of sampling; 15 households were subsequently selected from each enumerative area. Round 6 enumerated a larger sample of 16,772 households, compared to 8,688 households in Round 5. Of these 15,528 households (92.62%) did not consume any tobacco. 7 households were deleted from the dataset for having zero value for annual household expenditure. Each household was visited every 6th day in a 35 day cycle.

During both surveys a diary of daily expenditure was used to support the interviews. During the first visit, a literate member of the household was trained to record all subsequent expenditure and submit the diary to the interviewer on his next visit. Where a household had no literate member, the enumerator made daily visits to record all expenditure in the diary.

These questions were administered to households for reporting consumption quantities and expenditure for different products: Was anything spent on less frequently purchased item in the last 12 months? Amount spent on a frequently purchased item?

Household expenditure is grouped into twelve broad categories: Food & non-alcoholic beverages; Alcoholic beverages; Clothing & footwear; Housing, water, electricity & gas; Furnishings, household equipment & maintenance; Health; Transport; Communications; Recreation & culture; Education; Miscellaneous goods & services; and Tobacco.

6. RESULTS

6.1 Descriptive Statistics

The tables below show the descriptive statistics pertaining to 2005/2006 and 2012/2013. Both datasets have been segregated into Smoking and Non-smoking categories.

Table 2. Descriptive statistics from the 2005/2006 Ghana Living Standards Survey

Description	Smoking Households	Non-smoking Households	Full sample
Average annual household expenditure (cedis)	1,374	5,085	4,755
Average annual household expenditure (adjusted for inflation)[3]	674	2495	2333
Median annual household expenditure (cedis)	752	1,220	1,178
Median annual household expenditure (adjusted for inflation)	369	599	578
Average annual tobacco expenditure (cedis) by tobacco consuming households	37.61	0.00	37.61
Average annual tobacco expenditure (cedis) by tobacco consuming households (adjusted for inflation)	18.45	0.00	18.45
Average number of children in household	2.76	1.96	2.03
Average number of adult males	1.39	1.01	1.04
Average household size	5.52	4.16	4.28
Average number of adults in household	2.76	2.19	2.24
Average age of household head	48.63	45.03	45.35
Average age of adults in household	41.36	39.22	39.39
Average age of children in household	7.92	8.17	8.15
Average years of education of household head	10.24	11.84	11.76
Average years of education of most educated household member	8.8	11.50	11.30
Percentage of households not consuming tobacco			91.11
Percentage of households consuming tobacco			8.89
n = 8,635			

[3] Amount was adjusted using the year 2002 as the base period

Table 3. Descriptive statistics from the 2012/2013 Ghana Living Standards Survey			
Description	**Smoking Households**	**Non-smoking Households**	**Full sample**
Average annual household expenditure (cedis)	5,104	7,071	6,926
Average annual household expenditure (adjusted for inflation)[4]	1113	1542	1511
Median annual household expenditure (cedis)	3,805	5,215	5,109
Median annual household expenditure (adjusted for inflation)	830	1137	1114
Average annual tobacco expenditure (cedis) by tobacco consuming households	123.86	0.00	123.86
Average annual tobacco expenditure (cedis) by tobacco consuming households (adjusted for inflation)	27.01	0.00	27.01
Average number of children in household	2.96	1.95	2.02
Average number of adult males	1.42	1.03	1.06
Average household size	5.75	4.20	4.32
Average number of adults in household	2.79	2.25	2.29
Average age of household head	49.47	45.55	45.84
Average age of adults in household	41.64	39.41	39.58
Average age of children in household	8.09	8.16	8.15
Average years of education of household head	9.89	12.0	11.91
Average years of education of most educated household member	9.41	12.05	11.88
Percentage of households not consuming tobacco			92.62
Percentage of households consuming tobacco			7.38
n = 16,765			

Tables 2 and 3 above show that annual expenditure on tobacco increased from an average of 37.61cedis to 123.86 cedis. After adjusting for inflation, it represents an increase in almost half from 18.45 cedis to 27.01 cedis over a 7 year period. The prevalence rate of tobacco use among households also declined from 8.89% to 7.38%.

Non-tobacco-consuming households enjoy a better standard of living than tobacco-consuming households. This is observed by non-tobacco-consuming households having a smaller household size, and better educated household members in both surveys. This is corroborated in a study of Ghana by John et al. (2012b) who found that tobacco users were more likely to be poor and less educated.

