TOBBACO CONSUMPTION AND HOUSEHOLD WELFARE IN NIGERIA

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DEDICATION

This thesis is dedicated to God, the father of lights.

Also, to the memory of my dad, Oladipupo Adeniji.

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ABSTRACT

Tobacco consumption has been associated with chronic health conditions and deterioration in household welfare. Consequently, the efforts at mitigating its impact is global. Previous national and sub-population epidemiologic studies have provided evidence that suggests that there is an increasing level of tobacco consumption in Nigeria with little attention paid to investigating the welfare effects of tobacco consumption in the country. Therefore, this study was designed to assess the impact of tobacco use on household welfare in Nigeria.

Neoclassical Theory of Consumer Choice (NTCC) served as framework. The NTCC relates household welfare/utility to the consumption of goods and services, subject to households' budget constraint. Following this, the consumption of basic goods and the risk of incurring Catastrophic Health Expenditures (CHE) were used as indicators of household welfare. The Harmonised Nigeria Living Standards Survey of 2009/10 was utilised. Quadratic Almost Ideal Demand System, which provides empirical approximation for the NTCC were specified for tobacco budget share and unit value. National, rural and urban price elasticities of tobacco demand were estimated using within and between clusters variation in prices and quantities demanded. Budget share equations, which controlled for price effects and household size (equivalence scale), were calibrated for household consumption of goods and services (food, education, clothing, health, energy, transportation, recreational activities, and communication). Households were stratified using their tobacco consumption status and households with total health expenditure above 40% of its total non-food expenditure or capacity-to-pay were adjudged to have incurred CHE. Health expenditure models were estimated and excess healthcare spending and risk of CHE attributable to tobacco consumption were predicted. Seemingly Unrelated Regression was used to estimate the impact of tobacco consumption on household welfare. All estimates were validated at $\alpha \leq 0.05$.

Household size, cluster effects, education, and income significantly influenced tobacco consumption among households in Nigeria. The price elasticity of tobacco demand in the national sample was -0.62. Also, rural and urban price elasticities of tobacco demand were -0.63 and -0.49, respectively. In all samples, price elasticity of demand for tobacco was fairly inelastic. Tobacco consumption significantly crowded out the consumption of household goods such as vegetables, fruit, and milk (-0.0102), clothing (-0.0139), communication (-0.0015), and education (-0.0032). However, there was complementarity between tobacco consumption, transportation (0.0040), recreational activities (0.0074) and health (0.0067). On average, tobacco consumption increased health expenditure by 32.9%. Similarly, smoking households residing in rural settings incurred a higher burden of CHE by 3.11%. For all households with a member or members who consumed tobacco, excess medical spending attributable to tobacco consumption increased the CHE by 2.57%.

Tobacco use had impact on the consumption of some basic/essential household commodities and increased the risk of catastrophic health expenditure in Nigeria. Households can enhance their welfare by diverting the portion of their resources spent on tobacco consumption to consume other basic household goods.

Keywords: Tobacco consumption in Nigeria, Household catastrophic health expenditure, Price elasticity of tobacco demand, Quadratic Almost Ideal Demand Systems

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TABLE OF CONTENTS

Title page		i
Certification		ii
Dedication		iii
Acknowledgements		iv
Abstract		vii
Table of contents		viii
List of Tables		xi
List of figure		x
CHAPTER ONE: INTRODUCTION		
1.1	Background to the Study	1
1.2	Statement of Problem	3
1.3.	Research Questions	8
1.4.	Objectives of the Study	9
1.5.	Justification for the Study	9
1.6Scope of the Study		13
CHAPTER TWO		
LITERATURE REVIEW AND THEORETICAL FRAMEWORK		
2.1.	Background to the study	14
2.1.1	Overview of tobacco use	14
2.1.2.	History of tobacco control legislation in Nigeria	30
2.1.3	Tax Policy on Tobacco in Nigeria	36
2.1.4	The burden of selected tobacco-related diseases in Nigeria	40
2.1.5	Population growth and poverty in Nigeria	45
2.1.6	Socio-demographics of Tobaco Use in Nigeria	49
2.1.7	Tobacco Industry in Nigeria	51
2.1.8	Acess to tobacco products in Nigeria	63
2.1.9	History of Tobacco Use	64
2.1.10	Health Hazards of Tobacco Use	66
2.2.	Theoretical Review	78
2.2.1.	Neoclassical Theory of Consumer Choice	78
2.2.2.	Separable Utility Function	85
2.2.3.	The Revealed Preference Theory of Demand	85
2.2.4.	Catastrophic Health Expenditure	87
2.3.	Methodological Review (Consumer Demand Systems)	89
2.3.1.	Rotterdam Model	89
2.3.2	Almost Ideal Demand System (AIDS)	92
2.3.3	Quadratic Almost Ideal Demand System (QUAIDS)	95
2.3.4	Qualitative Response Regression Models	98
2.4	Review of Empirical Literature	98
2.4.1	Estimation of Cigarette Consumption Function and Pice Elasticity of Demand for Tobacco	98

2.4.1.1. Analysis with aggregated data 99
2.4.1.1.1. Conventional and addictive models of price elasticity of tobacco demand 99
2.4.1.1.2. Analysis with individual level data 108
2.5. Approaches to measuring household welfare 114
2.5.1 Descriptive studies on tobacco consumption and household welfare 117
2.5.2 Studies that adopted econometrics models to examine tobacco consumption and household welfare 118

CHAPTER THREE
Methodology
3.1. Introduction 126
3.2. Theoretical Framework 126
3.3. Methodology 130
3.3.1. The model 130
3.3.1.1 Estimation of tobacco consumption function and price elasticity of demand for tobacco 133
3.3.1.2 Effect of tobacco consumption on the consumption of basic household goods 136
3.3.1.3 Excess health expenditure and catarstrophic health spending attributable to the consumption of tobacco 138
3.3.2 A-Priori Expectation 141
3.3.3. Estimation technique 141
3.3.4. Description of variables 142
3.3.5. Data 144

CHAPTER FOUR
RESULTS AND DISCUSSION
4.1. Introduction 145
4.2. Descriptive statistics 145
4.2.1 Household consumption pattern, poverty status, and smoking habits 147
4.3. Econometrics results 159
4.3.1 Tobacco consumption function and price elasticity of demand for tobacco 159
4.3.2 The impact of toabbaco consumption on basic household goods 164
4.3.3 The impact of household consumption of tobacco on their medical spending 169
4.3.3.1 Predicted mean excess spending imputable/attributable to the consumption of tobaaco 171
4.3.3.2 Incidence of catastropi health expenditure is before and after deduction of excess medical spending attributable to tobaaco consumption 174

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATION
5.1. Introduction 178
5.2. Summary of findings 178
5.3. Conclusions 181
5.4 Contribution to knowledge 182
5.5. Policy Recommendations 182
5.6. Study limitation 184

5.7. Suggestion for further studies 184
REFERENCES 185
Appendix I 201
Appendix II 202
Appendix III 206
Appendix IV 210
Appendix V 211
Appendix VI: 214

LIST OF TABLES

Table 2.1**:** Population Aged 15 and above (thousands) 25
Table 2.2**:** Trends in current and projected tobacco consumption among adults of ages 15 26
Table 2.3**:** Trends in average daily (and projection of) tobacco consumption among Adults of ages 15 and above in Nigeria 29
Table 2.4: Interventions to reduce tobacco consumption 33
Table 2.5: Status of implementation of WHO FCTC in Nigeria 34
Table 2.6: Prices and taxes of tobacco products 39
Table 2.7: Proportion of the Population living in Poverty 48
Table 2.8: Tobacco consumption profile of Nigerian adults 50
Table 2.9: Area harvested, yield and production of tobacco leaves (unmanufactured tobacco) in Nigeria, 2006 – 2018 54
Table 2.10: Tobacco production in Nigeria (1995-2012) 56
Table 3.1: Description of variables 142
Table 4.1: Household Socio-demographic profile and poverty status 146
Table 4.2: Total annual expenditure pattern by poverty status (Computed from HNLSS, 2010) 149
Table 4.3: Total annual expenditure pattern by smoking habit (Computed from HNLSS, 2010) 150
Table 4.4: Average annual expenditure pattern by smoking habit (Computed from HNLSS, 2010) 151
Table 4.5: Difference in average budget share allocated to consumption of goods between tobacco consuming and non-consuminghouseholds by Sector 154
Table 4.6: Average budget shares (in percentage) between tobacco consuming and non-consuming households 156
Table 4.7: Mean budget shares in percentages by household poverty status 157
Table 4.8: Estimates of tobacco consumption function and unit value equation 159
Table 4.9: Conditional price elasticity of tobacco demand 162
Table 4.10: Estimates of the coefficient of tobacco consumption (*d*) in budget share equations by Sector 165
Table 4.11: Estimates of the coefficient of tobacco consumption (*d*) in budget share equations by poverty status 168
Table 4.12: Prediction of health expenditure attributable to tobacco consumption 170
Table 4.13: Excess mean medical expenditure 172
Table 4.14:Medical expenditure before and after accounting for the impact of tobacco Consumption 173
Table 4.15: Incidence of CHE by poverty, sector and smoking status 175

LIST OF FIGURES

Figure 2.1: Four stages of tobacco smoking epidemic 16
Figure 2.2: Welfare effects of an increase in tobacco excise tax that causes an increase in its price 18
Figure 2.3Prevalence of tobacco consumption by region in 2012 19
Figure 2.4: Household exposure to secondhand smoke in restaurant, by region in 2012 21
Figure 2.5: Pattern of tobacco use in Nigeria in 2012 (%) 22
Figure 2.6: Percentage of manufactured cigarettes at last purchase among smokers in 2012 27
Figure 2.7: Average household monthly expenditure on manufactured tobacco (cigarettes) by region in2012 29
Figure 2.8: Smoking (current and projection) among adults aged 15 and above, by sex in Nigeria 42
Figure 2.9: Prevalence of tobacco use, age specific in 2000, 2010 and fitted projection for 2025 for Nigeria 43
Figure 2.10: Premature mortality due to non-communicable diseases 44
Figure 2.11: Categorisation of the population, by poverty status 46
Figure 2.12: Gross production value of tobacco leaves in Nigeria (2006-2016) 55
Figure 2.13: Cigarettes exports and imports in Nigeria (1995 – 2012) 57
Figure 2.14: Export and import of tobacco leaf (1995 – 2012) 59
Figure 2.15: Tobacco imports and exports in Nigeria, all products (2010-2017) 60
Figure 2.16: Trend in net export of all forms tobacco products (2010-2017) 62
Figure 2.17: Four stages of tobacco smoking epidemic 73
Figure 2.18: Welfare effects of an increase in tobacco excise tax that causes an increase in its price 84

CHAPTER ONE

INTRODUCTION

1.1. Background to the Study

Household welfare is broadly described as the level of well-being which emanates or is derived from the consumption of tangible goods and services including access to leisure and public goods (Grootaert, 1983; Kokoski, 1987; Nicita; 2009; Akerele and Adewuyi 2010; Wang*et al.* 2017). Moreover, translating the consumption of commodities to welfare depends on some household characteristics (physiological factors) as well as some environmental factors (Grootaert, 1983). Also, Muellbauer (1980) and Deaton (1997) stated that household welfare depends on the consumption of goods, household composition (equivalence scales), and access to public services.

Public health economists argue that tobacco consumption has implications for households' welfare along two major considerations. First, its use has been linked to causing several disease conditions (USDHHS, 2014), which oftentimes translate to an increase inmedical costs, morbidity, and mortality. This can also relate to the Disability Adjusted Life Years (DALYs) that are attributable to tobacco consumption. Second, studies have shown that it impacts household welfare as reflected in the consumption of basic household goods, especially for smoking households at the margin of poverty (Ross and Chaloupka, 2002; John 2008; Husain et. al., 2018).

When opposed to other modifiable health risk behaviors, smoking poses an extraordinarily high risk of premature death, according to Jha and Chaloupka (1999). More than half of prolonged tobacco consumers are expected to die in their most productive and active ages as a result of the toxic chemicals in tobacco. (Jha and Chaloupka, 1999; WHO, 2021).

In response to the reported health hazards of smoking as well as its impact on socio-economic welfare of smokers, countries and international organisations promote and adopt effective best buy policies aimed at reducing the number of individuals who consume tobacco[1] products around the world (Jha *et al*., 2006).

Even so, for households with a member or members who consume tobacco, there is a possibility that, given a fixed income/budget, tobacco use could displace the consumption of household commodities like food, cloths, education, shelter/housing, health, etc., goods that determine the welfare of such households (De Silva *et. al*., 2011; John *et. al*., 2011a; Husain *et al.* 2018; Nguyen and Nguyen 2020; Masa-Ud *et. al.* 2020).

Estimates show that tobacco consumption might represent a substantial and growing public health threat in Nigeria. The global consumption reported by the United Nations showed that about 1.7 billion naira (11 million United States Dollars ($USD)) was expended on tobacco use in Nigeria in 2010 alone (World Bank, 2010). Also, the Tobacco Atlas (2010) reported the prevalence of tobacco consumption of about 9 percent among adult men. In addition, the report revealed that the level of tobacco use among boys and girls in their teen years was 9.7 percent and 5.7 percent in Nigeria (Drope, 2011). Likewise, the WHO estimated men and women tobacco consumption in Nigeria at 12% and 10% respectively, as at 2011 (WHO, 2014). In 1998 and 2001, the Nigerian Federal Ministry of Health (FMoH) conducted surveys that reported that the smoking prevalence rates among people of ages above 15 years and adolescents (13-15 years old) were 18.1 percent and 17.1 percent, respectively (Drope, 2011). Also, FMoH estimated annual increase in tobacco consumption at 4.7 percent between 2001 and 2006.

Against this background, this study assessed tobacco consumption and household welfare in Nigeria for two fundamental reasons. First, there is the need to prevent the increase in smoking prevalence and ensure that tobacco use does not further exacerbate the already huge burden of chronic non-communicable health conditions in the country. In 2014, the

[1] Tobacco is a greenish plant grown in hot reions. The crop is native to Central and South America and was first grown in commercial quantity in Virginia, USA, in the 16th and 17th centuries. It can be smoked, chewed, or sniffed.

WHO reported that non-communicable diseases only were responsible for over 24% of total mortality in Nigeria, with mortality due to heart-related diseases, chronic obstructive pulmonary diseases, cancers, and diabetes rising steadily between the years 2000 and 2012 (WHO, 2014).

Second, there has been a steady increase in the prevalence of poverty since 1980 in Nigeria. In addition to this, the situation is further complicated by the recent huge decline in the price of crude oil in the global market which resulted in the decline of the value of the Nigerian Naira. Reports showed that in 2010, the level of poverty in Nigeria was 69%. In absolute terms, this translated to about 112.47 million people who are poor in the country (NBS, 2012). Furthermore, a recent report covering up to the second quarter of 2019 by World Data Lab, the World Poverty Clock, revealed that about 91.77 million Nigerians were living well below the poverty line (World Data Lab, 2019).

This study was designed to estimate tobacco expenditure function and the price elasticity of demand for tobacco. In addition, the study investigated the impact of household tobacco spending on the consumption of important household goods likehousing, food, clothing, education, energy, health, etc. The consumption of these goods together determines the socio-economic welfare of households[2] (Bagarani *et al.* 2009). Likewise, this study predicts the health expenditure attributable to tobacco use and assesses whether tobacco use contributes to higher risks of incurring Catastrophic Health Expenditure(CHE) among households.

1.2 Statement of the Research Problem

Tobacco consumption increases the risk of ill-health. Its use has been linked to causing health conditions such as heart-related health conditions, numerous types of cancers, chronic obstructive pulmonary diseases, etcetera, (Agaku *et al*., 2014). Tobacco use has also been linked to about 20% of all cancer deaths and around 70 percent of all lung and

[2] In the literature, the consumption of essential household goods has been adjudged as the preferred measure of household welfare and this is largely captured in living standard surveys. It has also been widely argued that expenditure data is a plausible proxy of ''permanent income'', since households, especially the poor ones, usually borrow or de-save to keep the level of consumption the same over time. (see: Balisacan *et al*. 2003; Dong, 2005; Bagarani *et al*. 2009)

pancreatic cancer mortality worldwide (WHO, 2007). It is a major risk factor for emphysema, diseases of the airways (COPDs), and the leading cause of avoidable diseases (WHO, 2008). Moreover, research has also shown that tobacco consumption may lead to miscarriages, pre-term births, underweight of baby, infant mortality among pregnant women who smoke, and erectile dysfunction increase (Korenman, 2004; Peate, 2005).

The total number of smokers around the world reached about 1.3 billion in 2011. This is expected to have increased to approximately 1.5 billion smokers by 2025 (Mackay *et al*., 2006). Projecting from the current consumption patterns of smoking globally, approximately 500 million adults will die consequently upon tobacco-related illnesses between the years 2000 and 2050 (Jha, 2009). Also, by 2030, tobacco use is expected to have risen so much that tobacco consumption in all forms will be the major cause of diseases and deaths worldwide (Jha and Chaloupka, 1999).

In 2015, the WHO predicts that annual tobacco consumption causes over 6 million deaths (approximately percent of all mortality globally), and 600,000 of those deaths were reported to be a direct consequence of the effects of secondhand smoking (WHO, 2015b). Likewise, it is predictable that tobacco-associated mortality will increase from about 6 million deaths yearly to around 8 million deaths annually come 2030. Worse still, it is projected that 80 percent of these deaths due to tobacco consumption will occur in low-income countries around the world. (U.S. National Cancer Institute and WHO, 2016).

In advanced countries, the overall effect of tobacco expenditures has a limited impact on the general standard of living of smokers (John, 2008). However, because of the high level of poverty in developingcountries, the scenario is different. Moreover, a research study conducted in 2008 revealed the more than 1.4 billion individuals, or about a quarter of the population of developing countries live below $1.25 a day (Chen and Ravallion, 2008). Recently, approximately 1.3 billion people are reported to be poor in LMICs using the multi-dimensional poverty measure (UNDP, 2020).

Furthermore, research has shown that poor households suffer disproportionately as a result of illnesses and diseases compared with economically viable households. (Bobak *et. al*.,

2000). Consequently, tobacco use and its socio-economic[3] and deleterious health effects could worsen the level of poverty, expose poor households to diseases, increase the inequality existing between the poor and the rich. This will be contrary to the goals of reducing inequality as expressed in the United Nations' Sustainable Development Goals (SDG) of 2015. Essentially, given that tobacco consumption is higher among the poor and less educated in Nigeria, as it is in most developing countries (Adeniji *et al*., 2016), then it raises more concern that the adverse economic and health impacts of tobacco use will be more concentrated among the poor in the future (Bobak *et al*., 2000). According to Koch and Tshiswaka-Kashalala (2008), reduced smoking will result in economic gains in addition to the benefits that will be generated from better health (reduction in morbidity and mortality).

Furthermore, the burden of catastrophic health care expenditure[4] (CHE) represents a significant concern for household welfare globally, especially in low-resource settings where a majority of patients incur out-of-pocket (OOP) payments to have access to health care. In those countries, studies have shown that OOP remains the main source of financing medical services (WHO, 2011; Van Minh *et. al*, 2013; Bernabe *et. al*., 2017; Bose and Dutta, 2018; Adeniji, 2021). Even so, having to pay OOP for health causes households to incur catastrophic expenditures, which in turn could result in a vicious cycle of poverty. What this portends is that households that are already living in poverty and also consume tobacco will most likely be predisposed to experiencing deepening poverty (Bonu *et. al*., 2005). Invariably, a reduction in the level of tobacco consumption will not only reduce the level/prevalence of tobacco-related diseases but will help in evading a possible cycle of poverty resulting from excessive health care spending as a result of individual/household tobacco use.

Similarly, tobacco consumption increases impoverishment through CHE, and as a mechanism for coping with medical expenditures, individuals may resort to borrowing, de-

[3] Socio-economic consequences of tobacco use include its effect on productivity and earnings of the smoker, effects on investment and consumption, and its effect on insurance and manpower availability.

[4] The World Health Organization (WHO) indicated that whenever household medical spending is equal or exceeds 40% of a household's non-subsistence/discretional income, it is considered catastrophic

saving, and selling of assets (Bonu *et. al*., 2005). Expenditure on tobacco, especially cigarettes, represents a large proportion of the economic burden for impoverished people (Efroymson *et al*., 2001).

On a more general note, the tobacco market appears to be affected by several market imperfections. Usually, most smokers underestimate the full economic cost of smoking (this raises concerns over imperfect and asymmetry information of the choice to smoke), especially in a developing country like Nigeria. Likewise, the choice to smoke does not cause harm to the smoker alone, it has harmful health effects/negative externalities on the public since both adults and children experience substantial adverse health consequences when exposed to secondhand[5] smoke. This is important since expenditure on treating morbidity attributable to tobacco consumption and exposure to second-hand smoke is partly funded using taxpayers' money (U.S. National Cancer Institute and WHO, 2016).

Moreover, tobacco consumption can harm household welfare in such a way that results in the reduction of the income available for purchasing important household goods (Wang *et al*., 2006). Usually, this results in a situation where households allocate lesser income to the consumption of essential goods and to add to this, tobacco consumption precipitates ill-health which then results in higher morbidity and mortality (John *et al*., 2011b).

Furthermore, in urban slums and rural locations in LMICs, low socioeconomic conditions, poor food intake, tobacco consumption, and poor environmental condition remain the most pressing problems. As a consequence of their living conditions, people are more susceptible to diseases and ill health (Gelband and Stansfield, 2001). Worse, the socioeconomically disadvantaged population, especially the undereducated, are disproportionately affected.

[5] This refer to the smoke which comes from tobacco products such as cigarettes, cigars and pipes (shisha).

Numerous studies have shown that smoking rates are higher and rising among the poor in developing countries (including Nigeria) (John *et al.,* 2011b; Ng *et. al*., 2014; Chen et.al., 2021). Approximately 84 percent of smokers live in LMICs (Guindon and Boisclair, 2003).

This is because, particularly among poor households in developed countries, smoking expenses usually account for a significant proportion of total household resources (Busch et al., 2004). Influenced by financial restrictions, tobacco consuming households who are poor have been found to sacrifice the consumption of basic householdgoods to use tobacco (John, 2008, 2012; Wang *et al*., 2006).

In other words, if tobacco use induces economically less viable households to forego the consumption of resources that are important to their well-being, then smoking reduces the quality of life in those households, which has a direct impact on children and women in family environments, potentially resulting in intra-household resource allocationpartiality. (Deaton, 1997; John, 2012). poverty and death at a young age. Similarly, quitting or reducing tobacco use can be advantageous in that tobacco smokers can redirect a portion of their income previously spent on tobacco to basic household products, thus improving the quality of life for those living in their households (Pu *et al.,* 2008; Siahpush et al., 2004).According to Busch *et al.*, 2004, quitting smoking frees up monetary capital that can be used to improve the smoker's wellbeing in the long run, in addition to the long-term health benefits.

Moreover, the Nigerian Tobacco Situation Analysis Coalition and Drope (2011) reported that statistics on tobacco related mortality are scarce in the Nigerian context. But from extrapolation of the data provided by the Lagos State government on 6,000 smoking-related illnesses recorded in hospitals across the State in 2006, more than 352,000 Nigerian citizens suffer as a result of tobacco-associated illnesses every year.

Furthermore, beyond what the burden of mortality associated with tobacco consumption is in the current period in Nigeria, this burden might be greater in two or three decades to come, (given that it takes that much time lag for smoking associated diseases to fully manifest) if adequate economic and legislative measures are not well developed to effectively control smoking (Allender *et al*., 2009). Abegunde *et al*., (2007) projected that 1.17% of the national income in Nigeria was lost due to mortality due to heart diseases, stroke, and diabetes in 2015.

The World Health Organization's Framework Convention on Tobacco Control (FCTC)[6] recommends a set of best buy policies such as the use of economic and legislative tools to control tobacco consumption and consequently maintain population and public health. The FCTC was ratified in Nigeria in 2011, therefore, it is needful to research the influence of tobacco use on household welfare in Nigeria in other to support the existing policies designed to curtail tobacco consumption in the country. This is done with the motivation that a policy change that causes a decline in the prevalence and level of tobacco use will lead to a substantial reduction in the possible negative welfare impacts of tobacco consumption individuals and households (Kwan *et al*., 2015).

1.3. **Research Questions**

1. What are the determinants and the price elasticities of tobacco consumption in Nigeria?
2. What is the effect of tobacco consumption expenditure on the consumption of other basic household commodities in Nigeria?
3. What is excess health expenditures and catastrophic health spending attributable to tobacco consumption in Nigeria?

[6]The WHO FCTC was adopted by the World Health Assembly in 2003. So far, 168 countries have ratified the document. The FCTC is the first multinational health agreement negotiated by the WHO (see http://www.who.int/fctc/en/). This document contains evidence-based and tested tobacco control protocol/measures that are easily apply-able in every country of the world. It is regarded as an '' international intervention for controlling tobacco use.

1.4. Objectives of the Study

This study investigated the impact of tobacco consumption on household welfare in Nigeria. Specifically, the objectives of the study were to:

1. estimate tobacco consumption function and price elasticity of tobacco demand
2. evaluate the effect of tobacco consumption expenditure on the consumption of other household basic goods
3. predict excess health expenditure[7] and catastrophic health expenditure (CHE) attributable to tobacco consumption

1.5. Justification for the Study

The impact of tobacco consumption on household socioeconomic welfare has witnessed significant attention, especially in advanced countries over the years. However, there have been few studies conducted in LMICs on the impact/effect of tobacco consumption on individual and household welfare. There is even more paucity of such studies in Africa (apart from South Africa). According to Jha *et al*. (2000), even though there is an increase in smoking in developing countries, the effort to control and forestall the socioeconomic welfare effect of tobacco consumption is undermined by a lack of evidence-based research that will support as well as facilitate the effective formulation of local policies to control tobacco consumption in those countries.

In particular, tobacco control in Nigeria has failed to garner the necessary drive towards curtailing tobacco consumption despite the increasing level of smoking prevalence and the country might be at risk of experiencing an escalation in the prevalence of acute and chronic health conditions associated with tobacco use and aggravation of the level of poverty. Also, this might have consequences on impoverishment due to CHE in the shortterm as well as in the more distant future.

[7]Excess health expenditure is used here to describe the difference between actual health costs and the costs that would have occurred had there been no tobacco consumption

Based on the recommendations of WHO, Nigeria ratified the provisions of the WHO FCTC in 2005 and this aided the formulation of the National Tobacco Control Bill 2009 which was passed in 2011. With this, policy makers in the country recognised the public and population health threat posed by tobacco consumption as well as its potential poverty/welfare impacts. However, it is not enough to merely adopt the provisions of the WHO FCTC which was developed based on the evidence provided by studies conducted in other countries.

As such, there is an increasing need to conduct studies on the welfare impacts of tobacco consumption and the possible impacts of measures such as the use of economic tools to curtail tobacco use. Even so, research studies are necessary to support the formulation of policies that is evidence-based towards aligning with "best buy"[8] interventions aimed at controlling the level of tobacco consumption among the population. Certainly, the campaign to curtail smoking in Nigeria would benefit from research studies on the economics of tobacco use which has been less advanced in the literature.

Such studies should provide evidence on the socio-demographic distribution of tobacco use and the impact of smoking on household expenditure patterns as well as provide price elasticity estimates to help design optimal excise taxes on tobacco, gaps[9] which this study aims at filling. This is important because the tobacco taxation aspect of the WHO FCTC is currently underdeveloped due to a lack of research evidence or findings on the effect of excise tax levied on the consumption of tobacco products in Nigeria. In general, these are important inputs in the development of tobacco control programs and are regarded as best buy policy recommendations, as advocated in WHO's FCTC through MPOWER measures[10].

[8] "Best buy" is a coinage used for highly effective public/global health tools or policy options for the control of tobacco consumption.

[9] This study analyses tobacco consumption under a separable utility framework; proposed methodology for estimating the effect of tobacco consumption on the incidence of CHE; estimated price elasticity for Nigeria; and investigates if smokers are at higher risks of incurring CHE

[10] MPOWER is an acronym coined in the WHO's FCTC which represents: Monitoring tobacco consumption through the enforcement of prevention policies; Protection of individuals from tobacco smoke, otherwise known as secondhand smoke; Offering of support to smokers who desire to quit tobacco consumption;

In addition to what is already known globally regarding the possible poverty impact of tobacco use, this study investigates whether tobacco use reduces the consumption of goods that are important for the welfare of the household. Also, the study assessed whether tobacco consumption exposes households to a higher risk of incurring CHE, with the view that if this is the case in the Nigerian context, controlling the level of tobacco consumption will be important in protecting households. Usually, poorer households benefit the most from interventions aimed at protecting individuals from incurring higher CHE attributable to tobacco consumption. This is important for achieving the goal of poverty reduction which is one of the most important goals articulated in the United Nations' SDGs. In addition to this, the reduction in the prevalence of tobacco consumption will improve population and public health (Bovbjerg, 2001; Filmer *et al*. 2002; Kawabata *et al*. 2002; Russell and Gilson, 1997).

In general, this study is justified along three broad areas which include:

1.5.1. Theoretical Justification

In economic theory, consumer's welfare is usually illustrated using the utility or satisfaction individual consumers derive from the consumption of goods and services. In terms of tobacco consumption, smokers will usually want to smoke given their satisfaction from smoking and the fact that some of them could be addicted to tobacco use. This study favors the use of a separable utility function[11] which is essentially different from the generic utility function adopted in earlier studies. The separable utility function disaggregates the utility derived from all the goods consumed into distinct utilities from each commodity in the consumption set. Theoretically, this utility function is more useful in analysing the welfare impact or effects of the consumption of a harmful commodity such as tobacco. The effect of tobacco consumption on household consumption of welfare

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Warning of the hazards associated with tobacco consumption and; enforcing total barns on all forms of tobacco advertising including promotional activities and sponsorship programmes; Raising of excise taxation on all tobacco products to discourage its consumption (see: http://www.who.int/tobacco/mpower/en/).

[11]This special type of utility function is discussed in details in chapter 3.

enhancing household goods is therefore considered to be similar to the effect of an increase or rise in the prices of goods and services in the household's or consumers' consumption bundle. Although, economic theory distinguishes the impact of changes in prices on the quantity demanded (consumption) from the effect of other variables that are considered to be determinants of demand. While, a change in price of commodities will cause a movement along the demand curve, changes in other determinants will bring about a total shift in demand, either inward or outward.

The intuition for analysing the crowding-out/spill-over impacts of tobacco consumption is such that the intensity of tobacco consumption or decision to quit smoking could either free up or place a further constraint on household resources (especially less economically viable households) which could then affect the welfare of such households. This represents a conceptual framework or transmission mechanism for depicting how the decision to smoke could have an impact on household welfare. Usually, this impact is expected to be felt more by acutely poor households.

1.5.2. *Methodological Justification*

There are two (2) methodological justifications for this study. A unit value (as a proxy for price) methodology for estimating price elasticity of demand, first popularised by Deaton (1988, 1997), was utilised to estimate the degree of responsiveness of demand for tobacco to price change. Also, this study proposed a methodology for predicting the excess CHE attributable to tobacco consumption which is considered an extension to the methodologies estimating the welfare effects of tobacco consumption.

5.1.3. Empirical Justification

Considerable literature has accumulated on the socioeconomic impacts of tobacco consumption in advanced countries and a small number of developing countries, especially in Africa. This research study determined the factors that influence tobacco consumption as well as the potential response of tobacco demand to price changes. Also, the study assessed empirically the effect of tobacco consumption on household socio-economic welfare in Nigeria by investigating how tobacco consumption affects the

consumption of welfare enhancing household goods. Similarly, in health economics, the welfare effects of medical spending are often captured by estimating the level of CHE. As such, the final component of this study predicted the excess medical outlays and exposure to higher CHE attributable to tobacco consumption. Therefore, this study is warranted since it provided estimates of the determinants of tobacco use in Nigeria and the possible response of tobacco demand if the government decides to raise excise taxes on the product. It also measured the welfare impact that households could face as a result of consuming tobacco products. Until now, this relation has not been researched in the Nigerian context.

1.6. **Scope of the Study**

This study covers some essential components of the economics of tobacco consumption and control as provided in the WHO's FCTC. While this area of research is very broad, this study only included the factors related to tobacco use, price elasticity, and the welfare effect of tobacco consumption. The Harmonised Nigeria Living Standards Survey (HNLSS) conducted in 2009/2010 was utilized to implement this study. The HNLSS was collected at household level and it is nationally representative. Similarly, the dataset contains comprehensive information on household characteristics/profile, consumption expenditures on broad categories of household commodities.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1. Background to the study

2.1.1. Overview of tobacco use in Nigeria

Tobacco products are put to use in different forms in Nigeria. It is generally used in the form of rolled tobacco and shredded cigarettes. This product can also be smoked through pipes for easy inhalation (this is called snuff). Over the years the subject of tobacco consumption and tobacco control activities in Nigeria have been immensely affected by the lack of yearly national data on the level of smoking in the population concerning important socio-demographics.

Essentially, Nigeria remains a very populous African country and is regarded as one of the leading countries in Africa when it comes to the level or prevalence of tobacco consumption[12]. The prevalence of tobacco consumption in Nigeria according to a survey of 1,270 adults conducted in 1990, indicated that 24 percent of men and about 7 percent of women smoked cigarettes every day. The Federal Ministry of Health (FMoH) conducted two separate studies in 1998 and 2001, respectively. They reported a smoking rate of 17.1 percent among adults of ages over 15 years. In the other study, they reported that about 18.1 percent of youths between ages 13-15 years consumed tobacco.

[12]The information as reported by Tobacco Atlas, 2015 showed that on average about 1 to 499 sticks of cigarette are consumed by a typical smoker in Nigeria on a yearly basis. Comparing this smoking rate to that of most developed and developing countries showed that the prevalence of tobacco consumption in Nigeria is low. Nonetheless, because of the huge population of the country, about 3,642,900 me and 660,800 women in the country smoke cigarette.

Reporting from the Nigerian Demographic and Health Survey (NDHS) conducted in 2008 in Nigeria, about 1% of women of ages 15-49 and 11.5 % of men of ages 15-49 consumed tobacco in the year under review. The adult segment of the population increased its tobacco consumption by as high as 32 percent from what it was in 1970 which indicates an increase in the influence of Western lifestyle on the Nigerian population within those years. Likewise, a report by the WHO (2009) revealed that the market for tobacco products and tobacco industry in Nigeria experienced an annual growth rate of 4.7% from the year 2001 up until 2006. In the continent of Africa as a whole, South Africa, Nigeria and Kenya are the three countries with the highest level of tobacco consumption. These countries account for about 47 percent of Africa's cigarette retail volume in 2011 alone.

The information contained in this background relied heavily on the Global Adult Tobacco Survey (GATS, 2012). The GATS 2012 is the foremost nationally representative study of/ survey of the adults' population (including men as well as women of ages 15 years plus) in Nigeria. The purpose of the survey is to systematically monitor year on year tobacco consumption (both smoke and smokeless) among the adult population of countries. The survey, therefore, helps to track important tobacco control measures. Nigeria is one of the few African nations that have implemented the GATS. This surveillance survey is developed and designed in conformity with international protocol (using standardized data collection tool/questionnaire and adopting sample design, aggregation, and analysis procedures) to generate globally comparable data on tobacco consumption. Primarily, the GATS survey was developed to enhance and to facilitate the control of tobacco use in countries of the world. This survey was supported and funded by Bloomberg Initiative to Reduce Tobacco Use, a program of Bloomberg Philanthropies. However, the survey was entirely implemented by the National Bureau for Statistics (NBS) under the auspices of the FMOH.

The GATS contains broad tobacco use/consumption information not previously captured in the earlier rounds of the Demographic Health Surveys as well as the Global Youth Tobacco Survey conducted in Nigeria. Until other rounds are carried out, the GATS conducted in 2012 remains the most comprehensive and recent population based survey

carried out with support from the WHO. Before 2012, there was no complete and detailed individual or population level data for a proper understanding of the magnitude and extent of tobacco use in Nigeria. As a result of this, there was not much going on in terms of surveillance of the trends and patterns of tobacco use and the impact of the recommended tobacco control strategies/measures in Nigeria.

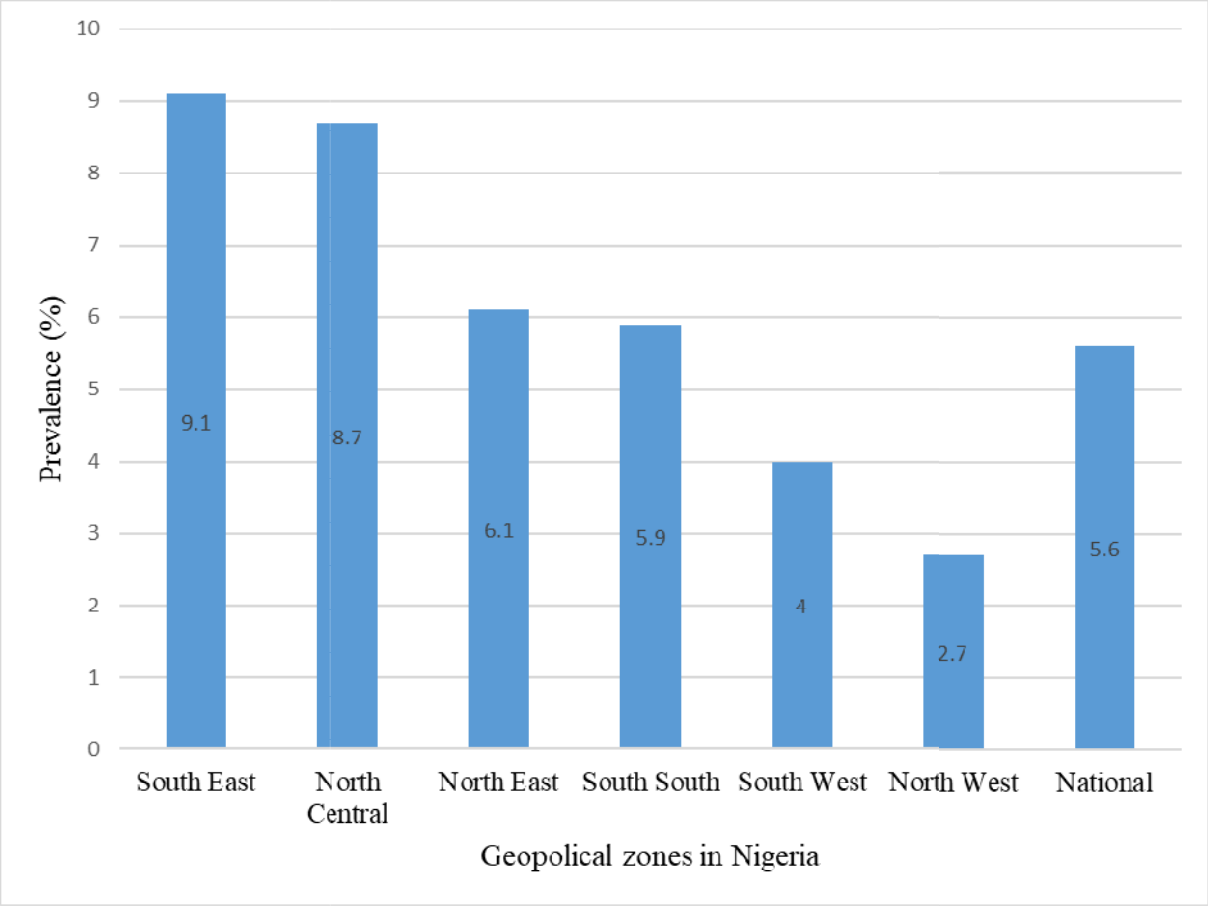

Figure 2.1:Prevalence of tobacco consumption by region in 2012

Source: *GATS, 2012*

Figure 2.1 depicts the prevalence of tobacco use by area. In 2012, the Southeast region had the highest tobacco use (9.1%) and the Northwest region had the lowest (2.7%).As of 2012, the prevalence rate for the entire nation was 5.6 percent, representing about 9,207,200 million people who used tobacco products. Given that the GATS, 2012 survey of the prevalence of tobacco consumption in Nigeria is the most recent, it is uncertain if the prevalence or level of tobacco use in Nigeria has progressed or regressed in 2019.However, some studies suggest that, despite the country's attempts to reduce tobacco usage, the rate of use may continue to rise as the population grows (WHO, 2014; 2015).

Passive smoking through secondhand smoke can be considered tobacco use/consumption. It constitutes a negative externality. Figure 2.2 portrays exposure to cigarette fumes (also known as secondhand smoke) and shows that in 2012, 50.3 percent of people in the Southeast region of Nigeria were exposed to secondhand smoke (mostly in some public places and in restaurants).North-central had a level of exposure of 27.8%, while Northeast and Northwest had a level of 27.5 percent. Nationally, 29.3 percent of people were exposed to secondhand smoke (This equates to approximately 6.4 million adults who were exposed to secondhand smoke during the study period).Given the documented negative effects of secondhand smoke on global health, these figures suggest that tobacco consumption is becoming more dangerous in the region.

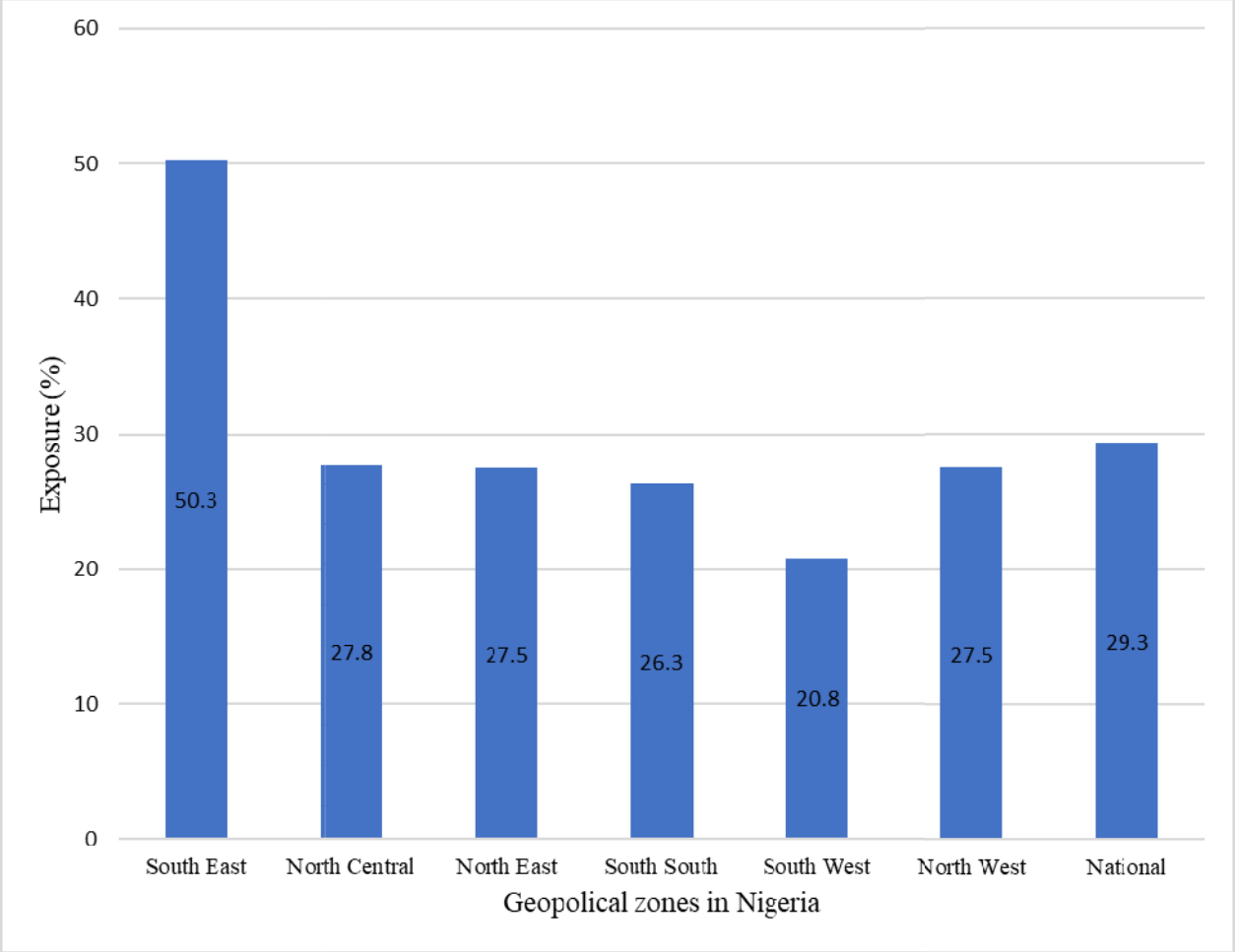

Figure 2.2: Household exposure to secondhand smoke in restaurant, by region in 2012
Source: *GATS, 2012*

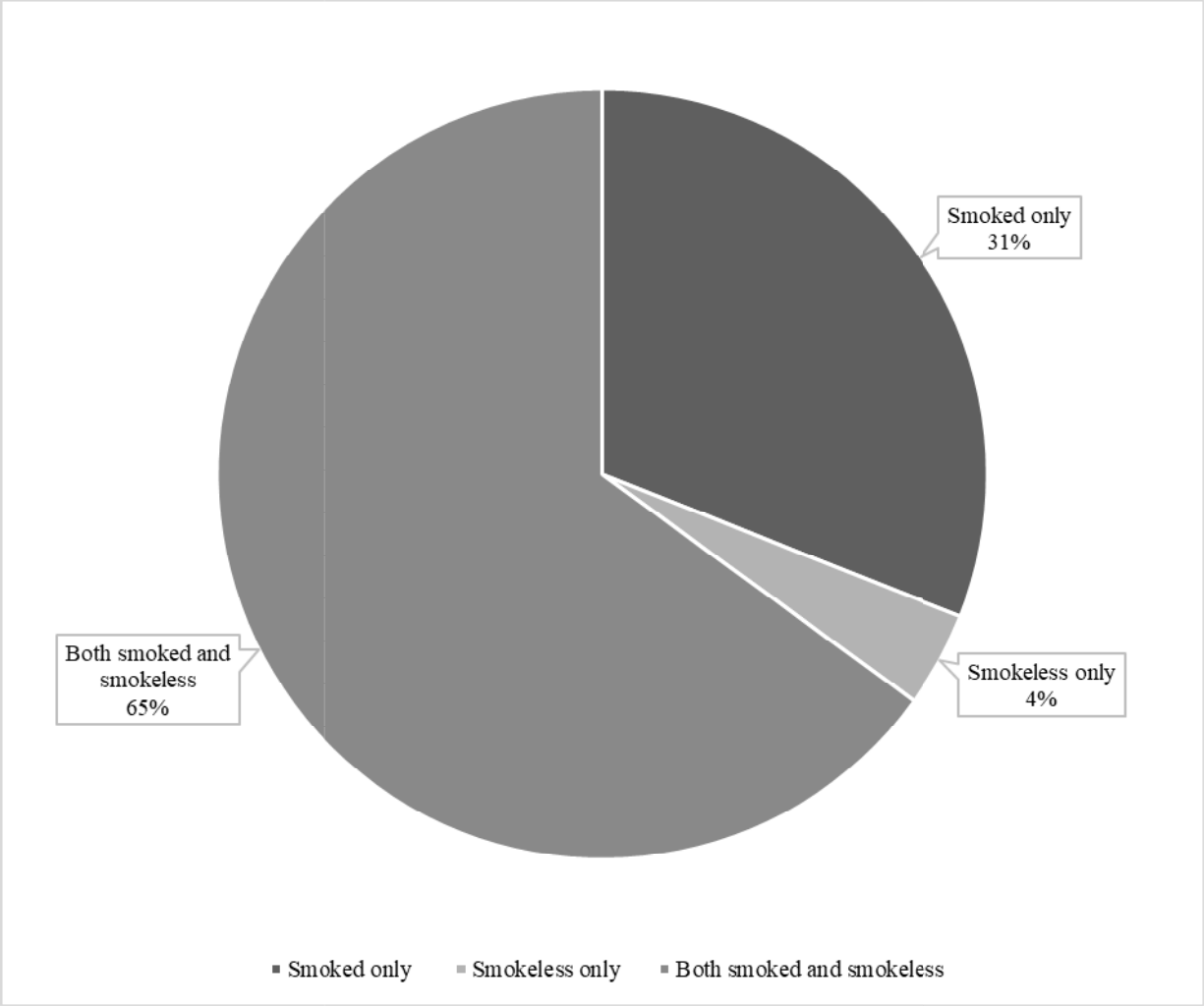

Figure 2.3: Pattern of tobacco use in Nigeria in 2012 (%)

Source: *GATS, 2012*

Tobacco use can either be in the form of smoked or smokeless. Smoked tobacco is usually consumed by burning, inhaling, and exhaling fumes while smokeless tobacco is tobacco products that are not burned but rather involve chewing or sniffing (e.g. chewing tobacco, moist snuff, snuff, etc.). In 2012, 65% of tobacco consumption/use was in the form of smoked tobacco and 31% was smokeless. Only 4% of users consumed both smoked and smokeless tobacco. (Figure 2.3)