[4] Amount was adjusted using the year 2002 as the base period

6.2 Summary Statistics of Expenditure Share of the Populations

Tables 4 and 5 present the summary statistics of the expenditure share of the various categories of household expenditure. These are segregated into quintiles for both Smoking and Non-smoking households in order to enable observation of any differences in expenditure share allocations between the two groups. A test on the difference in mean expenditure is subsequently conducted to ascertain if both households allocate their expenditure significantly differently.

Table 4. Average Annual Household Expenditure Share (%) (2005/2006)

Category of Expenditure	Income Quintile					Full sample
	Q1	Q2	Q3	Q4	Q5	
Food						
Non Smoker	54.35	54.35	51.60	49.24	45.25	50.92
Smoker	48.73	47.38	47.79	44.94	42.20	46.87
Alcohol						
Non Smoker	3.64	1.88	1.62	1.44	0.99	1.91
Smoker	7.75	7.09	6.21	6.11	3.52	6.54
Clothing						
Non Smoker	7.78	8.20	8.75	8.75	8.65	8.43
Smoker	7.07	7.64	7.83	9.11	10.36	8.06
Housing						
Non Smoker	17.08	15.56	14.76	14.47	15.27	15.42
Smoker	16.62	16.76	14.37	13.53	15.46	15.55
Furnishings						
Non Smoker	1.70	1.84	2.04	2.25	2.36	2.04
Smoker	1.48	2.20	1.88	2.05	2.04	1.87
Health						
Non Smoker	2.67	2.46	2.37	2.07	2.20	2.35
Smoker	2.50	2.58	2.06	2.74	3.27	2.56
Transport						
Non Smoker	3.23	3.65	4.56	5.13	5.74	4.47
Smoker	3.69	2.52	4.76	3.80	6.13	3.95
Communications						
Non Smoker	0.57	1.00	1.66	2.14	2.94	1.67
Smoker	0.22	0.11	0.60	0.65	1.09	0.44
Recreation						
Non Smoker	2.90	2.78	2.93	3.37	3.52	3.10
Smoker	3.01	3.70	3.66	4.28	3.77	3.59
Education						
Non Smoker	1.73	2.36	2.89	3.69	5.16	3.18
Smoker	1.09	0.88	1.54	1.83	3.03	1.48
Miscellaneous						
Non Smoker	4.36	5.93	6.82	7.44	7.93	6.51

Smoker	3.15	4.21	4.96	7.07	6.04	4.73
Tobacco						
Non Smoker	0.00	0.00	0.00	0.00	0.00	0.00
Smoker	4.69	4.94	4.33	3.88	3.07	4.35
TOTAL						
Smoker	100.00	100.00	100.00	100.00	100.00	100.00
Non Smoker	100.00	100.00	100.00	100.00	100.00	100.00

Table 5. Average annual household expenditure share (%), (2012/2013)						
Category of Expenditure	**Income Quintile**					**Full sample**
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	
Food						
Non Smoker	57.40	57.42	56.06	53.34	49.05	54.56
Smoker	52.68	52.04	51.38	49.75	48.58	51.55
Alcohol						
Non Smoker	2.35	2.37	1.40	1.28	1.07	1.68
Smoker	5.94	6.90	4.62	4.82	4.00	5.62
Clothing						
Non Smoker	8.62	7.33	7.53	7.29	7.47	7.65
Smoker	7.99	6.34	8.33	7.43	7.24	7.52
Housing						
Non Smoker	12.21	12.35	11.94	12.46	14.02	12.61
Smoker	12.34	12.10	12.08	12.46	13.66	12.37
Furnishings						
Non Smoker	1.77	1.98	2.13	2.29	2.41	2.12
Smoker	1.70	1.68	1.96	1.98	2.07	1.81
Health						
Non Smoker	1.20	1.66	1.33	1.28	1.06	1.30
Smoker	1.64	2.05	1.70	1.77	1.65	1.77
Transport						
Non Smoker	4.28	4.36	4.97	5.85	7.23	5.37
Smoker	3.70	3.58	4.58	4.71	5.90	4.15
Communications						
Non Smoker	3.91	3.63	4.64	5.26	5.69	4.65
Smoker	2.45	2.49	3.08	3.80	3.87	2.87
Recreation						
Non Smoker	2.17	2.36	2.47	2.55	2.67	2.45
Smoker	3.03	3.14	2.62	2.71	2.65	2.91
Education						
Non Smoker	1.08	0.87	1.26	1.38	1.69	1.27
Smoker	0.66	1.04	1.49	1.54	1.47	1.08
Miscellaneous						
Non Smoker	4.99	5.67	6.27	7.01	7.64	6.34
Smoker	3.84	4.35	5.27	5.79	5.80	4.64
Tobacco						
Non Smoker	0.00	0.00	0.00	0.00	0.00	0.00
Smoker	4.03	4.28	2.89	3.24	3.11	3.71
TOTAL						
Non Smoker	100.00	100.00	100.00	100.00	100.00	100.00
Smoker	100.00	100.00	100.00	100.00	100.00	100.00

The tobacco budget share shows a reduction from 4.35% to 3.71% over the period of the study. The first, second, third, and fourth quintiles show a budget share reduction of 14.07%, 13.36%, 33.26% and 16.49% respectively. This explains that wealthy and poor households are the most reluctant to reduce the share of budget allocated to tobacco.

Food purchases take up the largest share of household expenditure. Non-tobacco-consuming and tobacco-consuming households allocate 50.92% and 46.87% of their budgets respectively to food in the first survey. This allocation increases substantially, to 54.56% and 51.55% respectively by the second survey. Poor households allocate the highest budget share to food compared to other income groups. This is indicative of the income constraint faced by these households.

A positive association is observed between alcohol and tobacco expenditure in both surveys. Non-tobacco-consuming households allocated 1.91% of their budget to alcohol, while tobacco-consuming households allocated 6.54%. These allocations are reduced by 12.04% within non-tobacco-consuming households and by 14.07% within tobacco-consuming households respectively.

Health, education, and other categories excluding food, transport, and communications experienced budget share reductions among both groups over the time of the study. Households allocated the extra budget made available by these reductions mainly to food and communications. The budget share allocation to communications by non-tobacco-consuming households increased from 1.67% to 4.65%, while that of tobacco-consuming households increased from 0.44% to 2.87%.

6.3 Main Results

The results of the test on the difference in mean expenditure by tobacco-consuming and non-tobacco-consuming households are presented below in tables 6 and 7. These differences do not account for socio-economic factors between the two groups; this aspect will be estimated later.

Difference in Expenditure share

Table 6. Difference in Weighted Mean Expenditure share (%) Between Non Smoking & Smoking Households (2005/2006)

Category of Expenditure	Income Quintiles					Full sample
	Q1	Q2	Q3	Q4	Q5	
Food	5.62***	6.97***	3.80***	4.30**	3.05*	4.05***
Alcohol	-4.12***	-5.20***	-4.58***	-4.68***	-2.53***	-4.64***
Clothing	0.71	0.55**	0.91	-0.36	-1.72**	0.37
Housing	0.46	-1.20	0.39	0.94**	-0.19	-0.13
Furnishings	0.22**	-0.36	0.16	0.20	0.32	0.17**
Health	0.18	-0.12	0.31	-0.67	-1.08	-0.20
Transport	-0.46	1.13**	-0.20	1.33***	-0.40	0.52
Communications	0.35***	0.89***	1.05***	1.49***	1.85***	1.23***
Recreation	-0.11	-0.92	-0.74	-0.91**	-0.25	-0.49**
Education	0.64***	1.48***	1.36***	1.85***	2.12	1.69***
Miscellaneous	1.21***	1.72***	1.87***	0.37	1.88***	1.78***
Tobacco	-4.69***	-4.94***	-4.33***	-3.88***	-3.07***	-4.35***

Note: A positive value indicates that the expenditure on this category by non-tobacco-consuming households is higher than the expenditure of tobacco-consuming households.
*, ** and *** implies the difference is statistically significant at the 10%, 5% and 1% level respectively.