Figure 2.4 shows the percentage of manufactured cigarettes at last purchase among smokers in 2012 as reported in GATS, 2012. Benson and Hedges was the most popular brand among smokers as 44.3% of manufactured cigarettes smoked were this brand. This was followed by Rothmans (19.5%) and London White (9.7%). The best two most popular brands of cigarettes, Benson and Hedges and Rothmans are the leading brands/products manufactured and distributed by the British American Tobacco Company of Nigeria (BATN). Standard (1.9%), Don Chester (4.8%), and Aspen (6.9%) were some brands that had some patronage among smokers at the time of the survey. Cigarettes brands with very low consumption among smokers were lumped up and referred to as other brands (12.9%)

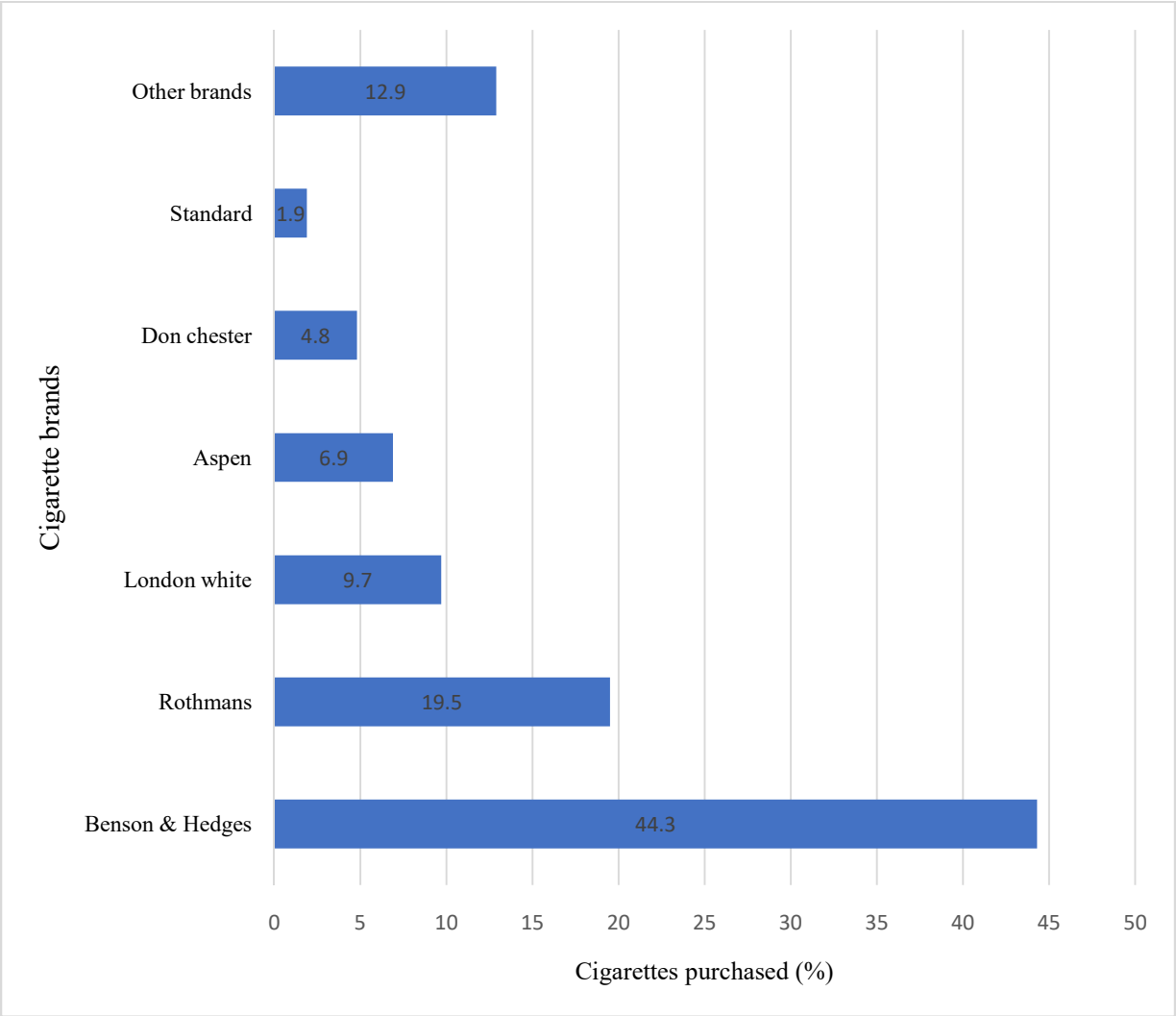

Figure 2.4: Percentage of manufactured cigarettes at last purchase among smokers in 2012

Source: *GATS, 2012*

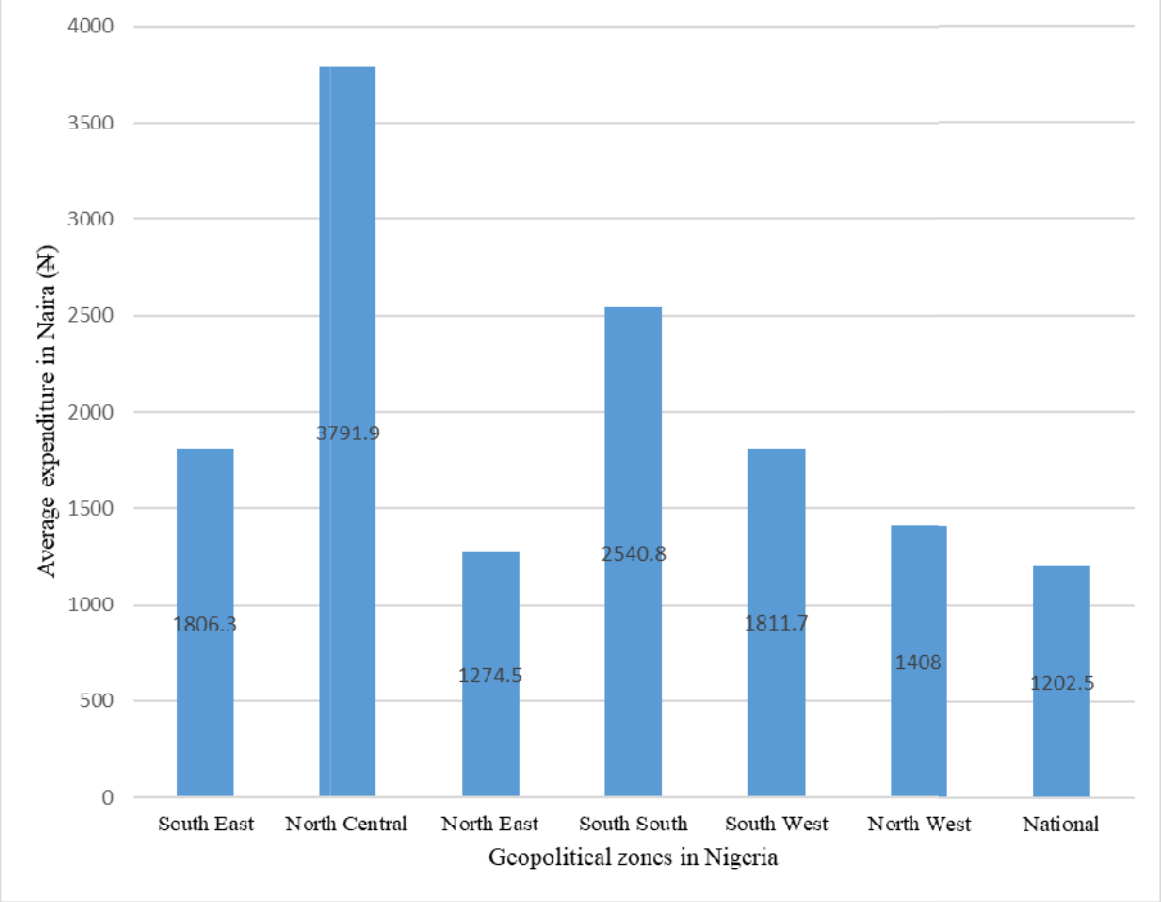

Figure 2.5: Average household monthly spending on manufactured tobacco (cigarettes) by region in 2012

Source: *GATS, 2012*

In the GATS, average monthly expenditure on manufactured cigarettes was elicited. Figure 2.5 shows that smokers in the North-central and South-south spend more on average (N3791.9 and N2540.8, respectively) than smokers in other regionsof the country.When compared to a typical smoker in the Southeast (N1806.3), the average monthly spend on manufactured cigarettes was lower in the Northeast (N1274.5). In 2012, smokers spent N1202.5 on manufactured cigarettes, according to national estimates.Differences in the average monetary spend by smokers on manufactured cigarettes could be due to pricing differences across brands in different parts of the country. Furthermore, some tobacco consumers may be consuming higher-quality brands, which command greater prices.

In 2015, WHO conducted a study that estimated the trend in tobacco smoking in different countries of the world. This study was in response to a United Nations' mandate to explore possible solutions and make efforts to address the population and public health threat posed by four major non- communicable diseases (NCDs) which research has shown that tobacco use is a risk factor. Subsequently, the WHO drafted a strategy to reduce and prevent avoidable mortality from non-communicable diseases (NCDs). As part of this strategy, the WHO aims at promoting policy interventions among countries towards reducing the level or prevalence of current tobacco consumption by about 30 percent (WHO, 2015b).

With the help of epidemiologists and biostatisticians, WHO generated the trends in tobacco smoking by calibrating a Bayesian meta-regression analysis (i.e. an analysis based on the synthesis based on available research evidence) under with assumption of a negative binomial framework. The data for this extrapolation were obtained from the available information provided in the WHO FCTC Implementation Database which collects data on the country-level implementation of the recommended measures for ensuring the control of tobacco consumption. Another source of data was from the WHO Comprehensive Information Systems for Tobacco Control which also includes the WHO Infobase. Also, useful data were sourced from other reliable databases. As such, patterns and trend lines representing typical projections were generated. The intuition behind the

analysis and projections was to determine the level of tobacco consumption in the future given the information available regarding the tobacco control efforts of countries as well as the extent of compliance and implementation of the globally acceptable mechanisms for controlling tobacco use. Nonetheless, the outcome predicted in the analysis may be mildly modified by the impact of recent interventions or new interventions not already captured in the information available at the time of the analysis but are. The dynamics of tobacco use are usually discussed with considerations of the increase in population and a given level of tobacco control efforts.

In Table 2.1, the population aged 15 and above between the years 2000 and 2015 is shown. Also, a projection was made to the year 2025 based on the pattern or growth rate of the population in the past years. It was revealed that the population will double by the year 2025, from 69,421,000 to 136,110,000. Given the increase in population, it is projected that there would about 17 million smokers in Nigeria by the year 2025. (Table 2.2). Similarly, the number of daily smokers will reach about 13 million by 2025. (Table 2.3)

The WHO made the following projections of daily and current tobacco consumption in Nigeria. Similarly, projections were made for current and daily tobacco use, for males and females adults in the population for the years 2000-2025 (five-year interval) (WHO, 2015b) (Figure 2.8).

Table 2.1**:** Population Aged 15 and above (thousands)

Year	Men	Women	Both sexes
2000	34,947	34474	69,421
2005	39,762	39018	78,780
2010	45,230	44170	89,400
2015	51,725	50328	102,053
2020	59,633	57852	117,485
2025	69,198	66912	136,110

Source: *WHO, 2015a*

Table 2.2**:** Trends in current and projected tobacco consumption among adults of ages 15 and above in Nigeria

	Current and Projected tobacco Smoking (%)									
Year	Men			Women			Both sexes			
	Lower 95% CI	Point estimate	Upper 95% CI	Lower 95% CI	Point estimate	Upper 95% CI	Lower 95% CI	Point estimate	Upper 95% CI	Estimated no. of current smokers (in million)
2000	6.3	11.3	17.2	0.7	1.9	3.2	3.5	6.6	10.2	4
2005	7.2	13	19.8	0.7	1.6	2.7	4.0	7.4	11.3	6
2010	8.1	15	24	0.5	1.3	2.2	4.3	8.2	13.2	7
2015	8.2	17.4	29.1	0.4	1.0	1.9	4.4	9.3	15.7	10
2020	8.4	20.2	35.7	0.3	0.8	1.5	4.4	10.6	18.9	13
2025	8.3	23.7	44.7	0.2	0.7	1.3	4.3	12.4	23.4	17
Voluntary target (30% relative reduction from 2010 to 2025)		10.5			0.9			5.4		

Source: *WHO, 2015a*

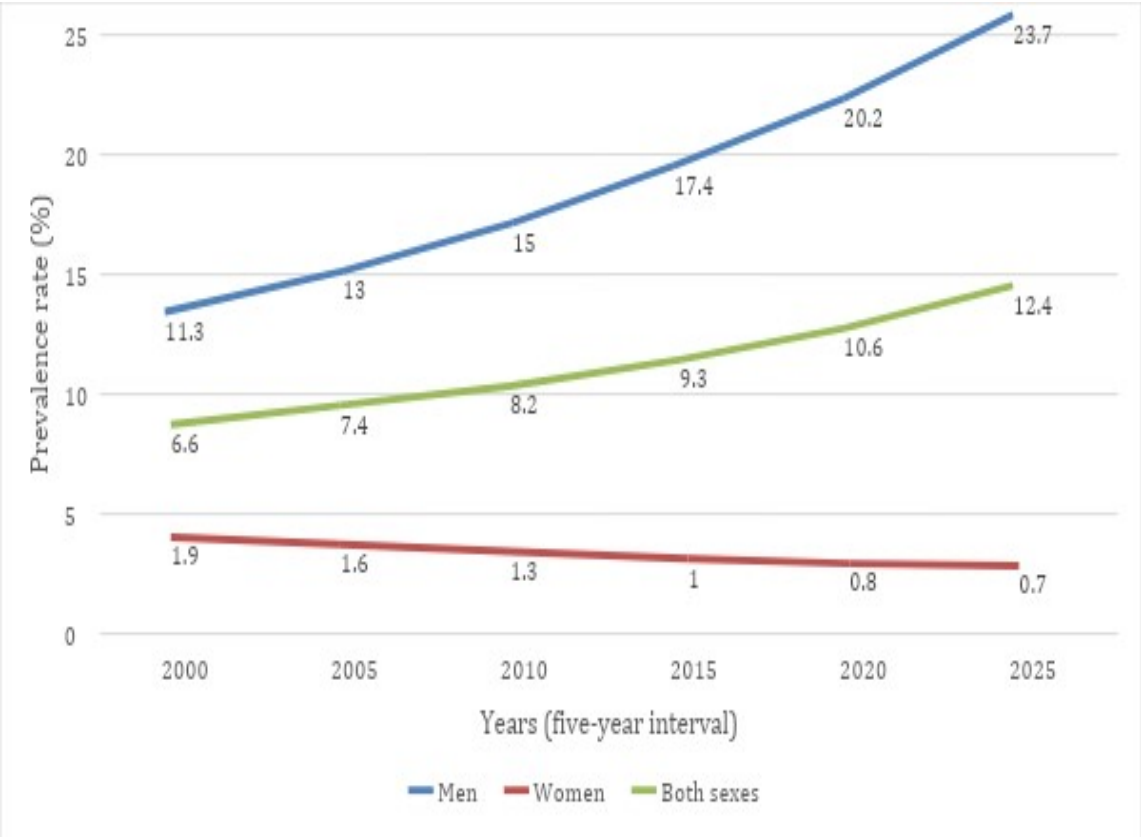

Figure 2.6: Smoking (current and projection) among adults aged 15 and above, by sex in Nigeria

Source: *WHO, 2015*

Table 2.3: Trends in average daily (and projection of) tobacco consumption among adults of ages 15 and above in Nigeria

	DAILY TOBACCO SMOKING (%)									
	Men			Women			Both sexes			
Year	Lower 95% CI	Point estimate	Upper 95% CI	Lower 95% CI	Point estimate	Upper 95% CI	Lower 95% CI	Point estimate	Upper 95% CI	Estimated no. of daily smokers (in million)
2000	4.0	8.9	14.5	0.5	1.5	2.7	2.3	5.2	8.6	4
2005	4.8	10.3	16.9	0.4	1.2	2.2	2.6	5.8	9.6	5
2010	5.0	11.8	19.6	0.4	1.0	1.9	2.7	6.5	10.9	6
2015	5.6	13.7	23.4	0.2	0.8	1.5	2.9	7.3	12.6	7
2020	5.8	16.0	28.0	0.2	0.6	1.2	3	8.4	14.8	10
2025	6.6	18.7	34.9	0.1	0.5	1.1	3.4	9.8	18.3	13
Voluntary target (30% relative reduction from 2010 to 2025)		8.3			0.7			4.5		

Source: *WHO, 2015a*

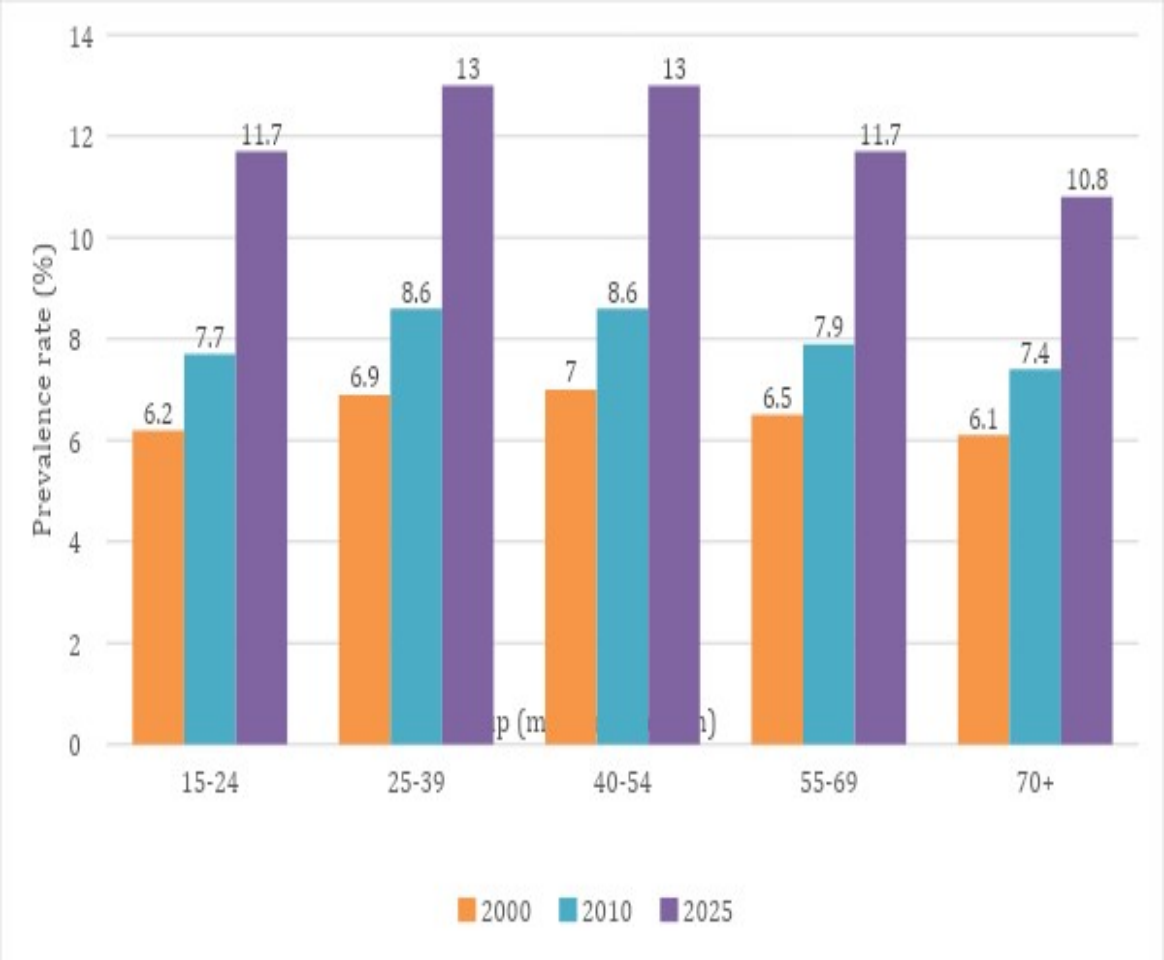

Figure 2.7: Prevalence of tobacco use, age specific in 2000, 2010 and fitted projection for 2025 for Nigeria

Source: WHO, 2015

With a total population of adults 15 years and above at 89 million in 2000, the WHO estimated that about 8% (approximately 7,358,700) of Nigeria's population smoked tobacco in the same year. This prevalence increasedslightly to about 12% (approximately 16,868,400 smokers) in 2010 and the level of tobacco smoking is projected to more than double among male adults in 2025 (23.7%) with regards to the level of tobacco consumption and tobacco control activities in 2010. According to the report, if tobacco control efforts remain at their was in 2010, Nigeria will struggle to achieve the 30% reduction in tobacco use by 2025 (WHO, 2015a). Between 2000 and 2015, current smoking (both sexes) among adults aged 15 years and above increased steadily and this poses a huge threat to population health in the future. (Table 2.2)

2.1.2. History of tobacco consumption control legislation in Nigeria

The earliest attempt to legislate on tobacco use in Nigeria was in 1990 through the Tobacco Smoking (Control) Decree 20, 1990. It became an Act (Tobacco Control Act 1990 CAP 16) in 2001 as a result of the return to a democratic system of government in Nigeria. This tobacco control Act was deemed to be grossly inadequate and through the activities of various tobacco control stakeholders, it was repealed and the ''National Tobacco Control Bill 2009'' was enacted and passed by the Senate in 2011. A review of existing tobacco control documents revealed that the implementation of the Tobacco Smoking (Control) Decree of 1990 was weakened by the activities of the tobacco industry as they attempted to manipulate public health policy in Nigeria. According to Egbe *et al*. (2017), the tobacco industry used numerous strategies to attempt to influence the government in favour of its activities. Also, the industry used frontline groups, the tobacco trade union and the Tobacco Advisory Council of Nigeria, to frustrate tobacco control efforts. Consequently, the Decree failed to attain its tobacco control potentials (Egbe *et al*. 2017). Also, the tobacco industry was implicated to be responsible for the failure to review the Tobacco Smoking (Control) Decree 20, 1990 in 1995 due to their anti-tobacco control strategies.

However, the National Tobacco Control Bill of 2009 complied with the provisions of WHO FCTC (approved by agencies for local tobacco control in the community and other international organisations viz:, Framework Convention Alliance, International Development Research Centre, Tobacco Free Kids, etc. which provided for the control of all production activities, product sales, advertising and promotion, sponsorship and the implementation of tobacco taxation in Nigeria. Prior to this, a National Smoking Cessation Committee was formed in 1999. The efforts of the committee culminated in more awareness regarding the threats of tobacco consumption and as a result an agency of the government, advertisement by the Advertising Promotion Control (APCON) of Nigeria, placed a ban on all forms of commercial and non-commercial tobacco in 2002 (Drope, 2011).

The National Tobacco Bill 2009 made such provisions as the prohibition of smoking in all public places such as recreation centres, restaurant/bars/clubs houses, public transportation, private and public schools, hospitals, etc.; an outright and total ban on any forms of advertising whether a direct and indirect advertisement, proscription of sales of tobacco products 1000-metre radius of areas/environments that are designated as non-smoking area. These provisions ensure that the government can deploy litigations against tobacco production and marketing. In doing this it is possible to force the tobacco industry to pay for whatever damages caused by the sales and consumption of its products.

In 2004, Nigeria joined several other countries around the world (126 countries) in signing the FCTC and eventually ratified this global tobacco control agreement on 20 October, 2005. The FCTC is an agreement signed and adopted at the 56th World Health Conference held in Geneva, Switzerland on 21 May 2003 (Shibuya *et al*. 2003) and was implemented regarding article 19 of the WHO constitution (Murphy, 2003). The treaty is regarded as a supranational agreement that seeks to safeguard against the devastating health consequences of tobacco consumption both in the present and in the future. This effort will also be beneficial in reducing the possible welfare consequences of tobacco consumption and exposure to tobacco smoke through the proposed universal public health standards and measures that specify the risks of tobacco consumption and the strategies towards

curtailing tobacco use in all forms globally (Brandt, 2009; Brandt, 2012; Shibuya *et al*. 2003).

The key highlights of the WHO FCTC are depicted with the acronym MPOWER, which refers to the following:

- Monitoring tobacco consumption and implementation of policies designed to prevent its use;
- Protect individuals from secondhand smoke and its consequent effects;
- Offer therapeutic support and help to smokers who wish to quit smoking;
- Warn about the dangers of tobacco consumption through the use of warning labels and graphics;
- Enforce total bans on all forms of tobacco advertisement, promotion and sponsorship; and
- Raising excise taxes on tobacco products from time to time to discourage tobacco consumption.

These standards are regarded as minimum requirements, and signatories to the FCTC treaty are encouraged to enforce stricter standards in regulating/controlling tobacco consumption than the treaty requires countries to adopt (WHO, 2005). A review of the implementation of the WHO FCTC in Nigeria is shown in Table 2.2.

Significant provisions of the WHO FCTC require that parties (countries) implement the following measures:

Table 2.4: Interventions to reduce tobacco consumption

Topic	Measure	Articles
Lobbying	Ensure that there exist limited interactions between lawmakers and the tobacco industry to avoid undue influence.	Article 5.3
Reduction in tobacco demand	The use of taxes and other legislative measures to reduce tobacco consumption/demand.	Article 6 and 7
Passive smoking	Obligation to protect all individuals from exposure to tobacco smoke/secondhand smoke in indoor workplaces, public transport, and indoor public places.	Article 8
Regulation	The contents and emissions of tobacco products are to be regulated and ingredients are to be disclosed.	Article 10
Packaging and labeling	Large health warnings (at least 30% of the packet cover, 50% or more recommended); deceptive labels ("mild", "light", etc.) are prohibited.	Article 9 and 11
Awareness	Public awareness for the consequences of smoking.	Article 12
Tobacco advertising	Comprehensive ban, unless the national constitution forbids it.	Article 13
Addiction	Addiction and cessation programs.	Article 14
Smuggling	Action is required to eliminate the illicit trade of tobacco products.	Article 15
Minors	Restricted sales to minors.	Article 16
Research	Tobacco-related research and information sharing among the parties.	Articles 20, 21, and 22

Source: *WHO FCTC, 2005*

Table 2.5: Status of implementation of WHO FCTC in Nigeria

Article	Requirement	Nigeria status
Article 5.1 **National strategies, plans, programmes, and coordinating mechanism**	Each Party shall develop, implement, periodically update and review comprehensive multi-sectoral national tobacco control strategies, plans, and programmes, establish or reinforce and finance a national coordinating mechanism or focal points for tobacco control	National agency with staff as well as national strategies, plans, and programmes on tobacco control.
Article 6 **Price and tax measures to reduce the demand for tobacco products**	Take account of national health objectives concerning tobacco control and adopt or maintain measures which may include implementing tax and price policies on tobacco products to contribute to the health objectives aimed at reducing tobacco consumption, and prohibiting or restricting tax- and duty-free tobacco products.	The total tax on most sold brands is 32%
Article 8 **Protection from exposure to tobacco smoke**	Adopt and implement measures, providing for protection from exposure to tobacco smoke in indoor workplaces, public transport, indoor public places, and, as appropriate, other public places.	Smoke-free policies in health care facilities, educational facilities, government facilities, and indoor offices.
Article 11 **Packaging and labeling of tobacco products**	Adopt measures within three years of entry into force that requires the display of rotating series of health warnings and other messages on tobacco product packaging that cover at least 30% of the principal display areas – ideally 50% or more and include pictures or	Requirement of specific health warnings covering 15% of the display area in all packages.

	pictograms—and that prevent false, misleading or deceptive packaging and labeling.	

Source: *Nigeria report card on the WHO Framework Convention on Tobacco Control, 2009*

Other government legislations to control tobacco use include the Abuja smoke-free policy enforced in 2007 by the then minister of the Federal Capital Territory (FCT) and the smoke-free policy adopted in Osun State. This policy bans smoking in specific public places to curtail exposure to second smoke by non-smokers (Drope, 2011).

Also, litigation has been deployed as one of the tools to advocate for a reduction in smoking by the tobacco control community in Nigeria. There is this instance in April 2007 when the Attorney-General and Commissioner for Justice of Lagos State on behalf of the Lagos state government brought litigation against 5 tobacco producing companies namely, International Tobacco Limited, British American Tobacco PLC, British American Tobacco Nigeria Limited, British American Tobacco (Investment) Limited and Philip Morris International, seeking to recoup the sum of N2.5 trillion claimed to have been spent on treating people who became sick from using tobacco products. This was followed by three other states – Oyo, Kano, and Gombe – and the Federal Government of Nigeria in 2007, taking a cue from the Lagos action, filed various cost-recovery suits against the tobacco industry (Drope, 2011).

More recently, the Environment Rights Action/Friends of the Earth Nigeria (ERA/FoEN) requested on 28 November 2016 through its solicitor Yinka Kotoye that the Nigerian Customs Service (NCS) make public the volume and brand names of cigarettes exported and imported from 2002 till date. Their request included information regarding the size of tax exemption/waiver benefited by the British American Tobacco Company and by other tobacco companies in Nigeria between 2004 and 2014 as a result of the Export Expansion Grant (EEG) Scheme. Also, they requested information on the volume of raw leaf imported into Nigeria by BATN as well as details of the country it was imported from within the same period.

2.1.3. Tax Policy on Tobacco in Nigeria

In Nigeria, law making is the sole responsibility of the national and state legislative arms and policies will have to be initiated at that level of governance. The country operates federal legislation in which certain issues and concerns are in the exclusive legislative list

which means that only the Federal government has an absolute exclusive legislative power and control over such matters, while issues that can be legislated upon by both Federal and State governments are in the concurrent legislative list and issues affecting the local governments are in the residual list. The laws guiding tobacco activities in Nigeria are typically federal laws. The judiciary of the three levels of government, federal, state, and local governments, simply oversees the enforcement of the laws. Tobacco tax revenue is collected and accrues to the Federation account and is shared among the three tiers of government at regular intervals alongside other federally collected revenues (CRES, 2013).

It is generally believed that tobacco tax increase, if well applied and managed, constitutes a very effective control measure to reduce consumption of tobacco products, particularly cigarettes. When taxes are increased, they translate into higher cigarette prices which invariably mean that smokers are bound to pay more to access cigarettes or maintain the same level of cigarette consumption. Inability to pay ruling prices means ineffective demand and indeed, leads smokers to quit, or at least reduce the smoking intensity, i.e. reduce the number of cigarette sticks they consume which thus reduces smoking intensity. Moreover, new consumers predominantly the youth, low-income persons, and the poor in general are likely to avoid smoking cigarettes since they may not be able to pay for them. It is estimated that a 10 percent increase in cigarette prices would trigger a reduction in tobacco demand by 2–6% in developed countries and by 2–8% in low- and middle-income countries (Chaloupka *etal*. 2002).

From a revenue generation perspective, higher tobacco taxes result in higher tax revenues for the government. The additional revenue may be deployed for development purposes including financing tobacco-control measures, providing health care for tobacco-induced ailments in sufferers, or used for other social services (CRES, 2013).

The imposition of tax and price policies aimed at causing a reduction in the level of tobacco consumption is generally regarded as an effective and efficient economic tool and this instrument is supported by the WHO Framework Convention on Tobacco Control.

The WHO recommended that at least 70 percent of the retail price of tobacco products should be due to excise taxes. Excise taxes levied on tobacco products have been seen to trigger a decrease in the level of tobacco consumption in the majority of the countries of the world. In terms of the tool of taxation in controlling tobacco use, there are broadly two forms of excise taxes which are specific and ad valorem. While the specific tax is levied based on the number of tobacco products, ad valorem is a form of tax levied with consideration of the value of the product. Nonetheless, the decision to adopt any of these types of excise tax usually has an impact on the amount of revenue generated from tobacco taxation by the government. Therefore, a good understanding of these variants is needed for designing optimal excise taxes on tobacco products.

Table 2.6: **Prices and taxes of tobacco products**

Retail price per pack*	**Excise tax***	**Total tax***
$1.89 In US dollars and the at official exchange rates	**27%** Excise tax Excise tax on tobacco combines ad valorem excise tax and specific excise tax	**32%** Total tax Total tax includes VAT and taxes apart from excise and import duties reported as of December 2009

CRES, 2013

The percentage of taxes in the retail price of cigarettes in Nigeria in 2009 is as depicted in Table 2.6. While tobacco excise tax was about 27 percent, other taxes accounted for about 5 percent of the total tax, such that excise tax (consisting of specific excise tax and ad valorem excise tax) and other taxes (VAT, etc.) together make 32%.

In 2017, tobacco prices increased due to an increase in tobacco taxes in the form of an increase in import tariff from 35% to 60% (Euromonitor International, 2018). An updated report by the then Minister of Finance, Mrs. Funke Adeosun revealed that excise tax on cigarettes in Nigeria is majorly ad-valorem tax which stands at 20% per pack as of 2018. However, a specific tax of #1 per stick of cigarette (#20 per pack of 20 cigarette sticks) was introduced on June 4th, 2018. This specific tax rate is expected to increase to #2 per stick of cigarette in 2019 and a further increase of 0.90 kobo (to #2.90) in 2019 ("Nigeria's New tax on tobacco," 2018). This increase in the taxes levied on tobacco products is expected to be reviewed in January 2021. However, this has not happened due to the effect of the COVID-19 pandemic on the economy and the decision by the government not to increase the taxes levied on commodities to avoid worsening the economic condition of citizens. Although, it has been argued by tobacco control advocates that this should not apply to tobacco products in view of the impac of tobacco consumption on public and population health.

2.1.4. The burden of selected tobacco-related diseases in Nigeria

In 2014, the WHO estimated that tobacco-related diseases such as cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes (chronic non-communicable diseases) accounted for about 24% of total deaths in Nigeria (WHO, 2014). The adult risk and modifiable factors to these diseases are tobacco use, excessive alcohol consumption, raised blood pressure, and obesity. Figure 2.9 showed that age-standardised death rates per 100,000 fell slightly between the years 2000 and 2004 for males and females. But it increased slightly after 2004 and then followed a similar pattern between 2006 and 2012.

Deaths from cardiovascular diseases were the highest within the review period accounting for close to 300 deaths per 100,000, while deaths due to diabetes and chronic respiratory diseases were the lowest. For the disease categories, more male deaths due to cancer occurred between 2000 and 2012 while more females died as a result of cardiovascular diseases than males. Deaths from chronic respiratory diseases were almost the same among both sexes. Figure 2.9 illustrates the percentage of total deaths for all ages for males and females. As indicated earlier, non-communicable diseases are estimated to account for almost a quarter of total deaths within the period reviewed (WHO, 2014). Given the steady increase in the prevalence of tobacco use shown above, morbidity and mortality due to tobacco consumption will likely increase further in the future if tobacco control effort is not strengthened in Nigeria.

Figure 2.10 shows the likelihood of dying between ages 30-70 as a result of the four non-communicable diseases included in the analysis. The disease category with the highest death rates among males and females in 2014 was cardiovascular diseases followed by cancers, diabetes, and chronic respiratory diseases, in that order. For cardiovascular diseases and diabetes, mortality was higher among females while the death rates due to tobacco consumption were higher among males relative to females as shown in the figure (WHO,2014).In effect, the burden of these diseases combined poses an increasing and substantial public health threat to Nigeria, and efforts to stem the increase of these diseases remain at the centre of population health policy discourse globally.

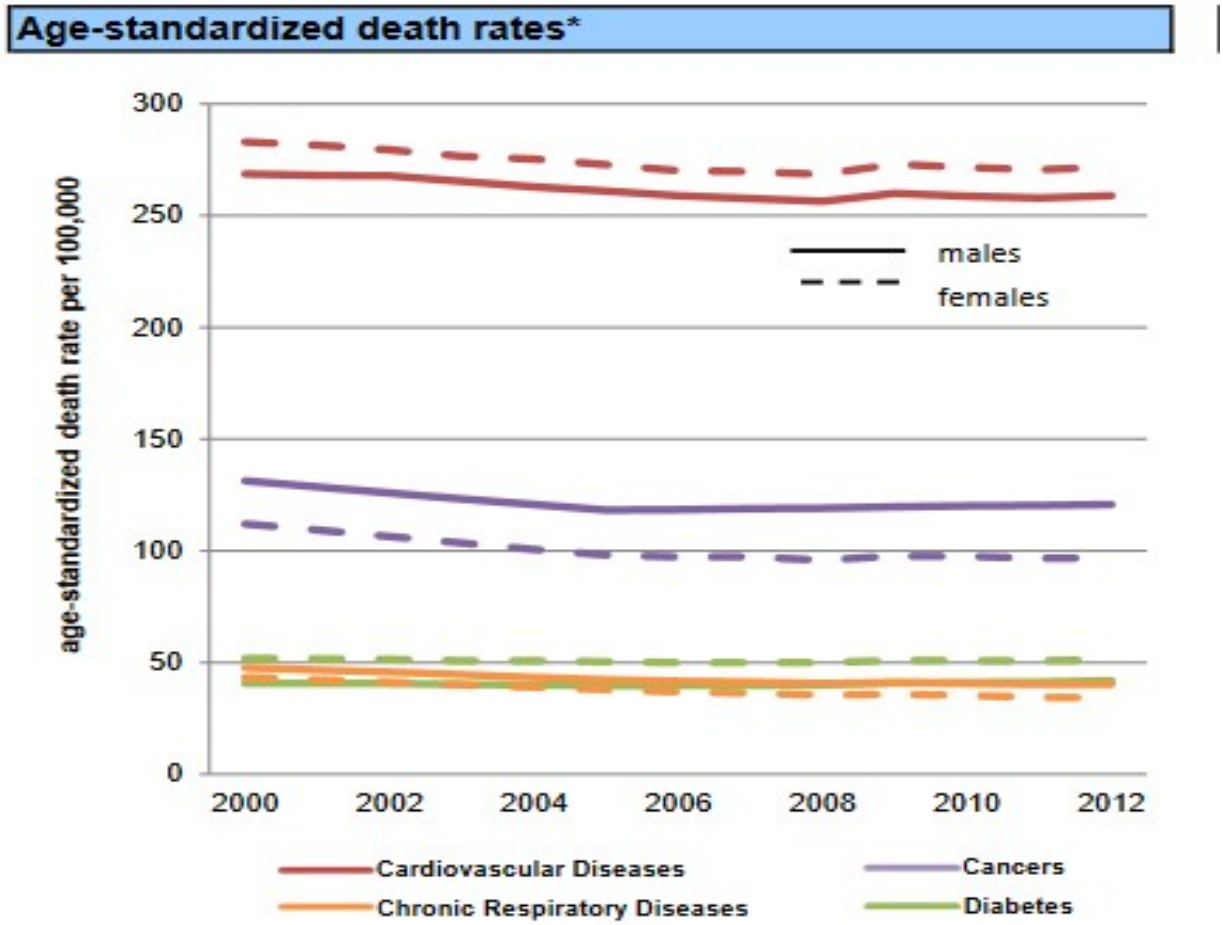

Figure 2.8: Age standardized mortality rates due to selected non-communicable diseases

Source: *WHO, 2014*

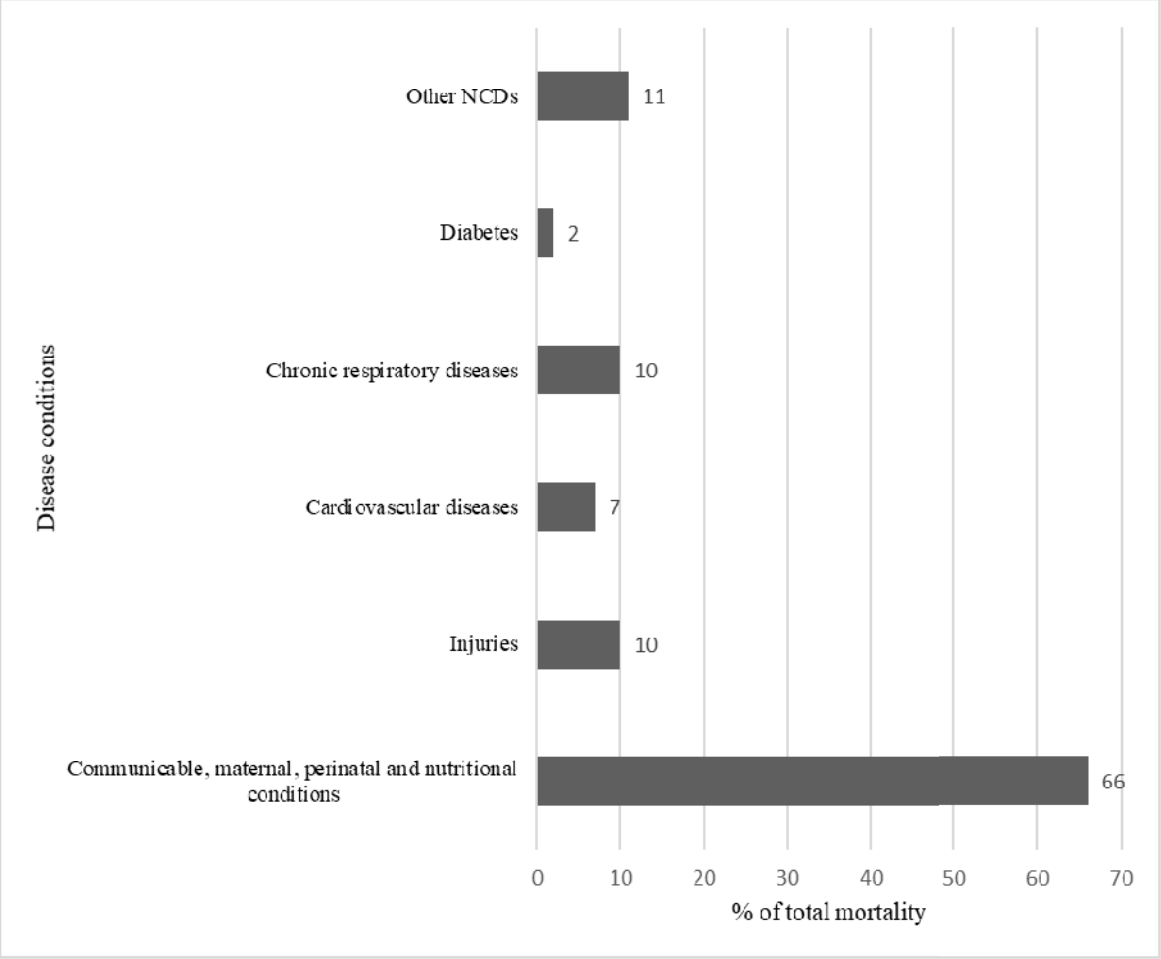

Figure 2.9: Proportional deaths (% of total deaths, all ages, both sexes, in 2014)

Source: *WHO, 2014*

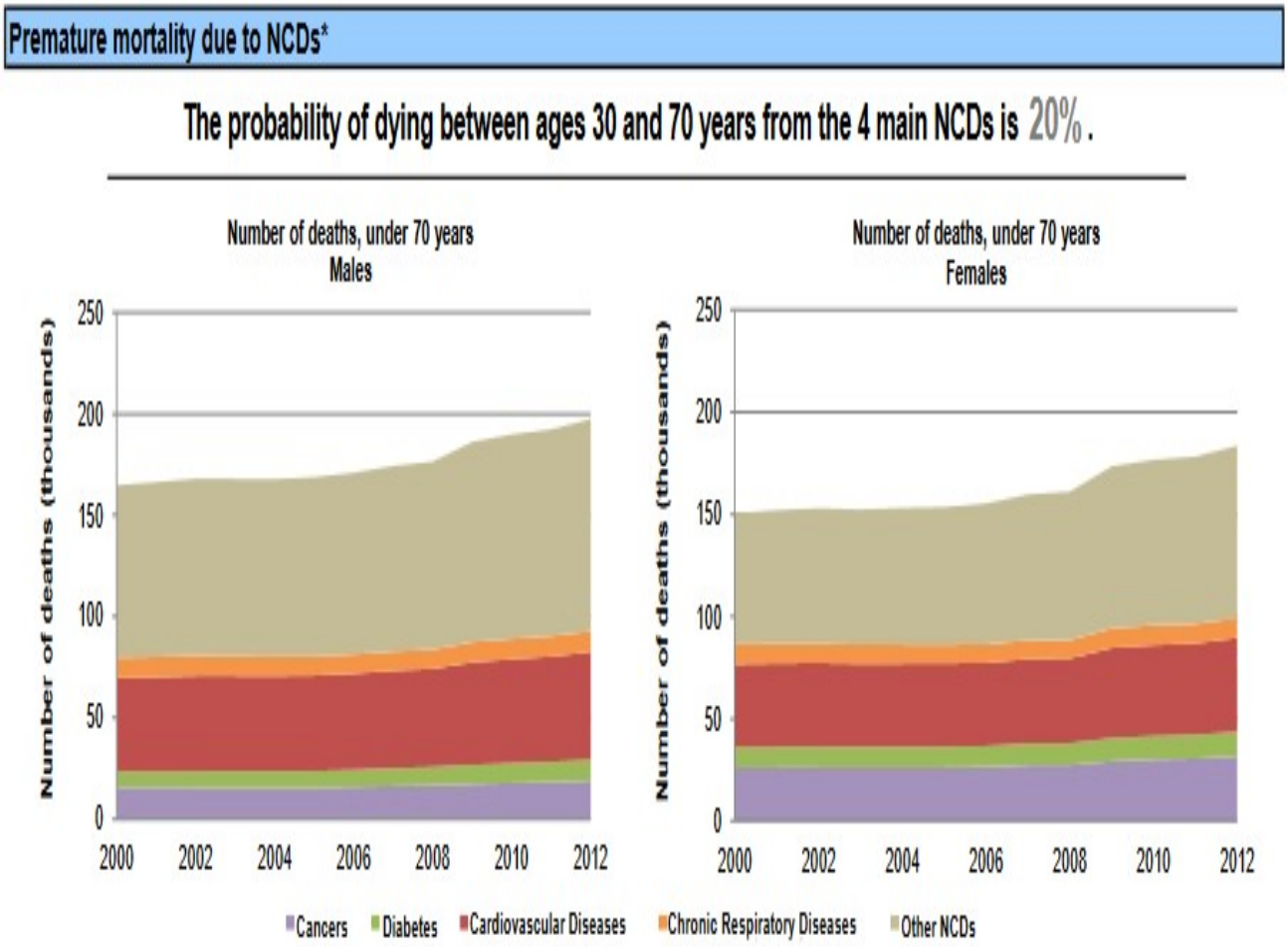

Figure 2.10: Premature mortality due to non-communicable diseases

Source: *WHO, 2014*

Recently in 2017, the WHO conducted a study on the morbidities and mortalities from four target non-communicable diseases which include cardiovascular diseases, chronic respiratory diseases, cancers, and diabetes. The study revealed that the percentage of deaths from NCDs increased to 26% from 24% in 2014 and 2015. This accounted for 570,000 deaths and of these deaths, 20% was due to mortality from the aforementioned target NCD (WHO, 2017). (Figure 2.10)

2.1.5. Population growth and poverty in Nigeria

For several decades, the level of poverty[13] has increased due to the inability of the Gross Domestic Product (GDP) to keep up with the ever growing population in Nigeria. This situation is further worsened by corruption, inadequate level of planning, rising inflation level, unemployment, and incessant civil, religious, and political unrest in the country. This standpoint is more worrying when we consider the effect of tobacco consumption on poor households. Research has found that tobacco use is more predominant among the poorest section of the population and the multiplier effect of smoking on household welfare can be substantial.

[13] According to a report by Fitch International, the poverty level in Nigeria rose to about 72% in 2016. (see: https://www.ripplesnigeria.com/nigerias-poverty-level-index-hits-72-2016-fitch-reports/). This computation was based on productivity index.