Table 7. Difference in Weighted Mean Expenditure share (%) Between Non Smoking & Smoking Households (2012/2013)

Category of Expenditure	Income Quintiles					Full sample
	Q1	Q2	Q3	Q4	Q5	
Food	4.72***	5.38***	4.69***	3.59***	0.47	3.01***
Alcohol	-3.58***	-4.53***	-3.22***	-3.54***	-2.93***	-3.94***
Clothing	0.63	0.99	-0.80	-0.13	0.23	0.13
Housing	-0.13	0.25	-0.14	-0.01	0.36	0.24*
Furnishings	0.07	0.30	0.17**	0.31	0.33	0.31**
Health	-0.44***	-0.39	-0.37**	-0.49**	-0.59**	-0.47***
Transport	0.58	0.78*	0.39	1.14	1.33	1.22***
Communications	1.46***	1.13***	1.56***	1.46**	1.82*	1.78***
Recreation	-0.86***	-0.79*	-0.14	-0.16	0.02	-0.46***
Education	0.43***	-0.17	-0.23	-0.16	0.22**	0.19***
Miscellaneous	1.15***	1.32***	0.99	1.23	1.84	1.70***
Tobacco	-4.03***	-4.28***	-2.89***	-3.24***	-3.11***	-3.71***

Note: A positive value indicates that the expenditure on this category by non-tobacco-consuming households is higher than the expenditure of tobacco-consuming households.
*, ** and *** implies the difference is statistically significant at the 10%, 5% and 1% level respectively.

The difference in household expenditure on food, tobacco, alcohol, education, recreation, and miscellaneous items among tobacco-consuming and non-tobacco-consuming households has become smaller over the period of the study. Food and education show the most profound

reduction of budget share difference among both groups. The difference in food share between the two groups declined from 4.05% to 3.01% while the difference in education went down from 1.69% to 0.19%, implying that non-tobacco-consuming households decreased their budget share allocations to food and education relative to tobacco-consuming households.

However the difference in budget share on other expenditure categories such as housing, furnishings, health, communications, and transport became larger among both groups. Transport, communications, and health showed substantial increment. This shows that non-tobacco-consuming households increased their budget share relative to tobacco-consuming households in transport and communications, while tobacco-consuming households increased their budget share on health relative to non-tobacco-consuming households over the period of the study.

Regression Results

Tables 8 and 9 below present the results of the Engel curves estimated from the Quadratic Almost Ideal Demand System for both periods using the model below

$$w_i = \alpha_{1i} + \alpha_{3i}q + \alpha_{4i}a + \beta_{1i} \ln M + \delta_{1i} (\ln M)^2 + U_{ij}$$

Table 8. Results of the quadratic conditional Engel curve 2005/ 2006

	Food	Alcohol	Clothing	Housing	Furnishing	Health	Transport	Communications	Recreation	Education
Q	-219.4539***	-62.492***	-20.5228***	-47.3178***	5.2363***	383.1266***	-5.9586***	9.7359***	25.9700***	45.516***
lnM	1239.575***	344.5796***	115.6398***	246.8816***	-30.8773***	-2127.938***	32.7853***	-55.9823***	-147.8467***	-251.5542***
(lnM)²	-75.0594***	-21.0547***	-7.0309***	-15.0315	1.8671***	128.8103***	-1.8961***	3.4789***	8.9411***	15.3447***
n = 8,628										

Note: parameters of q are divided by 100. *, ** and *** shows levels of significance at 10%, 5% and 1% respectively.

Table 9. Results of the quadratic conditional Engel curve 2012/ 2013

	Food	Alcohol	Clothing	Housing	Furnishing	Health	Transport	Communications	Recreation	Education
q	-3.1734***	-1.9100***	-2.3331***	1.4363***	0.0972***	3.6059***	-1.3019***	0.9690***	-0.7198***	-0.2933***
lnM	59.3731***	-2.5744***	11.4602***	-26.8323***	-2.0963***	-24.2768***	-0.0550***	2.4834***	2.9564***	-0.9697***
(lnM)2	-3.7195***	-0.3042***	-0.8489***	1.7008***	0.1467***	1.6203***	0.0446***	-0.0028***	-0.2152***	0.0730***
n=16,741										

Note: parameters of q are divided by 100. *, ** and *** shows levels of significance at 10%, 5% and 1% respectively.

q shows the pre-allocated expenditure on tobacco and it indicates the extent of crowding-out. For example, for every one cedi increase in the pre-allocated amount on tobacco, there is a reduction in the budget share allocated to food (**M**) by 2.1945% or 0.021945 x **M** cedi in the first survey, and by 0.0372% or 0.0004 x **M** cedi in the second survey. **M** is the net-of-tobacco budget of a given household in that year.

The coefficients (**ln M**) and $(\ln M)^2$ indicate whether households allocate more or less expenditure, in the case of a normal or inferior good, to an expenditure category as they become

wealthier which helps identify which expenditure categories are considered as necessities, luxury, inferior or sticky goods at different income levels by households.

The results show that tobacco expenditure consistently crowd-out expenditure on food, alcohol, clothing and transport, while crowding-in furnishings, health and communication.

In the first period, a 10% increase (3.76 cedis) in tobacco expenditure leads to a decrease in the budget (**M**) to food by 8.25%, to alcohol by 2.35%, to clothing by 0.77%, and to transport by 0.22% while a 10% increase (3.76 cedis) in tobacco expenditure leads to an increase in the budget (**M**) to furnishings by 0.20%, to health by 14.41%, and to communication by 0.37%.

In the second period a 10% increase (12.39 cedis) in tobacco expenditure leads to a decrease in the budget (**M**) to food by 0.39%, to alcohol by 0.24%, to clothing by 0.29%, and to transport by 0.16% while a 10% increase (12.39 cedis) in tobacco expenditure leads to an increase in the budget (**M**) to furnishings by 0.01%, to health by 0.45%, and to communication by 0.12%.

The reductions in the magnitude of crowding-in and crowding-out of other household expenditure by tobacco over the period can be partially attributed to the reduction in the household budget on tobacco from 4.35% to 3.71% over the period of the study. A significant portion of the reduction in the magnitude of crowding-in and crowding-out can be explained by the introduction of the tobacco control law in 2012.

6.4 DISCUSSION

This paper analyzed the effect of the tobacco control law in 2012 on household expenditure patterns. The results show that over the time of the study the household budget on tobacco reduced from 4.35% to 3.71%. There was also a reduction in the tobacco-use prevalence rate from 8.89% to 7.38%, contrary to the WHO's projected increase in the prevalence rate of tobacco use (WHO, 2015). Similarly other studies found a decrease in the prevalence rate of tobacco use after the introduction of tobacco control policies (San & Chaloupka, 2015; Ross et al., 2018). In addition, Ross et al. (2018) observed that the share of tobacco expenditure in the gross domestic product of Mauritius dropped significantly from 0.488% to 0.412% over the period of the study. Poor households showed a lower reduction in the tobacco budget than middle-income households in Ghana. In addition, the poorest households allocated the largest budget share to tobacco over the time of the study, implying that they bore the greatest burden from the adverse effects of tobacco use. This phenomenon is also observed in Mauritius (Ross et al., 2018).

The econometric results explain that tobacco-consuming households spent less on food and alcohol because of tobacco. Other studies observed a similar situation, in which expenditure on tobacco crowded out food in Turkey, Bangladesh, Indonesia and New Zealand (San & Chaloupka, 2015; Efroymson et al., 2001; Barraclough, 1999; Thomson et al., 2002).

Results on tables 4 and 5 show that non-tobacco-consuming households allocated more of their budget to education relative to tobacco-consuming households in both surveys. Poor households allocate the lowest budget share to education, especially poor tobacco-consuming households. Tables 2 and 3 show that on average, non-tobacco-consuming households are better educated than tobacco-consuming households. This is corroborated in a study by John et al. (2012b) who found that tobacco-consuming individuals in Ghana tend to be less educated. However, the difference in budget share allocation to education gradually diminishes over the time of the study, as both groups substantially reduce their budget share allocation. The education share of the budget declines from 3.18% to 1.27% among non-tobacco-consuming households, and from 1.48% to 1.08% among tobacco-consuming households. This is the effect of a USD 3 per child capitation grant, introduced by the government in 2005/2006 to help reduce the cost of education (Akyeampong, 2009).

The econometric results point out to a crowding-in of health expenditure by tobacco in both surveys. The magnitude of crowding-in however diminishes over the period of the study. Most studies also observed a crowding-in of health expenditure by tobacco due to the adverse effect of tobacco on the health of the consumer. Studies of India (John et al., 2011) and China (Liu et al., 2006) observed that tobacco-consuming households spent a significant part of their income on tobacco and tobacco related medical expenses.