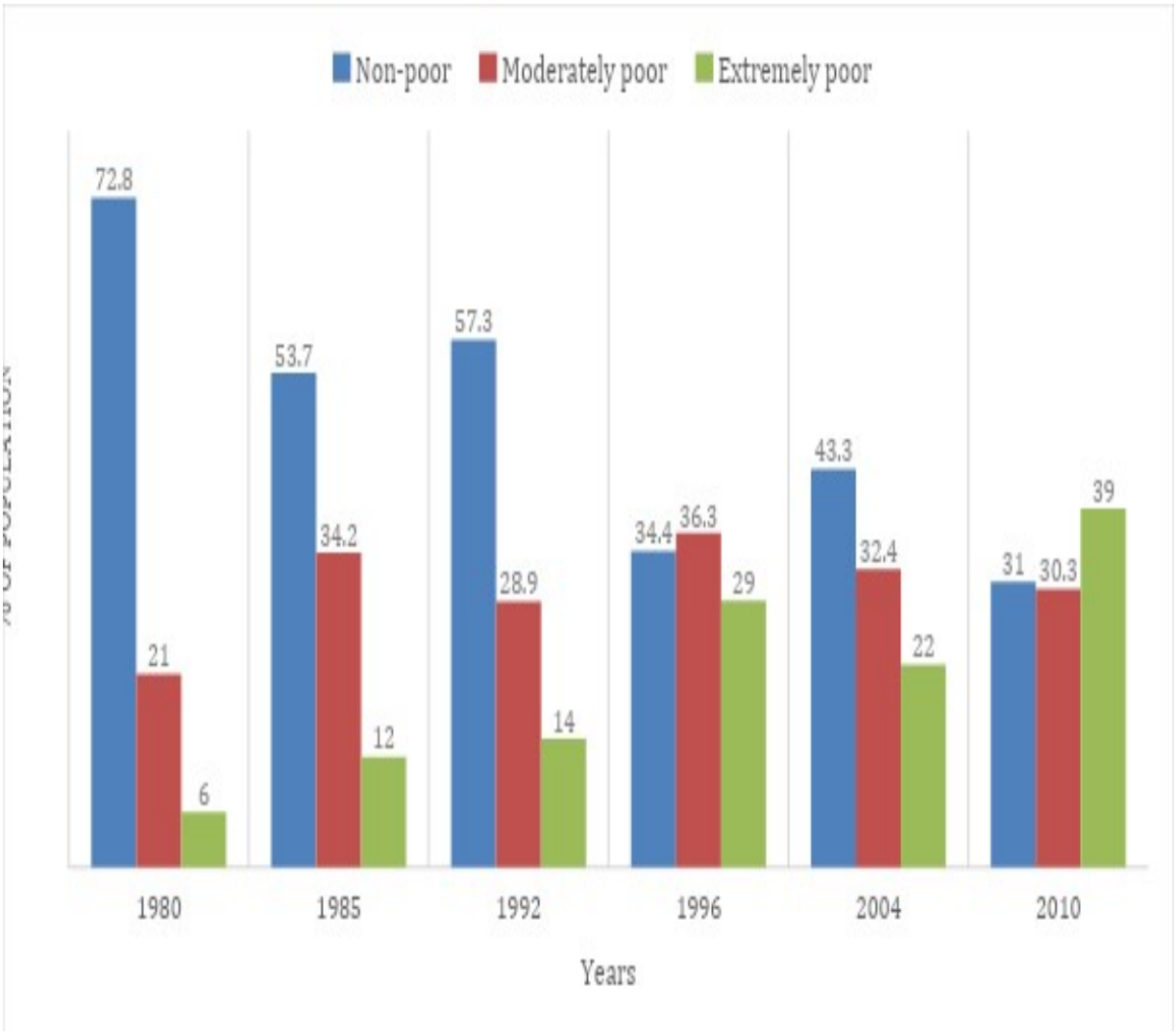

Figure 2.11: Categorisation of the population, by poverty status (relative poverty measure)

Source: *Nigeria Poverty Profile, 2012*

In Figure 2.11, the proportion of the population categorised as non-poor reduced from 72.8% in 1980 to 31% in 2010 and the fraction of the population that is extremely poor became larger within the same period. This indicates that the efforts to reduce poverty in Nigeria should now be top of policy makers' priority. In addition to other programs targeted at improving economic conditions, it should be considered how tobacco use reduction could allow economically disadvantaged households to redirect the portion of their earnings previously spent on smoking into other household needs (clothing, food, education, insurance, health, etc.).The additional income generated by increasing the indirect tax on tobacco products will help the government. This revenue would be significant if the price of petroleum fell as a result of the recent economic downturn.

Table 2.7 shows the poverty incidence, estimated population, population in poverty. The proportion of the population living in poverty has consistently increased over the reviewed period (1980-2010). This is depicted in Table 6 below from 1980 to 2010. Following the recent round of the HNLSS 2018/2019, the NBS reported that the poverty headcount in Nigeria was about 40 percent of the population. This translates to about 82.9 million people living in poverty as in 2019 (NBS,2020).

Table 2.7: Proportion of the Population living in Poverty

Year	**Poverty Incidence (%)**	**Estimated Population (Million)**	**Population in poverty (Million)**
1980	27.2	65	17.1
1985	46.3	75	34.7
1992	42.7	91.5	39.2
1996	65.6	102.3	67.1
2004	54.4	126.3	68.7
2010	69.0	163	112.47

Source: *National Bureau of Statistics. (HNLSS 2010)*

2.1.6. Socio-demographics of Tobacco Use in Nigeria

Table 2.8 revealed that the level of tobacco consumption among household heads was 4.4% and of these, 78.1% consumed tobacco daily. The majority of the smokers (68.4%) started daily smoking before they had reached 25 years. Also, majority reported that they initiated tobacco consumption between ages 15 and 19. This suggests that adolescents and young adults within this age range may be more susceptible to initiating smoking. Nonetheless, 70.4% of those who reported that they currently smoked, consume less than half of one pack every day. Similarly, about 7% of the participants consumed more than a pack of manufactured cigarettes on a daily basis.

Table 2.8: Tobacco consumption profile of Nigerian adults

Characteristics	Frequency	Percentage
Ever Smoked		
Yes	750	7.7
No	9015	92.3
Total	**9765**	**100.0**
Current Smokers		
Yes	429	4.4
No	9336	95.6
Total	**9765**	**100.0**
Smoking frequency(n=429)		
Daily	335	78.1
Less than Daily	94	21.9
Age at initiation of daily smoking(n=335)		
10-14 yrs	21	6.3
15-19yrs	121	36.1
20-24yrs	87	26.0
25-29 yrs	43	12.8
30yrs and above	28	8.4
Can't remember	35	10.4
Number of manufactured cigarettes smoked per day(n=335)		
None	14	4.2
Less than ½ a pack	236	70.4
½ pack to < a pack	62	18.5
A pack and above	23	6.9

Computed from *GATS, 2012*

2.1.7. Tobacco Industry in Nigeria

Tobacco industry in Nigeria is dominated by the British American Tobacco Nigeria (BATN) and holds a market share in excess of 80%. As a result of the company produces more than 80% of total cigarettes consumed and exported in Nigeria and also has a sizeable market share within the ECOWAS region (CRES, 2013). This ensured that Nigeria moved from net-importer of tobacco to net-exporter of it over a few years (Drope, 2011).

BATN has been growing tobacco leaf for over 100 years in Nigeria and celebrated the centenary of the presence of its parent company (BAT) in the Nigeria tobacco market about seven years ago, precisely in 2012. The company began growing tobacco leaf in Ago-Are and thereafter spread to Northern Nigeria (Zaria, Sokoto and Sabo Birn). Presently, BATN leaf operations are located in Ago Are, Otu, Iseyin, Igbojaye, and Idiko Ago as the concentrated zones of production in Nigeria. Production in Zaria zone is also very strong and thriving because tobacco has no food value but economic value to the growers (CRES, 2013).

Tobacco growers/farmers number about 10,000 and about 1,000 are in Oyo State. They are all registered with BATN as out growers. They receive agronomic and extension support from BATN. The farmers also receive production inputs and credit support from BATN. As a result of the extensive support farmers received they are obliged to sell their leaf output to their benefactor, BATN. Since there is no serious second buyer in the system, BATN acts as a de facto monopsonist. To compensate for environmental impact of tobacco cultivation, particularly the removal of trees and vegetation to pave way for the cultivation of tobacco, each of the tobacco farmers is expected to cultivate at least 100 stands of trees supplied by BATN. Apart from farmers, some other 300,000 people are believed to derive income from legitimate tobacco business in Nigeria. BATN also claimed it paid over N100 billion in taxes to the government since 2002 (CRES, 2013).

BATN has a cigarette manufacturing plant in Ibadan and an upgraded factory in Zaria. Between them the factories produce such brands as Benson and Hedges, Rothmans and

Marlboro among others. These are sold mostly through informal channels and outlets – kiosks and other makeshift sales outlets. These outlets are popular because they are easily accessed by the lower income smokers who patronize such outlets for cigarette packets and/or stick purchases. Formal channels are supermarkets, hotel bars, airport duty-free shops and high grade shopping malls. In formal outlets, cigarettes are sold in packets or rolls and never in sticks.

In general, BATN enjoys monopoly power in the Nigerian tobacco industry and can fully or partially pass excise tax burdens to consumers depending on the pricing policy/strategy the firm deems suitable to achieving its profit maximising objectives. Also, BATN's market power ensures that it exercises price leadership such other small firms in the tobacco industry follows the prices set by BATN. According Euromonitor International, BATN dominated volume sales in 2017 as a result of high demand/consumption of their top brands- namely Benson & Hedges, London White and Rothmans. The report however revealed that the market shares of BATN dropped slightly in the last five years prior to 2017 due to the business activities of other competitors in the industry. So far, the company has experienced a strong competition from Japan Tobacco International (Euromonitor International, 2018).

Owing to the market power of BATN, the company controls what the value of tobacco leaves are, and it is likely local farmers are unsure of the quality of leaves they picked to argue for appropriate pricing. Nigerian tobacco workers which are predominantly women and young childrenare often predisposed to skin illnesses due to the fact that they handle raw tobacco leaves with their bare hands without adequate protection.

The annual land area under tobacco, the yield and the annual volume of leaves produced are as shown in Table 2.9. The land area of tobacco harvested fluctuated throughout the review period (i.e.2006-2018) and seemed to decline for the most part. Between 2017 and 2018, there was a slight increase of the land area used for cultivation of tobacco leaves from 9,800ha to 10,289ha. Despite the decline in the land area, the crop yield was fairly stable. The highest increase in yield was experienced in 2008 (6,667hg/ha) and the lowest

crop yield (4,737hg/ha) occurred in 2007. Similarly, the production of tobacco leaves witnessed over 55 percent drop between 2006 to 2018 (from 14,000 tons to 6,255 tons). The production of unmanufactured tobacco was the highest in 2006 (14,000 tons) and the lowest in 2015 (5,000 tons).

In a similar analysis of tobacco production conducted by the WHO in 2012, the Agricultural area used for tobacco production between 1995 and 2012 was fairly stable all through the period. Meanwhile, the crop yield per hectare increased (from about 2700 Hg/Ha to 10000 Hg/Ha) steadily during the same period. This may be as a result of improvement in tobacco growing technology adopted in the industry. This is reflected in the number of cigarettes produced in 2005, even though the data for other years are not available.

The gross production value of unmanufactured tobacco between 2006 and 2016 is depicted in Figure 2.13. During the period under review as seen in the trend line, there was a marked fall in the value of tobacco leaves. In 2008, there was a shock in the form of a large increase in the amount of unmanufactured tobacco cultivated in the country (which was the highest during this period), although the reason for this jump was is not known. After 2008, the value declined again until 2006 when the lowest value was recorded.

Table 2.9 shows the volume of tobacco production between 1995 and 2012. The agricultural area for producing tobacco increased sharply from 58,400,000 hectares in 1995 to 71,300,000 hectares in 2000. However, between 2005 and the year 2012, it was relatively stable. Likewise, the proportion of land devoted to cultivating tobacco relative to the total agricultural land was stable during the review period. About 0.04% was devoted to growing tobacco leaf in 1995 in which there was a 0.01 increase in 2000 (to 0.04). Afterward, the percentage of arable land devoted to cultivating tobacco dropped by 0.02 in 2005 and remained the same at 0.03 from 2005 to 2012. This was reflected in the volume of tobacco production during the period as the number of tobacco manufactured was the highest in the year 2000 (22,000 metric tons). The volume of sticks of cigarettes produced

was only reported for the year 1995 (256,000,000 sticks) and the year 2005 (1,813,000,000 sticks).

Table 2.9: Area harvested, yield and production of tobacco leaves (unmanufactured tobacco) in Nigeria, 2006 – 2018

Year	Area harvested	Yield	Production (tonnes)
2006	23000	6087	14000
2007	19000	4737	9000
2008	18000	6667	12000
2009	18281	6322	11558
2010	14789	6131	9066
2011	12600	6085	7668
2012	10883	6112	6652
2013	9375	6132	5749
2014	9144	5969	5458
2015	9500	5263	5000
2016	9700	5670	5500
2017	9800	6122	6000
2018	10289	6080	6255

Source: *FAOSTAT, 2020*

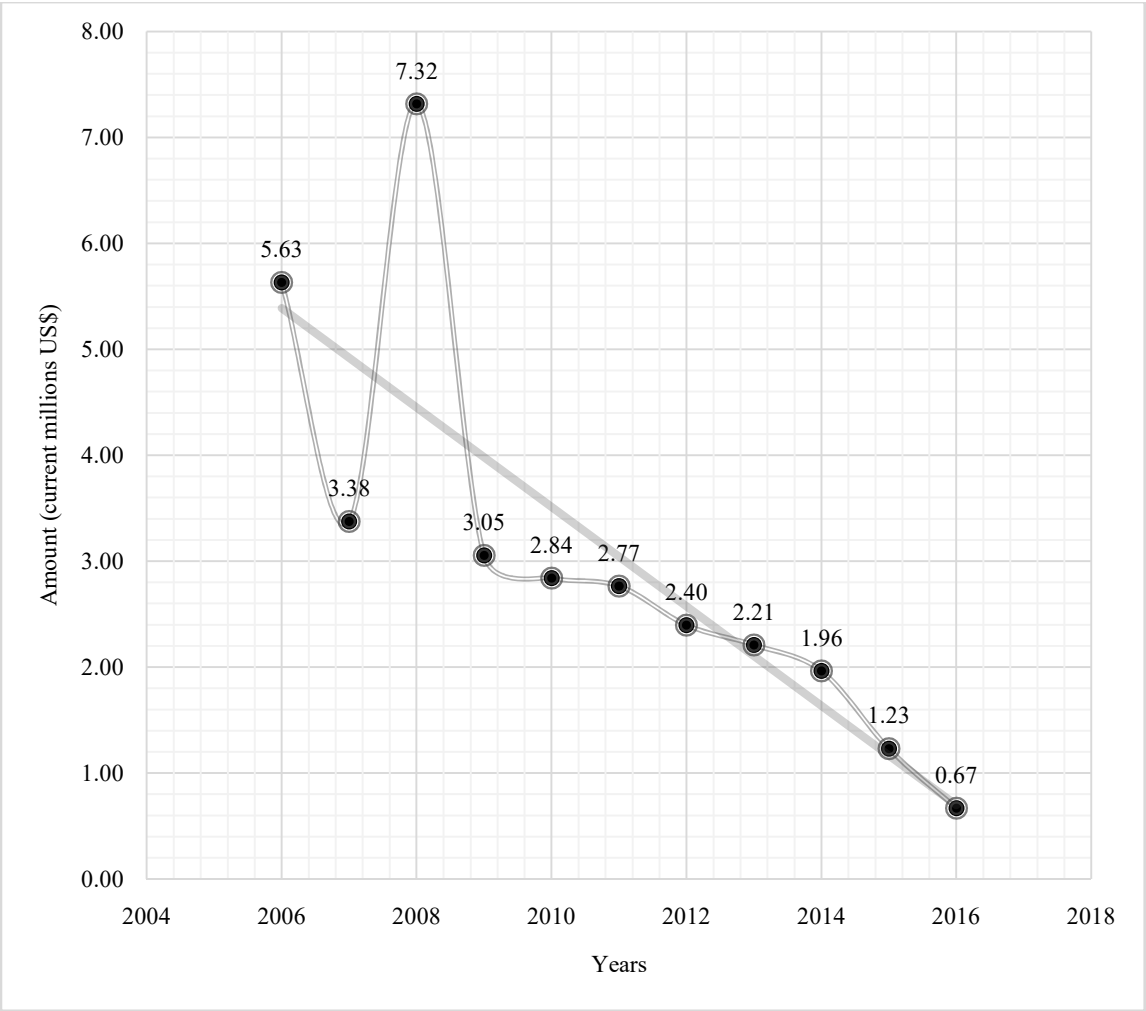

Figure 2.12: Gross production value of tobacco leaves in Nigeria (2006-2016)
Source: *FAOSTAT,* 2020

Table 2.10: Tobacco production in Nigeria (1995-2012)

Tobacco Production	Unit of measurement	1995	2000	2005	2010	2012
Agricultural area	Hectares	58,400,000	71,300,000	72,700,000	70,000,000	72,000,000
Area harvested under tobacco crop	Hectares	26,448	37,000	25,000	18,075	18,000
Land devoted to tobacco growing (% of agricultural land)		0.04	0.05	0.03	0.03	0.03
Tobacco leaf production	Metric tons	9,200	22,000	15,000	17,200	17,500
Crop yield per hectare	Hg/Ha	3,479	5,946	6,000	9,516	9,722
Cigarette production	Sticks in millions	256		1,813		

FAOSTAT, 2012

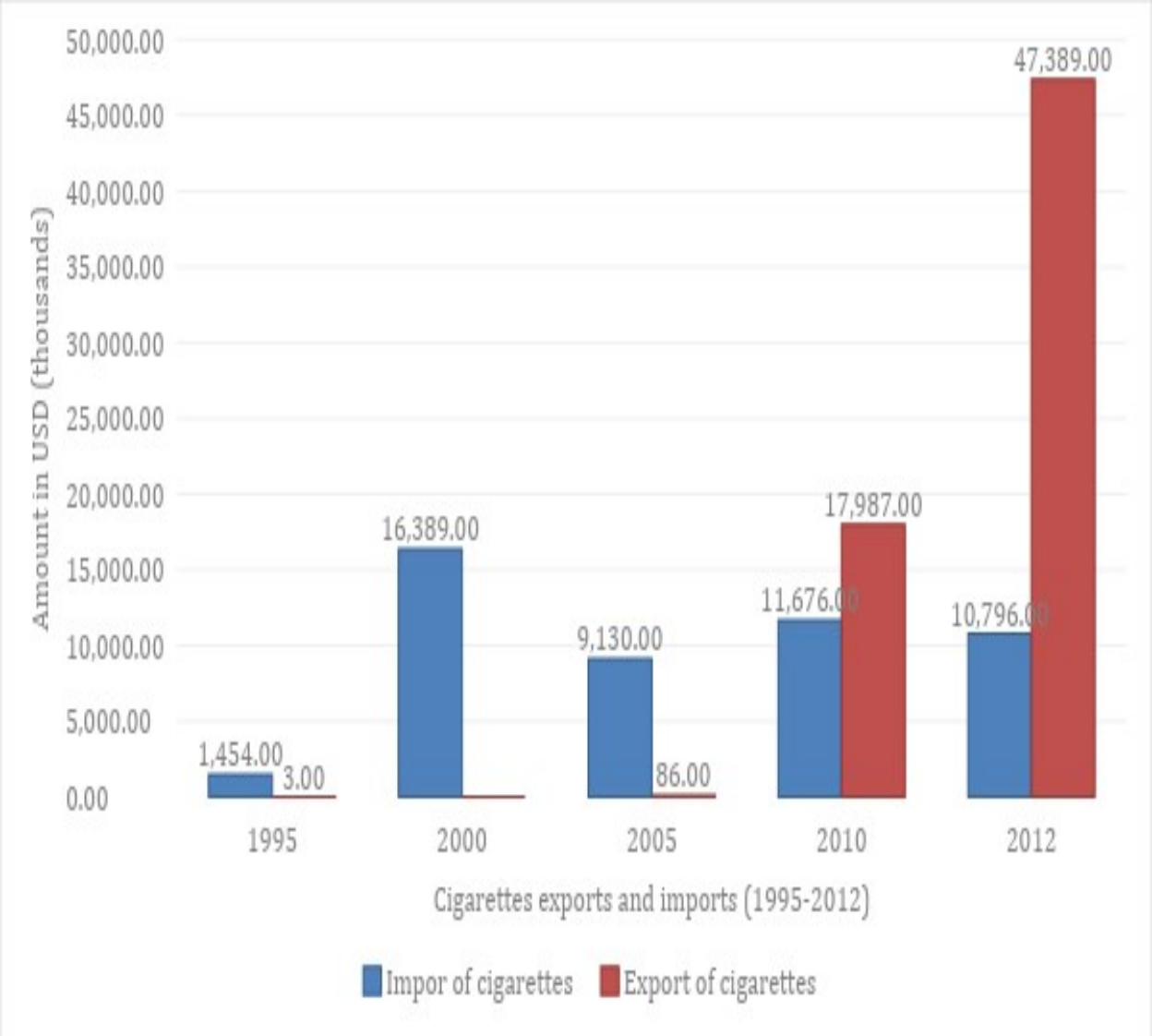

Figure 2.13: Cigarettes exports and imports in Nigeria (1995 – 2012)
Source: FAOSTAT, 2020

The value/volume of cigarettes exported and imported in Nigeria between 1995 to 2012 is shown in Figure 2.13. During this review period, the value of cigarettes imported exceeded its export from 1995 to 2005, with the highest negative net export occurring in the year 2000. However, there was a marked change in 2010 when the value of cigarettes imported was 11,676,000 United States Dollars (USD) and the value of export stood at 17,987,000 USD (with a difference of 6,311,000 USD). This coincides with the time that the tobacco industry in Nigeria was beginning to grow more tobacco leaf in the country. The positive net export in 2012 (36,593,000 USD) was even higher compared to that experienced in 2010.

Figure 2.13 show the export and import of tobacco leaf between 1995 to 2012. Import exceeded export for all the years and the implication of this is that tobacco production in Nigeria depends heavily on the importation of tobacco leaf from other countries. The figure shows that the value importation of tobacco leaf increased every year apart from 2000 when it decreased. The increase in the importation of tobacco leaf was the highest between 2005 and 2010 when the value more than doubled from 33,974,000 USD to 71, 706,000 USD. In contrast, the value of imports was low during the review period when compared with the value of export.

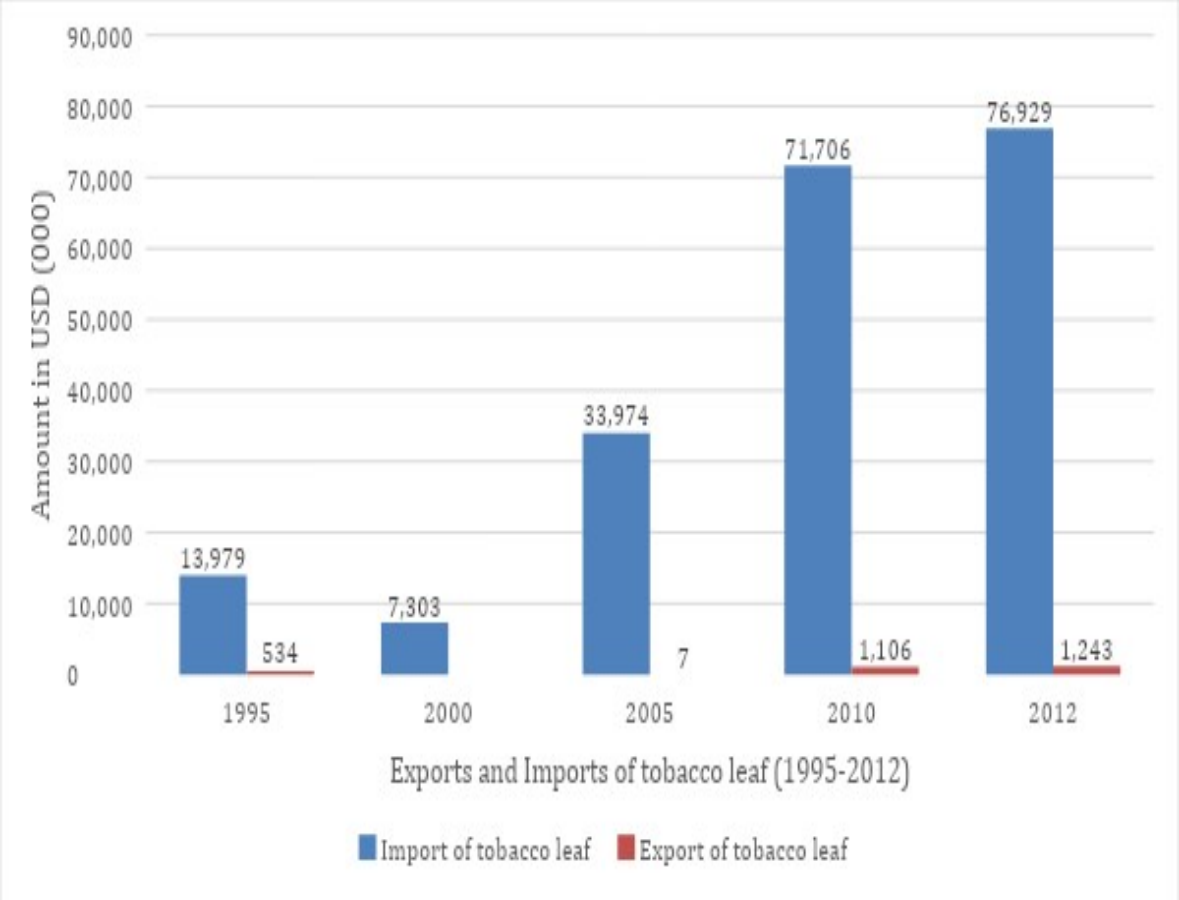

Figure 2.14: Export and import of tobacco leaf (1995-2012)
FAOSTAT, 2020

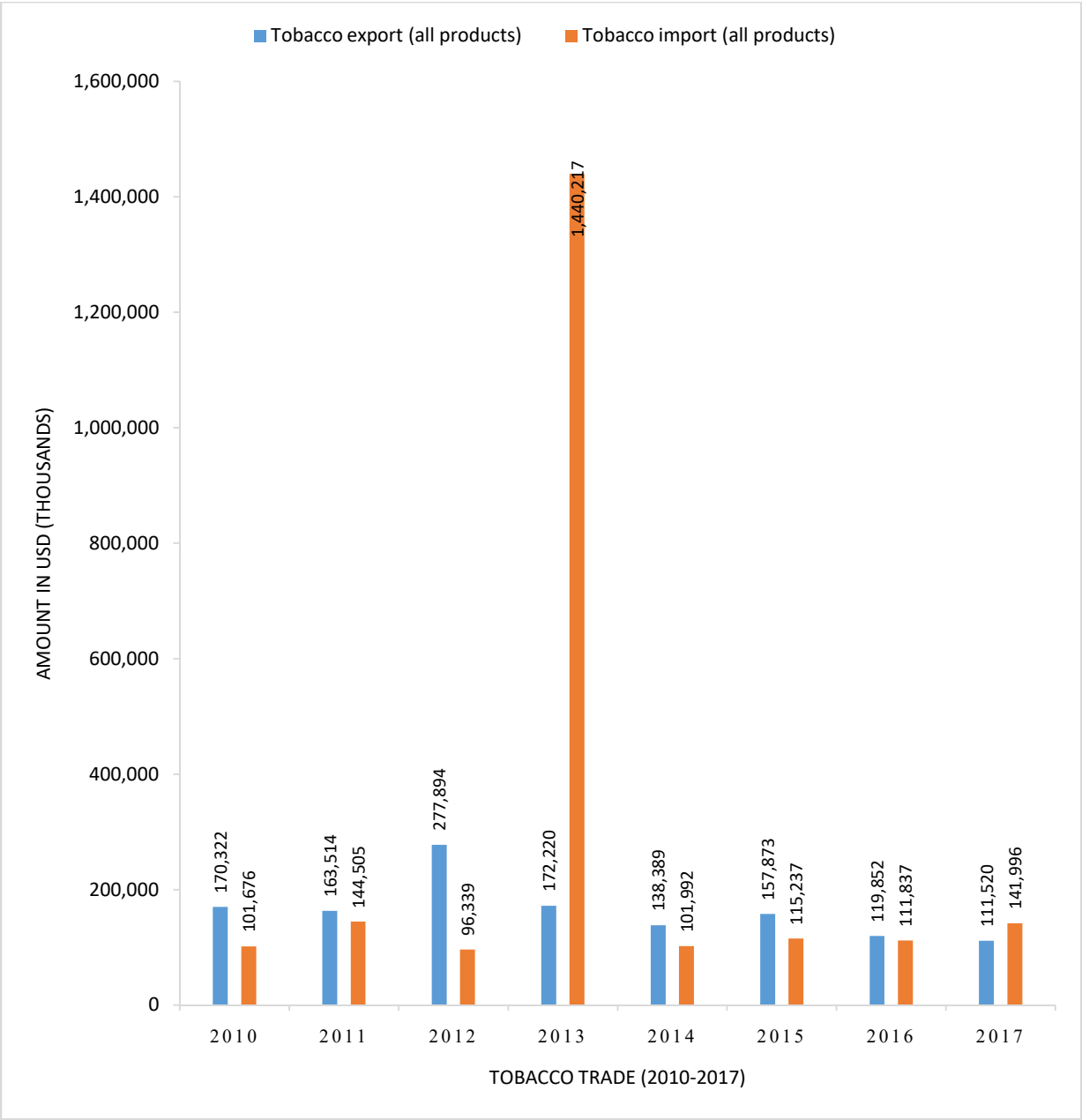

Figure 2.15: Tobacco imports and exports in Nigeria, all products (2010-2017)

Source: *UN COMTRADE database, 2020*

From 2010 to 2017, Figure 2.15 depicts the imports and exports of all forms of tobacco products (i.e. tobacco or tobacco substitute cigarettes, unmanufactured tobacco cigars, and cigarillos; tobacco refuse). Between 2010 and 2012, the value of all tobacco exports exceeded the value of all tobacco imports. The trend shifted from 2013 to 2015, when there was a period of negative net export. This was the highest level since 2013 when imports exceeded exports by a total of $1,267,997,000 (the highest within the period under review). The Nigerian tobacco industry achieved a positive net export in 2016, but the situation flipped again in 2017.

Figure 2.16 depicts the change in net export of all forms of tobacco products from 2010 to 2017 for a better understanding.The upward (peaks) and downward (troughs) motions are characteristic of a market cycle (also known as an economic or trade cycle) (troughs). The era between 2012 and 2014 had a bell-shaped shape, as seen in figure 2.13, indicating a massive negative export (with a difference of -1,267,997,000 USD).This pattern remained reasonably constant after 2014. Before 2013, there was a net export surplus as at 2013, and the number of exports recovered in 2014 before decreasing again in 2017.

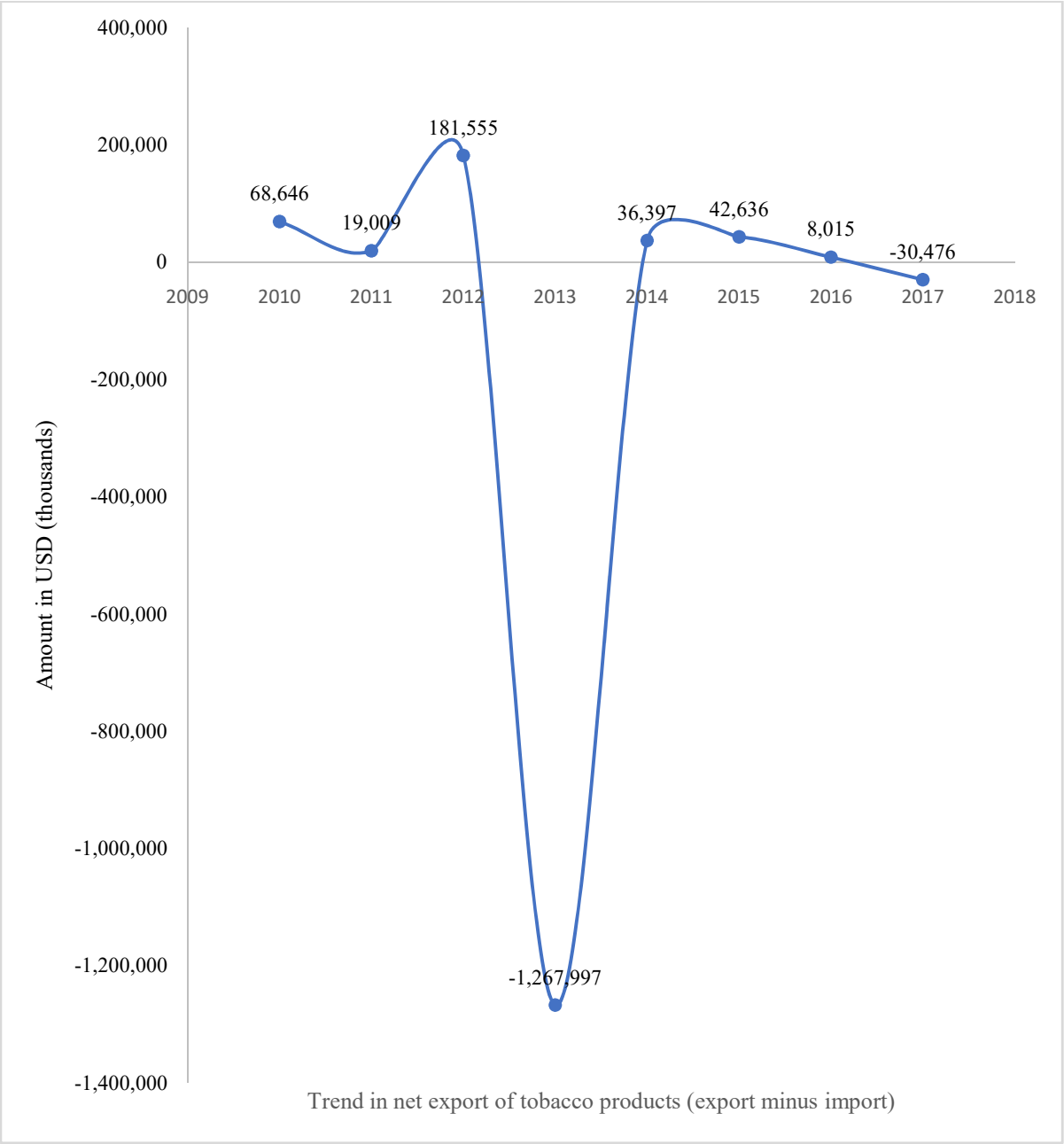

Figure 2.16: Trend in net export of all forms tobacco products (2010-2017)

Source: *UN COMTRADE database, 2020*

2.1.8. Access to tobacco products in Nigeria

Generally, there is easy access to tobacco products in Nigeria because there exist informal channels where smokers can easily have access to various tobacco products. Also, young and vulnerable segments of the population patronise this channel since there exists weak regulation until very recently following the efforts of anti-tobacco stakeholders, individuals, and public institutions (CRES, 2013). The anti- tobacco groups have become very formidable and with the support of Nigeria's National Assembly, they were able to secure the Anti-Tobacco Legislation which was assented to by the President to become law (Drope, 2011).

The problem with tobacco is the consideration of the economic and social risks associated with smoking and these are the points being emphasised by the anti-tobacco community. While manufacturers claim tobacco activities have significant revenue, household income, and employment effects and positive impacts on these variables, the anti-tobacco group argues that the risks and social costs associated with tobacco smoking have super high negative impact on society compared to the purported benefit of the tobacco industry to the economy. The direct negative impact of smoking relates to medical management of tobacco-related diseases of cancer and other respiratory diseases. Indirect costs are identified to include productivity loss arising from diseases, loss of investment, disability, and care of the disease provided by family members.

One of the groups that have been at the forefront of the campaign to reduce the growing tobacco market in Nigeria is the Professionals against Tobacco (PAT). This anti-tobacco group accused the Federal Government of supporting tobacco investment in the nation by empowering the inflow of such organizations. The PAT made this allegation while reprimanding the Government for opening the entryway of investment in Nigeria to the two outside tobacco organizations. The PAT gathering is included an alliance of Legal advisors, Writers, Specialists, Brokers, Bookkeepers, Architects, Educators, and so on.Other groups are fighting against tobacco production and use in Nigeria. They do so

because of their conviction that tobacco consumption is harmful and of no tangible benefit to the country. They encourage governments at various levels to use several forms of taxation to discourage the production of tobacco products. Civil society organizations are equally very active and wish that Government should do more than imposing tax (CRES, 2013).

2.1.9. History of Tobacco Use

Tobacco is a name given to plants belonging to the Nicotiana class of the Solanaceae (nightshade) family, according to the Columbian Reference book (Goodman, 2005). The term is also applied to the product made from tobacco leaves that are used in stogies, cigars, snuff, channel, and biting tobacco.Different types of tobacco plants, with various properties related to smoking (for example, fast consuming, slow expending, gentle, strong), have become well-known in various parts of the globe (Benedict, 2011). The alkaloid nicotine is the most important and distinctive ingredient of tobacco, and it is known for its sedative and calming properties (Goodman, 2005).

The tobacco crop is regarded as one of the most economically profitable cash crops in American farming and around the world (Hurt,2002). The crop was first grown in the North and South American continents and considered to originally belong to countries in these regions. In the eleventh month of 1492, members of the Columbus crew returned from Cuba where they had observed the smoking of dried leaves by the natives. A priest, Bartolome de Las Casas edited the lost manuscript of Columbus's voyages in 1514. He accounted that the natives of Cuba used certain herbs, lit them at one end, and chew or such it at the other end (Gilman, 2004). During this period, tobacco was used in form of chewing, smoking, snuffing tobacco, drunk as tea, and also used with other psychotropic plants by native Americans. Generally, tobacco was believed to have physiological and mind-adjusting impacts among the Mayans and Caribs in South America. Consequently, it was regularly burned as incense during conventional god worship Similarly, after a large number of captives was murdered in revenge to the god Tezcatlipoca, the Aztecs used it at functions. The prescription men of Brazil's cruder Tonoupinambaultiis tribe fill and light

their channels regularly, then puff the smoke into the embodiments of the accumulated average people (Doll and Hill, 1950).

It gradually became common practice and the packs of tobacco provided secular men with rapid access to the pleasure of the chemicals contained in tobacco (Gilman, 2004). Tobacco use in its general form could be done by merely drying the leaves. It is then inhaled into the lungs which meant that 400 chemicals including nicotine are deposited into the bloodstream of the smoker (Gilman, 2004; Goodman, 2005).

Regardless of the way that smoking was notable by then, it was not formally recognized by Europeans when it was first brought back by European travelers. Many saw the taking in of smoke as possibly dangerous. Others negated being introduced to second smoke in light of unsettling influences from tobacco use. Ruler James I of Britain gave an obstinate portrayal of his discontent and gloom for tobacco and smokers, the Counterblast to Tobacco dispersed in 1604 (Gilman, 2004; Goodman, 2005). In the acclaimed articulations of Lord James, smoking was qualified as a custom abhorrence to the eye, scornful to the nose, frightful to the cerebrum, dangerous to the Lungs, and working at a benefit smelling rage thereof, nearest resembling the awful Stygian smoke of the pit that is no-limit. A short time later, Britain pronounced a law that extended the guarded duty set on each pound of tobacco brought into Britain by then. So additionally, countries like Turkey put genuine disciplines on tobacco use to decrease smoking in the overall population. Regardless, tobacco use and trade continued to get conspicuousness in America and Europe (Gilman, 2004; Goodman, 2005).

In the early 1700s tobacco was a truly beneficial harvest in America because of quickly developing interest the world over, particularly in Europe. This prompted increasingly more tobacco exportation from America to nations in Europe and the development of tobacco as a money crop guaranteed to progress from a subsistence economy to an agrarian economy in America (Goodman, 2005). The tobacco crop was significant to such an extent that it turned into money in provinces, upheld by the best quality level, which implied that there was a customary conversion standard from tobacco to gold. It was

broadly utilized as cash by locals of Jamestown in Virginia, US, and John Rolfe, an English settler and tobacco trader was recorded to have made a fortune from tobacco exportation at his Varina Ranches Manor in Virginia. Right now as indicated by different notable records, producers of tobacco crop in America looked to expand benefit of tobacco development by connecting free works accessible through the slave trade (Goodman, 2005).This helped to keep pace with increasing demand for tobacco in importing European countries.

Tobacco trade had a huge effect on the economy of North America as around 33% of the all-out government income exuded from the extract charge on tobacco deals until 1883 in the US. At the turn of the American Common War that lead to the change from bondage to sharecropping, benefits from tobacco exchange plunged and tobacco shippers battled to stay aware of creations to satisfy the needs. Accordingly, James Bonsack in 1881 built up a bit of apparatus that mass created cigarettes. The machine cut the tobacco, dropped a particular proportion of the tobacco into a long compartment of paper, which the machine would then roll and push out the end where it would be cut by the machine into solitary cigarettes. This machine worked at different occasions the speed of a human-cigarette roller. This set off a colossal advancement in the tobacco business that persevered through well into the twentieth century, until the consistent divergences discovering prosperity results of smoking and tobacco-industry's control of nicotine of was revealed in this way (Eriksen *et al*.,, 2013).

Starting in the not so distant past, tobacco was either nibbled or smoked in pipes. While the general usage of tobacco continues, they are falling in created countries and extending in low-and center pay countries. Present day cigarettes and a couple of sorts of hand-moved cigarette, for instance, bidis-fundamental in Southeast Asia and India-now speak to up to 85 percent of all tobacco exhausted all around (Eriksen *et al*.,, 2013). Cigarette smoking appears to show much more genuine dangers to prosperity than earlier sorts of tobacco use (Jha and Chaloupka, 1999). According to a World Bank report in 1999, about 1.1 billion people smoke worldwide and 80% of these smokers live in creating countries.

This development in smoking is anticipated to reach in any event 1.6 billion smokers in 2025 or significantly more (Jha and Chaloupka, 1999).

2.1.10. Health Hazards of Tobacco Use

The health outcomes of tobacco use were obscure and to a great extent determined for a delayed timeframe. The training had been energized by the fantasy that smoking could be significant for mending various human ailments (Burns, 2007). In actuality, early European clinical specialists bolstered the position of local Americas that tobacco has mending properties. Monades of Seville, a Spanish doctor remembered tobacco for his new world assortment of herbs and medications from Focal and South America which were distributed in 1571 (Davids, 1992). Selections right now This Herb Tobacco has explicit goodness to recover torments of the head, and in especially happening to cold causes, along these lines it fixes the cerebral agony when it happens to an infection humor, or of a windy explanation, the leaves must be put hot to it upon the despairing and expanding them in the time that is needful, until the gloom be expelled. Some there be that do favor them with the Oil of Oranges, and it accomplishes a magnificent work (Davids, 1992). In any capacity of despairing that is in the body or any part thereof it helps, being of an infection cause, and applied hereunto it evacuates it, not without phenomenal worship. In agonies of the chest it has a brilliant effect, and in especially in those that do cast out have any kind of effect and rottenness at the mouth, and in them that are short loose. Likewise, some other old shades of perniciousness formation of the herb a smoldering and with Sugar made a Syrup, and being taken in a little sum, it causes to evacuate the Issues, and rottenness of the chest excellently, and the smoke being taken at the mouth, causes that the issue be put out of the chest, of them that do. In the anguish of the stomach, caused of cold causes, or backlash, the leaves being put very hot, it removes it, and breaks down it by expanding of them, until it is expelled.

The smoking and ailments connection were set up by various investigations through the 1940s and 1950s (Davis, 1992). In 1962, the Royal College of Physicians in England thought of a report detailing confirmations from a few investigations that related tobacco

use with illnesses and passing, particularly lung malignancy. Another report followed the previous one released 1964, this time by the top health spokesperson of the US of America. A comparative report titled " Preventing Tobacco Use among Young Individuals" was distributed in 1994, specifying the change from experimentation and the underestimation of fixation by new young smokers (Elders *et al.,* 1994). This report refreshed the study of smoking and fundamentally focused on tobacco use among teenagers and youthful grown-ups. Most as of late, a follow-up on Top health spokesperson Report in 2004 set up a connection between dynamic tobacco use and diseases, for example, weakened lung development, atherosclerosis, dyspnea, and asthma-related side effects in youth and pre-adulthood (US Department of Health and Human Services, 2004). These reports and numerous different investigations give proves that structure the reason for tobacco control the world over.

As early as 1856, Lancet published opinions of 50 physicians which associated smoking to increases in nervous paralysis, loss of intellectual ability, visual impairment and increase in crime rate (Davis, 1992). In the 20th century, researchers had begun to publish articles in scientific journals in relation to the negative health effects of tobacco use in whatever form. Though not often credited with the first set of studies linking tobacco to cancer of the lungs, researchers in Cologne, Germany establish a statistical correlation between cancer and smoking in 1929. These scientists were adamant that causation as a result of smoking was certain. Before long, findings published by Drs. Alton Ochsner and Michael De Bakey in the United States of America further corroborated this link (Burns, 2007).

Researcher kept on leading examinations on a potential relationship between tobacco use and maladies. The following investigation to give confirmations clarifying the connection was that done by Dr. Raymond Pearl of John Hopkins College. He reports to the New York Foundation of Medication his work titled " The Quest for Life span". Right now, reasoned that tobacco use is related with "an unmistakable of life span" and further depicted unexpected losses among smokers to be a corresponding capacity of smoking power. Dr. Pearl led an examination on 6,813 grown-up people; "two-third of the non-smokers had lived past sixty; 61 percent of moderate smokers had arrived at a similar age;

however just 46 percent of overwhelming smokers arrived at age sixty". Somewhere in the range of 1934 and 1938, the US Agency of Census announced that as smoking expanded among the number of inhabitants in people, increasingly more of Americans passed on because of lung malignant growth. This translated to about 36 percent rise in such deaths at the time.

Franz H. Muller and Erich Schoniger from Nazi Germany utilized a case-control epidemiological way to deal with buildup and record the lung malignant growth danger of smoking in 1939 presently before the start of the Primary Universal War. Muller emphasized that the extraordinary increase in tobacco use was the absolute most significant reason for the rising frequency of lung cancer (Proctor, 1996), an end educated by the examination he directed in 1939 where just 3 of 86 lung malignancy in male patients were non-smokers, 56 were overwhelming smokers (Doll and Hill, 1950). Late in the Principal World War nicotine was associated as a reason with the coronary heart issue endured by an astonishing number of troopers on the eastern front.

A 1944 report by a military field pathologist found that all of the 32 energetic officials whom he had assessed after death from coronary disappointment on the war front had been "eager smokers". The maker alluded to the Freiburg pathologist Franz Buchner see that cigarettes should be considered "a coronary lethal substance of the primary solicitation (Proctor, 1996). Further to this, Wynder, and Graham led a 605 men epidermoid, undifferentiated, or histologically unclassified kinds of bronchial carcinoma case-control study in the US in 1950. They found that only 1.3% were non-smokers and 52.1% were heavy smokers. Also, Doll and Hill carried out enlarged and similar study on 1465 cases in England in 1952. Both studies reiterated the claim linking tobacco use and lung cancer incidences. Their study design included relevant confounders such as the age, sex, urban or rustic home, and social class of the subject; word related history; introduction to air contaminations; types of household warming; the spot of meeting; questioner inclination; indicative predisposition; and the historical backdrop of smoking, including, for the individuals who had smoked, the time of beginning and stopping, the sum smoked before the beginning of disease, the primary changes in smoking history, the

most extreme sum smoked, the training as to breathing in, and the utilization of cigarettes or pipe (Proctor, 1996).

In 1952, Reader digest published an article titled "Cancer by the Carton" in the U.S. This article definite the wellbeing results of smoking (White, 2012). The effect of the article was incredible at diminishing cigarette request at that point. Comparable reports started showing up in other productions and the smoking open started giving more consideration to the wellbeing risks of smoking. Thus, cigarette deals eased back down for the absolute first time following various decades (White, 2012).

The tobacco business reacted, coasting a few systems planned for reestablishing the interest for cigarettes. By 1954 the major U.S. tobacco organizations had framed the Tobacco Business Exploration Gathering to counter the developing wellbeing worries of their cash turning item. At that point they started to sell mass-separated cigarettes and occupied with what was then called tar-wars under camouflage this empowers more beneficial smoking. Before this time, a consortium of tobacco makers mutually recognized " the expanded frequency of malignant growth of the lung, but on the other hand rushed to dismiss the thought this was because of smoking. They guaranteed that such connection needed substantive confirmation (Scott,1952).

In effect, the movement to scientifically establish that smoking was a significant factor in the occurrence of lung cancer was long and was never going to happen without a fight from tobacco manufacturers. In 1951 a correspondence got to Lancet that read: the proof is simply fortuitous; it is acquired from factual assessment of clinical material". Another kept in touch with the British Medical Journal in 1952, the main known cancer-causing agent in cigarettes is arsenic. Some reason other than, or extra to, the expansion in cigarette utilization must be tried to clarify the increment in bronchogenic disease (Schoental, 1951). Accordingly, another report was sent to the British Medical Journal in 1952, expressing that "the main known cancer-causing agent in cigarettes is arsenic. Some reason other than, or extra to, the expansion in cigarette utilization must be looked to clarify the expansion in bronchogenic malignant growth" (Scott, 1952). In 1954, the

American Tobacco Industry conveyed an announcement imparting certainty that their barrier against tobacco control would win: It acknowledges an enthusiasm for individuals' wellbeing as a fundamental obligation vital to each other thought in our business" however doesn't "accept that tobacco items are damaging to wellbeing" (Hammond, 1954; Steinfeld, 1985). Additionally, the case-control philosophy received by investigates that ascribed increments in lung malignancy to tobacco use was seriously reprimanded.

According to Hammond (1954), the case-control philosophy was cheap and simple to complete, yet needed sufficient controls and representativeness. This methodological analysis drove scientists to create what was then known as "planned partner structure". This examination configuration permitted analysts to look at the connection among smoking and malignant growths by enlisting smokers and non-smokers after some time to find out their maladies differentials over the time of the investigation. In White, (1990), companion contemplates include "a gathering of individuals who have all accomplished some occasions inside a characterized schedule period, for instance, a birth associate, or a marriage partner". Right now, regular experience is the nearness or presentation to cigarettes smoking among the associate of lung malignancy patients (White, 1990).The accomplice approach was embraced to look at the smoking-malignant growth connect by a few investigations, for example, Doll and Hill, (1954, 1956) and Hammond and Horn, (1988). These partner examines upheld the prior discoveries of case-control contemplates, they affirmed 'the relationship among smoking and lung harmful development and besides found that the lung ailment passing rate was extensively higher among individuals who consume tobacco compared with those who used channels or stogies; that the nature of the relationship among smoking and lung threat extended with the proportion of smoking; that the connection differed by the histological sort of tumor; and that the people who denied smoking had a lower downfall rate than regardless comparable subjects who kept on smoking as showed by White (1990). Besides, these examinations exhibited that smoking is a peril factor for coronary ailment (White, 1990).

In the survey of White, the finding that smoking is a hazard factor to coronary heart ailments was not caught by the Framingham investigation of hazard elements to

cardiovascular infections in 1950. In this way in 1957, this investigation had the option to demonstrate that the Hammond and Horn, Doll and Slope considers found a relationship between tobacco use and cardiovascular illnesses.

n 1962, information from two comparable examinations (Framingham study and Albany study) were pooled and dissected. The outcome indicated that substantial smokers had multiple times the danger of cardiovascular ailments contrasted with non-smokers (White, 1990). By 1970 as indicated by a publication by Lancet, the clinical world had gotten unequivocal on the wellbeing impacts of tobacco use.

More recently, review of the timeline for the health impacts of cigarette smoking by Kwan *et al.* (2015) show further confirmations that propose that tobacco use causes health impacts that are prompt or not long after smoking commencement which implies that these unfavorable health impacts start to show close to the time of inception of cigarette smoking. As indicated by them, these transient health results of cigarette smoking incorporate oxidative pressure, depletion of cancer prevention agent micronutrients, expanded irritation, bargained safe framework, altered lipid metabolism, and respiratory manifestations, for example, hacking, mucus, wheezing, and dyspnea. This infers a general lessened health status (or load of health) of a smoker starting at a time not a long way from the time of commencement (Kwan *et al.*, 2015).

Throughout the years, the example of tobacco use has pulled in a massive consideration from tobacco control specialists since the adjustments in the degree of smoking have suggestion on future weight of tobacco-related ailments. As per Shafey *et al.* (2010), the quantity of grown-up smokers around the globe is evaluated at 1.25 billion, while 20% of youthful young school understudies are present smokers (Warren *et al.*, 2006). Generally, the prevalence of tobacco use is diminishing in created countries and this decrease in smoking is offset by the extraordinary ascent in the quantity of individuals that smoke in certain nations in Asia, South America, Eastern Europe, and Africa. Accordingly, about 80% of the world's smokers live in low and center salary nations where tobacco control procedures are immature contrasted with high-pay nations. Greenhalgh *et al*., (2015) in

international examinations of smoking prevalence noticed that global examples in tobacco use and weight of death can be required to move dramatically from the created world to less wealthy nations. It has been evaluated that throughout the following two decades, 70% of tobacco deaths will be in creating nations (Hammond, 2009).

Lopez *et al.,* (1994), developed the following stages of the tobacco epidemic

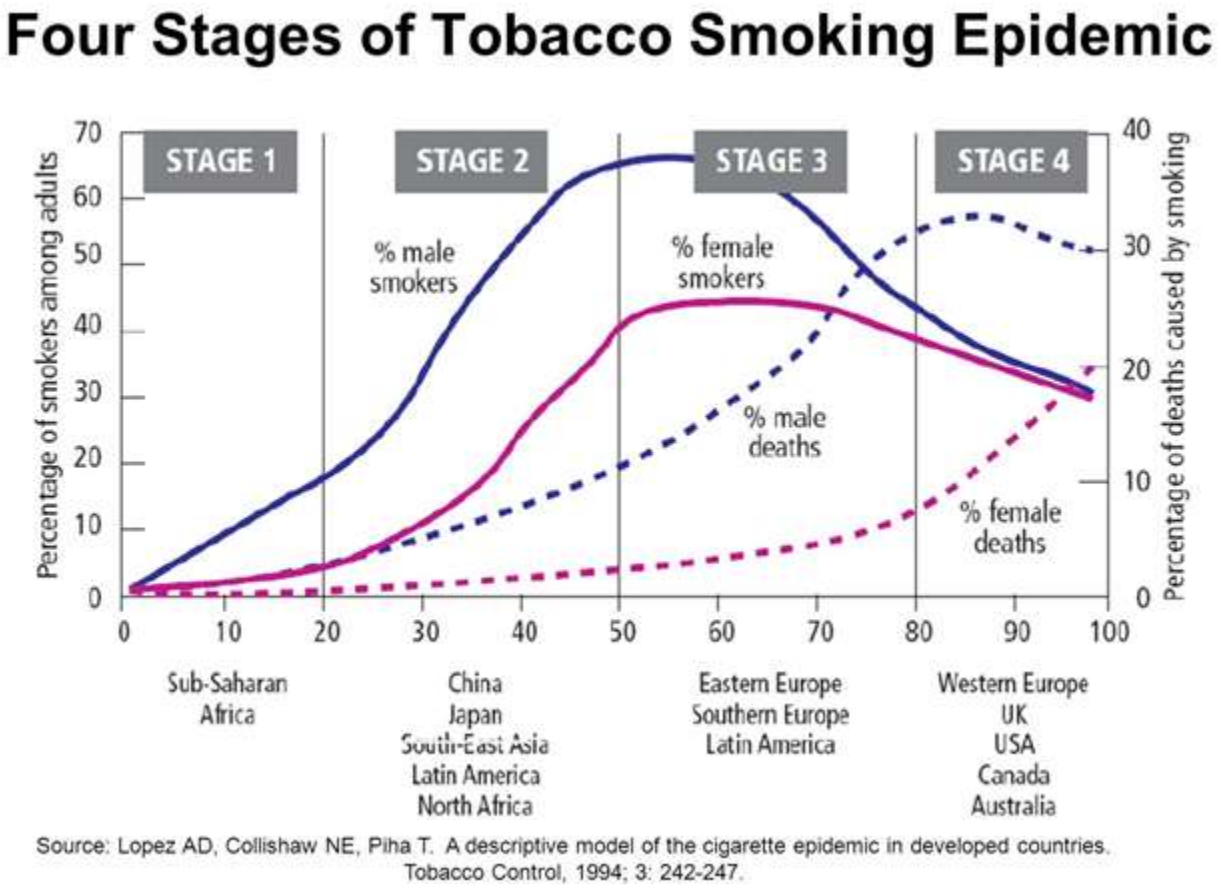

Figure 2.17: Four stages of tobacco smoking epidemic

Stage 1

This is the earliest phase of the tobacco scourge, a stage where the prevalence of tobacco use would be generally low, under 15% and rising. At this stage, prevalence of tobacco use among women would barely surpass 10% (could even be under 5% at times), maybe because of socio-cultural, strict, and monetary elements. Also, smoking power is low and usually beneath 500 cigarettes for each adult smoker with a substantially higher smoking prevalence among male smokers in contrast with the degree of tobacco use among the female populace altogether. Fundamentally, related mortality or infections because of smoking are not yet clear during this stage. Although this phase would normally be between 10 to 20 years, it makes a sharp ascent in tobacco use as smoking turns out to be socially worthy. Conversely, tobacco control systems are immature. Towards the end of stage 1, prevalence of smoking starts to increment with certain mortality ascribed to tobacco use. Overall, the rate of lung malignancy is rare, generally at the level practically identical to those saw among non-smokers (Lopez et al. 1994). It very well may be said that most sub-Sahara African nations, including Nigeria are inside this phase of the tobacco epidemic.

Stage 2

This stage of the tobacco epidemic may span between 2 to 3 three decades according to Lopez *et al.* (1994). Like the previous stage, the prevalence of tobacco use among the male population continues to rise, reaching as high as between 50% to 80%. Also, prevalence among female is rising but lags behind the rise in tobacco use among the male population. There is not enough awareness on the health consequence of tobacco use, as a result, the number of formal smokers that have quit smoking is low during this stage (Lopez *et al.* 1994). Correspondingly, smoking prevalence across different socio-demographic and economic backgrounds are not significantly different and maybe higher among high income individuals in the population. Average cigarette consumption among adult population reaches between 1000 to 3000 annually, with the male population consuming the largest chunk of these cigarettes like the case in the previous stage. Also,

tobacco control strategies remain largely undeveloped and public health information about the health hazards of tobacco use is low (Lopez *et al.,* 1994).

At this point in the progression according to the authors, there is inadequate political and public support for the implementation of tobacco control strategies. There would also be divergent views regarding the health impacts of smoking among different segment of people within the population. However, towards the end of this phase, about 10% of male deaths is been caused by tobacco use but female deaths as a result of smoking remains scarce. Due to tobacco use in the first stage and the earlier part of the second stage, male lung cancer rates (5 per 10,000 to 50 per 100,000 adult population) would have risen almost 10-times compared to what it is during the first stage. However, female lung cancer rates remain modest, perhaps reaching 8 to 10 per 100,000 (Lopez *et al.,* 1994).

Stage 3

This period of the tobacco epidemic is characterised by a decrease in the prevalence of tobacco use after arriving at a pinnacle of about 60% for a delayed span as indicated by Lopez et al. (1994). Towards the finish of this stage, prevalence would have fallen from 60% to around 40% and stays like that for over three decades in the continuum. As opposed to phase 2, there are noteworthy contrasts in the prevalence of tobacco use concerning diverse age classifications with the goal that tobacco use is lower among middle age and more seasoned men in the populace. Essentially, Lopez et al. (1994) proposed that at the later period of stage three, prevalence of tobacco use will encounter a momentary decline contrasted with that experienced with male prevalence. All the more critically, data about the health dangers of tobacco use gets far reaching and thus the pinnacle of tobacco use among female (from the experience of nations like USA, Canada, UK, and different nations where female prevalence is to some degree high, reflects prevalence between 35% to 45%) populaces will not be as high as the prevalence among male populace (Lopez et al., 1994).

Furthermore, the large disparity between male and female prevalence of tobacco use reduce to about 5% because during this stage 40% to 50% of young women are likely to

be regular smokers while tobacco use among women (55-60 years) is relatively low, say less than 10%. Essentially, the decline in tobacco use will be the highest among educated smokers because of their ability to respond more favourably to campaigns against tobacco use due its adverse health effect. Compared to the earlier stages of the epidemiological progression of tobacco use, the third stage marks a sharp rise in mortality as result of smoking with the level for males rising from 10% to as high as within 25-30% in a period of 30 years. In contrast, mortality due to tobacco use among female smokers remains comparatively low. In response to the widespread knowledge of the adverse health effect of tobacco use, the political environment becomes more supportive to tobacco control campaigns (Lopez *et al.*, 1994).

Stage 4

This phase in the epidemiological transition of tobacco use marks continuous and gradual decline in male and female smoking prevalence. The number of male mortality consequent on smoking would be expected to peak during the early part of this stage, perhaps at around 30-35% of all deaths. Also, this rate of mortality reaches its peak and then falls below 30% within a decade (Lopez *et al.,* 1994). At the same time, female mortality associated to tobacco use will "rising rapidly at the full health effect'' but the rate will be lower relative to male mortality from exposure to tobacco. Accordingly, deaths from exposure to cigarettes would be expected to peak at 25-30% about two to three decades into the fourth stage of the epidemiological progression. Altogether, mortality associated to tobacco use for both male and female will progressively decline.

Historically, there was a slow and reluctant start to control tobacco use in high-income countries, especially in the United States, after which tobacco control efforts finally began to gain momentum in the 1980s when researchers, governments at all levels and private companies increased actions to restrict cigarette smoking in public places. Reacting to this development, tobacco companies resorted to growing tobacco in Africa, Brazil and Paraguay in South America, India, Pakistan, the Philippines, Greece, Thailand, and the Dominican Republic. This strategy paid-off, as over 50% of the sales of U.S. tobacco companies was exported to Asian countries, such as Thailand, South Korea, Malaysia, the

Philippines, and Taiwan. Fundamentally, this transnational strategy by large tobacco companies witnessed tremendous success and this continues to be the case as more cigarettes are now consumed in developing economies and tobacco use is expected to increase further in these countries.

Generally, more than two-third of the anticipated increment in tobacco use will be because of increments in smoking in low-and middle-income countries principally in view of increment in urbanization, populace development, and financial development saw in these countries (Giovino *et al.*, 2012). Thus, the decrease in tobacco use in economically developed countries will be counterbalanced by constant increments in smoking in creating countries and tobacco-related maladies will probably increment a similar way. Overall, according to Jha and Chaloupka, (1999), the smoking pandemic is gradually moving from its original focus among men in economically developed countries, to ladies in created countries and men in low-income countries. Along these lines, this will additionally exasperate the weight of infections in low-and middle-income countries. The Global Discussion for Health Exploration completed an investigation that found that low-and middle-income nations represent most by far of infection trouble globally, yet these countries are least ready to bear the cost of the health care spending that will be related with the escalation of smoking-related plagues (Burke and Matlin, 2008; Peto and Lopez, 2004).

The veracity of the four stages of tobacco smoking epidemic by Lopez *et al.* (1994) has been tested by a number of studies. In 2012, Thun *et al*. investigated whether the predictions of the Lopez *et al.* model is reflected in the realities of countries at varying stages of economic development. Findings in the study revealed that in advanced economies the level of tobacco consumption among the male and female population has continued to decrease over the years. However, the decrease in tobacco use in those countries is observed to be less proportionate to that predicted in the Lopez *et al.* model. This means that the reduction in tobacco consumption has not matched what is expected both in terms of the level of awareness of the health effects of tobacco use and in terms of the tobacco control efforts in those countries. This could be as a result of often dynamic

strategies of the tobacco industry that aim to counter every effort to reduce the level of tobacco consumption in the population. In Thun *et el.,* study they found that the tobacco attributable mortality in the last 20 years prior to 2012, decreased among men and persistently increased or peaked among women over the same period. One important finding in their study was that the mortality rates attributable to tobacco use among woman and men are converging in developed countries. Thune *et al*., however, projected that in 2025, the burden of tobacco related deaths will likely decline to its lowest point. On the other hand, Thune *et. al.*, the pattern of tobacco related mortality observed in developing countries reflects that predicted in the work of Lopez *et. el*. but the picture among females was different in those countries. In conclusion, Thune *et. al.,* (2012) opined that separate criteria for determining the tobacco use epidemic in developing will better capture the realities in developing countries.

Similarly, a study utilised the stages of tobacco epidemic to understand tobacco consumption patterns/behaviour post-immigration (Constantine *et al.*, 2013). Like the suggestions made in the Thune *et. al.'s* work, findings in the Constantine *et al*., showed that the pattern of tobacco consumption behaviour pre and post immigrationamong males conform to that predicted in the Lopez *et. al*. model. However, the predictions of the model were not reflected in the realities observed among females pre and post immigration in the United States. Therefore, Constantine *et. al.* also suggests a review of the Lopez et al four stages of tobacco epidemic.

2.2. Theoretical Review

In the literature, household welfare has been modelled with consideration of expenditure patterns with regards to the quantities consumed (Blundell *et al*. 1994). To provide theoretical background for measuring household consumption, this section reviews relevant theories that are prominent in explaining consumer demand systems. First, the neoclassical theory of consumer choice and the revealed preference theory of demand are reviewed. Also, the underlying theory of how changes in income and prices affect the quantity of a good purchased formed the theoretical background for the control of tobacco

consumption using an economic tool, thus "elasticity of demand" is also briefly reviewed. Additionally, the concept of Catastrophic Health Care Expenditure (CHE) is also briefly discussed.

2.2.1. Neoclassical Theory of Consumer Choice

Consumer theory describes satisfaction (utility) to derive from consumption spending. It analyses how consumers maximise the optimal level of their consumption, as estimated by their inclinations subject to preferences on their expenditure or income. This theory establishes that consumers maximize their satisfaction subject to the restriction placed by their budget or income (Black *et al*., 2012, Hands, 2016). Likewise, the theory presupposes that individual welfare is reflected on the utility generated by the choice they make.

Generally, studies have used this theory to measure how to improve the welfare of individuals with respect to the income and price relation. Essentially, the level of individual consumption declines as the price of a good rises/increases. The theory hypothesizes that consumer can be restored to his/her initial welfare level through a monetary compensation for the welfare effect of the higher price; this has been referred to as ''substitution effect of price changes[14]''. As the prices of goods and services expands, purchasers will substitute away from that commodity, picking a greater number of different other options of alternative goods. In the event that no pay at the cost rise happens, at that point the decrease in real income, i.e., the consumer's purchasing power buying or welfare because of the price increase prompts a further decrease in the amount requested for normal goods; this is known as the income effect (Berliant and Raa, 1988).

The neoclassical consumer theory is viewed as a theory that favours methodological independence since it bolsters the clarification of every single economic phenomenon as far as the attributes and the conduct of people. Methodological independence expresses

[14] The idea is that smoking households are likely to substitute the consumption of important household commodities in favour of tobacco consumption and when this happens, tobacco expenditure can be said to cause a similar effect as that caused by an increase in price.

that any theory of how the economy functions ought to be developed from a comprehension of how the people inside it carries on (Samuels, 1989). Implanted in the theory are the suppositions that people are discerning in their dynamic and that the value instrument is fundamental for the general public to amplify welfare. The theory is worried about understanding the situations under which a harmony exists and whether those equilibria are novel and additionally steady. Comparative static examination is utilized in clarifying the theory and this analyzes the equilibrium that occurs in two distinct circumstances, to see the impact of changing outside conditions, for instance, the cost of raw materials, on output and price within a specific market (Samuels, 1989).

According to Weintraub (2007), the neoclassical theory is built on three broad assumptions which includes:

Rational preferences

This assumption presupposes that consumers choose the combination of goods that fully maximize their satisfaction or utility which defines consumer's welfare altogether. It has also been explained in what is called the " Rational Choice Hypothesis", which assumes that an individual has inclinations among the accessible goods or commodities choices that permit them to state which alternative suits their preferences given the contemplation of all the information expected to settle on such choices. The rationality condition requires that consumer preferences satisfy the conditions of completeness, transitivity and reflexivity.

However, Akerman (1997) referred to this assumption of rational preference as being "asocial individualism''. He explained that the neoclassical theory of consumer choice presupposes that consumer preferences are often exogenous and disconnected from the impact of social or economic institutions. An assumption which he thinks is unconvincing and difficult to ascertain if it corresponds to economic reality.

Utility Maximisation

Similarly, the neoclassical theory of consumer behavior is conceptualized such that individual consumers are assumed to maximize their satisfaction with respect to the level

of income available to them at any given period of time. Here, when consumers make purchasing decisions, the objective will be to maximize the total value derived from the money spent.

Full and Relevant Information

This assumption is also known as ‘’perfect information’’. It represents the condition required to make rational economic decisions by consumers. This appears to be a very important component of the dynamics of decision making process among individuals since it is only possible to make rational consumption decisions when all costs and benefits of consumer's choice are known. In application, the three assumptions are connected in some way which means that they must necessarily be jointly satisfied.

Despite the usefulness of the neoclassical theory of consumer choice in modeling the welfare impacts of tobacco consumption, the apparent or perceived consequence of smoking are normally thought little of by smokers to much so that the assumption of consumer rationality breaks down. Consequently, the decision to control tobacco consumption through legislative and economic tools by the government becomes justified.

Becker (1965) and Lancaster (1966a; 1966b), provided criticism of the neoclassical theory of behaviour. Their criticism was based on notion that there exists a direct relationship between commodities and consumer satisfaction as advanced in conventional theory of consumer behaviour. Instead, Becker and Lancaster believe that consumers demand for goods in expectation of some satisfaction and experiences that can be derived from consuming the commodity in what can be called "derived demand[15]" (i.e. the intentions of individuals when they demand for commodities is not for the sake of the goods but the characteristics obtainable from consuming the goods). For instance, in the case of tobacco consumption, the intuition behind this argument is that smokers do not demand for tobacco per se, but for the sense of enjoyment, psychological relief or social acceptance that they intend to derive from so doing. This stance was also supported by Muth (1966).

[15] This concept has also been used to describe the demand for healthcare by Michael Grossman 1972 (see: On the concept of health capital and the demand for health. *Journal of Political economy*, *80*(2), 223-255).

The neoclassical theory has attracted other major criticisms in relation to its accentuation on equilibrium. To start with, the scholars and proponents of the evolutionary economics and the school referred to as the Austrian financial economics consider the assumption of the equilibrium state in which demand and supply are at equilibrium (for example a state where there no motivations for these market forces to change) to be less hypothetical conceivable or less theoretically plausible. Rather, evolutionary economists concentrated on the dynamic procedure of disequilibrium (Samuels, 1989). Second, the examination of comparative statics in the neoclassical economic hypothesis suggest that with a fitting change in outer conditions any equilibrium is reachable (Samuels, 1989). An alternate perspective on this ideology by other a few scholars consider economic systems to be as way needy so that past conditions have an enduring and aggregate impact on what happens both in the present and later on. By and large, the neoclassical consumer theory/hypothesis remains the center of the literature that has endeavored to show consumer behaviour and was additionally valuable in building up the computable general equilibrium (CGE), a model that has helped in seeing how the economy works in overall.

In application, the neoclassical theory of consumer behavior is considered relevant to analysing the impact of tobacco consumption on household welfare since the consumption of goods and services represents a fundamental determinant of household welfare (Deaton, 2003). Given that tobacco consumption is one of the goods in the consumption set of smokers, the possibility is that changes in the level of tobacco use/consumption might have significant impact on the welfare of a typical smoker. This can be demonstrated through the classic income and substitution effect for analyzing changes in welfare of a hypothetical consumer. First, assuming a consumer decides to initiate smoking with his/her income remaining constant, this will likely displace or reduce the consumption of some essential social goods (substitution effect of tobacco consumption), causing a similar effect to that of an increase in price. Also, if the individual decides to quit smoking, more resources are freed up for the consumption of beneficial household commodities. This may also mean that the consumer is able to save the money previously spent on tobacco consumption (income effect). The income effect can also be referred to as ‘’Equivalent

Variation'' because it represents the variation in income that is equivalent in terms of welfare gained as a result of the decision to stop smoking. Another way of examining the reduction in consumer welfare attributable to smoking is to consider the loss of income due to sick days and reduction in productivity. When this happens, the smoker's budget line falls consequent on a diminished income, leading to reduction in consumption of other social commodities, ceteris paribus.

Furthermore, the welfare effects of tobacco use can be extended from individual analysis to its effect on households where the smoker is the breadwinner. This is such that smoking may likely increase the chance that the smoker will suffer ill-health and could lead to the death of the breadwinner causing severe economic effects on members of the household. A simple analogy of this is provided in Figure 2.19.

Budget lines (BL) and indifference curves as advanced in conventional economics are adopted to describe the possible welfare effects of increase in the excise tax on tobacco. Usually, when excise tax increase, it causes an increase in the price of the commodity. In Figure 2.19, the X and Y axis represent other household goods (X) and tobacco (Y), respectively. Assuming that a typical individual starts at the point where BL1 is tangential to IC1 (Qx1; Qt1, which represents the point where the individual maximises his/her welfare). When for instance there is an increase in excise tax which is followed by increase in the price of tobacco. Consequently, and given a constant disposable income, the BL will rotate inward to BL2. This causes a fall in the welfare of the consumer. However, if the goal is to return the individual to his/her initial level of welfare, a hypothetical budget (BLh) is drawn to intersect IC1. However, a new equilibrium point is achieved at Qxh and Qth where the individual or in this, a household, is restored back to its original welfare level, but instead with a reduction in the level of tobacco consumption which is compensated for by an increase in the quantity of other household commodities consumed. This is in essence referred to as "substitution effect". On the other hand, an

increase in tobacco consumption can lead to a decline in the consumption of other essential household goods, hence, the welfare effects of tobacco consumption.

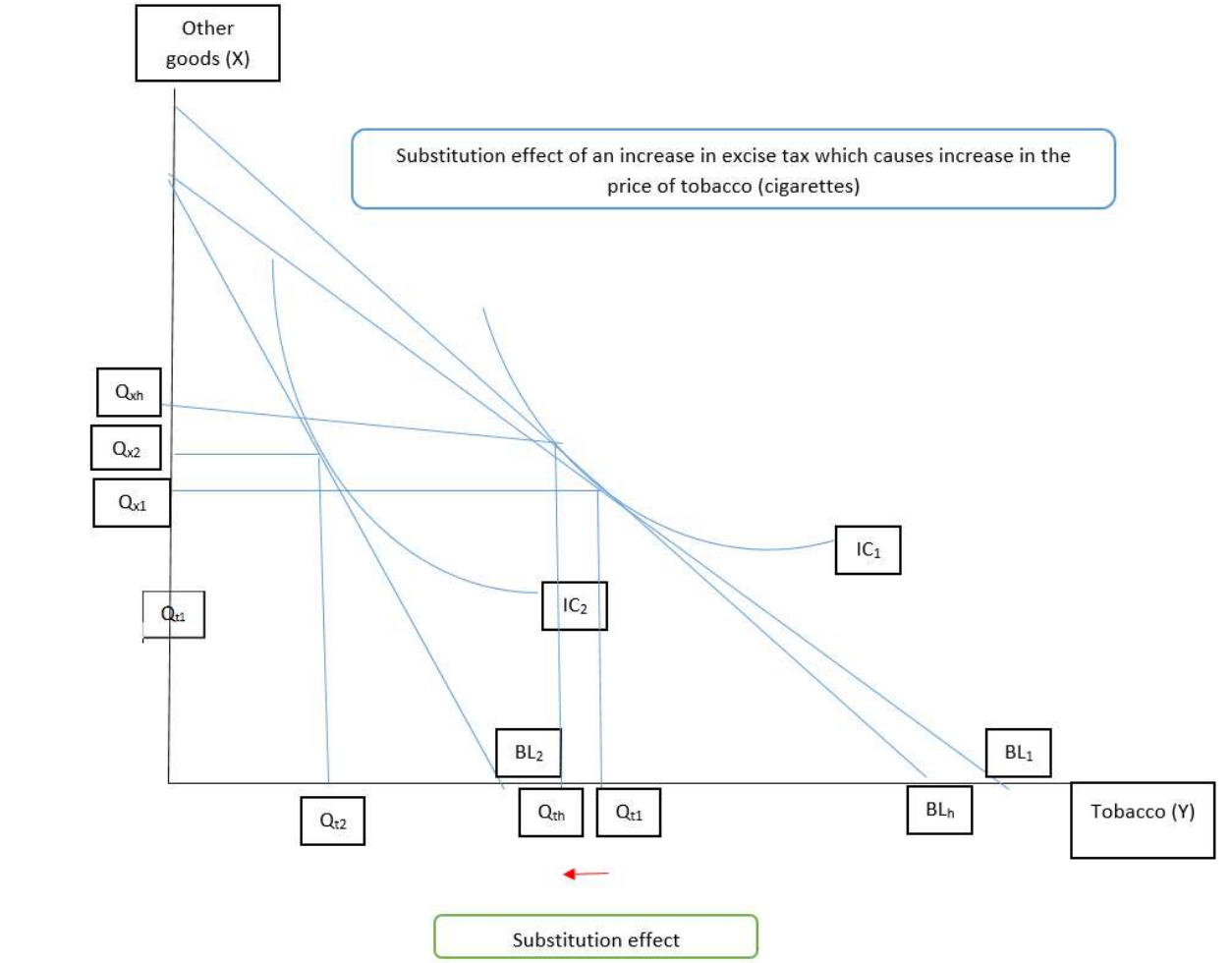

Figure 2.18: Welfare effects of an increase in tobacco excise tax that causes an increase in its price

2.2.2. Separable Utility Function

The separable utility function was originally developed by Leotiff (1947) and popularised by Strotz (1957). A separable utility function is a special type of utility that assumes that the satisfaction or welfare derived from all the goods and services in the consumption basket of a consumer can be partitioned. Strotz postulated that individuals allocate their disposable income among broad sets of commodities and that this is plausible if individual's utility function is separable.

This form of utility has been widely used in the literature[16] to ascertain the welfare effects of the goods consumed by a typical consumer. In particular, for examining the impact of tobacco consumption on household social goods, the separable utility condition must hold (Bergstrom, 2011). According to Aliprantis (1997), the separable utility function is theoretically similar to conventional linear utility function than previously expressed in the literature. By extension, Gorman (1959) argued that this type of utility function is additively separable and homogeneous.

2.2.3. The Revealed Preference Theory of Demand

This theory was developed by Paul Samuelson in 1938. It provided some entirely different perspectives in viewing and analysing consumer choice while retaining the underlying assumptions of the neoclassical theory of consumer choice viz. rationality, utility maximization and perfect information. As such, the assumptions underlying the revealed preference theory allows for establishing the classic law of demand without recourse to both the Marshallian cardinal theory of demand and Hicks-Allen indifference curve theory of demand (Wong, 2006). In principle, the theory favours comparability of consumer utility over measuring utility and assumes that the preferences of consumers can be revealed by their actual purchasing habits in various income and price situations.

[16] Afrait (1953) demonstrated the effect of separable utility on demand behavior. It was extended by Strotz (1957) and Gorman (1959).

Given this approach, Samuelson maintains that consumers' utility can be described with certainty without relying on the assumption of diminishing marginal rate of substitution. Thus, the revealed preference theory is generally referred to as providing ''behaviouristic'' explanation to consumer choice and it is said to be based on ordinal utility. In this simplistic analysis of consumer behavior, according to Professor Paul Samuelson, if a consumer is observed to choose a combination x_i over y_i and z_i, all feasible bundles, then this index consumer reveals preference for x_i over y_i and z_i.

This theory was criticised by some scholars. Prominent among them are Sen (1973) and Sagoff (1994), among others. Sen argued that the Revealed Preferences Theory of Demand provided little information about understanding the microeconomics of consumer behaviour. He based his argument on the fact that the assumption that preferences are directly revealed might be unrealistic and may not be testable. Sen concluded that "revealed preference" could either be a tautology or a controversial proposition of consumer choice. More importantly, this theory is faulted on the basis that the revealed choice of consumers does not necessarily translate to the set of consumption decisions which maximises consumer utility as often advanced in the neoclassical theory of consumer behaviour. More so that Sagoff (1994) argued that preferences can sometimes be based on empathy, courtesy/moral, ideas, personal commitments or obligations and the choice made as a result of these may not necessarily represent the choice that makes the consumer more comfortable.

In explaining consumer demand for a harmful good such as tobacco, the revealed preference theory of demand provides useful insights in application and it is more amenable to empirical verification. However, the theory has been criticized for ruling out the possibility of a consumer becoming indifferent between a number of commodity bundles (Wong, 2006). Given the theoretical framework provided by the neoclassical consumer theory and the revealed preference theory of demand, scholars have developed various demand systems with the aim of providing methodology approximations to consumer behavior in reality. Researchers employed descriptive and econometrics

methodologies to describe what effect tobacco consumption has on socio-economic welfare of smokers.

In economics, the demand theory connects the quantity of commodities demanded with their prices. In application, the tobacco consumption function can be stated as follows:

$$TC^d = f(P, \Pi, Y, T, LR)$$

(2.1)

Equation (3.1) specified tobacco consumption (TC^d) as a function of the price of tobacco (P), prices of other basic household commodities, was captured using a price aggregator (Π), total household income (Y), household preferences(which represents the decision about tobacco consumption) and a vector of legislative tools for controlling tobacco consumption(LR). In ‘’Demand Theory’’, price elasticity is conceptualised as a measure of responsiveness of the quantity of a given good or service demanded to changes in its price, i.e. to either increase or decrease in its prices. The formula for the coefficient of price elasticity of tobacco demand can be derived by differentiating equation (2.1) with respect to price:

$$\eta = \frac{\partial TC^d}{TC^d} / \partial P /_P$$

(2.2)

2.2.4.Catastrophic Health Expenditure

Another concept that is generally utilized in the literature to research the likely impact of the health care cost imposed on households as a result of expenditure on managing tobacco-related morbidity/illnesses is "catastrophic health expenditure". It is operationalised to estimate/measure the impact of medical use on the welfare of individual family units or households. The factors characterizing whether a family unit experienced CHE or not are total family out-of-pocket expenditures on medical goods and services as a proportion of total family assets or resources (income, expenditure, or consumption). In the literature, there is usually a discussion with respect to whether total household consumption or total non-food expenditure (for example discretionary consumption) ought

to be utilized as the denominator when estimating the weight of total health expenditure. Be that as it may, the greater part of the investigations supported the utilization of total non-food consumption expenditure since it is assumed to give a better differentiation between poor and rich households (O'Donnell *et al*., 2008). Also, as indicated by van Doorslaer *et al*. (2007) in estimating the danger of CHE, medical spending as a share of household expenditure net of spending on essential household commodities ought to be utilized as the denominator.

If H_e represents out-of-pocket health or clinical expenditure,E, the total household expenditure/resources (total household expenditure or total household income and$f(e)$, total food spending or non-discretionary expenditure (i.e. expenditure made towards the purchase of food). Therefore, a household would have incurred CHE if:

$$\frac{H_e}{E} \; or \; \frac{H_e}{(E-f(e))} > z$$

(2.3)

where z represents the specific or specified threshold which can range from 5% to 40% depending on whether the denominator will be total household expenditure or total household non-food expenditure. Parameter z denotes the threshold over which the absorption of household income and resources by spending on healthcare goods and services is considered or adjudged to predispose households to the risk of impoverishment. Spending 10% of total household expenditure on medical care could be seen to intensify the risk of incurring CHE, however, 10 percent of non-discretionary expenditure may not result in that same outcome for richer households. This will likely be directly related to the income level of the household and may also depend on subjective judgements (Van Doorslaer *et al*., 2007). In health economics studies, different thresholds have been adopted depending on the preference of the authors. In general, when total household income, usually proxied with household expenditure, is used as the denominator, thresholds like 5%, 10%, 20% or even 25% have been adopted (Pradhan and Prescott 2002; Wagstaff and van Doorslaer 2003). More importantly, the justification for deciding

what threshold to use must be that which exposes households to the risk of CHE and causes them to sell family assets, sustain debt, or become impoverished or even sacrifice the consumption of important household goods that are expected to enhance their welfare (Russell, 2004).

2.3. Methodological Review (Consumer Demand Systems[17])

In estimating consumer demand systems[18], several models have been proposed, popularised and used in the literature to test the neoclassical theory of consumer choice. These models include the Rotterdam model, the Almost Ideal Demand Systems and the Quadratic Almost Ideal Demand Systems. These variants of demand systems belong to the Price Independent Generalised Logarithmic (PIGLOG[19]) form proposed by Workings (1943). The PIGLOG specification of demand systems expresses household budget share w_i as a linear function of the logged expenditure (E) (income) and it provides a general framework for developing several consumer demand systems. One important characteristics of the PIGLOG demand specification is that it enables exact aggregation of consumers through the rational decision of a single representative consumer. According to Workings (1943), such demand system can be specified thus:

$$w_i = \alpha_i + \beta_i lnE, \qquad i = 1, \dots, n \tag{2.4}$$

Equation (2.4) assumes that prices are constant and this general framework is relevant for analysing cross-sectional data since it offers limited difference in prices and a substantial variation in expenditure (E) or the level of household income.

[17]Three demand systems are briefly reviewed here; detailed derivation of the models can be found elsewhere. (see: Barnett and Serletis, 2008, Clements and Gao, 2015). Other demand systems similar to the one discussed include: The ''Linear Expenditure Systems'' (Stone 1954, ''Generalised Leontief'' (Diewert, 1973) and the ''Translog System'' (Christensen *et al.,* 1975).

[18] This methodology is employed to achieve objectives 1 and 2 of this study.

[19] This implies a system of demand equations which does not involve price and which allows for the aggregation of consumer behavior as if it were the outcome of a single representative utility maximising consumer (see: Deaton and Muellbauer, 1980). This form of demand systems has been highly recommended when using a cross-sectional data because individuals living within the same cluster are expected to face the same prices. This is plausible in reality due to localized markets in villages in developing countries. According to Clause Lesser (1963, 1976), the PIGLOG specification provides an excellent fit to estimating demand equations using a cross-sectional data.

2.3.1. Rotterdam Model

The Rotterdam model was developed and popularised by Theil (1965) and Barten (1966). This system of demand was the first model to provide econometric specification of the neoclassical theory of consumer demand. The model specified a Marshallian demand function for good i and takes the total differential of the demand function specified. The model uses utility-maximisation conditions to give restrictions on the systems of demand equations. In effect, in the Rotterdam model, the utility function is not determined expressly so that it allows for what is referred to as flexible functional form. Preferences are not overlooked as the utility function gives limitations on the slopes of the demand systems. Essentially, the Rotterdam framework can be viewed as consistent with a range of utility functions under the framework provided by the neoclassical consumer theory.

Clements and Gao (2014), provided a simplified step-wise analysis of the Rotterdam model thus:

A consumer is often faced with a utility function (objective function) and a budget constraint. If p_i and q_i represent price and quantity of goods, $i = 1, \dots, n.$, the problem of the consumer will to:

$$u(q_1, \dots, q_n)$$

(2.5)

Subject to

$$E = \sum_{i=1}^{n} p_i q_i$$

(2.6)

where u represents, utility derived by the consumer from consumption of a set of commodities. The demand equation is given as:

$$q_i = f(E, p_1, \dots, p_n)$$

(2.7)

Where E denotes total expenditure (income) of the consumer. If equation (2.7) is differentiated, it becomes:

$$\partial q_i = \frac{\partial q_i}{\partial E}\ dE + \sum_{j=1}^{n} \frac{\partial q_i}{\partial p_j} \partial p_j$$

(2.8)

When there is a change in price, the total effect of the price change can be decomposed or disintegrated into both substitution effect and income effect, with income (E) remaining the same. Thus, equation (2.8) can be expressed as what is known as Slutsky equation, thus:

$$\frac{\partial q_i}{\partial p_j} = S_{ij} - q_i \frac{\partial q_i}{\partial E}$$

(2.9)

The first term on the right hand side (S_{ij}) represents the substitution effect of price change and the second term is the income effect of price change. Equation (2.9) can be further expressed as:

$$dq_i = \frac{\partial q_i}{\partial E}\left(dE - \sum_{j-i}^{n} q_j\, dp_j\right) + \sum_{j=1}^{n} S_{ij}\, dp_j$$

(2.10)

The term in the bracket is the deflation of the change in income (E) of real income effects of the n price changes. Setting $(lny) = \frac{dy}{y}$, equation (2.10) can be expressed logarithmically as:

$$d(lnq_i) = \frac{E}{q_i}\frac{\partial q_i}{\partial E}\left[d\ (ln\ ln\ E\ ) - \sum_{j=1}^{n}\frac{p_j q_j}{E}\ d\ (lnp_j)\right] + \sum_{j=1}^{n}\frac{p_j}{q_i}S_{ij}\ d(ln\ ln\ p_j)$$

(2.11)

For simplicity, let $\eta_i = \frac{\partial(ln\ \ _i)}{\partial(lnE)} = \left(\frac{E}{q_i}\right)\left(\frac{\partial q_i}{\partial E}\right)$, which is the income elasticity of good i.

Also, setting $\eta_{ij} = \frac{\partial(lnq_i)}{\partial(lnp_j)} = \left(\frac{p_j}{q_i}\right)S_{ij}$, which is $(i,j)^{th}$ price elasticity of demand.

And, $w_j = \frac{p_{jq_j}}{E}$, where $w_j$represents the budget shares of j^{th} commodities and

$d(lnQ) = d(lnE) - \sum_{j=1}^{n} w_j\ d(lnp_j)$, which denotes the change in real income.

Therefore, equation (2.11) becomes:

$$d(lnq_i) = \eta_i d\ (ln\ ln\ Q\ ) + \sum_{j=1}^{n}\eta_{ij}\ d(lnp_j)$$

(2.12)

Equation (2.12) is the Rotterdam version of a system of n demand systems and it satisfies the adding-up constraint ($\sum_{j=1}^{n} w_i\,\eta_{iE} = 1$).

The Rotterdam model in its attempts to provide a fair approximation of the neoclassical theory is logically compelling, yet there remain major weaknesses of the application of the model in reality. The model has been criticised for its inability to capture Engel curvature especially with its linear form in all parameters which is considered counter-intuitive for some goods. Also, the linear form of the model satisfies the budget constraint but the double log does not (Clements and Gao, 2015). Another feature of the Rotterdam model is that it was not developed with the consideration of a representative consumer (a utility function). This is different from the algebraic specification of consumer utility by other demand systems. However, the proof of a demand system's consistency with the theoretical regularity condition for rational neoclassical economic theory of consumer

behaviour does not necessarily require the assumption of a representative or typical consumer. This is shown in the theoretical foundation for the Rotterdam model by in Barnette (1979).

2.3.2. Almost Ideal Demand Systems (AIDS)

Like the Rotterdam model, the Almost Ideal Demand Systems belong to the PIGLOG family. This model of consumer demand was developed by Deaton and Muellbauer (1980) and has been used extensively to model the neoclassical theory. The AIDS model is of comparable generality to earlier models (systems of demand equations) such as the Rotterdam model. It imposes an arbitrary first-order approximation to the theory of consumer behaviour (also the theory of demand). According to Deaton and Muellbauer, the AIDS model satisfies the underlying axioms of the neoclassical theory of consumer behaviour in that it ensures exactness of choice; represents and aggregates consumers without necessarily imposing parallel linear Engel curves; possess a functional form that is amenable to cross-sectional or time series household budget data; simple to estimate; and able to test the homogeneity and symmetry conditions or restrictions (Deaton and Muellbauer, 1980).

The AIDS specifies the budget shares w_i of various commodities as linear function of the logarithm of total household expenditure and the logarithm of relative prices. The model is shown to satisfy the theoretical properties usually desirable for estimating a system of consumer demand. The AIDS starts from a specific class of preferences, which permits exact aggregation of consumers (through the rational decisions of a representative consumer). With this approach, market demand equations are represented as the outcome of the choice of the assumed representative consumer. While the Rotterdam model was developed from the Marshallian demand specification, the AIDS was based on duality rule in that the costs or expenditure function (the Hicksian demand function), $c(u, p)$, which represents the minimum level of household consumption expenditure that is important to achieve or attain a given level of utility at particular prices. The AIDS cost function is specified as:

$$lnc(u,p) = \alpha_0 + \sum_k \alpha_k \, lnp_k + \frac{1}{2}\sum\sum \gamma^*_{kj} \, lnp_k lnp_j + u\beta_0 \prod_k p_k^{\beta_k} \quad (2.13)$$

where $\alpha, \beta \; and \; \gamma$ are parameters and $u\beta_0 \prod_k p_k^{\beta_k}$ denote a Cobb-Douglas utility aggregator. For the expenditure function in equation (2.13) to be a valid representative of aggregated preferences, it must be linearly homogeneous in p (e.i. constant prices across consumers, especially for a cross-sectional data). Given that the cost function possess quantities demanded that are derivatives of the prices (Diewert, 1971; Shephard, 1953), so that $\frac{\partial lnc(u,p)}{\partial p_i} = q_i$, multiplying the two sides by $\frac{p_i}{c(u,p)}$ we have:

$$\frac{\partial lnc(u,p)}{\partial lnp_i} = \frac{p_i q_i}{c(u,p)} = w_i \quad (2.14)$$

where w_i is the budget share of good i. Given the relation in equation (2.13), equation (3.14) can be differentiated with respect to price (p_i) to have:

$$\frac{\partial lnc(u,p)}{\partial lnp_i} = \frac{p_i q_i}{c(u,p)} = w_i = \alpha_i + \sum \gamma_{ij} \, ln \, ln \, p_j + \beta_i u \, \beta_0 \prod_{pk} \beta_k \quad (2.15)$$

$$w_i = \alpha_i + \sum \gamma_{ij} \, ln \, ln \, p_j + \beta_i u \, \beta_0 \prod_{pk} \beta_k \quad (2.16)$$

In equation (2.16), the budget share w_i is specified as a function of utility and the prices goods (compensated demand equation or Hicksian demand function). A utility maximizing condition requires that total expenditure E be equal to $c(u,p)$ and if inverted to derive the Marshallian demand function, we have u as a function of p and E. If we do this for equation (2.14) and substitute the result into equation (2.16), then the budget share equation becomes a function of p and E. This is so that the AIDS in budget share form is given as:

$$w_i = \alpha_i + \sum_{i=1}^{n} \gamma_{ij} \, lnp_j + \beta_i ln \left(\frac{E}{P}\right) \quad (2.17)$$

Where P is a price index or price aggregator defined by

$$\alpha_0 + \sum_k^n \alpha_k \, lnp_k + \frac{1}{2}\sum_{i=1}^n \sum_{i=1}^n \gamma_{kj} \, lnp_k lnp_j \quad (2.18)$$

In modeling the neoclassical theory, equation (2.17) has the following restrictions:

$$\sum_{i=1}^n \alpha_i = 1, \quad \sum_{i=1}^n \gamma_{ij} = 0, \quad \sum_{i=1}^n \beta_i = 0 \quad (2.19)$$

$$\gamma_{ij} = \gamma_{ji} \quad (2.20)$$

Given these restrictions, equation (2.17) denotes a system of demand function which adds up to total household consumption expenditure ($\sum_{i=1}^n w_i = 1$) and which is homogeneous of degree zero in prices (constant prices).

This methodology was employed by Busch *et al.* (2004); Eozenou and Fishburn (2007); and Pra and Arnade (2009) to model tobacco demand. Despite the methodological robustness of the AIDS, it has been criticised for its linear specification which is similar to the Rotterdam model. While the AIDS specification is theoretically plausible for some household commodities such as clothing, luxuries, it is counter-intuitive for other commodities as food.

2.3.3. Quadratic Almost Ideal Demand System (QUAIDS)

The QUAIDS[20], developed and popularised by Banks *et al*. (1997), nests and provides methodological extension to the Rotterdam model by Theil (1965) and the Almost Ideal Demand Systems popularized and used by Deaton and Muellbauer (1980) in providing theroretical approximations to the neoclassical theory of consumer choice/demand. The later models[21] of consumer demand have specifications that suggests linear relationship between budget shares and the log of expenditure (income) and a log of expenditure which is invariant of commodity prices. But, the QUAIDS model introduced a quadratic parameter in the logarithm of household consumption expenditure $(In\, E)^2$ to capture

[20] Also known as quadratic AIDS.

[21] The Rotterdam and Almost Ideal Demand Systems are specified such that the budget share wi is a function of commodity prices (which is considered constant) and the log of income. This is referred to as two-ranked specification. However, given the weaknesses of the Rotterdam and AIDS models according to Banks et al. (1997), a quadratic termIn E2, capturing Engel curvature is introduced in a three-ranked budget share specification.

Engel curvatures since a linear relationship between commodity budget shares and consumer income might not be empirically plausible (at least for many goods apart from food). Also, the QUAIDS ensures that the coefficient of $(In\ E)^2$ varied with prices.

Banks *etal*. (1997) introduced a general form of budget shares with three ranks:

$$w_i = A_i(P) + B_i(P) ln\ E + C_i(P) g(E)$$

(2.21)

where i represents 1, ……., N commodities, P is the vector of prices, $ln\ E$, the log of expenditure (income) and $g(E)$, a smooth function of expenditure (income). The three terms $A_i(P)$, $B_i(P)$, and $C_i(P)$ show the empirically plausible 3 ranks in describing Engel curves (Lewbel, 1991) and the terms are differentiable functions. Also, $C_i(P)g(E)$ captures nonlinearity against the Price-Independent Generalised Logarithmic (PIGLOG) specification adopted by AIDS and Rotterdam models where $C_i(P)$ is near zero.
According to Banks et al. (1997), all demand equations/systems consistent with the three-rank equation (2.21) have a Marshallian demand function of the form:

$$ln\ ln\ V(p,E) = \left[\left\{\frac{lnE - lna(p)}{b(p)}\right\}^{-1} + \lambda(p)\right]^{-1}$$

(2.22)

where $\left\{\frac{lnE - lna(p)}{b(p)}\right\}^{-1}$ is the indirect utility or Marshallian demand function of a PIGLOG (exact aggregation of preferences) demand system where budget share w_i are linear in log of expenditure. Also, $lnE - lna(p)$ deflates the effect of changes in prices of other commodities on real logged income (i.e the substitution effect in Slutsky decomposition). $b(p)$ denotes the price index or price aggregator P. $\lambda(p)$ captures nonlinearity and it is differentiable and homogenous function of degree zero in the prices of goods. Applying Roy's identity to equation (3.21), the budget share equation becomes:

$$\omega_i = \frac{\partial lna(P)}{\partial lnp_i} + \frac{\partial lnb(P)}{\partial lnp_i}\,(ln\ ln\ E) + \frac{\partial \lambda}{\partial lnp_{ib(p)}}(ln\ ln\ E)^2$$

(2.23)

$A_i(P)$, $B_i(P)$, and $C_i(P)$ in equation (2.15) correspond to the ith in p derivative of $\partial lna\ (P)$ and all rank 3 exactly integrate able utility-derived demand equations in the form of equation (2.15) have $g(E) = (ln\ ln\ E)^2$(see proof in Banks et al. (1997). Equation (2.23) is similar to equation (2.17), but the former equation differs in that the prices of commodities affect the logged expenditure and logged quadratic expenditure.