Limitations

The most ideal data type for this type of study is a panel dataset. It would have allowed this study to look at same households over both surveys and predict more accurately the impact of the tobacco control law on household expenditure patterns. In the absence of a panel dataset, this study used two cross-sectional datasets, complemented by instrumental variable estimation to correct for endogeneity.

The imperfection of total household expenditure as an instrument could have an impact on the estimates of the Engel curves.

7. CONCLUSION

This paper aims to contribute to the literature on the impact of tobacco on other household expenditure. It also considers the effect of the tobacco control law introduced in Ghana in July 2012 on household expenditure patterns.

This study used a GMM 3SLS with instrumental variables to estimate Engel curves in order to ascertain the impact of tobacco expenditure on other household expenditure in the years 2005/2006 and 2012/2013. The results show a crowding-out of food, alcohol, clothing and transport, and a crowding-in of furnishings, health and communication expenditure by tobacco. The magnitude of crowding-in and crowding-out however declined over the period under study. The poorest households bore the brunt of the crowding-out of other household expenditure by tobacco. In addition, there was a significant reduction in the budget share households allocated to tobacco, and a reduction in the prevalence rate of tobacco use among households.

It seems plausible that the introduction of the tobacco control law in 2012 was associated with a reduction in the prevalence rate of tobacco use and a reduction in the budget share allocation to tobacco. This corroborates the findings of other studies measuring the impact of tobacco control policies on tobacco consumption.

REFERENCES

1. Akyeampong, K. 2009. Revisiting Free Compulsory Universal Basic Education (FCUBE) in Ghana [Online] Available at: https://www.researchgate.net/profile/Kwame_Akyeampong/publication/44840160_Revisiting_Free_Compulsory_Universal_Basic_Education_FCUBE_in_Ghana/links/5943a0e4a6fdccb93ab57070/Revisiting-Free-Compulsory-Universal-Basic-Education-FCUBE-in-Ghana.pdf?origin=publication_detail [Accessed 23 November 2018]

2. Banks, J., Blundell, R. & Lewbel, A. 1997. Quadratic Engel Curves and Consumer Demand. The Review of Economics and Statistics, 79: 527 – 539

3. Barraclough, S. 1999. Women and Tobacco in Indonesia. Tobacco Control 8:327–332

4. Best, C. M., Sun, K., de Pee, S., Bloem, M. W., Stallkamp, G. & Semba, R. D. 2007. Parental tobacco use is associated with increased risk of child malnutrition in Bangladesh. Nutrition, 23: 731–738

5. Blecher, E. H. & Ross, H. 2013. Tobacco use in Africa: Tobacco Control through Prevention. American Cancer Society

6. Block, S., & Webb, P. 2009. Up in smoke: Tobacco use, expenditure on food, and child malnutrition in developing countries. Economic Development and Cultural Change, 58: 1–23

7. Busch, S. H., Jofre-Bonet, M., Falba, T. A. & Sindelar, J. L. 2004. Burning a hole in the budget: Tobacco spending and its crowd-out of other goods. Applied Health Economics and Health Policy, 3: 263 – 272

8. Campaign for Tobacco-Free kids. 2019. Legislation by country Ghana [Online] Available from https://www.tobaccocontrollaws.org/legislation/country/ghana/laws [Accessed 27 January 2019]

9. Chelwa, G. & van Walbeek, C. 2014. Assessing the Causal Impact of Tobacco Expenditure on Household Spending Patterns in Zambia. Economic Research Southern Africa: Working paper 453: 1-40.

10. Customs and Excise (Duties and Other Taxes) (Amendment) Act, Act 739. 2007. Government gazette. 29th June. Assembly Press: Government Printer. Ghana

11. Doku, D., Koivusilta, L., Raisamo, S. & Rimpelä, A. 2010. Do socioeconomic differences in tobacco use exist also in developing countries? A study of Ghanaian adolescents. BMC Public Health, 10:758

12. Efroymson, D., Ahmed, S., Townsend, J., Alam, S. M., Dey, A. R., Saha, R., Dhar, B., Sujon, A. I., Ahmed K. U. & Rahman, O. 2001. Hungry for tobacco: an analysis of the

economic impact of tobacco consumption on the poor in Bangladesh. Tobacco Control, 10: 212 – 217