For estimation purposes, Banks *et al.* (1997) constructs a simple quadratic specification consistent with the Marshallian demand function in equation (2.22). They extended Deaton and Muellbauer AIDS model specification so that $lna(p)$ has the form:

$$lna(p) = P = \alpha_0 + \sum_i^n \alpha_i\, ln(p_i) + \frac{1}{2}\sum_i^n \sum_j^n \Upsilon_{ij}\, ln(p_i) ln(p_j) \qquad (2.24)$$

and $b(p)$ is the Cobb-Douglas price aggregator, given as:

$$b(p) = \prod_{i=1}^n p_i^{\beta_i}$$

(2.25)

Imposing the restrictions emanating from the neoclassical theory on the budget equation,

$$\lambda(p) = \sum_{i=0}^n ln\,(p_i)$$

(2.26)

The adding-up condition[22] is satisfied if the following holds.

[22] This restriction imposed here is not testable, but it is theoretically intuitive because it suggests that the summation of all the goods and services consumed by a household is equal to the reported expenditure at the given/reported market prices.

$$\sum_{i=1}^{k} \alpha_i = 1, \sum_{i=1}^{k} \beta_i = 0, \sum_{i=1}^{k} \lambda_i = 0 \; and \; \sum_{i=1}^{k} \gamma_i = 0 \; \forall i \quad (2.27)$$

Such that

$$\sum_{j=1}^{n} \gamma_{ji} = 0 \qquad \forall i \quad (2.28)$$

$$\gamma_{ij} = \gamma_{ji} \; \forall i \neq j \quad (2.29)$$

The QUAIDS specification in equation (2.23) becomes:

$$\omega_i = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} \, lnp_j + \beta_i ln\left\{\frac{E}{a(p)}\right\} + \frac{\lambda_i}{b(p)}\left[\left\{ln\frac{E}{a(p)}\right\}\right]^2 \quad (2.30)$$

The QUAIDS provides a model of consumer demand (through observed patterns of individual consumption) which is theoretically consistent. In particular, Banks *et al.* (1997) conducted a nonparametric analysis of individual consumption patterns that showed that specification of Engel curves require quadratic term in the logarithm of expenditure. However, given that the QUAIDS was tested using a time series data, too much importance was given to variation in prices which is not necessary for analysis involving cross-sectional data. This methodology has been used by John (2008, 2011b), Koch and Tshiswaka-Kashalala (2008), Pu *et al.* (2008) and Chelwa and van Walbeek (2014) to estimate tobacco expenditure function.

2.3.4. Qualitative Response Regression Models

Apart from studies that employed systems of consumer demand to estimate tobacco consumption function and the effect of tobacco consumption on household welfare, several other studies employed variants of qualitative response model (otherwise referred to as discrete choice models) to achieve the same set of objectives. The different qualitative response regression models that have been used include logistic regression

models, fractional logit model and multinomial logistic regression model. By and large, the outcome variable in this types of models are qualitative in nature (Gujarati, 2009) and the differences comes as a result of the nature and/or number of the response variable. In particular, logistic regression was first advanced by David Cox in 1958 to establish a statistical framework that will enable a relation of the probability of the dependent variable as a result of the effect of one or more explanatory variables which are also called predictors (Cox, 1958; Walker and Duncan, 1967). This statistical framework is used such that we are able to ascertain the probability of a given outcome given the presence of risk factors.

2.4. Review of Empirical Literature

2.4.1. Estimation of Cigarette Consumption Function and Price Elasticity of Demand for Tobacco

Researches establishing the use of the impact of increases in the excise taxation on tobacco products and consequently, price increases as a tool for reducing aggregate consumption of tobacco has a long history. In these studies, increases in excise taxation on tobacco products was established as the most effective mechanism/tool for controlling the level of tobacco consumption according to Jha and Chaloupka (2000). Over the years, research studies have generated evidence that suggests that increases in excise taxes and consequently increase in the prices of tobacco products will trigger a decline in the level of tobacco consumption and may even lead a smoker to quit smoking. Nonetheless, irrespective of the objectives of the reviewed studies and where the study was conducted, a common aim is to generate reliable evidence with respect to the effect or response of the demand for tobacco products to prices changes. Also, studies have investigated the implication of this on government revenue (Abedian and Jacobs, 2001; Gilmore *et. al*., 2010; Chaloupka *et al*., 2012).

However, in conducting researches on tobacco consumption function, there has been the dichotomy of what kind of data used in the analysis, either aggregate level data or individual level data. While a piece of the relevant literature on tobacco consumption used

aggregate data to estimate the impact of price on the consumption of tobacco products, the other constituent of the literature to a great extent utilized individual-level data sets to model the degree of responsiveness of tobacco demand to changes in prices and income. Regardless of whether aggregate-level data or individual level data was used, the price elasticity estimates for tobacco demand from these studies to a great extent fall inside the moderately wide range from - 0.14 to - 1.23, yet most fall in the smaller range of - 0.3 to - 0.5 (Chaloupka and Warner, 2000). The review in this section is separated into two expansive however unmistakable literary works (i.e. studies that employed aggregate-level data and studies that used individual-level data) on the impact of prices on cigarette demand.

2.4.1.1. Analysis with Aggregated Data

Various research studies utilized aggregate data and suitable econometric techniques to estimate the impacts of prices on cigarette demand after controlling for inflation, income, tobacco-control enactment, and a number of country-wide socio-economic and demographic variables. There are two broad strands of studies with respect to the type of econometric modelling of the marginal changes in cigarette demand with respect to variation in prices. While some authors favoured conventional demand models, others employed the use of addictive demand models. The basic difference between these models is that the later recognizes the impact of addiction on successive cigarette demand by consumers, while ordinary demand models regressed important variables on cigarette consumption. These studies are discussed as follows:

2.4.1.1.1. Conventional and addictive models of price elasticity of tobacco demand

Studies that employed conventional demand models to investigate the impact of cigarette prices on the level of tobacco consumption did so in such a way that empirical models are calibrated so that tobacco consumption is the dependent or outcome variable and it is regressed agianst covariates such as prices, income, tobacco control approaches, and a variety of financial and segment factors (Seldon and Doroodian, 1989).

Warner (1990) carried out a similar research study to the one mentioned above and presumed that value responsiveness in economically less-viable countries is probably going to be bigger than that seen in advanced countries, attributable to the moderately low wages and low degrees of cigarette use in low-income countries. This submission has implications for whether increased tobacco taxes are positive or regressive, and the study's findings are backed up by findings from related studies in Papua New Guinea (Chapman and Richardson, 1990), China (Mao, 1996; Xu *et al.* Keeer, 1998), Zimbabwe (Maravanyika, 1998), South Africa (van der Merwe, 1998a).

The issue of whether cigarette taxes is progressive or regressive remains a subject of debate among authors and researchers. The researchers that believe cigarettes taxes are regressive do so for two salient reasons. First, they argued that sales excise taxes are essentially regressive, posing more tax burdens on the poor compared the rich. Their intuition stems from the fact that they believe that such tax models ensures that the rich are able to save, assuming that they cut back the consumption of tobacco. Consequently, it is possible to divert that portion of their income and thereby invest a larger share of their resources. On the other hand, the poor spend a greater share/portion of their income on tobacco consumption. They further argued that cigarette taxes are regressive because tobacco use is more prevalent among individuals that are poor which suggest that imposing constant increase in the prices of the product will essentially place higher tax burdens on smokers that are already experiencing low standard of living thereby worsening the welfare of such individuals. Second, the idea that tobacco taxes are regressive was supported by the fact poor smokers might rather cut down on the utilisation of other basic household goods in order to smoke. Other studies, on the other hand, conclude that cigarettes excise taxes are progressive because poor smokers react more to rises in cigarette pricing than wealthier smokers (Renler, 2004).Additionally, empirical findings provide evidence that less educated, young adults and poorer smokers discounts the future more than the rich, more literate and older smokers such that the former category responds more rapidly to cigarette excise tax changes than the latter (Grossman *et al.,* 1998).

Baltalgi and Goel, (1987); Peterson *et al.* (1992) basically compared movements in cigarette consumption when there are changes in taxes (Baltagi and Goel, 1987). These studies used states in the United States as case study. As earlier mentioned, these studies were comparative analysis of the degree responsiveness in tobacco consumption for States that increased the excise tax on cigarettes and the level of tobacco consumption for other States where its price had not been change and had remained the same prior to the study. The idea was to examine the trend for both scenarios so as to establish if changes in the cigarette prices is accompanied with a corresponding decline in the level of consumption. Baltalgi and Goel found price elasticity of tobacco demand in the same of -0.17 to -0.56 of that found in the studies that adopted rigorous econometric techniques. Essentially, studies which favoured conventional models have also used both aggregate and individual level data sets to describe the relationship between price increase and the quantity of cigarette demanded.

Moreover, there are variants of the addictive models that have been used for investigating the demand for tobacco products. These varying versions include imperfectly rational behaviour addiction model (which assumes that a typical smoker know that his/her present level of tobacco consumption is affected by past smoking habits but the smoker does not factor in the future consequence that will emanate from consuming tobacco or smoking and consequences that will arise as a result addiction). Other conventional specification/models of the demand for tobacco/cigarettes are the myopic addiction model and rational addiction model (Chaloupka and Warner, 1999). Becker and Murphy (1988) developed a model of rational behaviour addiction which formed the basis for other addictive models used by researchers in analysing cigarette demand. As stated in the work of Gruber and Koszegi (2000), the rational addictive behaviour model is a standard approach for modelling cigarettes demand. The model assumes that customers have stable yet conflicting short-run andlong-run preferences. Individuals pick a future consumption pathway that optimises present satisfaction, yet further down the road say in the future changes to this arrangement (Schelling, 1978). The theoretical underpinning for the rational addictive model is similar to Life-cycle hypothesis by Franco Modigliani with

respect to inter-temporal analysis of consumers' marginal utility. Life-cycle hypothesis presupposes that consumers smooth-out their consumption pattern irrespective of the level of income to ensure that marginal utility of cigarette consumption is equal in each period.

The archetypal distinction between rational addiction behaviour models and myopic behaviour models is that the formal incorporates the effect of contemporaneous consumption level as well as to previous consumption, myopic models simply discount the impact of future consumption on current cigarette consumption decision. However, there are situations when rational addiction model becomes consistent with the assumptions of the myopic model (van Walbeek, 2005). In this case, the consumer's discount rate is infinitely large so much that the consumer's time preference places more value on current consumption and a negligible value on future consumption. But, this is hardly the case in reality, especially among richer smokers. According to the review carried out by van Walbeek, (2005), there are important noteworthy points about the interactions between time preference and addiction, alluding to the work of Becker and Murphy (1988). To start with, consumers who discount or neglect the future all the more vigorously are bound to become addicted compared with those who are not. Furthermore, addicts with higher discount rates will be moderately more receptive to changes in the price than those with lower discount rates. Thirdly, the long-run price elasticity of interest will be more noteworthy, in real terms, than the short-run price elasticity. Fourthly, the effect of an anticipated change in the price of the addictive commodities will be more prominent than the effect of an unexpected or predictable price change.

Another conventional addiction model is "the nearsighted/myopic habit model". It is theoretically like the propensity arrangement or irreversible demand models/specifications and adaptive expectation model. The premise of the empirical implementation of the model is that the present cigarette consumption relies upon, other than the variables remembered for the conventional interest model, a "stock of habits" representing the deteriorated whole of all past consumption of the addictive commodity (Mullahy, 1985; Baltagi and Levin, 1986). The rational addictive model is the model utilised for estimating

demand for cigarettes (Becker and Murphy, 1988; Becker *et al*., 1991; Pekurinen, 1991; Chaloupka, 1990, 1991, 1992; Keeler *et al.*, 1993, Sung *et al*., 1994; Conniffe, 1995; Duffy, 1996; Cameron, 1997; Nguyen *et. al*., 2012; Martinez *et. al*., 2015; Becker *et. al*., 2017).

The assumption underlying the rational addiction model is plausible in that consumers include the reliance between past, current, and future consumption into their utility maximisation plan. This is as opposed to the presumption certain in myopic behaviour models, that future ramifications are disregarded when settling on the present choice. As such, myopic behaviour models infer a boundless discount of future consumption, while rational behaviour models suggest that future ramifications are considered. Empirically, the interest condition (model for estimation) is determined as the amount/quantity of cigarettes demanded in the present time frame being an element of both past and future consumption of the addictive commodity just as those different variables that are included as covariates in the conventional demand model.

Becker and Murphy (1988) as well as Becker *et al*. (1991) also adopted the assumptions from rational addiction model to develop several hypotheses. Initially, the amounts of the addictive commodity consumed by an individual in various timeframes are viewed as corresponding or complementary. Along these lines, current consumption of an addictive commodity like cigarettes is oftentimes inversely related to its current prices, yet also dependent on all previous and future prices. Therefore, the long-term impact of a lasting change in prices will surpass the present or short-term impact (Becker *et al*., 1991; Becker and Murphy, 1998). In addition, the proportion of the long term to short term price impact increments as the level of individual's addiction rises. Likewise, the model predicts that the effect of an expected price change will be higher compared with that of an equivalent unexpected variation in price, while a permanent change in price will largely have greater impact than a temporary change in price. Finally, the degree of responsiveness of price fluctuates with time preferences, and the same manner, individuals with higher addiction

discount rates will have greater responsiveness to price changes compared those with relatively lower discount rates (Becker *et al*. 1991; Becker and Murphy, 1998).

Becker *etal*. (1994)[23] used a framework suggested by ‘’rational addiction’’ to conduct an empirical check on the addictive nature of tobacco demand. Their finding provides evidence that suggests the importance of inter-temporal linkages in cigarette consumption as a result of consumers’ rational addictive behavior (Becker *et al*., 1990). Generally, their price elasticity estimates led to conclusions that long-run price changes is higher than that of comparable short-term elasticities and also that temporal price effects are less than permanent price effects on cigarette consumption (Becker *etal*., 1990).

Another study was conducted by Gruber and Köszegi (2000) with a slightly different assumption that allows for time inconsistency in consumer preferences. This underlying assumption presupposes that cigarette smokers plan to smoke more now in order to smoke less in the future and eventually fails to smoke less when the future arrives because of the known addictive nature of tobacco consumption. Just like the conclusions in the Becker-Murphy study, Gruber and Köszegi (2000) found a compelling evidence that cigarette consumption falls when possible futures hikes in taxes are publicised, however, Gruber and Köszegi (2000) recommends that for optimal cigarette taxation, the tax authorities should consider a tax that is one dollar higher than that proposed in the rational addiction model as a result of the ‘’internalities’’ smokers impose on themselves (Gruber and Koszegi, 2000).

More recently, Auld and Grootendorst (2004) conducted a study that tested the rational addiction model for non-addictive household commodities like eggs, milk, meat, fish, energy, transportation, oranges etc. Their findings showed that when aggregated data is employed for analysis, the rational addiction behaviour model provide biased evidence and most times, the estimations are in favour of the rational addiction proposition (Auld

[23]The ‘’rational addiction model’’ as developed in the study led to predictions that the present consumption of addictive commodities should most likely respond to future prices variations, and that optimal government control of addictive commodities should be dependent on their interpersonal externalities.

and Grootendorst, 2004). They made these conclusions based on the following evidences: the application of the model of rational addiction to non-addictive goods in their study indicated that these commodities are rationally addictive, meanwhile, Monte Carlo simulations demonstrate that their result is likely to be as a result of serial correlation, endogeneity bias from prices or due the situation of over-identification of the instrumental variable estimator (Auld and Grootendorst, 2004). They conclude that time-series data sets will usually not be enough to significantly establish whether the observed behaviuor is due to rational addiction or rather as a result of serial correlation in the consumption matrix (Auld and Grootendorst, 2004).

Despite the general consensus regarding the empirical plausibility of the rational addiction behaviuor model, there seem to be a major weakness of the model. For instance, rational addiction model assumes that smokers have perfect foresight that consuming one more cigarette in the current period will accentuate the aspiration to smoke or consume even more tomorrow and reduce future stock of health. Also, the model presupposes that smokers are able to effectively compare the discounted benefits of smoking to the discounted costs of smoking in order to make rational decisions. However, several empirical studies reveal that smokers often underestimate the cost of tobacco use. In Chaloupka *etal*., (2000b), the authors criticise the failure of the rational addiction model to account for a future possibility of smokers regretting that they ever initiated smoking.

Information from different countries, including the United States, was included in a UN Economic and Social Development Department study of problems in the global tobacco market/economy (Becker *et al*., 1991; Chaloupka, 1990, 1991, 1992, Keeler *et al*., 1993, and Sung *et al*., 1994), Finland (Pekurinen, 1991),Greece (Cameron, 1997) and Ireland (Conniffe, 1995), the U.K. (Duffy, 1996), The logical addictive model's ideas were put to the test to see if they were correct. The results of those tests are combined. Studies based on data from the United States, Finland, and Australia generally support the logical compulsion model's hypothesis, but those based on data from the United Kingdom, Greece, and Ireland found little support. These last examinations, be that as it may, are

generally constrained by the small number of perceptions accessible for the analysis and by the utilization of several profoundly adjusted regressors.

Explicit factors included for the demand model of individual model are different, which was contingent upon the economic model calibrated and the accessibility, availability and sort of the data. Significant variables that have been assessed incorporate prices of tobacco consumption as well as other determinants like income, the extent of tobacco advertising cigarette, sales promotion activities and tobacco control activities such as public health education of the health consequences of tobacco use. Cigarettes prices was broadly conceptualised, by and large, including the price tag of cigarettes, yet the time and different expenses related with smoking. The restrictions placed on tobacco consumption in public spots and private places, for instance, force additional expenses on smokers by driving them outside to smoke, by expanding the time and inconvenience related with smoking, or by forcing fines for smoking in confined zones. Also, confines on access to tobacco by youth may build the time and potential legal expenses related with smoking.

Townsend *et al*. (1994) considered the differential impacts of price on tobacco consumption for individual subgroups in the population, stratified by socio-demographic characteristics such as gender, age, educational background etc., and economic status, utilizing information aggregate data drawn from the 1972 to 1990 English General Family Survey. With this, Townsend *et al.* (1994) were able to address the obvious limitation of using aggregated data in terms of the isolated effects of price changes with respect to different socio-demographic variables. They discovered that women were more sensitive to price changes than men. They also found that men and women from lower socioeconomic groups were more price sensitive than those from higher socioeconomic groups, and that teenagers (16-19 years old) and young adults (20-24 years old) were less price sensitive than adults.

Likewise, Harris (1994) measured the impacts of tobacco prices on smoking prevalence and per capita cigarette consumption using annual time-series data sourced from the

National Health Interview Surveys collected in the U.S. Also, aggregate level data of cigarette consumption from 1964 to 1993 was used for the analysis. Harris (1994) concluded that about 50% of the effect of price changes was on smoking prevalence. Guindon *et al*. (2011) conducted a study and findings in their study revealed that there was a degree of substitutability between tobacco consumption and alcohol consumption. They also found that the extent of substitutability was dependent on the economic status of the household. This evidence was consistent with that found in the study of Townsend *et al*. (1994).

In a comparable study implemented by Townsend *et al.* (1994) in the United Kindom. The authors calibrated and estimated regressions regarding the impact of a price change on the quantity of tobacco/cigarette demand. They found a range of elasticities. Essentially, their findings revealed that men and women in the lowest socio-economic categorisation exhibited higher response to a change in the price of tobacco when compared with richer individuals. Also, further evidence Townsend *et al*.'s study showed that poorer men and women were less responsive to health warnings that portrays the negative consequences of tobacco consumption. By and large, they concluded that effective excise tax hikes will be beneficial for reducing the health disparities between the poor and the rich. This assertion is valid, since a decline in the level of tobacco consumption among the poor (due to their higher cut bake in quantity demanded of tobacco) could generate health gains.

Also, the results found in Layte and Whelan (2004) were not a long way from the evidences provided in the study of Townsend *et al*. (1994). Layte and Whelan adopted the use of regression technique to analyse the data sourced from Central Statistics Office (CSO) and Eurostat data. These authors argued that socio-demographic characteristics of smokers play important roles in the decision to initiate tobacco use as well as the decision to quit smoking and that the proportion of detriment and hardship help to clarify half of the differential of class. These earlier assertions were additionally validated by the conclusions of Murphy (2007). Murphy examined household and individual-level socio-demographic variables and the impacts of these factors on tobacco consumption in Ireland using data drawn from CSO. This study showed that the number of cigarettes consumed

daily was positive associated with respondents' level of education, age, sex, marital status, eligibility for medical card etc.

Before the breakthrough in modern econometrics methods, the use of aggregated data sets to determine the reaction in cigarette consumption attributable to price change was often affected be endogeneity issues. This was partly due to the inability to ascertain the direction of causation between tobacco consumption and the increase in its price. Without the application of sophisticated econometric technique, there would predictably intense correlation between independent covariates and the price of cigarettes. In essence, the estimation of tobacco demand equation will be sensitive to how well the model includes important variables in the calibrated model for estimation appraisals of the impact of cost and different factors can be touchy to consideration and prohibition of other significant factors. Be that as it may, this solitary displaying setback has been tended to by late examinations. These investigations were able to generate estimates for the price elasticity of tobacco demand in a comparatively narrow range, centered on -0.4 using sophisticated econometric techniques. Examples of such studies are Keeler *et al*. 1996, Jha and Chaloupka (1999), Reidy and Walsh, 2011, Chaloupka *et al.* (2000) and van Walbeek (2005).

Gallet and List (2003) adopted a baseline estimation and reviewed a number of literature on the impact of price on the quantity of tobacco demand. Varying econometric techniques, a single equation, semi-log, OLS, were implemented to investigate this relation with tobacco demand the outcome variable. A total number of 86 studies from 1933 to 2001 were systematically reviewed. The main conclusion from their findings is that neither addiction models nor 2SLS or 3SLS differed significantly from the OLS baseline. Estimates based on the Almost Ideal Demand System (AIDS), GLS, and MLE produced higher inelastic elasticities, but GMM estimates produced somewhat greater elasticities.

2.4.1.1.2. Analysis with individual level data

Where there are no aggregate data for the analysis of cigarettes demand, a number of studies have used individual-level data from surveys. Generally, earlier reviews of the literature have indicated that estimated price elasticity of cigarettes demand from studies that have either used aggregate-level data or individual-level data report comparable estimates that are not significantly or expressively different. Nevertheless, arguments for the use of individual as well as household-level data hinged on the believe non-aggregated data helps to circumvent the issues discussed earlier regarding the use of aggregate data. This is because data at the individual level will as much as possible avoid endogeneity or simultaneity bias[24] and the possibility of multi-collinearity between cigarette price and other variables that affects aggregate cigarette demand. More importantly, microeconomic data avoids the interdependence between supply, demand and price since individual decision to smoke are too tiny to influence the market price of cigarettes (Deaton, 1997). Therefore, the simultaneity between price and aggregate demand can be ignored in the analysis of individual level data (Deaton, 1997).

[24]In econometrics, simultaneity bias occurs when a variable on the right hand side of the causal inferential model (say other variables that affects cigarette consumption) and the variable on the left hand side of the same model equation influence each other at the same time. Usually, statistical inferences from a system of equations affected by simultaneity bias is often invalid. On the hand, endogeneity bias arise as a result of correlation between explanatory variable and the error term. This occurs when there is measurement errors, uncontrollable confounder, simultaneous causality and omitted variables. Generally, in model estimation where some of the explanatory variables are determined by variables that include the dependent variable, the error term is bound to be correlated with one or more of the explanatory variables and the Ordinary Least Squares (OLS) estimate will be biased and inconsistent (Deaton, 1997).

Thus, income data sets as well as the socio-demographic variables associated with cigarette demand are invariant to prices and policy variables when microeconomic data are used. Much of the time, aggregate price data neglect to represent interstate or regional contrasts in cigarette prices yet individual level information assists with representing the impact of transportation cost and local markets on the regional cigarette costs, in this way dispensing with one-sided appraisals of value flexibility of interest for a cigarette. To control for interstate value differential, especially in the US, concentrates, for example, (Lewit et al., 1981; Chaloupka and Pacula, 1998a, 1998b) remembered a proportion of the value differential for the estimation to control for conceivable cross-fringe shopping because of value changes. Some different examinations just included examples of individuals who don't live approach lower-value areas (Lewit and Coate, 1982; Wasserman *et al*, 1991; Chaloupka and Grossman, 1996; Chaloupka and Wechsler, 1997 Alternatively, some studies avoided the possibility of biased estimates by adopting a weighted average price which included own-locality price and prices in nearby States (Chaloupka, 1990).

Furthermore, individual level data allows for the estimation of price elasticity of demand with respect to different socio-demographic considerations, age, gender, income status, location, education etc. For instance, it takes into consideration in estimating the impact of cigarette value minor departure from the smoking participation and conditional tobacco demand (intensity elasticity) which are unrealistic when the accumulated information is utilized. By and large, specialists looking at the impacts of price on tobacco consumption participation using individual-level information from cross-sectional studies presupposes that price impact assessed for youth shows the effect of price on smoking inception. Then again, price elasticity of tobacco demand estimates for adults fundamentally clarifies the impacts of price increases on quitting (Chaloupka and Warner, 2000).

A number of studies have also examined the impact of cigarette prices on smoking onset. Douglas and Hariharan (1994) used retrospective data drawn from the Smoking Supplements to the 1978 and 1979 National Health Interview Surveys. They investigated the ages at which survey respondents reported that they first smoked. Essentially, the

authors used current state of residence of the respondents and matched data on cigarette prices to the survey data to measure the impact of price on smoking initiation (Douglas and Hariharan, 1994). They proposed a hazard model in which "failure" was assumed to refer to never smoking and utilized a comparatively broad minor departure from standard term techniques. This received the split population length model created by Schmidt and Witte (1989). The model assumes that a large sample of the data never consumed tobacco.

Douglas and Hariharan's theoretical, methodological as well as empirical framework was nested on the Becker and Murphy (1988) rational behaviuor addiction model. Douglas and Hariharan (1994) generated findings that indicated that a number of individual level socioeconomic and also demographic covariates imposed significant effect on smoking initiation, for example they found evidence that educational attainment, gender and race are significant variables in determining when smoking is initiated (Douglas and Hariharan, 1994). But, it was interesting to note that their estimates with respect to the impact of cigarette prices were not significant in the calibrated model. Due to errors-in-variables issue related with both the retrospective data on smoking onset and the price of cigarettes, they saw that price impacts were probably was biased towards zero. However, their estimates show no significant impact on smoking initiation.

Douglas (1998) provided extension to the work carried out by Douglas and Hariharan (1994). They estimated a time-varying variable model specification that permits the hazard of tobacco consumption onset to respond to increase in prices and other important covariates. Douglas (1998) considered the hazard of smoking cessation in addition to that of initiation within the same empirical framework. He also estimated the impact of smoking regulations and information smoking onset as well as smoking cessation or quitting. He used the data drawn from the cancer risk factor supplement to the 1987 National Health Interview Survey for his analysis and made similar conclusion to that in Douglas and Hariharan (1994) which established that cigarette price has little impact on smoking initiation. This conclusion again might be due to errors-in-variables problems that could have impacted on this finding as earlier observed (Chaloupka and Warner, 2000).

DeCicca *et al*. (1998) used data set sourced from the National Instruction Longitudinal Overview in Russia to do facilitate examination on the issue of cost and smoking inception. This informational collection contains data on youth smoking at eighth, tenth, and twelfth grades. They treated each flood of the informational index as autonomous cross-segments and got evaluations of the value flexibility of youth smoking interest like the discoveries in the prior investigations. DeCicca *et al*. (1998) assessed the likelihood of smoking in twelfth grade for an example that prohibited the individuals who were smokers in eighth grade. Their evaluations for the effect of cigarette imposes on the likelihood of smoking inception between the eighth and twelfth grade were not measurably altogether unique in relation to zero simply like the discoveries of Douglas and Hariharan (1994) and Douglas (1998). DeCicca *et al*. (1998) saw that the contrasts between the discoveries in their investigations could be credited to the likelihood that cigarette charge rates are an intermediary for in secret assessment against tobacco smoking or because of some other surreptitiously factors. On the off chance that this happens to be the situation, the value versatility of cigarette request assessed utilizing cross-sectional examinations are probably going to be essentially higher contrasted with that evaluated from aggregated data.

As stated in the review carried by Dee and Evans (1998), the conclusion in DeCicca *et al.* (1998) was likely to have been affected by the omission of missing values for some variables. Dee and Evans (1998) examined the price and smoking initiation relation using the panel data employed by DeCicca *et al.* (1998). They instead included the observations with missing values for important independent variables/factors (variables such as income, parental education, and number of siblings), along with dummy variables representing observations that has missing data. Dee and Evans (1998) included a variety of binary indicator in their model specification instead of the "continuous" measures used in DeCicca *et al.* (1998). This led Dee and Evans to arrive at a negative and significant price elasticity of smoking initiation.

Ohsfeldt *et al.* (1998a) used data from September 1985 Current Populace Study to evaluate the impacts of tobacco excise taxes and State laws limiting smoking in public puts on the likelihood of current tobacco consumption and current smokeless tobacco use

among males in the USA. They estimated the likelihood of use by using a logistic regression model. Their findings suggest that higher smokeless tobacco excise tax rates have a negative association with the probability of smokeless tobacco use, while increases in cigarettes excise tax rates are related to higher odds of current smokeless tobacco use (Ohsfeldt *et al.,* 1998). Still on the subject of effect of tobacco tax rates on smoking initiation, Guindon (2012) conducted an exhaustive systematic review of existing studies on the impact of tobacco prices on smoking onset. He concludes that the findings in most of the studies had fairly serious methodological setbacks such as recall bias and use of weak empirical approaches. He observed that earlier studies failed to provide convincing evidence that suggest that price increases impose significant effect on smoking initiation and quitting (Guindon, 2013).

A significant downside of utilizing the individual-level data for the estimation of demand for cigarettes is that self-revealed information on cigarette utilization downplays the genuine consumption level. Warner (1978) built up that overview based self-revealed utilization essentially and significantly downplayed genuine deals. However, the argument has been that microeconomic data implicitly approximates reported cigarette consumption to actual consumption so that estimates of price elasticity of cigarette demand is not systematically biased. Apart from this, other forms of simultaneity caused by omitted or unobservable variables are considered to affect analysis from individual level data. According to Wasserman *et al.* (1991) contemplates utilizing individual-level data might be dependent upon a considerable natural inclination in that excluded factors influencing tobacco use might be associated with the included determinants of demand. Neglecting to represent this can create one-sided estimates for the included factors. For instance, surreptitiously supposition against smoking may influence both cigarette deals and the quality of tobacco control approaches (excise taxes and, thus, prices). Ohsfeldt *et al*. (1997b) considered this chance in their investigation of cigarette smoking and other tobacco utilize that utilized data from the 1992/93 Current Populace Overview Tobacco Use Enhancements. Shockingly, in the wake of demonstrating cigarette excise taxes and other tobacco control approaches as an element of cigarette smoking, different pointers of

conclusion against smoking, and different components, they found prices largely affect tobacco demand (Chaloupka and Warner, 2000).

Some studies have also employed the use of individual level data drawn from large scale expenditure surveys to conduct analysis on the price elasticity of cigarette demand (John (2005); John (2008); Eozenou and Fishburn (2009); Guindon *et al.* (2011); Chen and Xing (2011); Chelwa (2014). A common feature of these studies is the use of unit values[25] as a proxy for cigarette price in the absence of data on the price tobacco products. These studies employed the methodology proposed by (Deaton, 1997) on the estimation of price elasticity of demand based on variation in price over space. This is especially relevant in developing countries where transportation is often underdeveloped and where markets are not always well integrated (Deaton, 1997).

As cited in Deaton (1988), the behaviour of unit values was extensively described in some studies (Houthakker and Prais (1953); Prais and Houthakker (1971) but it was never used for the estimation of price elasticity, perhaps the authors were a little cautious of its empirical plausibility (Deaton, 1988). However, subsequent studies (Timer and Alderman (1979); Timer (1981); Chervichovsky and Meesook (1984); and Pitt (1983) where able to regress quantities demanded on calculated unit values. Their findings were seen to be plausible. More recently, Eozenou and Fishburn (2009) gauged the price elasticity related to demand for tobacco in Vietnam using the methodology proposed by Deaton (1990). The Deaton (1997) methodology is such that the unit value is purged of quality effects and the reported quantity consumed is corrected for measurement error. With this they were able

[25] As per Deaton (1997), household responses frequently give an important source of price data. Basically, in studies family units are approached to report the physical amount bought just as the complete consumption on every ware. From this snippet of data, we can advantageously say that the proportion of these two perceptions is a proportion of the unit esteem and can precisely be utilized as a fitting intermediary for cost whenever cleansed of value impacts. The thought behind this is unit esteem is influenced by the decision of value just as the real value that the individual faces in the market. Deaton (1997) directed an investigation to test whether the unit esteem gives valuable data on the real cost of products. He did this investigation utilizing the Pakistani data from the 1984-85-Household Salary and Consumption Overview and the Maharashtra State test from the 38th round of Indian NSS. He relapsed the unit esteem against a lot of fakers for every one of the four areas in the review Punjab, Sindh, North West Wilderness Region, and Baluchistan (the discarded classification). The regression analysis was aimed at to capturing broad regional and seasonal price patterns. Deaton (1997) used the analysis of variance to decompose the price variation into between-village and within-village components. He found the F-statistics to be significant at conventional values and that the village fixed effect explain around half of the total variation in price. This provides evidence that spatial price variation and that the unit value provides a noisy guide to actual commodity price.

to estimate an Almost Ideal Demand System from spatial variations in prices and quantities demanded. Their estimated price elasticity for cigarette demand is -0.53, which is not significantly different from previous empirical studies for developing countries (Eozenou and Fishburn, 2009).Likewise, Selvaraj *et. al.* (2015) estimated the price elastic of different tobacco products in India using the unit value methodology. They found that poorer households were more price responsive relative to the economically more viable ones. The price elasticities were for bidi were -0.43, for the poorer group, and -0.08 for richer ones. This pattern is the same for products like cigarettes and leaf tobacco, according to findings in Selvaraj *et. al.* (2015).

2.5. Approaches to Measuring Household Welfare

Broadly speaking, the concept of household welfare is multidimensional and for many decades, there has been an ongoing discussion regarding how best to measure it. According to Grootaert (1983), there are three major approaches to measuring household welfare. These approaches are:

1. *Estimation of Indices of Welfare*: Grootaert stated that this approach entails simultaneously estimating a multi-equation model that captures household consumption and employment behaviour in which case the household attains optimum welfare subject to the constraints of real income, prices of goods and services, time endowment of individual household members, wealth accumulation and the wage rate facing each household member in the labour market. This approach lends from the work of Muellbauer (1980), which presuppose that household welfare is a direct function of the consumption of goods, leisure (measured at individual level), composition of household and access to social/public services. This approach to measuring welfare is fairly complex and the review of existing literature showed that different variants of this approach has been implemented (see: Feliciano, 2001; Porto, 2003; Nicita, 2008 Porto, 2015).

2. *Total Household Expenditures*: This approach is mostly money metric and favours the estimation of household consumption/budget shares such that welfare is a function of

the goods and services consumed by households (Grootaert, 1983; Deaton 1997). The underlying assumption when implementing this welfare measure is that the preferences revealed by the goods consumed by households implicitly account for other important preferences as against the previous approach which explicitly accounted for considerations such as the choice to have leisure and the "decision to have more children" (Grooteart, 1983). Otherwise stated, the later are treated as exogenous and are reflected in the revealed preference of households (Grootaert, 1983). Essentially, Grootaert concludes that welfare is a function of household consumption and measuring it requires calibrating a model of household expenditures and controlling for the effects of prices (i.e. a cost-of-living measure/index) and equivalence scale. According to Deaton (1980), Laspeyres Index and Paasche Index are "first order approximations of a true cost-of-living index". Nonetheless, Grootaert noted that when using cross-sectional data, the use of Laspeyres Index and Paasche Index as proxies for cost-of-living (which is often used control for the effects of inflation on welfare changes), breaks down. He therefore recommends the use of different price indices for different groups (e.g. rural/urban as well as different regional locations). This is particularly useful when dealing with cross-sectional surveys from developing countries due to the huge variation in prices faced by households residing in different geographical locations. Moreover, Grootaert also emphasized the importance of accounting for household size and composition given the differences in preference of adults and non-adult members of the household.

Furthermore, another author, Deaton (1997) adopted the "the social welfare function", a theoretical framework developed and popularized by Atkinson (1970), to illustrate the concept of welfare from the total household expenditure perspective. He submits that aggregate welfare is a "non- decreasing" function of per capita consumption in a given population. It is important to mention that the household expenditure approach of measuring welfare is more popular among the studies that assessed household welfare due to its simplicity, efficiency, feasibility and minimal data requirements

(see: Glewwe 1991; Grootart *et al.,* 2002; Basu *et al*., 2004; Yusuf 2008; Ferreira *et al*., 2011; Adepoju and Oni, 2012; Wang *et al*., 2017).

3. *Full Income Concept*: This approach, unlike the earlier mentioned approaches, aggregates all income (income from labour, endowment, assets etc.). It also places monetary value on leisure and appears to take into consideration all aspects of income available to households (Grootaert, 1983). This approach has also been referred to as the reduced-form approach to measuring welfare. However, this approach requires substantial data that are often not available in developing countries.

In particular, studies investigating how tobacco consumption affects households' overall welfare (through the consumption of goods and services) mostly adopted the total household expenditure approach. Although some of the research used descriptive methodologies to look at the impact of household tobacco spending on healthcare, others used econometric models.

2.5.1 *Descriptive studies on tobacco consumption and household welfare*

Efroymson *et al.* (2001) directed clear analyses of tobacco consumption, tobacco consumption, and destitution by basically looking into accessible measurements on family tobacco uses and from that point contrasted these expenses and potential spending on nourishment and other essential family products in Bangladesh. They found that all things considered, male smokers spend more than twice as much on cigarettes according to capita consumption on dress, lodging, health, and instruction consolidated (Efroymson et al., 2001). The authors submitted that tobacco spending bothers destitution and establishes, imposes a critical economic weight on poor Bangladeshis.

The relation between child anthropometry andtobacco consumption (underweight, stunting, wasting, severe underweight, severe stunting, and serious wasting among children of ages beneath five) in Bangladesh was investigated by Best *et al.* (2007). They conducted a cross-tabulation of household tobacco expenditure and tobacco consumption status. The prevalence of parental tobacco use was linked to a higher risk of stunting, underweight, and wasting in the study. Findings in Best *et al.* show that parental tobacco consumption may aggravate child malnutrition and diminish household expenditure on food and other essential commodities.

A research work was carried out on the effect of tobacco consumption in imposing economic hardship on acutely poor families and households in New Zealand by Thomson *et al.* (2002). The authors calculated the percentage of expenditure outlay towards purchasing tobacco by economically less viable households and found that tobacco spending has the potential to affect the wellbeing (in the form of poorer diet) of children and that this impact is much higher in households/families with more than member who consume tobacco and families with heavy smokers.

In China, Xin *et al.* (2009) investigated the impact of tobacco consumption, quitting and medical costs on household consumption expenditure patterns on goods and services. The authors employed descriptive statistics to compare household expenditure and consumption of medical or clinical care services with respect to household smoking status. Their findings showed that spending on essential household commodities reduced for every five packets of cigarettes consumed by a household with at least one smoker. They opined found that this impact was the highest among low-income rural households. Similarly, their findings showed that medical expenditure was substantially in households with quitters. Their study also showed that ill-health was the main reason why smokers quit smoking in China.

Efroymson *et al.* (2011) conducted a study that reviewed existing evidence of the association between tobacco consumption and household poverty in Vietnam. By extension, they assessed the effects of tobacco use control (economic and legislative) policies on the employment generated by Vietnamese tobacco industry. The reviewed

included 50 articles on topics related to tobacco use and health, the economics of tobacco use and the potential impact of tobacco control policies. Their review generated comprehensive evidence that tobacco consumption invariable contribute to household the incidence of poverty and inequality in Vietnam. Further evidence showed that there exists no significant negative association between the policies restricting tobacco consumption and employment level in Vietnam.

2.5.2. *Studies that adopted econometrics models to examine tobacco consumption and household welfare*

Majority of the studies on the impact of tobacco consumption on household consumption expenditure pattern and poverty adopted econometric models. The first in this series is Busch *et al.* (2004), they estimated an Almost Ideal Demand System (AIDS) and included alcohol, food, tobacco, housing, clothing, transportation and healthcare in the model. Fundamentally, their study revealed that there was an increase in cigarettes prices as food expenditures increased due to a decline in tobacco us which accompanies reduction in tobacco use. They calibrated a model that controlled for the possible effects of socio-demographic characteristics and the presence of heterogeneity. Following this, their findings showed that tobacco and food were substitutes. What this means is that smokers cut expenditure on food in order to smoke and when they are forced to reduce the amount of cigarette smoked (consequent on increasing the price of cigarettes), they feasibly divert a portion of smoking expenditure to the purchase of food.

Hu *et al.* (2005) used cross-tabulations and simple regression analysis to investigate the differences in household expenditure (on food, housing, clothing, and education) in terms of the tobacco use status of the households. The technique adopted this study provided a simple analysis of tobacco consumption, household welfare as well as impoverishment in China. While the cross-tabulation provided a descriptive background of household expenditure with respect to individual household smoking status (number of packs smoked), the authors specified a regression model where total expenditure less tobacco expenditure was the dependent variable and household smoking status was one of the explanatory variables.

Holding other variables (household income, educational level and household size) on the right hand side constant, Hu et al investigated the effect of household smoking status on household per capita spending on food, housing, education and clothing. They generated evidence that indicated that on average, every extra/additional pack of cigarettes smoked or consumed in a month reduced other household consumption expenditures by 2.9 Yuan per capita (between 9–12 Yuan per household) every month. Similarly, Liu *et al.* (2006) investigated the effect of two expenses related to tobacco consumption (excessive medical/health outlay traceable to smoking and direct expenditure on the consumption of tobacco products) on household poverty status. They estimated excessive health expenditure inferable to tobacco consumption implementing a log-linear regression model[26] of health spending with individual smoking status (currently smoke, formerly smoked, never consumed tobacco or smoked) as part of the covariates after controlling for household demographics and economic profile (Liu *et al.,* 2006).

The use of a log-linear regression model to examine this relationship is methodologically plausible since smoking expenditure and excessive health expenditure imputable to tobacco consumption cannot be said to have a linear relationship with changes in household poverty status. The impoverishment effect of tobacco consumption was estimated by the adjustments or changes in the poverty headcount after the expenditures made on consuming tobacco were subtracted from individual household income. They found that the excessive health expenditure imputable to tobacco consumption lead to an increase in poverty count by 1.5% for households residing in urban locations and by 0.7% for the rural households. Liu *et al.* (2006) concluded that the poverty headcount for households living in urban locations as well as for households residing in rural settings increased by 6.4% and 1.9%, respectively, as a result of household direct expenditure outlay towards tobacco consumption only. The authors also found that excessive health expenditure imputable to tobacco use generated further impoverishing for 30.5 million urban residents and 23.7 million rural residents in China.

[26]A log-linear model is a mathematical model in the form of a function whose logarithm is a linear combination of the model's parameters, allowing linear or multivariate regression to be applied (i.e. the log of the regressand is a function of the logs of the regressors).

Wang *et al.* (2006) adopted a Fractional logit specification to evaluate the effect of tobacco use on the consumption of other important household goods and services (specifically on household expenditure seventeen goods) in rural setting in China. The methodology utilized in the study is such that the authors were able to estimate the relationship. In the study, values of varying household spending intervals were assessed following appropriate transformations.

Like the binary logit model, the half Logit model uses provision regression as a relation operation. However, it's been argued that this model ignores endogenous insightful variables and unobserved heterogeneous impacts, all of which are significant political economy issues. According to Papke and Wooldridge (2008), this limitation is often overcome using panel information techniques under strict and poor exogeneity assumptions. When using the half Logit model, Wooldridge (2005) planned the ballroom dance control operation technique for dealing with endogeneity issues.

Furthermore, the measurement of zero tobacco expenditure, which may be a function of budget constraints or sheer self-discipline, should be considered when estimating the effect of tobacco expenditure on menage expenditure trend. By using a cross-sectional sample, zero expenditure will occur as a result of infrequent purchases (i.e., infrequent tobacco expenditure) (Vermeulen, 2003).This classification is important because it has implications for political economy specifications, with zeros requiring certain transformations within the book specifications as a result of self-discipline (Vermeulen, 2003). If zero expenditure occurs as a result of sheer self-discipline, there is preference heterogeneity between tobacco consuming households and those who do not consume tobacco; on the other hand, if zero expenditure occurs as a result of sheer self-discipline, there is preference heterogeneity between non-smoking and smoking households (John, 2012). Nonsmokers, on the other hand, do not get any satisfaction from consuming tobacco products and are unlikely to use tobacco even though it is available for free. In order for the projections to be unbiased and credible, the preferences of households should vary (Vermeulen, 2003).

Vermeulen (2003) suggests a null hypothesis test to see whether household demand is influenced by a binary variable ‘d' that takes one of two values: one or zero, which is a function of whether the money is expended on smoking or towards the consumption of other basic household commodities. He conceptualised the pairwise variable as an indicator that ensures preference homogeneity is rejected if it is relevant in alternative commodity demand.

There is a chance that households with members who consume tobacco and those without smokers make the same conditional choices over alternative products in the analysis of consumer preferences, in which case the null hypothesis is accepted (Vermeulen, 2003). Furthermore, the null hypothesis test delineated higher than is useful in deciding whether the binary variable is unrelated to clients' use of alternative commodities.(Vermeulen, 2003).Furthermore, Vermeulen (2003) stated that the binary indicator ‘d' is separable from ‘q' (the consumption vector of other n commodities). If this assumption is right, there would be a financial effect if a non-smoking household member decides to start smoking. It is probable that smoking initiation, on the other hand, has the same effect as a price increase in economic theory.In the study of a compensated demand mechanism, tobacco spending induces a substitution effect, as consumers substitute away from other product consumption in order to initiate or increase smoking while maintaining their income level unchanged, assuming that the households have a separable utility function and tobacco consumption is in 'q'.

In a separable utility function, the rate at which goods are substituted in$x^j$is not affected by the level of consumption of any goods inx^j(Black *et al.,* 2012; Eatwell *et al.,* 1987). If a household has separable tastes, the amount of money spent on all of the products in the consumption range determines the demand for a product in the consumption bundle. (Black *et al.,* 2012; Eatwell *et al.,* 1987).Smoking initiation and intensification allows customers to spend less on other essential household needs in order to free up money to smoke in this situation.

Vermeulen (2003) used the Belgian household budget survey from 1987 to 1988 to test this hypothesis. He used Banks *et al*(1997) Quadratic Almost Ideal Demand Method (QUAIDS) to estimate Engel curves derived from an eleven-good conditional demand system. He wanted to see whether the null hypothesis of corner solutions generating zeros could be dismissed.Household demographic characteristics and tobacco expenditure conditioning are among the QUAIDS specified ($P_t t$) and observed preference heterogeneity of tobacco consumers and non-tobacco users. According to the F-statistics table, seven of the eleven items calculated had values above the critical value of 2.6. As a result, he was able to rule out user separability, which immediately rules out the null hypothesis of zeros generated by corner solutions.

Koch and Tshiswaka-Kashalala (2008) estimated budget shares as a function of household tobacco consumption expenditure, per capita net expenditure, and equivalence scale in South Africa using a linearised approximation of the Quadratic Almost Ideal Demand System.Their empirical results indicate that tobacco spending is followed by spending on housing, food, and entertainment, and that tobacco spending crowds out spending on electricity, adult and child clothes, healthcare, transportation, and education in the home.They also noted that as per capita household tobacco expenditure increased, the portion of household budget devoted to clothing, adult and infant, medical care facilities, and transportation expenditure decreased, while household shares of goods such as housing and entertainment increased.

To investigate the effect of tobacco consumption on consumption of other household basic commodity needs, John *et al.* (2011a) used a Seemingly Unrelated Regression. They find that tobacco spending outnumbers education spending in a nationally representative 2004 Cambodia Socio-Economic Survey.In India, John *et al.* (2011b) estimated the impact of tobacco use and the resulting healthcare/clinical expenditure on poverty. To determine the medical costs associated with tobacco use, an epidemiological approach was used. They

estimated a smoking-attributable fraction in the process. (SAF[27]) To calculate tobacco attributable healthcare costs, multiply the approximate value by total healthcare spending in tobacco-using households. Tobacco outlays/spending, as well as the resulting or associated medical expenses due to tobacco use, were deducted from monthly household total consumption expenditures in their report.They stated that this provided a fair estimate of household disposable income, enabling them to determine India's true poverty level. According to them, accounting for tobacco-related direct spending will increase rural and concrete economic condition rates by 1.5 and 0.73 percent, respectively. According to them, a total of fifteen million Indians are affected.

Following the work of Vermeulen, Pu *et al*. (2008), John (2012), and Chelwa and van Walbeek (2014) calculated a method of quadratic conditional Engel curves to investigate the spill-over impacts of tobacco and alcohol spending on household expenditure trend (2003).When households' socio-demographic characteristics and preference variability were dominant, this framework supported consistent estimates of the effect of tobacco spending on household expenditure behaviour.To prevent endogeneity bias with the regressors within the estimated QUAIDS Equation, John (2012) used the Wu-Hauseman test (Cong, 2000) to screen for endogeneity for all the instructive variables and found tobacco expenditure and total social unit expenditure to be endogenous for nearly all of the observations.Following Keen's (1986) work, as a proxy for tobacco spending, he used an instrumental variable (adult sex ratio). According to the literature, the adult sex quantitative relationship is supposed to correlate with household tobacco expenditure, but not with the stochastic error term, since males in most countries smoke more than females.John (2012) avoided contemporaneous correlation (correlation of the response variable with the random disturbance term), making the QUAIDS calculable. The 3SLS method is a three-stage technique statistical procedure. Grieve and van Walbeek (2014) used a similar method, but permitted the instrumental variable to be correlated with the

[27]This term is generally calculated to ascertain the proportion of costs that can be attributed to tobacco use. It has been widely used in costs of smoking studies.

disturbance term.In comparison to non-smoking households, these research found that smoking households spend less on certain welfare-enhancing commodities.

A review of methodologies for describing client demands by Banks et al. (1997) show that the applying of Quadratic Almost Ideal Demand Systems has many empirical evidenceover different models of demand like the metropolis model and also the virtually Ideal Demand Systems where the expenditure share Engel curves are linear in the logarithm of income. This is because a linear logarithmic expenditure share model might be sufficient in describing consumer behavior for the consumption of certain goods such as food and fuel but for several other goods (clothing, education, alcohol, electricity e.t.c.), the linear model will have to be extended to include a quadratic term in the log of expenditure for adequate analysis of client behavior (Banks *et al.* 1997). As a result, Banks et al. made useful additions to Deaton and Muellbauer's Almost Ideal Demand System (1980). The QUAIDS model provides an appropriate structure for analyzing reported household spending and welfare in consumer theory.This model's proposition was based on a non-parametric study of consumer spending. To prevent biases as a result of falling to account for Engel curvatures, Banks et al. discovered that Engel curves need the quadratic terms within the power of expenditure.Yao *et al.* (2014) employed generalized equation modelling to investigate the determinants of smoking-induced deprivation in China. Their findings revealed that low-income and middle-income smokers have higher risk of smoking-induced deprivation compared to high-income smokers. They also found no statistically significant association between smoking intensity, price per pack of cigarettes and smoking-induced deprivation.

Some studies have looked at the likelihood of catastrophic health-care spending and impoverishment as a result of borrowing and selling assets to pay for medical bills.Bonu *et al.* (2005) investigated the likelihood and levels of borrowing and distress selling of assets as coping mechanisms to covering hospitalization costs among regular users of tobacco. Using a bivariate, multivariate and logistic regression analysis, they found a higher risk of borrowing or selling of assets (experience of catastrophic expenditure) during hospitalization for individuals who smoke and among non-smokers that belong to

households that have at least one smoker. As a result, smoking expenses pose a greater threat to low-income households' standard of living. (Efroymson *et al.,* 2001; Tsai *et al.,* 2005; Wang *et al.,* 2006).

From the literature review, therefore, it is evident that few studies have investigated the impact of tobacco consumption in Africa, where the prevalence of tobacco use is rising, howbeit, slowly. The level of concern created by this outlook is even higher given the fact that a large number of poor households live in Africa and the consumption of tobacco could worsen the welfare of those households. In Nigeria, this picture is the same. Despite the evidence that tobacco consumption is rising in the country, little attention has been devoted to the likely impacts of tobacco use on households in Nigeria. This represents a gap in knowledge.

CHAPTER THREE

THEORETICAL FRAMEWORK AND METHODOLOGY

3.1. Introduction

This chapter provides the theoretical framework and the empirical methodology for the study. First, recalling that households' welfare can be empirically depicted in a model of consumer demand (Engel curves), the Quadratic Almost Ideal Demand Systems (QUAIDS), which nests the neoclassical theory of consumer demand was adopted to estimate tobacco consumption function. Afterwards, the unit value methodology popularised by Deaton (1997) was utilised to estimate the price elasticity of demand for tobacco in Nigeria.

Second, given the theoretical background provided by a ''Separable Utility Function'', QUAIDS specification was used to estimate the effect of tobacco consumption on the consumption of other essential household goods such as food, education, clothing, fruits and vegetables energy and health (as a proxy of household welfare). The separable utility function was employed to ascertain if tobacco spending causes a ''substitution effect'' on social goods. This utility function is different from the generic utility function used in previous studies. In effect, this type of utility function is conceptually useful in investigating the impact of household expenditure on tobacco consumption on the consumption of other essential social commodities, especially in low-income households such as Nigeria. Lastly, three health expenditure models, log-linear analysis, were calibrated and estimated to predict excessive medical/clinical spending imputable to tobacco consumption and ascertain if this expenditure increases household experience or

incidence of CHE. Here, the natural logarithm of health expenditure was equated to a combination of important covariates.

3.2. Theoretical Framework

The Separable Utility Function was developed by Leontief (1947) and first implemented by Strotz (1957) to analyse two-stage optimisation in the theory of consumer utility/satisfaction. Given the assumption of separability among the commodities consumed by households, the first stage entails partitioning goods and services into subsets and optimizing intensities within each subset. In the second stage the within set intensity is held fixed while the between set intensities are optimized. A utility function is separable if it can be written in the form:

$$U = U(U_1(x^1), U_2(x^2), \dots U_n(x^n) \quad (3.1)$$

where x^1,… x^nmake a partitioning of the products available in the household consumption bundle. Taking into account the prices of all the goods in the consumption bundlex_i,$(p_1, \dots p_n)$, the household optimises its satisfaction subject to the constraint created by the available household resources thus:

$$\text{Max } U = U(U_1(x^1), U_2(x^2), \dots U_n(x^n); a) \quad (3.2)$$

$$\text{s.t } \sum_{i=0}^{n} p_i x_i = E \quad (3.3)$$

where $''E''$ depicts household totalexpenditure and ‘’a’’ depicts a vector of household socio-demographic profile. Assuming the utility in equation (3.2) is additively separable and setting up a Langragian multiplier to derive the utility maximising quantities of goods consumed thus

$$L = U(U_1(x^1) + U_2(x^2), \dots U_n\,(x^n); a) + \lambda(E - \sum_{i=0}^{n} p_i x_i) \quad (3.4)$$

Differentiating L with respect to x_i

$$\frac{\partial L}{\partial x^1} = \left(U_1(x^1)\right)^1 - \lambda P_1 = 0 \quad (3.5)$$

$$\frac{\partial L}{\partial x^2} = \left(U_2(x^2)\right)^1 - \lambda P_2 = 0 \quad (3.6)$$

$$\frac{\partial L}{\partial x^n} = \left(U_n(x^n)\right)^1 - \lambda P_n = 0 \quad (3.7)$$

$$\frac{\partial L}{\partial \lambda} = E - \sum_{i=0}^{n} p_i x_i = 0 \quad (3.8)$$

This is such that the Marshallian demand curves is a function of P, E, a and can be derived as follows:

$$x_i = h^i(p_1, \dots p_n, ; a) = h^i(P, E, a)(i = 1, \dots, n) \quad (3.9)$$

In theory, the separable utility function described in equation (3.1) allows for two-stage budgeting: The household/individual smoker determines how much to spend on cigarettes first, then allocates the remaining funds to other household goods consumption. When total tobacco spending rises and a nonsmoking household member continues to smoke, the consumption of other basic household needs is affected in a separable utility specification. Assuming tobacco is the nth commodity and that the household′s consumption range consists of n−1 commodities at prices $(p_1, \dots p_n)$. It is common for households to have no leverage over market prices and to have a fixed income. Because of the addictive aspect of smoking, the household uses a two-stage budgeting system, with overall expenditure on other goods except tobacco as follows:

$$M = E - p_t t \quad (3.10)$$

where $p_t t$ is total tobacco spending and M is the total expenditure less tobacco spending . The utility maximization problem becomes:

Max$U = U(U_1(x^1), U_2(x^2), \dots U_n(x^n)$a)

(3.11)

s.t$\sum_{i=0}^{n-1} p_i x_i = M$

(3.12)

When analyzing the welfare effects of consuming harmful goods such as tobacco, it will be erroneous to assume that the consumer derives positive utility from consuming the product. Therefore, given the evidence that tobacco consumption causes harmful effects in addition to the utility the smoker derives from smoking and assuming there are two commodities in the consumption bundle of a smoker, tobacco demand (TC^d) and basic household goods (BG^d), d represents demand or consumption. Equation (3.11) and (3.12) can be written as:

$$\text{Max}U = U\ (U_1(TC^d)U_2(BG^d)) \tag{3.13}$$

$$\text{s.t } P_1TC^d + P_2BG^d = M \tag{3.14}$$

While a typical smoker hopes to maximize the utility from tobacco consumption, tobacco control mechanisms are developed to cut tobacco use and minimise dis-utilities (morbidity and mortality). In general, the harmful effects of tobacco use may outweigh the satisfaction derived from consuming it. For ease of exposition the utility derived from tobacco consumption as indicated in equation (3.14) only considers the utility. The intensity of tobacco consumption or decision to quit will affect the quantity of other basic goods consumed, especially for households whose resources are limited.

Imposing preference separability (or preference heterogeneity) on equation (3.11) such that the utility function of households without a member who consumes tobacco are not affected by tobacco because it is not in their consumption bundle, x_i. Tobacco spending, on the other hand, allows smoking households to reduce their intake of other essential household goods. A Lagrangian multiplier is generated from equations (3.13) and (3.14), resulting in the utility-maximizing consumption package,x_i as follows:

$$x_i = c^{i,n}\left(P_{1,}, P_2, M, x_n; a\right) \qquad such\ that\ n = 2 \tag{3.15}$$

As a consequence of smoking households' two-stage budgeting,$c^{i,n}$ reflects the conditional demand function for the household consumption bundlex_i. That is, conditional on whether the household consume tobacco or not.Since tobacco spending has no effect on the utility maximising quantities in the budget range of non-smokers, the use of a separable utility function is preferable since it follows Vermeulen's principle of preference separability (2003).

The tobacco consumption function can be written as follows:

$$TC^d = f(P, \Pi, Y, T, LR)$$

(3.16)

Tobacco consumption(TC^d)is expressed as a function of tobacco price (P), prices of other products, denoted by a price aggregator (Π), total household income (Y), household taste/preferences (whether to smoke or not), and a vector of regulatory restrictions (LR)on tobacco use in equation (3.16). (LR).

Theoretically, equation (3.16) can be differentiated with respect to price P and income Y to derive the price and income elasticities[28] of tobacco consumption thus:

$$\frac{\partial T^{\ d}}{\partial P} = f_p < 0, \frac{\partial TC^d}{\partial Y} = f_Y > 0$$

(3.17)

[28]The price and income elasticities of tobacco consumption are important policy inputs towards reducing tobacco demand. While price elasticity of tobacco demand helps to determine the degree of responsiveness of demand to increase in excise taxation on tobacco, information on the income elasticity of tobacco demand helps to benchmark tobacco affordability. (see: An Analysis of Cigarette Affordability Evan Blecher and Walbeek Corne (2008).

3.3. Methodology

3.3.1. The model

The QUAIDS, developed by Banks *et al.* (1997), nests and provides methodological extension to the Rotterdam model by Theil (1965) and the Almost Ideal Demand Systems developed by Deaton and Muellbauer (1980) in providing approximations to the neoclassical theory of consumer demand. The later models of consumer demand have specifications that suggests linear relationship between budget shares and the log of expenditure (income) which is invariant with commodity prices. But, the QUAIDS model introduced a quadratic term in the log of expenditure $(In\ E)^2$ to capture Engel curvatures since a linear relationship between commodity budget shares and consumer income might not be empirically plausible (at least for many goods apart from food). Also, the QUAIDS ensures that the coefficient of $(In\ E)^2$ varied with prices.

Banks *et al.* (1997) introduced a general form of budget shares with three ranks:

$$w_i = A_i(P) + B_i(P) ln\ E + C_i(P) g(E) \quad (3.18)$$

where i represents 1, ……., N commodities, P is the vector of prices, $ln\ E$, the log of expenditure (income) and $g(E)$, a smooth function of expenditure (income). The three terms $A_i(P)$, $B_i(P)$, and $C_i(P)$ show the empirically plausible 3 ranks in describing Engel curves (Lewbel, 1991) and the terms are differentiable functions. Also, $C_i(P)g(E)$ captures nonlinearity against the Price-Independent Generalised Logarithmic (PIGLOG) specification adopted by AIDS and Rotterdam models where $C_i(P)$ is near zero.

According to Banks *et al.* (1997), all demand systems consistent with the three-rank equation (4.13) have a Marshallian demand function of the form:

$$ln\ ln\ V(p,E)\ = \left[\left\{\frac{lnE-lna(p)}{b(p)}\right\}^{-1} + \lambda(p)\right]^{-1}$$

(3.19)

where $\left\{\frac{lnE-lna(p)}{b(p)}\right\}^{-1}$ is the indirect utility or Marshallian demand function of a PIGLOG (exact aggregation of preferences) demand system where budget share w_i are linear in log of expenditure. Also, $lnE - lna(p)$ deflates the effect of changes in prices of other commodities on real logged income (i.e. the substitution effect in Slutsky decomposition). $b(p)$ denotes the price index or price aggregator P. $\lambda(p)$ captures nonlinearity and it is differentiable and homogenous function of degree zero in prices. Applying Roy's identity to equation (4.18), the budget share equation becomes:

$$\omega_i = \frac{\partial lna(P)}{\partial lnp_i} + \frac{\partial lnb(P)}{\partial ln\ _i}\ (ln\ ln\ E)\ +\ \frac{\partial \lambda}{\partial lnp_{ib(p)}}(ln\ ln\ E)^{\,2}$$

(3.20)

$A_i(P)$, $B_i(P)$, and $C_i(P)$ in equation (3.20) correspond to the ith in p derivative of $\partial lna(P)$ and all rank 3 exactly aggregable utility-derived demand systems in the form of equation (3.19) have $g(E)$ = $(ln\ ln\ E)^{\,2}$(see proof in Banks et *al*. (1997). Equation (3.20) is the QUAIDS specification of systems of demand equation.

For estimation purposes, Banks *et al.* (1997) constructs a simple quadratic specification consistent with the Marshallian demand function in equation (3.19). They extended Deaton and Muellbauer AIDS model specification so that $lna(p)$ has the form:

$$lna(p) = P = \alpha_0 + \sum_i^n \alpha_i ln(p_i) + \frac{1}{2}\sum_i^n \sum_j^n \Upsilon_{ij} ln(p_i) ln\left(p_j\right) \qquad (3.21)$$

and $b(p)$ is the Cobb-Douglas price aggregator, given as:

$$b(p) = \prod_{i=1}^n p_i^{\beta_i} \qquad (3.22)$$

Imposing the restrictions emanating from the neoclassical theory on the budget equation,

$$\lambda(p) = \sum_{i=0}^{n} ln(p_i) \quad (3.23)$$

The adding-up condition is satisfied if the following holds.

$$\sum_{i=1}^{k} \alpha_i = 1, \sum_{i=1}^{k} \beta_i = 0, \sum_{i=1}^{k} \lambda_i = 0 \; and \; \sum_{i=1}^{k} \gamma_i = 0 \; \forall i \quad (3.24)$$

Such that

$$\sum_{j=1}^{n} \gamma_{ji} = 0 \qquad \forall i \quad (3.25)$$

$$\gamma_{ij} = \gamma_{ji} \; \forall i \neq j \quad (3.26)$$

Thus when fitted for data, the QUAIDS specification in equation (3.20) becomes:

$$\omega_i = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} lnp_j + \beta_i ln\left\{\frac{E}{a(p)}\right\} + \frac{\lambda_i}{b(p)}\left[\left\{ln\frac{E}{a(p)}\right\}\right]^2 \quad (3.27)$$

The QUAIDS provides a model of consumer demand (through observed patterns of individual consumption) which is theoretically consistent. In particular, Banks *et al.* (1997) conducted a nonparametric analysis of individual consumption patterns that showed that specification of Engel curves is better fitted when a quadratic term in the logarithm of expenditure is introduced.

3.3.1.1 Estimation of tobacco consumption function and price elasticity of demand for tobacco

To estimate the determinants of tobacco consumption, QUAIDS was specified. Also, the methodology developed and popularised by Deaton[29] (1988, 1989, 1990 and 1997) was utilised to estimate the price elasticity of demand for tobacco/cigarette. Noting the cross-

[29]This methodology has also been adopted by Eozenou and Fishburn (2007); Grieve and van Walbeek (2015). Given the scope of this chapter, only important steps to applying Deaton's methodology to estimating prices elasticity in the absence of price data are given here. For discussion of the methodology in full, see Deaton (1997, p.296-299)

sectional[30] nature of the data utilised for the study (HNLSS[31]). Deaton's methodology can be used to estimate the percentage change in quantity consumed based on changes in unit values across clusters in the absence of price data.After accounting for the effects of quality shading and measurement errors, the aim is to regress spatial price fluctuations or spatial variance in prices against spatial variations in demand to assess the price elasticity of demand. This is achieved in a manner that is consistent with the demand theory's framework(Deaton, 1988; Crawford *et. al*, 2003).

Deaton's approach is based on two assumptions. To begin, commodity prices within the cluster are assumed to be constant. Second, there is price difference between clusters, also known as price variance between clusters. To evaluate demand elasticity, cluster means of commodity prices can be regressed against cluster means of quantities. The methodology entails for using the "unit value" (the ratio of total/group expenditure (Ei) and quantity demanded) as a proxy for product prices since In LMICs, most household expenditure surveys do not collect price data. This is expressed as:

$$v_{ic} = \frac{p_t t_{ic}}{q_{ic}} \tag{3.28}$$

where v_{ic} is the unit value of a commodity (tobacco products), $p_t t_{ic}$ is household total tobacco expenditure and q_{ic} is the quantity of tobacco consumed. It should be noted that the unit value derived in equation (3.28) is a function of the income (quality effects), household characteristics and price (Deaton, 1988).As shown in equation (3.28), there are 2 data requirements for computing unit values, but only tobacco consumption expenditure was stated in the HNLSS. As a result, the quantity consumed was calculated using the GATS data's mean quantity consumed by households. When using the unit value as a proxy for price, two methodological issues arise. According to Deaton (1997), the unit value is embedded with quality effects and measurement errors. The latter being as a result of recall bias. Likewise, quality effects borders on ‘’quality heterogeneity’’ which occurs when consumers respond to an increase in price by substituting away to another low

[30] Estimating price elasticity of demand from a cross-sectional data is in principle the degree of responsiveness of quantity demanded across clusters with respect to variation in between-cluster prices (see: Deaton,1997).
[31] Discussed in the data section

quality brand, and consequently a low price brand. This according to Deaton is referred to as ‘’quality shading’’. Therefore, if cluster means of unit values are regressed against cluster quantities, the outcome will be unit value elasticity of demand and not price elasticity of demand. Essentially, Deaton proposed how to consistently and efficiently correct the unit value elasticity of demand of quality effects and measurement errors in order to generate the price elasticity of demand. Details of how this should be done according to Deaton (1997) are as follows:

Two equations were set up, the budget share equation for tobacco consumption and a unit value equation for only the households that reported tobacco expenditure.

$$\omega_{ic} = \alpha_{1i} + \varrho_i a + \beta_{1i} lnE_{ic} + \varphi_{1i}(lnE_{ic})^2 + \theta_1 \sum_{J=1}^{N} lnP_c + f_c + u_{1ic} \quad (3.29)$$

$$lnv_{ic} = \alpha_{2i} + \varrho_i a + \beta_{2i} l_n E_{ic} + \theta_2 \sum_{J=1}^{N} lnP_c + u_{2i} \quad (3.30)$$

The demand system has J commodities such that J = 1,…,N and ω_{ic}represents the proportion of total household spending spent on tobaccoE_{ic} of household i living in cluster c and lnv_{ic} is the natural log of unit value. Also, a, lnE_{ic} and $(lnE_{ic})^2$ are a vector of demographic characteristics of households, such as household size, gender, age, education, and sector; total household expenditure logged; total household expenditure squared (for only smokers). Total household expenditure, household socio-demographic characteristics, and price determine the budget share and unit value. A price term P_c was included in the budget share and unit value equations. Even though there are no observed prices and the equations were estimated without it, the values were generated later in the analysis. The values of β_{1i} and β_{2i} was used to control for the effects of measurement error and recall bias on budget shares and the unit values. The f_c captured cluster/enumeration area fixed effects. The f_c, the food price index, was used to control for within cluster variations.

Equations (3.29) and (3.30), as well as the coefficient of logged total household expenditure, were used to account for the impacts of tobacco spending and household demographic characteristics on the household budget share of tobacco consumption and

unit value. The mean (average) of budget shares was then calculated, and the unit values of smoking households were represented as follows:

$$y_c^w = \frac{1}{n_h} \sum h \in c \, (ln\omega_{ic} - \hat{\beta}_{1i} lnE - \varrho_i a) \tag{3.31}$$

$$y_c^v = \frac{1}{n_h} \sum h \in c \, (lnv_{ic} - \hat{\beta}_{2i} lnE - \varrho_i a) \tag{3.32}$$

Equation (3.31) and (3.32) are quantities,y_c^w, and unit values,y_c^v, controlled of the impacts of household spending (quality shading) and household demographics (measurement errors). Moreover, $n_h$is the number of smoking households that made up a subset of cluster c households. This is to account for the impact of household income on budget share (demand) and unit values. This allowed the researchers to use unit values from tobacco spending to disentangle quality choice and measurement errors from the estimated unit values. In effect, y_c^w was regressed on y_c^v so that the coefficient obtained was denoted as ϕ. Subsequently, the following Deaton formulas were used to calculate the price elasticity of tobacco demand:

$$\epsilon_P = \frac{\hat{\theta}_{1i}}{\bar{w}_i} - \hat{\theta}_{2i} \tag{3.33}$$

Where $\bar{w}_i$ denotes the average budget shares of tobacco, $\hat{\theta}_{2i}$ and $\hat{\theta}_{1i}$ were generated from equations (3.29) and (3.30), and they represent the coefficients of the unobserved price and derived using the following formula:

$$\hat{\theta}_{1i} = \frac{\hat{\phi}}{1+(\bar{w}_i - \hat{\phi})\zeta} \tag{3.34}$$

$$\hat{\theta}_{2i} = 1 - \frac{\hat{\beta}_{1i}(\bar{w}_i - \hat{\theta}_{1i})}{\hat{\beta}_{2i} + \underline{\bar{w}_i}} \tag{3.35}$$

$$\zeta = \frac{\hat{\beta}_{1i}}{\hat{\beta}_{2i} + \bar{w}_i(1 - \hat{\beta}_{1i})} \tag{3.36}$$

Where $\hat{\beta}_{1i}$ and $\hat{\beta}_{2i}$ are the coefficients of the budget share equation, (3.29) and unit value equation, (3.30) and ϕ was the estimate generated when y_{hc}^{w} was regressed on y_{hc}^{v}.

3.3.1.2 Effect of tobacco consumption on the consumption of basic household goods

The QUAIDS was also used to look at the effect of tobacco spending on household welfare (as determined by basic/essential goods consumption).Furthermore, assuming separable utility functions in households, the marginal rate of substitution[32] between any two commodities in x_i (the household consumption range) is not affected by the consumption level of any commodity not in x_i, which is tobacco in this case (Black *et al.,* 2012; Eatwell *et al.,* 1987). If a household has separable tastes, the amount of money spent on all of the products in the consumption range determines the demand for a goods in the consumption bundle (Black *et al.,* 2012; Eatwell *et al.,* 1987). Any crowding out of tobacco spending, given a separable utility function and with respect to smoking initiation and strength, would mean that it causes substitution effect. In terms of execution, the crowding-out consequences of tobacco/smoking spending are comparable to the influence of price increases in Demand Theory in classic economics. The following is the specification of the QUAIDS model:

$$\omega_i = \alpha_{1i} + \alpha_{2i} d + \varrho_i a + \beta_{1i} lnM + \varphi_{1i} (lnM)^2 + \theta_1 f_c + u_{1i} \quad (3.37)$$

where $\omega_i$the expenditure share of other products and excludes tobacco spending (food, clothes, education, fruits and vegetables, communication, and leisure activities). The parameter 'a' captures household demographics such as household size, gender, age, education, and sector. Also, lnM and $(lnM)^2$ are logged total household spending less tobacco consumption expenditure and the square of logged total household expenditure less tobacco spending, respectively. The term f_c in equation (3.37) controls for unobservable characteristics which are village/cluster specific and a stochastic term u_{1i} (this disturbance term was assumed to be normally distributed). The term d is a

[32]The marginal rate of substitution depicts how much a consumer's consumption of one good would adjust in response to an increase in consumption of another good while maintaining utility.

dummy variable that takes the value of 1 or 0, depending on whether a household made tobacco expenditure or not.

According to Workings[33] (1945), equation (3.37) can be estimated consistently without prices given the assumption that market prices are invariant within villages (occupied by demographically homogeneous households). This assumption is plausible since market prices for similar commodities in most villages are often the same in developing countries. Also, the usual distance and the consequent transport costs between local markets in low-income countries prevents the possibility of arbitrage activities (Deaton, 1988, 1989, 1990, 1997; Deaton and Grimard, 1992). In effect, tobacco expenditure will be adjudge to affect the budget share of respective commodities if the coefficient of $'d'$, i.e. α_{2i}, is negative and statistically significant. Therefore, the QUAIDS specification was fitted for household consumption of food, clothing, education, fruits and vegetables, communication and recreational activities which represented a system of demand equations.

More importantly, there are three broad approaches to measuring household welfare according to Grootaert (1983). These include estimation of indexes of welfare; total household expenditure and the full income concept. The consumption of the aforementioned commodities is assumed as direct indicators and micro-determinants of household welfare as indicated in Deaton (1985; 1997). This ensures that the conceptualisation of household welfare in this study aligned with the "total household expenditure" approach. This view point assumes that household preference patterns are revealed in the consumption of goods and services and implicitly account for important components of household welfare (Grootaert, 1983). In particular, the total household expenditure approach to welfare measurement presupposes that welfare can be captured by constructing an index of household expenditure with appropriate control for price effects and effects of household size. The price effect describes the cost-of-living and according to Deaton (1980), Laspeyres Index and Paasche Index are plausible approximations/reflection of the "true cost-of-living". On the other hand, household size

[33]This functional form of Engel curves specification has been extensively used in the literature (see Leser, 1963 and Lewbel, 2010)

and composition which has also been referred to "equivalence scale" is an important determinant of household welfare. In equation (3.37), the budget share equation, cluster effect (proxied by food price index) and household size were included as covariates in line with the recommendations of the literature regarding the measurement of household welfare when implementing the total expenditure approach. Food price index is used because constructing the Laspeyres Index or the Paasche Index require the knowledge of current as well as base quantities of commodities which are not available in cross-sectional surveys. The food price index measures the volatility of the food prices faced by households in relation to other commodities and can be used as a measure of cost-of-living.

3.3.1.3 Excess health expenditure and catastrophic health spending attributable to the consumption of tobacco

The impoverishing effects of health expenditure, i.e. CHE was ascertained by adopting the 40% threshold which has been widely implemented in the literature. This threshold was used in a WHO study. Forty percent threshold in relation to household non-food expenditure is valid for assessing the impoverishing impacts of medical outlays (Daneshkohan *et al.,* 2011; WHO, 2005; K. Xu *et al.,* 2003). In this analysis, household non-food expenditure or "capacity to pay" was utilised as the denominator and total household medical spending or expenditure was used as the numerator.

The intuition behind this approach is to establish the maximum proportion of household income that ought to be devoted to purchasing healthcare goods and services. In a nutshell, monetary outlays in excess of this maximum could weigh on household income and could be detrimental to the standard of living of households in episodes of health shocks, especially for economically less viable families.

Therefore, estimating the incidence of CHE is such that households whose healthcare spending is in excess of 40 percent of total non-food expenditure were adjudged to have incurred CHE. The following formula was used to estimate the incidence of CHE among households:

$$\frac{H_e}{(E-f(e))} > z \quad (3.38)$$

where H_e was used to denote household out-of-pocket spending on medical goods and services,E, denotes total household income (in this case household expenditure was used to proxy household income) and finally $f(e)$, represents total food spending/expenditure (also known as non-discretionary expenditure). As earlier mentioned, z denotes a specific threshold which is 40% in this case) which represents the point at which spending on health care consumes a household's resources/income to the point of impoverishment.

In the second step, the prediction of medical spending or expenditure imputable to tobacco consumption expenditure was made. A model calibrating the logarithm of household health expenditure and other important covariates was utilized to achieve this. It has been observed that health expenditure data in most surveys exhibit a high degree of skewness since some household may report zero health expenditure. Likewise, medical spending can reveal high variability. Consequently, it was important to adopt a log-linear model of health expenditure which has been seen by statisticians to resolve the issues aforementioned. This methodology has been utilized in previous studies (Liu *et al.,* 2006; Xin *et al.,* 2009b).

The log-linear household medical expenditure model was specified as follows:

$$lnHE = \alpha_0 + \alpha_1 S^h + \alpha_2 a + \varepsilon \quad (3.39)$$

where $lnHE$ represents the logged household medical expenditure. Also, for estimation 1 was added to all reported health expenditure to guarantee that the reported value is a positive number and was especially necessary to solve the issue of zero medical expenditure reported by some household. The S^h denotes a dummy variable which was introduced to capture household smoking or tobacco consumption status, 1 for households with at least one member who consume tobacco and 0 was imputed for household that had no member who consumed tobacco. Likewise, a is denotes a vector of households' socio-

demographic and economic characteristics/profile. These variables include sex, age, education, and poverty status, which are necessary to account for other household characteristics that can influence medical spending.

Afterwards, a counterfactual picture for equation (3.39) was also estimated. The idea here was to predict household medical expenditure if we assume that no household member consumed tobacco products and then the ones were replaced to reflect this assumption. Consequently, the predicted medical expenditure attributable to tobacco use or to tobacco consumption was estimated thus:

$$\widehat{HE} = \widehat{HE^s} - \widehat{HE^{cf}}$$

(3.40)

where $\widehat{HE}$represents the estimated health-care costs associated with tobacco use, $\widehat{HE^s}$ is the estimated/calculated health expenditure for tobacco consuming households depicted in equation (3.39) and $\widehat{HE^{cf}}$ is the counterfactual which reflected a scenario where there is no tobacco consumption. In addition, the probability of experiencing greater CHE (which is also a measure of the impoverishing or welfare impact of tobacco consumption) was therefore ascertained by subtracting $\widehat{HE}$the ability to pay otherwise known as the capacity-to-pay in equation, derived from the denominator (3.38). The wording changes thus:

$$\frac{H_e}{(E-(f(e)+\widehat{HE})} > z$$

(3.41)

In equations (3.38) and (3.41), the reference category was households with no tobacco use in their consumption range.To assess the effect of excessive health spending on tobacco-using households, the mean excessive expenditure was applied to the mean medical spending and deducted from tobacco-using households' capacity to pay.Liu et al. (2006) and Xin et al. (2006) have applied this method (2009b).

3.3.2. A-Priori Expectation

The expectation of this study follows from the theoretical framework and the review of literature. Tobacco consumption is expected to be a function of some socio-demographic variables as well as household income. Also, the price elasticity of tobacco demand is expected to be within the inelastic range. For households with members who consume tobacco, this is expected to have impact on the consumption of other basic commodities. Finally, it is expected that smoking households may be exposed to higher health expenditure and hence, higher risks of CHE. These a-priori expectations are borne out of the earlier findings on tobacco consumption and its effects on household welfare (Liu et al. 2006;Xin et al. 2006).

3.3.3. Estimation Technique

The standard Ordinary Least Square (OLS) was used to estimate the budget share and unit value models. For the systems of demand equations, QUAIDS, the Seemingly Unrelated Regression (SURE) was used. While this is similar to the OLS estimates, it is potentially more efficient when estimating all budget shares equations simultaneously and in addition, it is robust to heteroscedasticity and serial correlation in cross-sectional data (Zellner, 1962). To fulfil the adding up condition, the budget share designated “other goods” was dropped. This approach was also adopted by earlier studies (Abdulai, 2002; Rijo, 2008, 2012; Dybczak *etal*., 2014 Chelwa, 2015. Also, OLS was used to estimate the log-linear model of health expenditure.

3.3.4. Description of variables

Table 3.1: Description of variables

Objectives	Dependent variables	Independent variables	Description
Objective 1	-Budget share of tobacco -Unit value of tobacco (as a proxy for the price of tobacco consumed)	Socio-demographic variables- sex of household head (HH), HH age in years, household size, sector (urban or rural); total household expenditure; total household expenditure squared; cluster fixed effect (f_c)	-Sex of HH- dummy variable: 1 if male and 0 if female - Sector- dummy variable, 1 if urban and 0 if rural -Unit value: tobacco expenditure divided by quantity consumed, where quantity consumed is the computed annual mean of tobacco consumed by households using GATS data. -Cluster fixed effect (f_c): The food price index reported in the data was used to capture cluster effects.
Objective 2	Budget shares of basic goods: food; education; clothing; health; energy; transportation; recreational activities; communication	Socio-demographic variables- HH sex, HH age in years, household size, sector (urban or rural); household smoking status (smk) total household expenditure less tobacco expenditure; total household expenditure less tobacco expenditure squared; cluster fixed effect	-Sex of HH- dummy variable: 1 if male and 0 if female - Sector- dummy variable, 1 if urban and 0 if rural -Household smoking status (smk)- Dummy variable: 1 if there is a member of the household who consume tobacco and 0 if otherwise - Cluster effect (f_c): The food price

			index reported in the data was used to capture cluster effects.
Objective 3	Household health expenditure	Socio-economic variables- age, sex, level of education; household smoking status (smk); household poverty status (non-poor, moderately poor and extremely poor).	-Sex of HH- dummy variable: 1 if male and 0 if female -Household smoking status (smk)- Dummy variable: 1 if there is a member of the household who consume tobacco and 0 if otherwise Poverty status: households with expenditure greater than two-thirds of the household per capita expenditure were classified as non-poor whereas those with expenditure below two-thirds of the household per capita expenditure were categorized as poor. Also, poor households further classified into extremely poor and moderately poor. Households with less than one-third of total household per capita expenditure are core-poor (extreme poor) while households with expenditure greater than one-third of per capital expenditure but less than two-thirds of the per capita expenditure were classified as moderately poor.

3.3.5. Data

The National Bureau of Statistics conducted the Harmonised Nigerian Living Standard Survey (HNLSS) in 2009/2010, provided the data for this investigation. The HNLSS is a nationally representative survey that collected detailed information on household demographics, well-being, and fertility patterns.Education and skill preparation, work and time usage, family unit income, use and use of a broad range of goods, including tobacco use (National Bureau of Statistics, 2012).This survey used the enumerated areas used in the 2006 Housing and Population Census of households and individuals conducted by the National Population Commission.The survey's sample frame included all 774 local government territories in Nigeria's 36 states, as well as Abuja, the Federal Capital Territory (FCT).A multi-stage sampling design was utilised to randomly sample 100 family units in every local government from the primary sampling units (PSUs) which formed part A of the survey. In addition, for part B of the survey, 50 households were chosen at random from each local government area. In general, section A of the survey gathered data on household standard of living, while part B of the survey gathered information on household monetary outlays for the purchase of goods and services.A total of 77,400 family units were selected for the study. The survey's B section (consumption approach) contained 38,700 nationally representative family units. This section of the survey was used for this investigation because it provided data on the consumption expenses of Nigerian families and households.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1. Introduction

This chapter presents descriptive statistics in section 4.2. Section 4.3 presents the econometrics results followed by the discussion of findings.

4.2. Descriptive Statistics

The socio-demographic characteristics of the households are shown in Table 4.1. For ease of exposition households were categorised into different poverty strata using relative poverty measures. Sixty-eight percent of the households had annual expenses that were less than two-thirds of the weighted mean per capita spending, putting them in the poor category. Poor households are evenly distributed throughout the six geopolitical zones, with the highest concentration of non-poor households in the South-West region. Clearly, there have been far more male-headed households than female-headed households. Male-headed households in rural areas had the best level of poverty (13,128) according to the UN agency. Also, a lot of households with no formal education fell inside the poor cluster.

Table 4.1: Household Socio-demographic profile and poverty status

Sociodemographic Characteristics	Non-poor		Moderately poor		Extremely Poor		Total	
	rural	urban	rural	Urban	rural	urban	rural	urban
Zone								
North Central	674	612	752	261	2903	465	4329	1338
North East	656	231	768	134	2956	221	4380	586
North West	1182	564	1417	245	4286	500	6885	1309
South East	1053	590	839	194	1706	159	3598	943
South South	1440	754	824	213	1811	245	4075	1212
South West	724	2672	556	735	895	532	2175	3939
Gender								
Female	1175	1208	814	365	1429	302	3418	1875
Male	4554	4215	4342	1417	13128	1820	22024	7452
Age								
<25	594	419	367	94	595	65	1556	578
26-35	1344	1334	1160	318	2904	331	5408	1983
36-45	1059	1139	993	405	3792	564	5844	2108
46-55	942	990	935	362	3193	499	5070	1851
56-65	887	752	868	285	2296	376	4051	1413
>65	903	789	833	318	1777	287	3513	1394
Highest Educational Level								
None	2457	1241	2752	617	8429	858	13638	2716
College Degree	257	660	130	129	209	114	596	903
Post-Secondary	423	807	303	215	791	249	1517	1271
Primary	1447	1192	1240	424	3324	485	6011	2101
Secondary	1145	1523	731	397	1804	416	3680	2336
Marital Status								
Divorced/Separated	295	323	163	68	275	58	733	449
Living together	54	29	39	13	61	10	154	52
Married Monogamous	4486	4241	4219	1426	12991	1815	21696	7482
Married Polygamous	35	56	51	19	117	26	203	101
Widowed	859	774	684	256	1112	213	2655	1243

Computed from the *HLSS, 2010.* Note: Characteristics like gender, age, highest educational level and marital status were strictly that of household head.

4.2.1. Household consumption pattern, poverty status, and smoking habits

Except for non-poor rural households, the share of food in total annual expenditure is higher than forty-fifth in Table 4.2 for all household economic situation classifications. (37.25). For all poor households, the food share is greater than five hundredth, although this is not always the case for non-poor households.Rice in all kinds, bananas, tubers, and vegetables have the highest share of food expenditure classes. Extremely poor rural households spent the least amount of money on alcohol (0.62 percent), Households in rural areas that are relatively poor (0.62 percent) are next (0.55 percent). Furthermore, tobacco and narcotics have the highest share of total household budget in poorer households, especially in very poor households (0.05 percent). In general, tobacco expenditure is low, but in moderately and very poor households, it may account for a significant portion of total annual household expenditure. Non-poor households' share of overall annual non-food spending is marginally higher than that of moderately (31.73%) and extremely poor (32.75%) urban households (41.59 percent).

The total annual household expenditure composition by smoking activity as shown in Table 4.3. Non-smoking households spend a higher proportion of their social unit budgets on rice of all types, alternative cereals, and fruits than households with at least one smoker.

When compared to the share of health spending in rural non-smoking households, however, the total share of health spending in rural smoking households is slightly higher (24 percent). Similarly, in both urban and rural settlements, Table 4.3 reveals that tobacco-dominated households spend significantly more on alcoholic drinks than non-smokers. This represents the lower proportion of basic household commodities in tobacco users' budgets relative to non-smoking households.

Table 4 compares the average household annual spending trend based on whether or not a member of the household smokes. There is evidence that tobacco use had an impact on the average household spending on the majority of food groups, regardless of the social unit's economic situation. Especially, poor household expenditure on milk, cheese, and egg was

compared among the various economic status as a result of its importance within the nutritional intake of children underneath age 10, non-smoking households spent a lot of resources on these products compared to smoking household. In both urban and rural areas, however, the average household expenditure on alcoholic beverages is higher among tobacco-using households than among non-tobacco-using households.

The implication is that tobacco and alcohol are compatible products. As such, the consumption of both commodities will reduce the remaining resources for the consumption of other welfare enhancing goods, especially among economically less viable households. This will further worsen the welfare of such households. Similarly, this impact will be further aggravated by the health implication of tobacco use and excessive alcohol consumption as established in the existing literature (Hanson and Li, 2003; Middleton *et. al.*, 2010; Sarkar *et. al*., 2015; Madapaddy *et. al*., 2018). It is also noteworthy that rural smoking households have the highest overall health-care spending.

Table 4.2: Total annual expenditure pattern by poverty status (Computed from HNLSS, 2010)

	NON-POOR				MODERATELY POOR				EXTREMELY POOR			
	URBAN		RURAL		URBAN		RURAL		URBAN		RURAL	
N	**5423**		**5729**		**1782**		**5156**		**2122**		**14557**	
	Expenditure	**Share**	**Expenditure**	**Share**	**Expenditure**	**Share**	**Expenditure**	**Share**	**Expenditure**	**Share**	**Expenditure**	**Share**
Rice in all forms	115,079,140.50	5.89	90,026,906.95	4.86	27,785,445.68	7.51	56,134,851.75	6.18	21,841,607.39	7.01	101,106,349.60	6.13
Maize grain and flours	19,828,484.66	1.01	10,765,825.43	0.58	4,595,619.93	1.24	7,423,570.98	0.82	3,707,650.58	1.19	10,938,913.28	0.66
Other cereals	20,710,182.46	1.06	13,621,934.43	0.73	5,441,659.08	1.47	11,025,560.68	1.21	5,039,179.19	1.62	20,545,418.05	1.25
Bread and the like	53,407,623.74	2.73	33,517,704.29	1.81	9,526,139.60	2.58	19,808,806.87	2.18	7,640,782.69	2.45	36,634,474.89	2.22
Bananas & tubers	149,042,580.52	7.63	86,174,461.35	4.65	31,409,355.51	8.49	52,634,363.14	5.79	24,827,162.30	7.97	91,736,891.69	5.56
Poultry	18,592,680.63	0.95	8,642,559.02	0.47	2,087,184.92	0.56	2,814,897.00	0.31	1,078,153.32	0.35	3,610,836.16	0.22
Meats	85,664,602.44	4.38	69,511,882.38	3.75	17,813,296.24	4.82	46,255,844.45	5.09	16,404,959.85	5.27	93,990,933.60	5.70
Fish & seafood	76,258,797.86	3.90	78,077,222.36	4.21	19,780,782.82	5.35	52,736,574.78	5.81	17,139,073.64	5.50	107,061,559.84	6.49
Milk, cheese & eggs	21,580,930.38	1.10	13,839,572.99	0.75	3,713,623.79	1.00	8,214,686.08	0.90	2,570,057.85	0.83	15,550,506.91	0.94
Oils, fats & oil-rich nuts	58,017,263.21	2.97	55,069,430.84	2.97	14,215,987.74	3.84	39,623,934.08	4.36	14,108,185.86	4.53	83,823,013.24	5.08
Fruits	11,196,178.67	0.57	8,531,473.77	0.46	2,098,597.81	0.57	5,543,846.78	0.61	2,053,679.33	0.66	9,355,275.69	0.57
Vegetables excludes pulses (beans & peas)	88,966,628.60	4.55	76,486,095.10	4.13	23,145,937.84	6.26	60,159,938.27	6.62	21,200,435.40	6.81	125,365,160.04	7.60
Pulses (beans & peas)	76,600,711.63	3.92	64,681,782.02	3.49	19,811,851.90	5.36	49,298,072.51	5.43	19,139,666.72	6.15	101,069,067.07	6.13
Sugar, jam, honey, chocolate & confectionary	12,117,429.50	0.62	13,053,138.93	0.70	3,348,354.16	0.91	11,147,819.11	1.23	3,109,768.96	1.00	22,175,446.28	1.34
Non-alcoholic beverages	34,886,235.86	1.79	22,696,027.07	1.22	5,490,959.84	1.48	13,914,257.76	1.53	4,203,071.00	1.35	20,888,472.56	1.27
Alcoholic beverages	7,635,299.91	0.39	9,172,291.08	0.49	1,454,190.04	0.39	5,038,033.17	0.55	1,037,446.25	0.33	10,209,519.32	0.62
Food consumed in restaurants & canteens	24,887,585.97	1.27	8,469,130.00	0.46	3,747,043.95	1.01	4,747,718.43	0.52	2,074,490.94	0.67	6,702,982.23	0.41
Food items not mentioned above	18,327,130.25	0.94	28,243,054.10	1.52	5,289,702.00	1.43	20,935,970.04	2.30	6,338,524.75	2.04	50,496,943.87	3.06
Total food expenditure	892,799,486.80	45.69	690,580,492.08	37.25	200,755,732.86	54.27	467,458,745.90	51.46	173,513,896.01	55.71	911,261,764.33	55.25
Total monetary value of education	54,502,160.31	2.79	30,670,355.88	1.65	12,075,656.63	3.26	15,736,710.36	1.73	9,447,431.75	3.03	32,032,350.57	1.94
Total monetary value of health	192,625,635.54	9.86	385,000,117.28	20.77	39,139,600.95	10.58	174,386,334.78	19.20	25,455,163.96	8.17	206,645,854.59	12.53
Total non-food exp. excl. education.& health	812,578,545.08	41.59	744,986,183.65	40.19	117,355,549.87	31.73	248,030,022.38	27.30	101,993,119.38	32.75	491,961,613.81	29.83
Total household food and non-food consumption expenditure less tobacco and narcotics	1,953,689,199.49	99.99	1,853,351,818.30	99.98	369,867,168.45	99.99	908,154,252.34	99.97	311,416,084.07	99.99	1,648,510,347.46	99.95
Tobacco products	232,967.52	0.01	467,069.85	0.03	44,683.96	0.01	296,469.19	0.03	33,527.80	0.01	774,613.58	0.05
Electricity	32,119,588.05	1.64	10,038,827.99	0.54	8,677,232.58	2.35	6,733,116.49	0.74	7,531,570.08	2.42	13,686,781.01	0.83
Gas	1,805,107.56	0.09	44,102.68	0.00	132,647.64	0.04	-	0.00	85,196.36	0.03	-	0.00
Kerosene	12,945,699.54	0.66	10,402,665.12	0.56	4,260,053.60	1.15	9,950,159.71	1.10	4,560,472.24	1.46	25,431,477.03	1.54
Petrol	21,448,889.75	1.10	9,144,617.50	0.49	2,644,365.05	0.71	4,944,011.87	0.54	1,807,519.67	0.58	7,035,516.90	0.43
Diesel	279,629.01	0.01	101,013.97	0.01	45,619.61	0.01	99,978.52	0.01	36,897.51	0.01	162,994.44	0.01
Clothing	47,232,557.52	2.42	41,221,916.53	2.22	11,255,327.68	3.04	31,731,728.77	3.49	9,517,418.43	3.06	67,846,002.93	4.11
Transportation	50,467,251.02	2.58	26,839,352.96	1.45	7,514,511.96	2.03	17,681,056.46	1.95	6,046,950.74	1.94	30,947,019.97	1.88
Recreation and culture	9,810,955.89	0.50	7,862,879.31	0.42	2,046,660.40	0.55	5,115,503.47	0.56	1,575,317.22	0.51	8,726,126.40	0.53
Communication	52,160,225.28	2.67	24,584,223.50	1.33	10,306,129.76	2.79	13,830,935.63	1.52	6,697,213.11	2.15	23,406,928.22	1.42
Total household expenditure	1,953,933,328.70	100	1,853,814,116.55	100	369,914,999.53	100	908,449,616.15	100	311,450,329.61	100	1,649,285,524.85	100

Table 4.3: Total annual expenditure pattern by smoking habit (Computed from HNLSS, 2010)