13. Ghana Health Service. 2010. Needs assessment for implementation of the WHO Framework Convention on Tobacco Control in Ghana [Online] Available at: http://www.who.int/fctc/implementation/needs/Ghana_Needs_assessment_report_english.pdf?ua=1 [Accessed 9th March, 2018]

14. Ghana Statistical Service. 2005. Ghana Living Standards Survey 5, 2005 [Online] Available at: http://www.statsghana.gov.gh/ [Accessed 20 March 2018]

15. Ghana Statistical Service. 2013. Ghana Living Standards Survey 6, 2012 [Online] Available at: http://www.statsghana.gov.gh/ [Accessed 20 March 2018]

16. Gilman, S. E., Martin, L. T., Abrams, D. B., Kawachi, I., Kubzansky, L., Loucks, E. B., Rende, R., Rudd, R. & Buka, S. L. 2008. Educational attainment and cigarette smoking: a causal association? Int J Epidemiol, 37: 615–624

17. Hu, T., Mao, Z., Liu, Y., Beyer, J. & Ong, M. 2005. Smoking, standard of living, and poverty in China. Tobacco Control 14: 247–250

18. Husain, M. J., Datta, B. K., Virk-Baker, M. K., Parascandola, M. & Khondker, B. H. 2018. The crowding-out effect of tobacco expenditure on household spending patterns in Bangladesh. Available from https://doi.org/10.1371/journal.pone.0205120 [21st January, 2019]

19. John, R. M. 2006. Crowding-out Effect of Tobacco Expenditure And Its Implications on Intra-Household Resource Allocation. Working Paper Series No. WP-2006-002. Indira Gandhi Institute of Development Research.

20. John, R. M. 2008. Crowding out effect of tobacco expenditure and its implications on household resource allocation in India. Social Science & Medicine, 66: 1356–1367

21. John, R. M., Sung, H.-Y., Max, W. B., & Ross, H. 2011. Counting 15 million more poor in India, thanks to tobacco. Tobacco Control, 20: 349–352

22. John, R. M, Ross, H. & Blecher, E. 2012a. Tobacco expenditures and its implications for household resource allocation in Cambodia. Tobacco Control, 21: 341 – 346

23. John, R. M., Mamudu, H. M., Liber, A. C. 2012b. Socioeconomic Implications of Tobacco Use in Ghana. Nicotine & tobacco research: official journal of the Society for Research on Nicotine and Tobacco, 14: 1205-1212

24. Jumrani, J. & Birthal, P. S. 2017. Does consumption of tobacco and alcohol affect household food security? Evidence from rural India. Food Security, 9: 255–279

25. Keen, M. 1986. Zero Expenditures and the Estimation of Engel Curves. Applied Econometrics, 1: 277-286.

26. Koch, S. F. & Tshiswaka-Kashalala, G. 2008. Tobacco substitution and the poor. University of Pretoria Working Paper Series no. 32

27. Kyei-Faried, S. 2014. Reporting Instrument Of The Who Framework Convention On Tobacco Control [Online] Available at: https://untobaccocontrol.org/impldb/wp-content/uploads/reports/ghana_2014_report.pdf [14 January 2019]

28. Laaksonen, M., Rahkonen, O., Karvonen, S. & Lahelma, E. 2005. Socioeconomic status and smoking: Analysing inequalities with multiple indicators. Public Health, 15: 262–269

29. Liu, Y., Rao, K., Hu T. W., Sun, Q. & Mao, Z. 2006. Cigarette smoking and poverty in China. Social Science and Medicine, 63: 2784 – 2790

30. Mendez, D., Alshanqeety, O. & Warner, K. E. 2013. The potential impact of smoking control law on future global smoking trends. Tobacco Control, 1: 46–51

31. Ministry of Finance and Economic Planning. 2000. The Harmonized Commodity Codes and Tariff Schedules 2000. Ghana

32. Ministry of Finance and Economic Planning. 2007. The Harmonized System and Customs Tariff Schedules 2007 [Online] Available at: http://www.gra.gov.gh/docs/info/HS_2007.pdf [Accessed 10th March, 2018]

33. Ministry of Finance and Economic Planning. 2012. The Harmonized System and Customs Tariff Schedules 2012 [Online] Available at: http://www.gra.gov.gh/docs/info/customs/Ghana_Customs_HS_Code.pdf [Accessed 9th March, 2018]