	SMOKER				NON SMOKER			
	URBAN		RURAL		URBAN		RURAL	
N	87		418		9240		25024	
	Expenditure	Share	Expenditure	Share	Expenditure	Share	Expenditure	Share
Rice in all forms	1,207,713.78	4.86	3,348,089.28	4.65	163,498,479.78	6.26	243,920,019.02	5.62
Maize grain and flours	138,481.18	0.56	613,819.85	0.85	27,993,273.98	1.07	28,514,489.83	0.66
Other cereals	101,776.41	0.41	647,209.98	0.90	31,089,244.32	1.19	44,545,703.19	1.03
Bread and the like	589,951.35	2.37	1,504,920.98	2.09	69,984,594.68	2.68	88,456,065.07	2.04
Bananas & tubers	1,692,102.11	6.81	3,631,114.87	5.04	203,586,996.23	7.80	226,914,601.31	5.23
Poultry	180,836.87	0.73	501,998.04	0.70	21,577,182.00	0.83	14,566,294.14	0.34
Meats	896,318.68	3.61	3,624,950.82	5.04	118,986,539.85	4.56	206,133,709.60	4.75
Fish & seafood	1,329,602.39	5.35	4,653,953.96	6.47	111,849,051.92	4.28	233,221,403.02	5.37
Milk, cheese & eggs	200,388.79	0.81	683,503.08	0.95	27,664,223.24	1.06	36,921,262.89	0.85
Oils, fats & oil-rich nuts	573,646.59	2.31	1,824,039.17	2.53	85,767,790.22	3.29	176,692,338.99	4.07
Fruits	114,438.86	0.46	371,543.89	0.52	15,234,016.94	0.58	23,059,052.35	0.53
Vegetables excludes pulses (beans & peas)	958,112.29	3.85	3,402,814.10	4.73	132,354,889.55	5.07	258,608,379.31	5.96
Pulses (beans & peas)	961,212.91	3.87	3,423,246.36	4.76	114,591,017.34	4.39	211,625,675.24	4.88
Sugar, jam, honey, chocolate & confectionary	143,541.04	0.58	402,724.24	0.56	18,432,011.58	0.71	45,973,680.07	1.06
Non-alcoholic beverages	424,189.21	1.71	1,296,953.01	1.80	44,156,077.50	1.69	56,201,804.38	1.30
Alcoholic beverages	678,601.78	2.73	2,156,346.24	3.00	9,448,334.43	0.36	22,263,497.34	0.51
Food consumed in restaurants & canteens	546,578.87	2.20	714,702.01	0.99	30,162,542.00	1.16	19,205,128.65	0.44
Food items not mentioned above	175,581.83	0.71	873,995.36	1.21	29,779,775.16	1.14	98,801,972.64	2.28
Total food expenditure	10,913,074.95	43.90	33,675,925.26	46.78	1,256,156,040.72	48.12	2,035,625,077.05	46.91
Total monetary value of education	522,310.28	2.10	1,447,990.57	2.01	75,502,938.41	2.89	76,991,426.24	1.77
Total monetary value of health	2,238,480.78	9.00	17,401,957.78	24.18	254,981,919.67	9.77	748,630,348.88	17.25
Total non-food consumption expenditure excluding education and health	11,146,696.21	44.84	19,742,663.28	27.43	1,020,780,518.11	39.10	1,465,235,156.56	33.76
Total household food and non-food consumption expenditure less tobacco products	24,533,389.76	98.69	70,447,506.57	97.87	2,610,439,062.25	100.00	4,339,568,911.53	100.00
Tobacco products	311,179.28	1.25	1,538,152.62	2.14	-	0.00	-	0.00
Electricity	223,877.93	0.90	756,149.20	1.05	48,104,512.79	1.84	29,702,576.28	0.68
Gas	-	0.00	-	0.00	2,022,951.55	0.08	44,102.68	0.00
Kerosene	197,403.27	0.79	652,730.28	0.91	21,568,822.11	0.83	45,131,571.58	1.04
Petrol	173,997.28	0.70	720,273.08	1.00	25,726,777.19	0.99	20,403,873.19	0.47
Diesel	-	0.00	-	0.00	362,146.13	0.01	363,986.93	0.01
Clothing	388,605.11	1.56	2,582,690.14	3.59	67,616,698.51	2.59	138,216,958.09	3.19
Transportation	529,149.57	2.13	1,680,396.80	2.33	63,499,564.15	2.43	73,787,032.59	1.70
Recreation and culture	128,569.85	0.52	694,305.37	0.96	13,304,363.65	0.51	21,010,203.80	0.48
Communication	737,903.03	2.97	1,221,825.67	1.70	68,425,665.12	2.62	60,600,261.67	1.40
Total household expenditure	24,859,595.60	100	71,980,346.02	100	2,610,439,062.25	100	4,339,568,911.53	100

Table 4.4: Average/per capita annual expenditure pattern by smoking habit (Computed from HNLSS, 2010)

	SMOKER				NON SMOKER			
	URBAN		RURAL		URBAN		RURAL	
N	87		418		9240		25024	
	Expenditure	Share	Expenditure	Share	Expenditure	Share	Expenditure	Share
Rice in all forms	1,207,713.78	4.86	3,348,089.28	4.65	163,498,479.78	6.26	243,920,019.02	5.62
Maize grain and flours	138,481.18	0.56	613,819.85	0.85	27,993,273.98	1.07	28,514,489.83	0.66
Other cereals	101,776.41	0.41	647,209.98	0.90	31,089,244.32	1.19	44,545,703.19	1.03
Bread and the like	589,951.35	2.37	1,504,920.98	2.09	69,984,594.68	2.68	88,456,065.07	2.04
Bananas & tubers	1,692,102.11	6.81	3,631,114.87	5.04	203,586,996.23	7.80	226,914,601.31	5.23
Poultry	180,836.87	0.73	501,998.04	0.70	21,577,182.00	0.83	14,566,294.14	0.34
Meats	896,318.68	3.61	3,624,950.82	5.04	118,986,539.85	4.56	206,133,709.60	4.75
Fish & seafood	1,329,602.39	5.35	4,653,953.96	6.47	111,849,051.92	4.28	233,221,403.02	5.37
Milk, cheese & eggs	200,388.79	0.81	683,503.08	0.95	27,664,223.24	1.06	36,921,262.89	0.85
Oils, fats & oil-rich nuts	573,646.59	2.31	1,824,039.17	2.53	85,767,790.22	3.29	176,692,338.99	4.07
Fruits	114,438.86	0.46	371,543.89	0.52	15,234,016.94	0.58	23,059,052.35	0.53
Vegetables excludes pulses (beans & peas)	958,112.29	3.85	3,402,814.10	4.73	132,354,889.55	5.07	258,608,379.31	5.96
Pulses (beans & peas)	961,212.91	3.87	3,423,246.36	4.76	114,591,017.34	4.39	211,625,675.24	4.88
Sugar, jam, honey, chocolate & confectionary	143,541.04	0.58	402,724.24	0.56	18,432,011.58	0.71	45,973,680.07	1.06
Non-alcoholic beverages	424,189.21	1.71	1,296,953.01	1.80	44,156,077.50	1.69	56,201,804.38	1.30
Alcoholic beverages	678,601.78	2.73	2,156,346.24	3.00	9,448,334.43	0.36	22,263,497.34	0.51
Food consumed in restaurants & canteens	546,578.87	2.20	714,702.01	0.99	30,162,542.00	1.16	19,205,128.65	0.44
Food items not mentioned above	175,581.83	0.71	873,995.36	1.21	29,779,775.16	1.14	98,801,972.64	2.28
Total food expenditure	10,913,074.95	43.90	33,675,925.26	46.78	1,256,156,040.72	48.12	2,035,625,077.05	46.91
Total monetary value of education	522,310.28	2.10	1,447,990.57	2.01	75,502,938.41	2.89	76,991,426.24	1.77
Total monetary value of health	2,238,480.78	9.00	17,401,957.78	24.18	254,981,919.67	9.77	748,630,348.88	17.25
Total non-food consumption expenditure excluding education and health	11,146,696.21	44.84	19,742,663.28	27.43	1,020,780,518.11	39.10	1,465,235,156.56	33.76
Total household food and non-food consumption expenditure less tobacco	24,533,389.76	98.69	70,447,506.57	97.87	2,610,439,062.25	100.00	4,339,568,911.53	100.00
Tobacco products	311,179.28	1.25	1,538,152.62	2.14	-	0.00	-	0.00
Electricity	223,877.93	0.90	756,149.20	1.05	48,104,512.79	1.84	29,702,576.28	0.68
Gas	-	0.00	-	0.00	2,022,951.55	0.08	44,102.68	0.00
Kerosene	197,403.27	0.79	652,730.28	0.91	21,568,822.11	0.83	45,131,571.58	1.04
Petrol	173,997.28	0.70	720,273.08	1.00	25,726,777.19	0.99	20,403,873.19	0.47
Diesel	-	0.00	-	0.00	362,146.13	0.01	363,986.93	0.01
Clothing	388,605.11	1.56	2,582,690.14	3.59	67,616,698.51	2.59	138,216,958.09	3.19
Transportation	529,149.57	2.13	1,680,396.80	2.33	63,499,564.15	2.43	73,787,032.59	1.70
Recreation and culture	128,569.85	0.52	694,305.37	0.96	13,304,363.65	0.51	21,010,203.80	0.48
Communication	737,903.03	2.97	1,221,825.67	1.70	68,425,665.12	2.62	60,600,261.67	1.40
Total household expenditure	24,859,595.60	100	71,980,346.02	100	2,610,439,062.25	100	4,339,568,911.53	100

Table 4.5 presents the difference in mean budget share of essential goods in the total budget (total expenditure) of smoking and non-smoking households. A negative mean budget share difference implies that smoking households consumed more of the respective commodity compared to non-smoking households and vice versa.

The "Food" category was disaggregated into "food less vegetable, fruit and milk (FIVFM)" and "vegetable, fruits and milk (VFM)" because of the health importance of the latter and to compare the level of consumption of these components among smokers and non-smokers. Households that reported tobacco expenditure spent more on FIVFM, transportation, recreational activities, and communication compared to households that reported no smoking expenditure, although the difference in the share of FIVFM is not significant in the rural and urban samples. However, non-smoking households spent more on VFM, education, clothing, energy (in the full and urban samples), and on other non-food. This result is expected because it validates the findings of scholars who believe that smoking has a negative impact on household nutritional status.

The differences in budget share on VFM, clothing, health, and recreational activities were statistically significant at 1%. A few conclusions can be drawn from this. First, although the re-allocation of household resources can be from the consumption of any other commodities, however, smokers can benefit more by diverting the portion of their budget devoted to tobacco consumption into increasing their intake of VFM which have been found to provide substantial health gains (James *et al*., 1997; He et al., 2007; Hartley *et al*., 2013) and are considered healthy foods (Guenther *et al.*, 2013). Nevertheless, it can also be argued that smokers derive satisfaction from smoking and may not have any incentive to quit smoking and therefore it becomes difficult to convince such individuals to divert the portion of their resource devoted towards tobacco consumption to consuming other commodities that improve their health.

In particular, high consumption of vegetables and fruits has been researched to reduce the likelihood of coming down with several NCDs. For instance, a study that investigated the global burden of disease attributable to low consumption of vegetables and fruits estimated that about 2.635 million deaths occur yearly worldwide and are associated with an inadequate level of vegetable and fruit intake (Lock *et al*., 2004). The study revealed that an increase in daily intake

of vegetables and fruits has the potential to reduce the burden of ischemic heart diseases and ischemic stroke, among other diseases, by 13% and 19%, respectively (Locket *et al*., 2004).

Likewise, milk intake remains a vital component of the nutrition of households, especially for families with children that are below the age 12. Within those ages, children need adequate consumption of milk for their growth and development. Block and Webb (2009) conducted a study that examined tobacco consumption and child malnutrition in developing countries. They found a statistically significant reduction in child nutritional status among households with at least one smoker.

Second, smoking households reported higher expenditure on health and continuous tobacco consumption could predispose them to severe ill-health. This will necessitate that they demand more medical services with spill-over impacts on the consumption of other basic and essential household commodities. Overall, smokers can better their welfare by quitting and redirecting tobacco spending towards consuming commodities that is beneficial to their health.

Table 4.5: Difference in average budget share allocated to consumption of goods between tobacco consuming and non-consuminghouseholds by Sector

Budget Share	Full	Rural	Urban
Food less veg., fruit and milk	-1.4768* [0.8674]	-1.2940 [0.9868]	-2.5774 [1.8764]
Veg., fruits and milk	1.3434*** [0.3041]	1.3927*** [0.3514]	1.6733*** [0.6133]
Education	0.2466 [0.2828]	0.0860 [0.2857]	0.4506 [0.8068]
Clothing	2.3414*** [0.4083]	2.8520*** [0.4844]	1.7503*** [0.6660]
Health	-1.4332*** [0.3649]	-1.6595*** [0.4045]	-0.0667 [0.8573]
Energy	0.2695 [0.2669]	-0.2125 [0.2732]	1.4960** [0.7283]
Transportation	-0.4585** [0.2027]	-0.5396** [0.2229]	-0.5010 [0.4831]
Recreational Activities	-0.7169*** [0.1021]	-0.8229*** [0.1098]	-0.2442 [0.2595]
Communication	-0.1861 [0.1716]	-0.2641 [0.1789]	-0.6973 [0.4435]
Tobacco	-2.3448*** [0.0160]	-2.4761*** [0.0197]	-1.7138*** [0.0195]
Other Non-food	0.3860 [0.5123]	0.1755 [0.5398]	0.2417 [1.3501]

Note: Figures in square brackets are the corresponding standard errors. The ***, ** and * indicate statistical significance at 1%, 5% and 10% level, respectively.

Table 4.6 shows the difference in mean budget shares between households with at least one smoker and households with no smokers. This was compared by sector/location (rural or urban). In all the samples- full, rural, and urban, households with at least one smoker expended more on food, health care, transportation, recreational activities, communication, and tobacco. On the other hand, households with no smokers had higher spending on clothing, VFM, energy, and education. The difference in the mean budget shares of VFM and clothing is significant at 1% in all the samples.

Table 4.6 reports differentials in mean budget shares in percentages among smoking and smoking households. This shows a similar trend to that revealed in table 4.5. Smokers devoted a higher percentage of their total expenditure to consuming FIVFM, recreational activities, and transportation compared to non-smoking households. In contrast, non-smoking households spent a greater portion of their total expenditure on VFM, education (human capital), clothing, and other non-food commodities.

Table 4.6: Average budget shares (in percentage) between tobacco consuming and non-consuming households

	Full	Rural		Urban	
		Non-smoker	Smoker	Non-smoker	Smoker
Number of Households	34,769	25,024	418	9,240	87
Food less veg., fruits and milk	47.36 [19.35] (0.00 , 100.00)	47.24 [20.03] (0.00 , 100.00)	48.53 [18.61] (1.26 , 84.70)	47.63 [17.42] (0.00 , 100.00)	50.21 [17.45] (5.20 , 84.47)
Veg., fruits and milk	8.96 [6.79] (0.00 , 100.00)	9.25 [7.13] (0.00 , 100.00)	7.85 [6.74] (0.00 , 98.28)	8.24 [5.71] (0.00 , 99.98)	6.57 [3.36] (0.00 , 14.67)
Education	1.77 [6.31] (0.00 , 92.30)	1.50 [5.79] (0.00 , 92.30)	1.41 [6.27] (0.00 , 83.17)	2.50 [7.51] (0.00 , 89.55)	2.05 [4.81] (0.00 , 28.08)
Clothing	8.21 [9.11] (0.00 , 86.93)	9.13 [9.87] (0.00 , 86.93)	6.28 [6.62] (0.00 , 43.70)	5.83 [6.20] (0.00 , 72.02)	4.08 [4.47] (0.00 , 23.41)
Health	3.24 [8.14] (0.00 , 93.06)	3.36 [8.12] (0.00 , 92.84)	5.02 [12.27] (0.00 , 93.06)	2.86 [7.97] (0.00 , 91.01)	2.93 [6.17] (0.00 , 39.05)
Energy	4.29 [5.95] (0.00 , 86.11)	3.78 [5.52] (0.00 , 86.11)	3.99 [6.54] (0.00 , 56.67)	5.71 [6.78] (0.00 , 65.95)	4.21 [3.81] (0.00 , 15.70)
Transportation	2.24 [4.52] (0.00 , 87.43)	2.03 [4.52] (0.00 , 87.43)	2.57 [4.18] (0.00 , 26.35)	2.79 [4.49] (0.00 , 71.55)	3.30 [4.17] (0.00 , 20.22)
Recreational Activities	0.54 [2.28] (0.00 , 77.07)	0.51 [2.16] (0.00 , 67.91)	1.33 [4.80] (0.00 , 54.98)	0.58 [2.41] (0.00 , 77.07)	0.82 [2.22] (0.00 , 13.53)
Communication	1.81 [3.83] (0.00 , 83.13)	1.39 [3.64] (0.00 , 83.13)	1.65 [2.94] (0.00 , 19.35)	2.95 [4.11] (0.00 , 55.23)	3.65 [4.75] (0.00 , 26.91)
Tobacco	0.03 [0.45] (0.00 , 23.46)	0.00 [0.00] (0.00 , 0.00)	2.48 [3.12] (0.05 , 23.46)	0.00 [0.00] (0.00 , 0.00)	1.71 [1.88] (0.05 , 9.54)
Other Non-food	14.11 [11.43] (0.00 , 100.00)	13.57 [10.95] (0.00 , 100.00)	13.39 [10.42] (0.18 , 54.07)	15.61 [12.53] (0.00 , 100.00)	15.37 [12.93] (1.38 , 63.09)

Note: Figures in square brackets are the standard error of the estimates, while those in parenthesis are the interval estimates of the corresponding mean.

Table 4.7: Mean budget shares in percentages by household poverty status

	Non-Poor		Moderately Poor		Extremely Poor	
	Rural	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**
Food less veg., fruits & milk	52.13 [29.07] (0.00 , 100.00)	50.65 [24.40] (0.01 , 100.00)	46.06 [22.56] (0.90 , 98.36)	45.33 [19.55] (1.64 , 95.61)	49.14 [17.51] (0.76 , 97.76)	48.28 [16.02] (1.44 , 94.61)
veg., fruits & milk	10.03 [16.71] (0.00 , 100.00)	8.78 [12.92] (0.00 , 99.98)	8.02 [7.30] (0.07 , 94.76)	7.39 [6.31] (0.04 , 93.64)	9.91 [6.55] (0.00 , 90.34)	8.51 [4.85] (0.13 , 73.93)
Education	15.40 [21.84] (0.00 , 92.30)	8.11 [9.83] (0.00 , 54.92)	10.99 [17.17] (0.02 , 77.43)	14.23 [15.67] (0.01 , 72.24)	7.72 [10.77] (0.00 , 85.19)	9.67 [11.90] (0.00 , 89.55)
Clothing	5.32 [7.70] (0.00 , 85.10)	4.32 [4.89] (0.00 , 49.54)	6.46 [6.85] (0.02 , 61.14)	5.14 [5.04] (0.04 , 52.37)	9.83 [9.99] (0.01 , 86.93)	6.34 [6.36] (0.00 , 72.02)
Health	25.71 [27.85] (0.00 , 93.06)	16.09 [20.56] (0.00 , 85.70)	22.38 [19.69] (0.05 , 87.21)	17.53 [19.72] (0.01 , 91.01)	7.71 [8.15] (0.02 , 87.07)	6.10 [7.75] (0.04 , 72.38)
Energy	3.16 [4.71] (0.00 , 31.04)	6.10 [7.36] (0.00 , 38.45)	3.65 [6.06] (0.05 , 71.95)	6.21 [7.96] (0.04 , 57.49)	5.18 [5.87] (0.07 , 86.11)	6.32 [6.65] (0.03 , 65.95)
Transportation	4.27 [7.46] (0.00 , 70.02)	4.21 [5.70] (0.00 , 71.55)	5.26 [5.82] (0.06 , 73.45)	5.37 [5.38] (0.06 , 47.86)	5.70 [5.98] (0.00 , 87.43)	5.17 [4.87] (0.00 , 42.87)
Recreational activities	1.96 [3.87] (0.00 , 34.44)	1.24 [2.03] (0.00 , 12.21)	2.14 [4.04] (0.00 , 28.95)	2.07 [5.25] (0.00 , 77.07)	2.14 [4.10] (0.00 , 67.91)	2.05 [4.08] (0.00 , 59.65)
Communication	3.66 [4.16] (0.00 , 31.28)	4.70 [4.70] (0.00 , 29.80)	5.12 [6.68] (0.02 , 64.88)	5.00 [4.67] (0.07 , 54.16)	5.47 [5.31](0.03 , 83.13)	5.35 [4.13] (0.08 , 55.23)

Note: Figures in square brackets are standard error of the estimates, while those in parenthesis are the interval estimates of the corresponding mean

Table 4.7 shows the mean expenditure shares in percentages by household poverty status. The share of household expenditure devoted to FIVFM (rural households: 52.13%, urban households: 50.65%) was the highest among non-poor households compared with moderately and extremely poor households. For the VFM category, non-poor households expended 10.03% of their household resources on average which was also higher than that spent by poor households. This pattern was similar for education and health. About 15.40% of household total expenditure was expended on the average for educational purposes among economically viable households residing in rural locations while moderately and extremely poor households residing in similar settings devoted 10.99% and 7.72% of their household resources, respectively. Likewise, non-poor households in rural locations spent 25.71% as a share of total expenditure towards medical consumption which was also higher than that expended by poor households residing in a rural location. However, moderately poor households residing in rural (22.38%) or urban (17.58%) centres reported higher health expenditure on average compared with urban non-poor households (16.09%). Similarly, poor households (moderately and extremely poor households) devoted higher expenditure as share total household resources to communication compared with non-poor households.

4.3. Econometrics results

4.3.1. Tobacco consumption function and price elasticity of demand for tobacco

Table 4.8: Estimates of tobacco consumption function and unit value equation

Variables	Full	Rural	Urban
	Budget Share		
HH_{size}	-0.1450** [0.0623]	-0.1309* [0.0700]	-0.1279 [0.1382]
HH_{age}	-0.1065 [0.1346]	-0.1080 [0.1507]	-0.1716 [0.2923]
HH_{hgh_edu}	-0.0054 [0.0972]	-0.0776 [0.1087]	0.2983 [0.2111]
urban	-0.2544** [0.1244]		
lnE	-0.5252*** [0.0629]	-0.5259*** [0.0668]	-0.5655*** [0.1948]
fixed effect	-2.5887*** [0.3166]	-2.2455*** [0.3553]	-4.1160*** [0.6911]
Constant	2.8190*** [0.8178]	2.8067*** [0.8789]	3.1626 [2.4675]
Number of Households	505	418	87
R-squared	0.2962	0.2777	0.4046
Adj R-squared	0.2877	0.269	0.3678
F(6, 498)	34.93***	31.69***	11.01***
	Unit Value		
HH_{size}	-0.1483** [0.0635]	-0.1337* [0.0714]	-0.1348 [0.1399]
HH_{age}	-0.1083 [0.1371]	-0.1098 [0.1538]	-0.1722 [0.2957]
HH_{hgh_edu}	-0.0051 [0.0990]	-0.0782 [0.1110]	0.3022 [0.2136]
urban	-0.2638** [0.1268]		
lnE	0.4672*** [0.0641]	0.4661*** [0.0682]	0.4332** [0.1970]
fixed effect	-2.6610*** [0.3226]	-2.3197*** [0.3626]	-4.1755*** [0.6992]
Constant	-5.0236*** [0.8333]	-5.0298*** [0.8970]	-4.7697* [2.4965]
Number of Households	505	418	87
R-squared	0.1825	0.1599	0.351
Adj R-squared	0.1727	0.1497	0.3109
F(6, 498)	18.53***	15.69***	8.76***

Note: HH denotes household and socio-demographic factors like age and education are solely those of the household head. *In E* stands for the natural log of household spending. Figures in square brackets are the corresponding standard errors. The ***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively.

The findings of the tobacco consumption equation and unit value models are shown in Table 4.8. Household size, location, household total spending, and cluster fixed effects were all significant drivers of tobacco use in the whole sample of the budget share regression (all households with at least one individual who consumed tobacco).Only household expenditure and cluster fixed effects were significant variables in both rural and urban populations. In all of the samples, the coefficient of household expenditures is negative and statistically significant (full, rural, and urban). This suggests a link between tobacco usage and total household spending that is negative. This outcome is similar to what has been found in earlier research. In India, Rijo (2008) calculated the price elasticity of tobacco products. To assess the expenditure share of tobacco, he utilised unit value to proxy the prices of the various tobacco products purchased, demonstrating that household spending was a major covariate. The coefficient on the log of total household expenditure, on the other hand, was positive, implying that as spending grew, smoking increased among tobacco-using households.

Chelwa (2015) estimated a tobacco consumption function for Uganda and showed that household tobacco spending/consumption had a negative influence on the consumption of basic household items, even though this conclusion is compatible with economic theory, in which the quantity consumed grows as wealth rises.This conclusion could also imply that lower-income households smoked more than higher-income households since household spending is still the most often used proxy for household income in the economics literature. Several studies have found that impoverished people/households are more likely than wealthy people/households to smoke.Efroymson et al. (2001) conducted a study in Bangladesh on the consequences of tobacco usage on the poor. Economically disadvantaged individuals/households were twice as likely to smoke as wealthy households, according to their findings.

Table 4.8 also showed that covariates such as the household head's age and level of education had no bearing on tobacco use/consumption. Other variables are significantly correlated with tobacco consumption in Nigeria, according to the R-squared statistics for complete, urban, and rural samples (0.2962, 0.4046, and 0.2777) in this study.Just about 40% of the heterogeneity in smoking behavior in the urban sample could be explained by the model's covariates.This is in

contrast to results from earlier research in developed countries (Rijo, 2008; Chelwa, 2015). Variables like household income/expenditure, household size, and cluster level effects (prices and tastes/preferences) account for about 80% of tobacco consumption behavior among smoking families, according to these studies (Rijo, 2008; Chelwa, 2015).Nonetheless, household size, total expenditures, and cluster fixed effects are all major predictors of tobacco consumption in Nigeria, according to this study.

Other social factors that have been strongly linked to tobacco consumption but are not captured in the model (tobacco consumption function) include peer pressure and smoking history (i.e. the influence of smoking behaviour of parents or close family members on children).For example, Cohen *et al.* (1994) investigated the impact of the parental activity on the onset of tobacco and alcohol use. They discovered that the two variables had a strong relationship. This variable could not be included in the tobacco consumption function because the data for this study did not elicit information on respondents' history of parental tobacco use.The high degree of variability in the data used in the study may be another explanation for the tobacco consumption model's low predictive capacity. In the statistical literature, data sets with a high degree of uncertainty have been found to affect the predictive ability of models (Tedeschi, 2005).

The covariates in the unit value regression followed the same trend as those in the tobacco consumption model. In the full sample of the model, household size, age and level of education, area, and household total expenditure were all important covariates.However, household spending and cluster fixed effects were the only relevant variables in rural and urban sub-samples. Deaton (1997), on the other hand, looked at cross-sectional data from developed countries and found evidence that these variables account for a significant portion of the differences in the unit value.

Table 4.9: Conditional price elasticity of tobacco demand

Statistic	Full	Rural	Urban
$\hat{E}_p$	-0.6247***	-0.6331***	-0.4895***
	[0.0028]	[0.0035]	[0.0247]
	(-0.6301 , -0.6192)	(-0.6401 , -0.6262)	(-0.5387 , -0.4403)
Number of Households	505	418	87

Note: The table shows price elasticity of tobacco demand (the effect of a change in unit value/price on the quantity of tobacco demanded), with standard errors in square brackets and the 95 percent confidence interval in parenthesis. Bootstrap samples were used to obtain these statistics. At the 1% mark, the *** denotes statistical significance.

Table 4.9 reveals statistically significant conditional price elasticity of tobacco demand for complete (-0.62), rural (-0.63), and urban (-0.49) samples in Nigeria. This means that tobacco demand is relatively inelastic in terms of price. Bootstrap samples were used to measure the standard errors and conditional price elasticity of tobacco demand.As the price of tobacco increases, the quantity demanded decreases, but not proportionally, according to the estimated price elasticity defined in classic economics. These statistics, for example, show that for every 5% increase in tobacco prices, the quantity of tobacco demanded in the full and rural samples drops by about 3%.

The corresponding reduction in tobacco demand in the urban sample (among smokers living in cities) will be around 2%. In this case, the tobacco industry/manufacturers will pass on a large portion of any increase in the excise tax on tobacco products to consumers. Almost all of the research on the price elasticity of tobacco products in developing countries and some developed countries has been conducted in developing countries.

Townsend (1996) investigated the connection between own-price and tobacco use in the United Kingdom (UK). She discovered figures ranging from -0.2 to -0.9, with the majority of them clustering around -0.5. According to the study's findings, every 1% rise in tobacco excise tax results in a 0.5 percent decrease in tobacco usage. In an analysis of tobacco taxes in developing countries, Chaloupka et al. (2000) discovered that the price elasticity of tobacco products had minimum and maximum values of -0.50 and -1.00.

However, estimates from developed countries showed lower prices, ranging from -0.25 to -0.50, implying that higher-income smokers are less likely than lower-income smokers to respond to price increases. Other research has found that poorer smokers are more vulnerable to price rises in tobacco products.

Cigarette excise taxes are also progressive, implying that they are progressive. Eozenou et al. (2001) measured the price elasticity of cigarette demand in Vietnam and found it to be about -0.53. According to the Rijo and Chelwa studies, the own-price elasticity of tobacco products ranged from -0.40 to -0.90 and -0.26 and -0.41, respectively.Guindon et al. (2001) researched in

India to determine the impact of cigarette taxes on different socioeconomic groups.Selvaraj et al. (2015) found that poorer consumers are more susceptible to price fluctuations in a study on the price elasticity of tobacco products in India. With a price elasticity of -0.43, poorer households had the highest price elasticity for bidi (a common tobacco product in India).

4.3.2. The impact of tobacco consumption on basic household goods

To estimate the budget shares for the different commodity categories, a correlation test was conducted and results revealed that there exists no collinearity between variables (see: appendix IV). The main diagonal of the correlation matrix, the line showing 1s from top left to bottom right indicates that there is a perfect correlation between the same variable. However, the cross coefficients (i.e. coefficients showing linear relationships between variables) reveal that there exists no correlation between all the variables except for the coefficients on $ln\ M$and $(lnM)^2$. As shown in the methodology, Mrepresents total household expenditure less tobacco spending. The correlation of these two variables was expected since it was inserted to capture Engel curvature (Banks, 1998).

Table 4.10: Estimates of the coefficient of tobacco consumption (*d*) in budget share equations by Sector

Budget Share	**Full**	**Urban**	**Rural**
Food less veg., fruits and milk	0.0151* [0.0084]	0.0211 [0.0179]	0.0114 [0.0095]
Veg., fruits and milk	-0.0102*** [0.0029]	-0.0158*** [0.0053]	-0.0091*** [0.0033]
Education	-0.0032 [0.0027]	-0.0047 [0.0074]	-0.0029 [0.0028]
Clothing	-0.0139*** [0.0041]	-0.0142** [0.0069]	-0.0152*** [0.0048]
Health	0.0067* [0.0035]	0.0022 [0.0084]	0.0055 [0.0038]
Energy	0.0009 [0.0028]	-0.0122 [0.0075]	0.0057** [0.0028]
Transportation	0.0040* [0.0021]	0.0042 [0.0049]	0.0046** [0.0023]
Recreational Activities	0.0074*** [0.0010]	0.0022 [0.0026]	0.0085*** [0.0011]
Communication	-0.0015 [0.0017]	0.0038 [0.0046]	-0.0016 [0.0018]

Note: Figures in square brackets are the corresponding standard errors. The ***, ** and * indicate statistical significance at 1%, 5% and 10% level, respectively. This table reports the impact of household smoking status on the consumption of basic goods. See appendix V for complete result.

Table 4.10 shows estimates of the impact of tobacco consumption with regards to the consumption of welfare enriching goods and services among urban and rural residents. As described in the methodology chapter, a negative and statistically significant coefficient on $'d'$ shows that the consumption of tobacco crowds/reduces the consumption of basic goods. Essentially, tobacco spending impacted negatively on the consumption of VFM and clothing in all the samples (full, urban, and rural). As seen in the descriptive analysis earlier, tobacco use had a positive impact on the consumption of FlVFM, health, energy, transportation, recreational activities, and communication. However, the impact of tobacco use on health was not significant for households residing in urban and rural locations. Likewise, the coefficient on $'d'$ was negative for education in all the samples but was not statistically significant. The trend of the effect of tobacco consumption was similar in all the samples.

This finding is similar to the one reported in John *et al.,* (2011). The study assessed the relationship between household tobacco expenditure and resource allocation in Cambodia and found that tobacco consumption displaced spending on education and clothing.Table 4.11 presents the impact of tobacco consumption on the budget shares of other commodities concerning households' poverty status. Estimates showed that the crowding out effect of tobacco spending is felt more by extremely poor households. Tobacco consumption displaced the consumption of FlVFM, VFM, clothing, education, and communication, and this impact was statistically significant for FlVFM, VFM, and clothing. Likewise, the budget shares of the majority of the basic household commodities were affected due to tobacco use. Although these effects were minimal and not statistically significant. For non-poor households, tobacco consumption had an insignificant impact on the consumption of VFM, health, and energy.

A similar study conducted by Efroymson *et al.,* (2001) investigated the economic impact of tobacco consumption on the poor in Bangladesh. They found that on average, tobacco spending affected food consumption and that households with at least one smoker could add 500 calories to the feeding of children if they divert tobacco expenditure to doing so.

Likewise, Wang *et al.* (2005) evaluated the relationship between tobacco expenditure and household consumption patterns in rural China. Evidence provided in their study indicated that smoking has the potential to displace the consumption of basic needs such as food, utilities, and durable goods, especially among poor households. Pu *et al.* (2008) investigated the crowding-out effects of tobacco and alcohol expenditure shares in Taiwan. Their study revealed that households with the lowest yearly income were the most vulnerable to forgoing the consumption of basic goods due to tobacco and alcohol consumption.

Table 4.11: Estimates of the coefficient of tobacco consumption (*d*) in budget share equations by poverty status

Budget Share	**Extremely Poor**	**Moderately Poor**	**Non Poor**
Food less veg, fruits and milk	-0.0186** [0.0088]	-0.0045 [0.0280]	0.0299 [0.0704]
Veg. fruits and milk	-0.0102*** [0.0031]	-0.0065 [0.0080]	-0.0169 [0.0201]
Education	-0.0040 [0.0028]	0.0059 [0.0096]	0.0097 [0.0280]
Clothing	-0.0156*** [0.0044]	-0.0024 [0.0096]	0.0009 [0.0257]
Health	0.0015 [0.0029]	0.0358 [0.0260]	-0.0014 [0.0673]
Energy	0.0025 [0.0029]	-0.0133 [0.0106]	-0.0005 [0.0231]
Transportation	0.0048** [0.0022]	-0.0030 [0.0072]	0.0033 [0.0180]
Recreational Activities	0.0084*** [0.0011]	-0.0017 [0.0036]	0.0021 [0.0064]
Communication	-0.0005 [0.0018]	-0.0120 [0.0077]	0.0064 [0.0158]

Note: Figures in square brackets are the corresponding standard errors. The ***, ** and * indicate statistical significance at 1%, 5% and 10% level, respectively. This table reports the impact of household smoking status on the consumption of basic goods. See appendix VI for complete result.

4.3.3. The impact of household consumption of tobacco on their medical spending

Table 4.12 shows the estimation of the impact of tobacco utilization on the medical consumption of households. In model 1, family unit or household smoking status was regressed on their reported medical spending, and this model was contrasted to model 2 and model 3 where important household characteristics, for example, age, educational level, family area of residence (rural or urban) and family unit poverty status/category were controlled for, all converged and merged into three classifications. Household poverty state was broadly categorised into extreme (core) poor, moderate poor, and non-poor following the poverty categorization of National Bureau of Statistics (2012).

Additionally, the share of household expenditure devoted to tobacco consumption was included in model 2 to improve the adequacy of the model and to reflect the impact of varying spending portions of household tobacco consumption. By and large, tobacco consumption had a positive and significant impact on household medical outlays. As such, households with a member or members who consume tobacco had greater medical spending (by 43.9%, 32.9%, and 41.5%) contrasted with non-smokers. Also, for the prediction of excess medical spending imputable or attributable to tobacco consumption, model 2 was viewed as suitable since the model controlled for important household. In addition to this, model 2 was adjudged to better predict the impact of tobacco consumption because the coefficient of its effect was significant at 5%.

Table 4.12: Prediction of health expenditure attributable to tobacco consumption

	Model specification 1		**Model specification 2**		**Model specification 3**	
	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
Intercept	4.2376***	0.0258	0.1846	0.1511	4.5545***	0.1550
Smoker	0.4391*	0.2142	0.3295**	0.1884	0.4151*	0.2141
Age in years			0.0257***	0.0615		
Rural Dwelling			-0.7324***	0.0540	-0.1872***	0.0595
mod_poor			0.6166***	0.1690	0.4711**	0.1920
ext_poor			0.5000***	0.1365	-0.3108**	0.1541
Primary/Secondary			0.4085***	0.0505		
Post-Secondary/College			-0.4411***	0.0760		
Budget share of tobacco consumption			0.1073***	0.0011		
Adj. R2	9.21E-05		0.2278		0.001308	
F-Stat	4.203**		1141***		12.38***	
Bayesian Information Criterion (BIC)	207,457.4		198,548.4		207,443.5	

Note that estimates with "***", "**" and "*" reflects levels of significance at 1%, 5% and 10%, respectively.

4.3.3.1. Predicted mean excess medical spending imputable/attributable to the consumption of tobacco

The coefficient on the dummy variable for tobacco consumption status (smoking status) was utilised to predict the excess medical spending attributable to tobacco consumption taking into consideration the poverty status of households (this is depicted in Table 4.13). Additionally, excess medical spending due to tobacco consumption, reported in Nigerian Naira (NGN), was observed to be higher among households that fell into the moderately poor category. Also, excess medical outlays attributable to tobacco use were the lowest among non-poor households. Similarly, households that were categorised as being acutely or extremely poor reported higher medical spending on health goods and services which could also be linked to tobacco use when compared with non-poor households. The implication of this is that while poorer households were shown to have a higher demand for health care services, tobacco consumption may further impose higher medical expenditure and this could aggravate the level of impoverishment among the already acutely poor households. In Table 4.14, the excess mean medical spending before the deduction of excess medical spending that was predicted and after the excess health expenditure was deducted. Essentially, the mean medical outlay for all tobacco-consuming households increased as a result of tobacco use irrespective of their poverty status.

Table 4.13: Excess mean medical expenditure

Household poverty category	N	Predicted mean excess medical/health expenditure (NGN)
Extremely poor	466	13,168.30
Moderately poor	28	37,734.90
Non poor	11	7,819.78

Table 4.14:Medical expenditure before and after accounting for the impact of tobacco consumption

	Mean medical spending					
	Non-Smoker			Smoker		
	N	**Mean**	**Standard Error**	**N**	**Mean**	**Standard Error**
Before accounting for excess health expenditure						
Extremely poor	31,711	28,583.08	485.29	466	39,627.75	5,010.15
Moderately poor	1,542	68,104.20	4,929.48	28	113,557.00	37,894.48
Non poor	1,011	54,326.50	5,070.35	11	23,532.30	15,830.13
After accounting for excess health expenditure						
Extremely poor	31,711	28,583.08	485.29	466	52,796.05	3,345.28
Moderately poor	1,542	68,104.20	4,929.48	28	151,291.90	25,302.15
Non poor	1,011	54,326.50	5,070.35	11	31,352.08	10,569.78

4.3.3.2. Incidence of catastrophic health expenditure before and after deduction of excess medical spending attributable to tobacco consumption

Table 4.15 shows the experience of CHE with regards to the poverty category or status of households, location/sector, and tobacco consumption status. The result indicated that of all the extremely poor families residing in rural settlements, 21.78% incurred CHE. Also, 15.45% of extremely poor households living in metropolitan or urban settings experienced CHE. However, the incidence of CHE was the highest among households that were moderately poor (29.12%), and residing within rural centres when compared with other households residing in similar settings. In addition, despite the economic status of non-poor households, it was observed that those households residing within rural settings also incurred CHE (23. 87%). Even so, 13.62% of non-poor families living in urban locations incurred CHE.

Moreover, the predicted excess medical spending attributable to tobacco consumption imposed higher CHE (0.32%) among households residing within rural locations and was in the non-poor category. By and large, tobacco consumption imposed slightly higher CHE on the households. Nonetheless, it has been observed that the minutest increase in medical spending can translate into a substantial financial burden for acutely poor households. Across all households residing in rural settings, excess medical spending attributable to tobacco use had an impact on the incidence of CHE and increased it by 3.11%. Also, for all tobacco-consuming households, medical spending attributable to tobacco consumption led to an increase in the incidence of CHE by 2.57%. Again, extremely poor households were the most affected. In general, there was an increase in the experience of CHE among all tobacco consuming households irrespective of their economic status or poverty category.

Table 4.15: Incidence of CHE by poverty, sector and smoking status

		CHE (Pre-deduction of health expenditure attributable to Tobacco consumption)		CHE (Post-deduction of health expenditure attributable to Tobacco consumption)		**Total**
	Sector	**No**	**Yes**	**No**	**Yes**	
Poverty Status						
Extremely_poor	Rural	19,146	5,330	19,136	5,340	24,476
		(78.22%)	(21.78%)	(78.18%)	(21.82%)	
	Urban	6,511	1,190	6,511	1,190	7,701
		(84.55%)	(15.45%)	(84.55%)	(15.45%)	
Moderately_poor	Rural	465	191	463	193	656
		(70.88%)	(29.12%)	(70.58%)	(29.42%)	
	Urban	776	138	776	138	914
		(84.90%)	(15.10%)	(84.90%)	(15.10%)	
Non_poor	Rural	236	74	235	75	310
		(76.13%)	(23.87%)	(75.81%)	(24.19%)	
	Urban	615	97	615	97	712
		(86.38%)	(13.62%)	(86.38%)	(13.62%)	
Smoking Status						
Non_smoker	Rural	19,519	5,505	19,519	5,505	25,024
		(78.00%)	(22.00%)	(78.00%)	(22.00%)	
	Urban	7,834	1,406	7,834	1,406	9,240
		(84.78%)	(15.22%)	(84.78%)	(15.22%)	
Smoker	Rural	328	90	315	103	418
		(78.47%)	(21.53%)	(75.36%)	(24.64%)	
	Urban	68	19	68	19	87
		(78.16%)	(21.84%)	(78.16%)	(21.84%)	

	Percentage of Smokers with CHE (Pre-deduction)	Percentage of Smokers with CHE (Post-deduction)	***Difference***
All	21.58	24.16	2.57
Rural	21.53	24.64	3.11
Urban	21.84	21.84	0.00
Extremely Poor	21.03	23.18	2.15
Moderately Poor	35.71	42.86	7.14
Non-Poor	9.09	18.18	9.09

The relationship between tobacco use and higher medical costs has been well documented in published studies. As in other studies (Xin *et al*., 2009a; Xu *et al.,* 2015the findings of this study revealed that excessive medical spending due to tobacco use was associated with a higher risk of CHE, with poor households bearing a disproportionate share of the burden. Smokers spent more money on health in all three models than non-smokers. Poor households with at least one smoker have a higher demand for medical services and, as a result, spend more on health insurance, which may have spillover or cascading effects on the use of other household products. Excessive medical spending strains families' finances, whether they are rich or not, and can quickly drive them into poverty.Since accounting for the costs of hospitalizations, emergency department visits, and clinic visits, a study of health care use and expenditures related to smokeless cigarette consumption by adults in the United States found a similar result, with smoking resulting in total annual excess spending of $3.4 billion (Wang et al., 2017).In another study, smoking was related to higher medical costs as well as an increase in household poverty (Xin *et al.,* 2009a, 2009b).

According to the estimates of this study, the average excess medical spending for smoking households was higher among extremely and moderately poor households than among non-poor households, with these households having average excess medical spending of NGN13, 168.30, NGN37734.90, and NGN7819.78, respectively.Furthermore, when excess average expenditure due to tobacco use was taken into account, average expenditure in poor and smoking households increased significantly more than in poor and non-smoking households.

This finding highlights the possible negative effect of tobacco use on health outcomes such as average hospital stay length and overall clinical outcomes during and after treatment. Smoking has also been related to a higher risk of post-surgery complications (Terry-McElrath et al., 2017).

According to a study, patients who smoke after successful percutaneous coronary revascularization have a higher risk of death from any cause than those who quit (Hasdai et al., 1997). In addition, a Chinese study discovered that smokers had higher indirect medical costs and costs related to tobacco use than non-smokers (Xin et al., 2009a).

Prior to determining the role of tobacco consumption in the rise in household CHE burden, researchers discovered that CHE affected all households, regardless of their poverty status.This is unsurprising, given that out-of-pocket expenditure, most often in the form of a service charge, remains the primary source of health-care funding in Nigeria, putting a considerable financial strain on household budgets.In the same location, the baseline burden of CHE was highest in moderately poor rural households (29.12 percent) and lowest in extremely poor rural households (21.78 percent). The rate of CHE was higher in rural households than in urban households.

This may be due to the high level of poverty in rural areas, as well as the fact that poor households have higher disease rates than wealthier households (Bobak et al., 2000; Harrison et al., 2003).As a result, tobacco use among low- and low-income households, especially in rural areas, will increase the risk of ill health and CHE. After accounting for the effect of unnecessary medical expenses on the burden of CHE, non-poor rural residents had a 0.32 percent increase.Excess medical expenses as a result of tobacco use had a small but substantial effect on the majority of households' CHE. Tobacco use also increased the risk of CHE in rural households by 3.11 percent. Tobacco use resulted in an increase in CHE of 2.57 percent for all smoking households. Overall, smoking raised the risk of CHE in all households, regardless of their socioeconomic status.The effect of higher medical costs attributable to tobacco usage was underestimated here because the health expenditures obtained in the survey did not account for indirect costs such as productivity loss, time spent locating health care facilities, caregiver costs, transportation costs from patient homes to the hospital, and intangible costs (the costs of pain).

CHAPTER FIVE

SUMMARY, CONCLUSIONS,AND RECOMMENDATION

5.1. Introduction

This chapter provides, in section 5.2, the summary of salient findings emanating from the study. This is followed by the major inferences and conclusions drawn from the result chapter of this research work in section 5.3. Likewise, in sections 5.4 and 5.5, the policy recommendation/implication, as well as the limitations of the study, were highlighted. Section 6.6, provides suggestions for future research.

5.2. Summary of findings

The overall welfare effects of tobacco consumption are already well established in published health and economics literature in developed countries. However, studies on how tobacco consumption/use impacts the consumption of other essential household commodities (which are often regarded as a measure of welfare) are less advanced in low and middle-income countries and particularly in sub-Saharan Africa.

This study evaluated the impact of tobacco consumption on household welfare in Nigeria. To provide important information regarding tobacco consumption in Nigeria, the study estimated tobacco consumption function and the price elasticity of tobacco demand in Nigeria. This was necessary to evaluate the determinants of tobacco use among households with at least one smoker as well as to investigate how smokers respond to changes in the prices of tobacco products. Findings in this component of the study provided the factors associated with tobacco consumption in Nigeria which is important for the surveillance of tobacco use in the country. In the WHO FCTC, surveillance of tobacco use from time to time is important for formulating policies towards controlling its use and in so doing, forestall possible present and future population health issues that might arise as a result of tobacco use.

This study revealed that household size, cluster effects, level of education/literacy, and income are significant determinants of tobacco consumption in Nigeria. This finding is supported by other studies that estimated tobacco consumption function in developing countries (John, 2008; Chelwa, 2015). However, these variables (household size, cluster fixed effects, level of education, and income explain less than 50% variation in the level of tobacco use in Nigeria. This presupposes that there exist other factors in addition to the ones revealed in this study, that explain the decision to consume tobacco in the Nigerian context. This is one area subsequent studies can explore.

Furthermore, several studies have shown that imposing excise tax/tax increases on tobacco products is the single most effective and cost-effective "intervention to reduce demand for tobacco" (Jha and Chaloupka, 2000). This study estimated the price elasticity of tobacco demand in Nigeria. In the absence of time series data, cross-section data was used to achieve this, given the unit value methodology popularised by Deaton (1988;1990;1998).

This study found that the price elasticity of tobacco is fairly price inelastic. The rural and urban price elasticity of tobacco demand estimated were -0.63 and -0.49, respectively, which is consistent with earlier research findings in developing countries where it has been found that the demand for tobacco products is more price elastic compared to developed countries. Overall, this study showed that the price elasticity of tobacco demand in Nigeria is -0.62 which is almost the same for the price elasticity in the rural sample at -0.63. According to this finding, every 5% increase in the price of tobacco results in a corresponding 3% decrease in the quantity of tobacco demanded in both the national and rural samples.In Nigeria, a 2% rise in the price of tobacco products would result in a 2% decrease in the amount of tobacco consumed in urban areas.This could also mean that smokers in rural centres are more sensitive to an increase in the price of tobacco products which appeals to intuition and is also plausible if we assume that poorer smokers reside in rural locations compared to rich smokers. Earlier studies show evidence that suggests that smokers in rural locations are more sensitive to price changes compared with smokers in urban settings (John 2008; Guindon *et al.,* 2011; Selvaraj *et al.,* 2015).

Apart from the other tools of controlling the health and welfare impact of tobacco consumption, the WHO FCTC highlighted the importance of tax increase and recommends/encourages the use of tax measures to reduce the prevalence of tobacco use in individual countries.

In addition, this study proceeded to evaluate the welfare impact of tobacco consumption. For households with one or more smokers, the study assessed the effect of this on the consumption of other basic/essential household commodities such as food (disaggregated into FIVFM and VFM), clothing, education, health, energy, communication, and recreational activities. As expected, tobacco consumption had a positive impact on expenditure on communication, health, and recreational activities. While, spending on recreational activities and communication could improve household welfare, the possible severe health consequences associated with tobacco use can be substantial. This is because smokers are usually predisposed to ill-health and consequently might demand more medical services on average.