34. Nana, V. N. 2014. Tobacco taxation in West Africa: Overview issues and options for tobacco control [Online] Available at: https://www.africaportal.org/publications/tobacco-taxation-in-west-africa-overview-issues-and-options-for-tobacco-control/ [Accessed 18 July 2018]

35. National Cancer Institute. 2017. The Economics of Tobacco and Tobacco Control [Online] Available at: http://www.who.int/tobacco/publications/economics/nci-monograph-series-21/en/ [Accessed 18 July 2018]

36. Nevo, A. & Rosen, A. M. 2012. Identification with imperfect instruments. The Review of Economics and Statistics, 94: 659 – 671

37. Owusu-Dabo, E., Lewis, S., McNeill, A., Anderson, S., Gilmore, A. & Britton, J. 2009. Smoking in Ghana: a review of tobacco industry activity. Tobacco Control, 18: 206–211

38. Pollak, R. A. 1969. Conditional demand functions and consumption theory. Quarterly Journal of Economics. 83: 60–68

39. Pu, C.-Y., Lan, V., Chou, Y.-J., & Lan, C.-F. 2008. The crowding-out effects of tobacco and alcohol where expenditure shares are low: Analyzing expenditure data for Taiwan. Social Science & Medicine, 66: 1979–1989

40. Public Health Act, No. 851 of 2012. 2012. Government gazette. 16th October. Assembly Press: Government Printer. Ghana

41. Ross, H., Moussa, L., Harris, T. & Ajodhea, R. 2018. The heterogeneous impact of a successful tobacco control campaign: a case study of Mauritius. Tobacco Control, 27: 83–89

42. Sachs, J. D., McArthur, J. W., Schmidt-Traub, G., Kruk, M., Bahadur, C., Faye, M. & McCord, G. 2004. Ending Africa's Poverty Trap. Brookings Papers on Economic Activity, 1: 117-216.

43. San, S. & Chaloupka, F. J. 2015. The impact of tobacco expenditures on spending within Turkish households [Online] Available at: http://tobaccocontrol.bmj.com [Accessed 4 February 2018]

44. Thomson, G. W., Wilson, N. A., O'Dea, D., Reid, P. J. & Howden-Chapman, P. 2002. Tobacco Spending and Children in Low Income Households. Tobacco Control, 11: 372-375

45. Tobacco Atlas, n. d. Ghana [Online] Available at: https://files.tobaccoatlas.org/wp-content/uploads/pdf/ghana-country-facts-en.pdf [Accessed 30 December 2018]

46. Tobacco Control Regulations, 2016 (L.I. 2247). 2016. Government gazette. 11th October. Assembly Press: Government Printer. Ghana

47. Van Walbeek, C. 2002. Recent trends in smoking prevalence in South Africa: Some evidence from AMPS data. South African Medical Journal, 92: 468 – 472

48. Van Walbeek, C. 2015. Tobacco Tax [Online] Available from http://www.tobaccoecon.uct.ac.za/sites/default/files/image_tool/images/405/Training/Emerging_Researcher_Programme_2015/Tobacco-Taxation.pdf [Accessed 13 March 2018]

49. Vermeulen, F. 2003. Do smokers behave differently? A tale of zero expenditures and separability concepts. Economics Bulletin, 4: 1 – 7

50. Wang, H., Sindelar, J. L. & Busch, S. H. 2006. The impact of tobacco expenditure on household consumption patterns in rural China. Social Science and Medicine, 62: 1414 – 1426

51. Wooldridge, J. M. Econometric Analysis of Cross Section and Panel Data, 2nd ed. Cambridge, Massachusetts: The MIT Press; 2010.

52. World Bank Group. 2018. Historical classification by income [Online] Available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups [Accessed 22 September 2018]

53. World Health Organization. 2005. WHO Framework Convention for Tobacco Control. WHO: Geneva, Switzerland

54. World Health Organization. 2010. WHO Technical Manual on Tobacco Tax Administration. WHO: Geneva, Switzerland

55. World Health Organization. 2015. WHO Global Report on Trends in Prevalence of Tobacco Smoking 2015. WHO: Geneva, Switzerland

56. World Health Organization. 2018. Tobacco Product Regulation: Basic Handbook. WHO: Geneva, Switzerland