Moreover, findings in the study showed that tobacco consumption crowded out the consumption of essential commodities/goods such as VFM (vegetable, fruit, and milk), clothing, and education. In particular, the consumption of VFM has been widely associated with improved nutritional status and thus improved health. For households with children under the age of twelve years, the consumption of milk is highly important for their growing up and therefore remains an important part of their dietary intake.

Third, the final component of the study predicted excess health expenditure and CHE attributable to tobacco consumption among households in Nigeria. The models estimated showed that tobacco consuming households reported higher health expenditure (by 43.91%, 32.92%, and 41.51% compared to non-smokers for non-poor households, moderately poor households, and extremely poor households) after controlling for other important covariates that are like to affect healthcare spending. Using the 40% threshold for estimating the incidence of CHE, this study found that households with at least one smoker were at higher risks of incurring CHE compared to non-smoking households.

5.3. Conclusions

This study assessed the impact of tobacco consumption on household welfare in Nigeria. Household welfare like in most economics literature was conceptualised to represent the level of household consumption of basic/essential commodities such as food, clothing, housing, education, communication, health, etc. As such, tobacco consumption has a negative effect on household welfare if it crowdsout the consumption of basic goods consumed by the household and vice versa.

The study estimated the tobacco consumption function and discovered that household size, cluster fixed effects, the household head's level of education/literacy, and income were all significant determinants of tobacco consumption in Nigeria.

In addition, the price elasticity of tobacco demand in Nigeria was calculated using budget shares (QUAIDS) and unit value equations, which allow for spatial variation in prices and quantities required. The price elasticity of tobacco demand in rural and urban areas was -0.63 and -0.49, respectively, while the national price elasticity was -0.62.This means that with every 5% increase in the price of tobacco, the quantity of tobacco requested in the national and rural samples would decrease by around 3%. In Nigeria, a 2% rise in the price of tobacco products would result in a 2% decrease in the amount of tobacco consumed in urban areas.In simple economic terminology, the demand for tobacco products in Nigeria is fairly price inelastic.

Furthermore, this study estimated a system of demand equations (QUAIDS), which modeled the impact of tobacco consumption on the consumption of other essential household goods (as a measure of household welfare). The calibrated demand equation/budget shares controlled for price effects (proxied with food price index) and the effect of household size/composition (equivalence scale). In this component of the study, estimates showed that tobacco consumption displaced/crowded-out the consumption of commodities such as VFM (vegetable, fruit, and milk), clothing and education, goods that are considered essential for healthy living. However, the study revealed a complementarity between tobacco use, communication, and recreational activities.

Finally, this study predicted the excess health expenditure attributable to tobacco consumption and the consequent excess CHE. Results showed that households with at least one smoker had higher health expenditure compared with households without smokers. To ascertain the poverty status, households with total expenditure greater than two-thirds of the total household per capita expenditure were classified as non-poor whereas those below were categorized as poor. Poor households were further categorized into moderately poor and extremely such that households with total expenditure less than one-third of total household per capita expenditure are core-poor (extreme poor) while those households with total expenditure greater than one-third of total expenditure but less than two-thirds of the total per capita expenditure were categorized as moderate poor.

In monetary terms, the health expenditure of smoking households exceeded that of non-smoking households by NGN13, 168.30 (for non-poor households), NGN37,734.90 (for moderately poor households), and NGN7,819.78 (for extremely poor households) on the average. Also, tobacco consumption increased the burden of CHE by 3.11% among households living in rural locations. For all smoking households, excess health expenditure attributable to tobacco consumption increased CHE by 2.57%. Overall, smoking increased the experience of CHE among all households irrespective of their poverty classification. Consequently, this study concludes that households with at least one smoker are at higher risks of incurring CHE compared to non-smoking households.

5.4. Contribution to Knowledge

This study provided estimates of the price elasticity of tobacco consumption in Nigeria. In addition to this, using the separable utility function, the effect of tobacco consumption on household welfare (as reflected in household consumption of basic goods and the experience of CHE), was investigated and reported.

5.5. Policy Recommendations

A major conclusion from this study is that tobacco consumption impacted the welfare of households. Its consumption reduced the consumption of some beneficial household

commodities (especially among extremely poor households) and on average slightly increased the risk of higher health expenditure.

Due to the welfare impact of tobacco consumption, this study recommends the following:

1. The use of economic tools via tax and price measures to reduce tobacco consumption. This is operationalised through a regular increase in the price of tobacco products by the government to discourage its use. Usually, this should have two broad impacts. First, a price increase may discourage tobacco consumption and result in quitting. Households can also substitute away from tobacco consumption in favour of other basic commodities. Second, from the law of demand, higher prices translate into lower demand and hence, lower consumption. Since the health impact of tobacco consumption is often a function of the intensity of its use (i.e. dose response effect), an increase in excise tax on tobacco products will reduce the number of cigarettes/packs smoked. Consequently, this may bring about some health gains and as a result cause a reduction in health expenditure. This study revealed that the demand for tobacco products in Nigeria will decline less proportionately to the change in price (i.e. fairly inelastic which is consistent with findings reportedin previous studies). Therefore, findings from this study support the use of tax and price measures to control tobacco use.
2. The estimates of price elasticity of tobacco demand generated in this study showed that the reduction in tobacco demand will be less compared to the increase in prices and this will represent a genuine source of significant government revenue, especially at this time that the Nigerian government is looking to boost revenue through taxation. This may not necessarily impose further tax burdens on the poor since poorer smokers are usually more tax responsive compared with richer smokers and the fact that tobacco taxation is adjudged to be progressive. Also, the revenue generated can be earmarked for the provision of effective tobacco control programmes and interventions. More so, the government invests heavily towards the provision of affordable health care to its citizens. As such, the revenue generated from excise taxes on tobacco consumption can be

designated to the treatment of health conditions that are due to tobacco use in the form of earmarked/hypothecated taxes.

3. Policy makers need to do more because the extent of implementation of tobacco control recommendations shows that there is immense room for improvementabout the recommendations stated earlier. In general, a reduction in the level of tobacco consumption will have economic gains in addition to the benefit it will have on population and public health in Nigeria.

5.6. Study limitation

This study has some limitations which were majorly as a result of limited data. This include non-availability of data on the trend of tobacco consumption in Nigeria apart from the incomplete estimate by the WHO. This prevented the possibility of assessing the pattern of tobacco consumption in the country over the years. Secondly, the data used for the study is a cross-sectional data and therefore did not provide the trend of important variables. The price elasticity of various tobacco products was also not estimated because it was not elicited in the HNLSS. Furthermore, since the HNLSS is a household-level data set, significant socio-demographic variables such as age, level of education, and gender were only included in the data set for the household head. As a result of this, this study may not have been able to capture the effect of these variables at individual level.

5.7. Suggestion for further studies

This study is the first study to estimate price elasticity (national estimate) of tobacco demand in Nigeria. However, future studies can explore the price elasticity of different tobacco products such as cigarettes, snuff, water-pipe (shisha) etc. This will be useful for ascertaining how these different products respond to price change in the Nigerian context. Likewise, it will also be important to look at the cigarette affordability across regions in Nigeria as well as the cost attributable to tobacco consumption.

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Appendix I

Distribution of respondents by region, sector and poverty Status (HNLSS 2009/2010)

Region	Sector		Poverty Status			Total
	Urban	Rural	Extremely Poor	Moderately Poor	Non Poor	
North Central	1,237 [22.5]	4,260 [77.5]	5,220 [94.96]	208 [3.78]	69 [1.26]	5,497 [100]
North East	545 [11.34]	4,259 [88.66]	4,613 [96.02]	148 [3.08]	43 [0.9]	4,804 [100]
North West	1,200 [15.08]	6,756 [84.92]	7,722 [97.06]	170 [2.14]	64 [0.8]	7,956 [100]
South East	804 [19.46]	3,327 [80.54]	3,712 [89.86]	344 [8.33]	75 [1.82]	4,131 [100]
South South	1,042 [21.65]	3,770 [78.35]	4,187 [87.01]	513 [10.66]	112 [2.33]	4,812 [100]
South West	3,557 [62.69]	2,117 [37.31]	5,028 [88.61]	481 [8.48]	165 [2.91]	5,674 [100]

Note: Figures in parentheses are percentages.

Appendix II

Mean and standard deviation of total household expenditure by components (HNLSS 2009/2010)

Region		Urban			Rural		
	Variable	Extremely Poor	Moderately Poor	Non Poor	Extremely Poor	Moderately Poor	Non Poor
North Central	Observations	1128	79	30	4092	129	39
	Food less Vegetable, fruits & diary	83,124.06 [58,318.48]	109,758.70 [63,834.26]	154,495.60 [88,174.22]	56,142.58 [40,708.04]	82,860.48 [63,747.09]	84,179.61 [97,656.83]
	Vegetable, fruits & diary	11,443.11 [9,909.66]	15,500.64 [14,788.24]	26,073.18 [34,978.88]	9,023.02 [9,963.72]	11,069.97 [10,328.59]	9,082.88 [11,166.82]
	Education	2,973.98 [14,144.34]	1,416.08 [8,158.45]	2,333.33 [8,914.67]	1,746.88 [7,421.24]	40.70 [297.76]	2,347.44 [11,084.20]
	Health	15,368.46 [40,971.93]	17,136.39 [43,916.76]	46,172.89 [89,281.07]	16,271.59 [45,533.47]	24,472.66 [56,216.80]	44,190.00 [75,656.52]
	Tobacco	5.61 [134.71]	61.60 [547.54]	- [-]	53.21 [713.34]	132.98 [1,012.63]	- [-]
	Energy	11,017.94 [15,836.36]	17,031.17 [22,759.88]	16,256.85 [19,329.33]	4,344.41 [7,902.23]	7,648.50 [15,781.64]	4,875.98 [11,677.75]
	Transportation	4,499.56 [8,305.94]	7,091.82 [8,922.05]	5,301.33 [7,753.93]	3,486.25 [9,539.21]	4,062.15 [6,614.53]	6,312.10 [7,679.90]
	Clothing	11,049.16 [13,498.41]	13,883.17 [18,053.55]	16,038.61 [17,083.37]	9,099.70 [11,190.42]	11,420.73 [12,859.36]	11,751.87 [18,831.45]
	Communication	5,377.73 [7,905.20]	6,834.90 [7,903.36]	9,389.06 [10,874.02]	2,225.80 [6,859.32]	3,299.10 [5,715.06]	5,746.75 [18,080.69]
	Recreational activities	795.01 [3,450.81]	929.92 [3,671.83]	2,605.56 [8,139.93]	582.09 [2,963.22]	1,027.57 [4,277.13]	252.04 [1,117.18]
	Others	23,909.65 [19,643.71]	33,801.24 [35,864.86]	36,250.80 [44,912.36]	11,507.34 [9,591.60]	13,499.20 [15,711.74]	11,320.97 [10,683.40]
	Total HH expenditure	169,558.60 [100,862.60]	223,384.10 [91,498.83]	314917.20 [116,564.00]	114,429.70 [73,598.54]	159,401.00 [91,421.64]	180,059.60 [136,200.60]
North East	Observations	490	30	25	4123	118	18
	Food less Vegetable, fruits & diary	78,905.18 [65,333.64]	110,116.10 [64,684.45]	124,637.80 [81,716.79]	54,967.59 [45,689.60]	90,895.20 [56,848.28]	129,337.70 [97,825.70]
	Vegetable, fruits & diary	14,567.27 [12,698.45]	18,359.50 [14,254.81]	24,248.65 [22,325.92]	11,354.05 [12,810.85]	16,600.70 [17,329.40]	18,270.28 [15,105.71]
	Education	3,456.44 [23,294.52]	2,726.23 [9,857.83]	3,983.36 [15,238.21]	849.73 [5,444.66]	774.73 [7,015.74]	878.33 [3,726.45]
	Health	23,788.64 [51,688.07]	14,807.50 [29,299.97]	16,054.68 [35,321.65]	17,913.98 [48,786.19]	27,477.92 [62,927.28]	5,359.44 [13,642.29]
	Tobacco	32.28 [573.51]	567.78 [3,109.84]	- [-]	16.76 [448.64]	156.72 [1,225.38]	- [-]
	Energy	8,299.60 [12,776.40]	8,899.99 [11,088.64]	11,240.42 [13,961.70]	3,442.86 [6,966.44]	4,614.71 [8,675.23]	10,672.31 [25,819.24]

	Transportation	2,222.06 [5,425.72]	2,697.86 [5,075.47]	3,623.67 [5,166.94]	2,324.71 [6,391.25]	5,062.19 [10,375.54]	1,480.28 [3,892.04]
	Clothing	10,714.85 [11,854.91]	12,958.02 [13,746.97]	14,611.07 [11,620.53]	11,183.87 [10,689.78]	14,622.74 [11,092.37]	17,563.60 [24,012.55]
	Communication	1,879.34 [5,420.55]	3,220.11 [6,867.48]	6,010.33 [11,812.11]	951.88 [5,300.10]	3,334.09 [11,033.13]	704.07 [1,921.28]
	Recreational activities	730.17 [3,074.14]	561.26 [2,620.70]	1,884.90 [5,389.64]	511.47 [2,480.01]	1,320.07 [4,000.95]	1,157.78 [3,293.87]
	Others	23,634.03 [22,742.86]	29,715.09 [34,742.12]	41,920.40 [47,056.56]	14,021.66 [11,655.56]	15,936.23 [17,098.39]	16,712.25 [14,388.61]
	Total HH expenditure	168,197.60 [104,612.40]	204,061.60 [100,673.10]	248,215.30 [116,143.20]	117,521.80 [79,553.51]	180,638.60 [82,966.49]	202,136.10 [120,946.40]
North West	Observations	1124	61	15	6598	109	104856.5
	Food less Vegetable, fruits & diary	91,615.53 [71,932.25]	107,580.90 [67,274.17]	116,143.00 [93,781.05]	50,801.82 [44,040.00]	70,167.06 [58,985.44]	53,364.00 [61,302.38]
	Vegetable, fruits & diary	16,944.77 [12,532.90]	20,275.84 [18,955.01]	19,547.78 [14,020.94]	11,843.06 [11,016.91]	15,436.26 [12,827.00]	9,866.17 [11,040.78]
	Education	3,572.42 [15,477.71]	5,330.66 [26,458.21]	580.00 [2,246.33]	934.31 [6,475.16]	2,821.51 [16,594.07]	660.63 [2,525.80]
	Health	19,669.60 [44,381.04]	16,989.51 [36,066.88]	33,007.00 [73,101.94]	18,487.28 [46,992.71]	66,329.91 [122,677.80]	12,025.00 [28,210.32]
	Tobacco	25.00 [471.67]	- [-]	- [-]	14.51 [427.67]	- [-]	- [-]
	Energy	11,370.68 [15,246.92]	13,130.29 [18,904.15]	12,436.25 [12,665.67]	4,832.33 [7,116.90]	4,099.66 [5,631.07]	4,764.43 [6,969.41]
	Transportation	2,261.42 [6,325.52]	5,158.17 [13,025.02]	6,251.78 [13,132.18]	1,218.97 [4,193.14]	2,486.81 [8,281.60]	157.14 [1,028.35]
	Clothing	14,683.14 [16,230.98]	15,581.79 [13,751.62]	14,856.55 [13,496.06]	11,941.34 [10,909.26]	16,585.57 [16,540.03]	9,602.72 [14,635.44]
	Communication	3,177.40 [7,962.83]	5,863.93 [10,386.31]	3,267.22 [7,353.22]	670.22 [3,129.65]	2,072.52 [11,381.72]	34.76 [170.26]
	Recreational activities	933.54 [4,025.20]	1,362.06 [3,403.43]	995.69 [3,798.00]	413.25 [2,249.62]	861.15 [4,619.56]	171.84 [717.20]
	Others	19,993.40 [19,887.61]	27,160.90 [23,978.54]	22,003.72 [13,940.54]	11,111.27 [7,129.99]	11,330.96 [7,979.05]	14,209.84 [8,673.92]
	Total HH expenditure	184,221.90 [111,552.00]	218,434.00 [92,858.16]	229,089.00 [153,224.40]	112,253.80 [74,931.05]	192,191.40 [126,849.90]	77,361.70 [11,103.12]
South East	Observations	710	82	12	3002	262	63
	Food less Vegetable, fruits & diary	94,295.77 [52,382.65]	100,270.80 [52,509.64]	148,814.50 [77,663.59]	70,750.44 [49,319.61]	91,430.14 [53,562.66]	114,027.00 [79,972.99]
	Vegetable, fruits & diary	16,610.09 [10,974.57]	18,250.45 [12,388.93]	26,010.31 [18,025.99]	12,465.24 [10,927.13]	18,912.06 [16,231.77]	20,315.44 [17,307.20]
	Education	6,636.20 [21,576.12]	2,033.29 [11,850.38]	2,316.67 [8,025.17]	5,227.93 [19,118.84]	1,762.48 [12,323.26]	330.95 [2,626.85]
	Health	25,609.04 [52,002.35]	55,225.24 [82,004.44]	104,866.70 [119,750.60]	29,955.55 [61,125.48]	68,774.09 [93,842.25]	66,132.71 [103,691.90]
	Tobacco	43.61 [322.97]	43.03 [231.30]	- [-]	71.29 [518.23]	99.14 [554.19]	73.39 [409.13]

	Energy	10,079.73 [13,211.15]	11,982.06 [15,932.84]	21,762.90 [46,727.88]	4,974.19 [8,016.45]	7,071.26 [11,972.71]	8,049.01 [13,745.51]
	Transportation	2,271.56 [5,623.60]	2,670.27 [5,596.69]	11,887.13 [29,773.27]	2,796.57 [5,877.70]	5,082.50 [8,125.95]	5,030.20 [6,623.06]
	Clothing	10,322.25 [11,018.68]	12,238.25 [13,807.11]	13,755.90 [13,106.01]	7,714.43 [9,745.16]	9,313.93 [9,920.65]	10,029.66 [11,504.95]
	Communication	8,246.30 [9,774.36]	9,914.35 [8,849.20]	22,635.05 [39,787.01]	3,432.39 [6,267.91]	5,130.12 [8,636.87]	5,102.28 [7,610.64]
	Recreational activities	1,786.45 [5,353.28]	2,316.39 [6,074.43]	4,926.94 [10,607.37]	1,231.13 [3,925.78]	1,616.03 [5,043.05]	1,705.41 [4,570.61]
	Others	50,348.33 [38,138.85]	52,732.18 [40,453.03]	49,680.02 [35,152.00]	23,807.20 [17,633.87]	28,659.34 [21,749.02]	24,808.05 [13,654.85]
	Total HH expenditure	226,205.70 [104,309.40]	267,633.30 [99,612.86]	406,656.10 [76,228.74]	162,355.10 [102,879.70]	237,751.90 [102,002.00]	255,530.70 [132,253.90]
South South	Observations	871	138	33	3316	375	79
	Food less Vegetable, fruits & diary	112,510.70 [67,926.67]	126,803.30 [53,043.84]	181,411.70 [84,828.64]	92,434.72 [58,417.88]	117,368.40 [57,283.12]	140,787.60 [97,606.40]
	Vegetable, fruits & diary	15,928.34 [11,994.01]	16,064.06 [8,979.07]	23,670.07 [15,980.70]	13,654.01 [11,275.89]	16,869.23 [9,618.13]	22,295.96 [16,290.01]
	Education	8,044.79 [23,569.99]	6,936.34 [22,614.29]	10,423.88 [28,821.69]	5,264.33 [20,280.87]	1,466.70 [9,756.77]	27,541.23 [70,736.79]
	Health	16,286.25 [40,968.73]	14,797.80 [43,402.03]	14,779.03 [37,133.35]	27,744.08 [57,412.63]	34,734.75 [69,959.61]	46,302.22 [87,940.49]
	Tobacco	38.13 [368.14]	7.05 [82.86]	- [-]	61.37 [598.64]	263.12 [1,806.52]	27.72 [246.39]
	Energy	11,024.98 [16,820.55]	14,967.02 [23,371.81]	18,681.46 [22,364.32]	4,605.60 [9,788.90]	5,686.18 [10,440.03]	4,350.39 [5,159.15]
	Transportation	5,408.24 [10,333.58]	8,984.21 [12,673.09]	9,536.26 [13,025.76]	3,531.91 [6,742.20]	7,095.77 [11,208.03]	6,414.68 [8,903.95]
	Clothing	12,324.93 [14,863.50]	14,811.14 [17,272.45]	17,966.68 [17,248.84]	12,594.98 [14,696.50]	15,463.28 [15,198.55]	17,509.63 [17,082.91]
	Communication	8,720.75 [12,492.44]	12,424.11 [15,563.19]	17,309.86 [18,820.34]	5,043.47 [8,413.61]	7,554.45 [10,201.17]	10,054.44 [14,428.51]
	Recreational activities	1,814.99 [7,122.70]	2,259.85 [6,842.13]	1,619.58 [3,504.38]	1,346.56 [4,386.44]	1,988.37 [6,050.75]	3,316.96 [7,570.31]
	Others	46,308.69 [38,434.59]	48,103.69 [45,782.13]	56,160.20 [76,276.96]	21,492.03 [19,165.29]	24,605.86 [29,805.32]	35,418.16 [47,783.40]
	Total HH expenditure	238,372.70 [113,700.10]	266,151.50 [84,086.51]	351,558.70 [114,976.40]	187,711.70 [102,603.00]	232,833.00 [88,647.92]	313,991.30 [123,332.20]
South West	Observations	3092	349	116	1936	132	49
	Food less Vegetable, fruits & diary	96,580.18 [61,145.15]	121,093.10 [59,967.95]	151,291.00 [68,811.96]	69,986.58 [49,655.96]	102,250.20 [55,784.97]	133,166.90 [97,352.32]
	Vegetable, fruits & diary	16,424.56 [11,031.13]	20,330.01 [16,263.94]	22,178.05 [14,971.97]	12,418.99 [9,081.42]	16,876.46 [13,710.77]	18,892.34 [17,740.06]
	Education	6,334.04 [19,472.38]	7,231.52 [22,631.03]	5,047.43 [17,039.81]	4,173.42 [15,592.61]	5,979.17 [27,381.14]	6,194.56 [22,707.46]
	Health	12,979.47 [33,708.26]	32,935.61 [65,354.43]	18,176.36 [50,339.80]	14,470.39 [38,567.51]	31,668.80 [66,609.38]	46,577.88 [105,051.80]

Tobacco	27.45 [425.40]	34.16 [389.50]	679.76 [3,928.46]	117.02 [967.95]	331.82 [2,072.30]	7.45 [52.14]
Energy	11,116.25 [16,142.85]	15,560.03 [24,822.32]	28,057.19 [35,595.54]	5,663.94 [10,549.62]	9,172.95 [17,482.02]	10,455.70 [12,881.98]
Transportation	8,570.41 [11,669.86]	13,780.65 [14,328.06]	13,325.74 [14,607.56]	5,924.94 [8,708.08]	10,032.89 [10,195.54]	8,552.42 [13,182.29]
Clothing	10,201.62 [12,451.30]	13,306.18 [14,742.74]	16,432.09 [19,578.68]	8,941.23 [10,222.52]	13,565.96 [11,788.37]	17,963.92 [12,207.48]
Communication	7,473.05 [10,453.57]	11,047.33 [13,434.63]	14,341.68 [15,046.29]	3,389.62 [6,519.75]	7,401.28 [18,197.81]	6,586.36 [8,959.40]
Recreational activities	1,113.80 [4,533.65]	1,355.30 [4,647.41]	1,390.68 [4,464.56]	858.71 [3,314.55]	1,769.34 [5,625.89]	3,172.84 [6,388.39]
Others	25,275.79 [25,195.84]	29,954.09 [31,463.21]	37,731.36 [50,153.75]	11,517.01 [10,783.62]	18,001.23 [35,336.10]	14,309.16 [17,943.17]
Total HH expenditure	196,069.20 [109,660.40]	266,593.90 [88,530.91]	307,971.60 [118,622.60]	137,344.80 [89,407.31]	216,718.30 [82,348.01]	265,872.10 [137,537.20]

Appendix III

Mean budget share of components of household expenditure by region

Region	Variables	Urban			Rural		
		Extremely Poor	Moderately Poor	Non Poor	Extremely Poor	Moderately Poor	Non Poor
North Central	Observation	1128	79	30	4092	129	39
	Food_vfm	0.4937 [0.1628]	0.4927 [0.1853]	0.4901 [0.2019]	0.5120 [0.1799]	0.5332 [0.2041]	0.4610 [0.2318]
	VFM	0.0700 [0.0440]	0.0709 [0.0620]	0.0795 [0.0806]	0.0862 [0.0634]	0.0755 [0.0565]	0.0505 [0.0428]
	Education	0.0135 [0.0510]	0.0046 [0.0254]	0.0067 [0.0256]	0.0131 [0.0485]	0.0007 [0.0051]	0.0136 [0.0525]
	Clothing	0.0689 [0.0739]	0.0592 [0.0540]	0.0528 [0.0499]	0.0855 [0.0888]	0.0827 [0.0923]	0.0757 [0.0846]
	Health	0.0187 [0.0492]	0.0659 [0.1549]	0.1334 [0.2564]	0.0210 [0.0521]	0.0852 [0.1628]	0.1498 [0.2722]
	Energy	0.0643 [0.0760]	0.0800 [0.1093]	0.0575 [0.0667]	0.0378 [0.0554]	0.0444 [0.0834]	0.0256 [0.0377]
	Transport.	0.0267 [0.0458]	0.0320 [0.0390]	0.0151 [0.0215]	0.0317 [0.0591]	0.0316 [0.0628]	0.0623 [0.0807]
	Rec. act.	0.0043 [0.0171]	0.0044 [0.0168]	0.0090 [0.0263]	0.0049 [0.0232]	0.0047 [0.0177]	0.0006 [0.0026]
	Commun.	0.0318 [0.0459]	0.0299 [0.0345]	0.0390 [0.0610]	0.0157 [0.0408]	0.0180 [0.0307]	0.0220 [0.0582]
	Tobacco	0.0000 [0.0009]	0.0002 [0.0022]	- [-]	0.0005 [0.0059]	0.0005 [0.0037]	- [-]
	w_onfd	0.1601 [0.1143]	0.1518 [0.1251]	0.1170 [0.1197]	0.1245 [0.0945]	0.0973 [0.0856]	0.0977 [0.0877]
North East	Observation	490	30	25	4123	118	18
	Food_vfm	0.4616 [0.1836]	0.5291 [0.1846]	0.5028 [0.1790]	0.4748 [0.1779]	0.5060 [0.2058]	0.5790 [0.2172]
	VFM	0.0899 [0.0525]	0.0872 [0.0594]	0.1038 [0.0752]	0.1021 [0.0734]	0.0935 [0.0725]	0.1167 [0.0890]
	Education	0.0145 [0.0625]	0.0126 [0.0435]	0.0136 [0.0471]	0.0062 [0.0333]	0.0053 [0.0474]	0.0034 [0.0143]
	Clothing	0.0695 [0.0670]	0.0636 [0.0627]	0.0630 [0.0406]	0.1044 [0.0892]	0.0922 [0.0704]	0.0908 [0.0790]

	Health	0.0214 [0.0463]	0.0411 [0.1135]	0.0300 [0.0811]	0.0204 [0.0510]	0.0870 [0.1804]	0.0235 [0.0656]
	Energy	0.0557 [0.0708]	0.0433 [0.0485]	0.0420 [0.0352]	0.0319 [0.0520]	0.0272 [0.0537]	0.0553 [0.0899]
	Transport.	0.0147 [0.0351]	0.0117 [0.0212]	0.0178 [0.0309]	0.0191 [0.0481]	0.0281 [0.0450]	0.0109 [0.0330]
	Rec. act.	0.0048 [0.0290]	0.0037 [0.0180]	0.0060 [0.0139]	0.0039 [0.0180]	0.0083 [0.0280]	0.0082 [0.0245]
	Commun.	0.0096 [0.0277]	0.0132 [0.0268]	0.0198 [0.0332]	0.0072 [0.0365]	0.0205 [0.0764]	0.0037 [0.0109]
	Tobacco	0.0002 [0.0035]	0.0021 [0.0114]	- [-]	0.0002 [0.0048]	0.0007 [0.0052]	- [-]
	w_onfd	0.1736 [0.1262]	0.1652 [0.1464]	0.1774 [0.1598]	0.1566 [0.1144]	0.0993 [0.0962]	0.1084 [0.1012]
North West	Observation	1124	61	15	6598	109	49
	Food_vfm	0.4717 [0.2007]	0.4635 [0.2244]	0.4607 [0.2174]	0.4313 [0.2256]	0.4130 [0.2434]	0.4176 [0.2696]
	VFM	0.0987 [0.0638]	0.0888 [0.0706]	0.0988 [0.0609]	0.1066 [0.0784]	0.0975 [0.0733]	0.0846 [0.0638]
	Education	0.0149 [0.0524]	0.0228 [0.0951]	0.0012 [0.0048]	0.0079 [0.0379]	0.0208 [0.0877]	0.0076 [0.0281]
	Clothing	0.0922 [0.0884]	0.0751 [0.0556]	0.0909 [0.1210]	0.1362 [0.1322]	0.1118 [0.1150]	0.1166 [0.1550]
	Health	0.0189 [0.0444]	0.0411 [0.1082]	0.0471 [0.0700]	0.0243 [0.0533]	0.0923 [0.1588]	0.0418 [0.1297]
	Energy	0.0686 [0.0824]	0.0669 [0.0779]	0.0623 [0.0446]	0.0522 [0.0653]	0.0301 [0.0509]	0.0545 [0.0664]
	Transport.	0.0107 [0.0275]	0.0193 [0.0439]	0.0150 [0.0301]	0.0100 [0.0339]	0.0136 [0.0446]	0.0016 [0.0082]
	Rec. act.	0.0056 [0.0278]	0.0048 [0.0111]	0.0023 [0.0082]	0.0035 [0.0177]	0.0053 [0.0268]	0.0023 [0.0087]
	Commun.	0.0138 [0.0358]	0.0324 [0.0716]	0.0073 [0.0161]	0.0055 [0.0272]	0.0136 [0.0792]	0.0006 [0.0036]
	Tobacco	0.0001 [0.0020]	- [-]	- [-]	0.0001 [0.0035]	- [-]	- [-]
	w_onfd	0.1346 [0.1098]	0.1457 [0.1434]	0.1413 [0.1213]	0.1380 [0.1128]	0.0935 [0.1024]	0.2105 [0.1755]
South East	Observation	710	82	12	3002	262	63
	Food_vfm	0.4291 [0.1432]	0.3864 [0.1596]	0.3686 [0.1828]	0.4602 [0.1656]	0.4130 [0.1870]	0.4834 [0.1998]
	VFM	0.0761 [0.0386]	0.0690 [0.0355]	0.0658 [0.0447]	0.0798 [0.0469]	0.0819 [0.0522]	0.0802 [0.0514]

	Education	0.0238 [0.0665]	0.0102 [0.0619]	0.0048 [0.0168]	0.0264 [0.0744]	0.0061 [0.0422]	0.0016 [0.0126]
	Clothing	0.0467 [0.0427]	0.0456 [0.0461]	0.0369 [0.0389]	0.0497 [0.0494]	0.0424 [0.0431]	0.0374 [0.0364]
	Health	0.0256 [0.0492]	0.1384 [0.2061]	0.2538 [0.2863]	0.0379 [0.0762]	0.1786 [0.2247]	0.1862 [0.2732]
	Energy	0.0462 [0.0511]	0.0505 [0.0694]	0.0526 [0.1053]	0.0343 [0.0411]	0.0325 [0.0561]	0.0291 [0.0435]
	Transport.	0.0101 [0.0233]	0.0096 [0.0186]	0.0266 [0.0680]	0.0149 [0.0281]	0.0213 [0.0311]	0.0189 [0.0235]
	Rec. act.	0.0064 [0.0191]	0.0083 [0.0208]	0.0113 [0.0244]	0.0079 [0.0282]	0.0061 [0.0186]	0.0052 [0.0136]
	Commun.	0.0350 [0.0357]	0.0366 [0.0300]	0.0509 [0.0810]	0.0185 [0.0315]	0.0216 [0.0292]	0.0163 [0.0238]
	Tobacco	0.0002 [0.0019]	0.0005 [0.0036]	- [-]	0.0006 [0.0039]	0.0007 [0.0043]	0.0005 [0.0027]
	w_onfd	0.2339 [0.1351]	0.2069 [0.1311]	0.1287 [0.0945]	0.1788 [0.1175]	0.1340 [0.1011]	0.1293 [0.0908]
South South	Observation	871	138	33	3316	375	79
	Food_vfm	0.4739 [0.1572]	0.4890 [0.1688]	0.5283 [0.1837]	0.5081 [0.1755]	0.5205 [0.1827]	0.4686 [0.2340]
	VFM	0.0687 [0.0418]	0.0623 [0.0328]	0.0700 [0.0410]	0.0761 [0.0474]	0.0762 [0.0410]	0.0746 [0.0470]
	Education	0.0284 [0.0746]	0.0242 [0.0731]	0.0262 [0.0720]	0.0239 [0.0730]	0.0055 [0.0367]	0.0710 [0.1824]
	Clothing	0.0515 [0.0517]	0.0544 [0.0535]	0.0540 [0.0472]	0.0694 [0.0691]	0.0683 [0.0601]	0.0596 [0.0587]
	Health	0.0165 [0.0462]	0.0341 [0.0877]	0.0385 [0.0942]	0.0320 [0.0668]	0.1035 [0.1808]	0.1204 [0.2174]
	Energy	0.0448 [0.0553]	0.0548 [0.0839]	0.0478 [0.0501]	0.0255 [0.0447]	0.0250 [0.0461]	0.0174 [0.0255]
	Transport.	0.0228 [0.0402]	0.0334 [0.0494]	0.0239 [0.0292]	0.0194 [0.0364]	0.0307 [0.0470]	0.0220 [0.0361]
	Rec. act.	0.0082 [0.0304]	0.0096 [0.0305]	0.0053 [0.0130]	0.0070 [0.0240]	0.0094 [0.0313]	0.0113 [0.0272]
	Commun.	0.0342 [0.0423]	0.0463 [0.0567]	0.0518 [0.0507]	0.0255 [0.0403]	0.0325 [0.0414]	0.0339 [0.0455]
	Tobacco	0.0002 [0.0016]	0.0000 [0.0004]	- [-]	0.0004 [0.0035]	0.0013 [0.0084]	0.0001 [0.0008]
	w_onfd	0.2108 [0.1427]	0.1777 [0.1246]	0.1531 [0.1589]	0.1326 [0.0960]	0.1067 [0.1064]	0.1197 [0.1158]
South West	Observation	3092	349	116	1936	132	49

	Food_vfm	0.4986 [0.1447]	0.4613 [0.1703]	0.5107 [0.1541]	0.5218 [0.1587]	0.4929 [0.1984]	0.5121 [0.2102]
	VFM	0.0905 [0.0446]	0.0770 [0.0495]	0.0723 [0.0378]	0.1020 [0.0650]	0.0823 [0.0638]	0.0775 [0.0771]
	Education	0.0269 [0.0734]	0.0293 [0.0934]	0.0153 [0.0487]	0.0220 [0.0661]	0.0229 [0.0912]	0.0170 [0.0598]
	Clothing	0.0525 [0.0528]	0.0512 [0.0550]	0.0496 [0.0501]	0.0642 [0.0572]	0.0657 [0.0562]	0.0850 [0.0612]
	Health	0.0229 [0.0644]	0.0939 [0.1910]	0.0456 [0.1326]	0.0322 [0.0780]	0.1019 [0.1939]	0.1046 [0.2418]
	Energy	0.0560 [0.0592]	0.0556 [0.0800]	0.0843 [0.0894]	0.0410 [0.0560]	0.0443 [0.0805]	0.0471 [0.0491]
	Transport.	0.0406 [0.0495]	0.0523 [0.0549]	0.0449 [0.0478]	0.0424 [0.0536]	0.0495 [0.0504]	0.0390 [0.0917]
	Rec. act.	0.0056 [0.0228]	0.0053 [0.0196]	0.0043 [0.0142]	0.0059 [0.0228]	0.0084 [0.0252]	0.0115 [0.0201]
	Commun.	0.0332 [0.0413]	0.0412 [0.0495]	0.0473 [0.0487]	0.0196 [0.0341]	0.0325 [0.0739]	0.0250 [0.0362]
	Tobacco	0.0001 [0.0021]	0.0001 [0.0017]	0.0022 [0.0129]	0.0011 [0.0084]	0.0018 [0.0113]	0.0000 [0.0001]
	w_onfd	0.1370 [0.0975]	0.1121 [0.0958]	0.1200 [0.1147]	0.1018 [0.0874]	0.0788 [0.1082]	0.0590 [0.0525]

Note: w_onfd denotes budget share of other non-food items

Appendix IV

Correlation matrix showing correlation between the QUAIDS covariates

Variable	smk	HH_{size}	HH_{sex}	HH_{age}	$urban$	lnM	$(lnM)^2$	$pcexp$
smk	1							
HH_{size}	-0.0261	1						
HH_{sex}	0.0040	0.2841	1					
HH_{age}	0.0134	0.0810	-0.1803	1				
$urban$	-0.0191	-0.1019	-0.0872	0.0050	1			
lnM	0.0052	0.0868	-0.0259	0.0492	0.2796	1		
$(lnM)^2$	0.0050	0.0872	-0.0252	0.0497	0.2826	0.9992	1	
$pcexp$	0.0116	-0.2746	-0.0822	-0.0411	0.0929	0.1893	0.1919	1

APPENDIX V: Results of budget shares' regression by sector

Results of budget shares' regression by sector

Budget Share	Variables	Full	Urban	Rural
Food less Vegetable, fruits & diary	Constant	-9.3959*** [0.2086]	-6.1297*** [0.4718]	-11.0096*** [0.2455]
	Smk	0.0151* [0.0084]	0.0211 [0.0179]	0.0114 [0.0095]
	Size of Household	-0.0086*** [0.0004]	-0.0065*** [0.0008]	-0.0095*** [0.0005]
	Sex of Household Head	0.0070** [0.0030]	-0.0007 [0.0047]	0.0093** [0.0037]
	Age of Household Head in Years	-0.0004*** [0.0001]	0.0001 [0.0001]	-0.0006*** [0.0001]
	lnM	1.6906*** [0.0358]	1.1170*** [0.0794]	1.9776*** [0.0425]
	lnM_sq	-0.0719*** [0.0015]	-0.0464*** [0.0033]	-0.0848*** [0.0018]
	Fixed effect	0.0256*** [0.0057]	-0.0676*** [0.0111]	0.0563*** [0.0067]
Vegetable, fruits & diary	Constant	-2.0899*** [0.0713]	-0.4587*** [0.1404]	-2.5185*** [0.0866]
	Smk	-0.0102*** [0.0029]	-0.0158*** [0.0053]	-0.0091*** [0.0033]
	Size of Household	-0.0008*** [0.0001]	0.0003 [0.0002]	-0.0014*** [0.0002]
	Sex of Household Head	-0.0014 [0.0010]	-0.0047*** [0.0014]	-0.0014 [0.0013]
	Age of Household Head in Years	0.0001*** [0.0000]	0.0001*** [0.0000]	0.0000* [0.0000]
	lnM	0.3918*** [0.0122]	0.1073*** [0.0236]	0.4679*** [0.0150]
	lnM_sq	-0.0172*** [0.0005]	-0.0051*** [0.0010]	-0.0205*** [0.0006]
	Fixed effect	-0.0364*** [0.0019]	-0.0097*** [0.0033]	-0.0445*** [0.0024]
Education	Constant	0.4977*** [0.0667]	0.2437 [0.1934]	0.4459*** [0.0719]
	Smk	-0.0032 [0.0027]	-0.0047 [0.0074]	-0.0029 [0.0028]
	Size of Household	0.0038*** [0.0001]	0.0042*** [0.0003]	0.0039*** [0.0001]
	Sex of Household Head	-0.0079*** [0.0010]	-0.0123*** [0.0019]	-0.0049*** [0.0011]
	Age of Household Head in Years	0.0000** [0.0000]	-0.0002*** [0.0000]	0.0000 [0.0000]
	lnM	-0.0967*** [0.0115]	-0.0506 [0.0325]	-0.0879*** [0.0124]
	lnM_sq	0.0045*** [0.0005]	0.0026* [0.0014]	0.0040*** [0.0005]
	Fixed effect	0.0285*** [0.0018]	0.0112** [0.0045]	0.0358*** [0.0020]
Clothing	Constant	2.0551*** [0.1013]	2.1092*** [0.1803]	1.9241*** [0.1251]
	Smk	-0.0139*** [0.0041]	-0.0142** [0.0069]	-0.0152*** [0.0048]
	Size of Household	0.0025*** [0.0002]	0.0018*** [0.0003]	0.0020*** [0.0003]

	Sex of Household Head	0.0096*** [0.0014]	0.0045** [0.0018]	0.0085*** [0.0019]
	Age of Household Head in Years	-0.0003*** [0.0000]	-0.0002*** [0.0000]	-0.0002*** [0.0000]
	lnM	-0.2950*** [0.0174]	-0.3227*** [0.0303]	-0.2704*** [0.0216]
	lnM_sq	0.0112*** [0.0007]	0.0130*** [0.0013]	0.0102*** [0.0009]
	Fixed effect	-0.0666*** [0.0028]	-0.0429*** [0.0042]	-0.0783*** [0.0034]
Health	Constant	0.6858*** [0.0877]	-0.1335 [0.2208]	1.3807*** [0.0990]
	Smk	0.0067* [0.0035]	0.0022 [0.0084]	0.0055 [0.0038]
	Size of Household	-0.0063*** [0.0002]	-0.0068*** [0.0004]	-0.0068*** [0.0002]
	Sex of Household Head	-0.0155*** [0.0012]	-0.0178*** [0.0022]	-0.0156*** [0.0015]
	Age of Household Head in Years	0.0004*** [0.0000]	0.0006*** [0.0001]	0.0004*** [0.0000]
	lnM	-0.1319*** [0.0151]	0.0134 [0.0371]	-0.2584*** [0.0171]
	lnM_sq	0.0067*** [0.0006]	0.0003 [0.0016]	0.0126*** [0.0007]
	Fixed effect	-0.0157*** [0.0024]	-0.0333*** [0.0052]	-0.0193*** [0.0027]
Energy	Constant	0.8780*** [0.0691]	0.4681** [0.1976]	0.7265*** [0.0737]
	Smk	0.0009 [0.0028]	-0.0122 [0.0075]	0.0057** [0.0028]
	Size of Household	-0.0005*** [0.0001]	0.0003 [0.0003]	0.0001 [0.0002]
	Sex of Household Head	0.0026*** [0.0010]	0.0095*** [0.0020]	0.0018 [0.0011]
	Age of Household Head in Years	0.0000 [0.0000]	0.0000 [0.0000]	0.0000 [0.0000]
	lnM	-0.1346*** [0.0119]	-0.0621* [0.0332]	-0.1052*** [0.0127]
	lnM_sq	0.0056*** [0.0005]	0.0024* [0.0014]	0.0041*** [0.0006]
	Fixed effect	-0.0266*** [0.0019]	-0.0244*** [0.0046]	-0.0201*** [0.0020]
Transportation	Constant	-0.3649*** [0.0519]	-0.4716*** [0.1285]	-0.4837*** [0.0597]
	Smk	0.0040* [0.0021]	0.0042 [0.0049]	0.0046** [0.0023]
	Size of Household	-0.0020*** [0.0001]	-0.0026*** [0.0002]	-0.0016*** [0.0001]
	Sex of Household Head	0.0026*** [0.0007]	0.0042*** [0.0013]	0.0021** [0.0009]
	Age of Household Head in Years	-0.0001*** [0.0000]	0.0000 [0.0000]	0.0000** [0.0000]
	lnM	0.0627*** [0.0089]	0.0772*** [0.0216]	0.0851*** [0.0103]
	lnM_sq	-0.0025*** [0.0004]	-0.0029*** [0.0009]	-0.0035*** [0.0004]
	Fixed effect	0.0009 [0.0014]	0.0061** [0.0030]	0.0015 [0.0016]
Recreation Activities	Constant	-0.0875*** [0.0260]	-0.0053 [0.0690]	-0.0933*** [0.0293]
	Smk	0.0074*** [0.0010]	0.0022 [0.0026]	0.0085*** [0.0011]

	Size of Household	0.0000 [0.0001]	-0.0001 [0.0001]	0.0001 [0.0001]
	Sex of Household Head	0.0005 [0.0004]	0.0003 [0.0007]	0.0008* [0.0004]
	Age of Household Head in Years	0.0000*** [0.0000]	0.0000** [0.0000]	0.0000*** [0.0000]
	lnM	0.0143*** [0.0045]	0.0015 [0.0116]	0.0150*** [0.0051]
	lnM_sq	-0.0006*** [0.0002]	0.0000 [0.0005]	-0.0006*** [0.0002]
	Fixed effect	0.0042*** [0.0007]	0.0015 [0.0016]	0.0051*** [0.0008]
Communication	Constant	-0.0108 [0.0435]	-0.1527 [0.1198]	-0.1277*** [0.0475]
	Smk	-0.0015 [0.0017]	0.0038 [0.0046]	-0.0016 [0.0018]
	Size of Household	-0.0014*** [0.0001]	-0.0017*** [0.0002]	-0.0010*** [0.0001]
	Sex of Household Head	0.0039*** [0.0006]	0.0065*** [0.0012]	0.0040*** [0.0007]
	Age of Household Head in Years	-0.0001*** [0.0000]	-0.0002*** [0.0000]	-0.0001*** [0.0000]
	lnM	-0.0090 [0.0075]	0.0174 [0.0202]	0.0127 [0.0082]
	lnM_sq	0.0008*** [0.0003]	-0.0003 [0.0008]	-0.0002 [0.0004]
	Fixed effect	0.0263*** [0.0012]	0.0239*** [0.0028]	0.0307*** [0.0013]

APPENDIX VI: Results of budget shares' regression by poverty status

Results of budget shares' regression by poverty status

Budget Share	Variables	Extremely Poor	Moderately Poor	Non Poor
Food less Vegetable, fruits & diary	Constant	-9.2701*** [0.2157]	-8.6614*** [1.5383]	-10.3548*** [1.7347]
	Smk	-0.0186** [0.0088]	-0.0045 [0.0280]	0.0299 [0.0704]
	Size of Household	-0.0093*** [0.0005]	-0.0109*** [0.0037]	-0.0237*** [0.0050]
	Sex of Household Head	0.0034 [0.0031]	0.0142 [0.0103]	0.0551** [0.0216]
	Age of Household Head in Years	-0.0004*** [0.0001]	-0.0012*** [0.0002]	-0.0005 [0.0005]
	lnM	1.6667*** [0.0371]	1.5932*** [0.2559]	1.8606*** [0.2943]
	lnM_sq	-0.0708*** [0.0016]	-0.0687*** [0.0107]	-0.0784*** [0.0124]
	Fixed effect	0.0286*** [0.0059]	-0.0031 [0.0229]	-0.1095** [0.0479]
Vegetable, fruits & diary	Constant	-2.1380*** [0.0747]	-1.5130*** [0.4376]	-1.9324*** [0.4966]
	Smk	-0.0102*** [0.0031]	-0.0065 [0.0080]	-0.0169 [0.0201]
	Size of Household	-0.0010*** [0.0002]	-0.0011 [0.0011]	-0.0014 [0.0014]
	Sex of Household Head	-0.0017 [0.0011]	-0.0030 [0.0029]	0.0118* [0.0062]
	Age of Household Head in Years	0.0001** [0.0000]	0.0000 [0.0001]	0.0002 [0.0001]
	lnM	0.4006*** [0.0129]	0.2838*** [0.0728]	0.3457*** [0.0842]
	lnM_sq	-0.0176*** [0.0006]	-0.0124*** [0.0030]	-0.0147*** [0.0036]
	Fixed effect	-0.0381*** [0.0021]	-0.0188*** [0.0065]	-0.0168 [0.0137]
Education	Constant	0.4982*** [0.0681]	-0.2949 [0.5291]	0.7465 [0.6912]
	Smk	-0.0040 [0.0028]	0.0059 [0.0096]	0.0097 [0.0280]
	Size of Household	0.0038*** [0.0001]	0.0087*** [0.0013]	0.0101*** [0.0020]
	Sex of Household Head	-0.0075*** [0.0010]	-0.0147*** [0.0036]	-0.0164* [0.0086]
	Age of Household Head in Years	0.0000 [0.0000]	-0.0007*** [0.0001]	-0.0010*** [0.0002]
	lnM	-0.0975*** [0.0117]	0.0507 [0.0880]	-0.1574 [0.1173]
	lnM_sq	0.0045*** [0.0005]	-0.0018 [0.0037]	0.0074 [0.0050]
	Fixed effect	0.0299*** [0.0019]	-0.0129 [0.0079]	0.1160*** [0.0191]

Clothing	Constant	2.0455*** [0.1070]	0.3686 [0.5284]	2.8435*** [0.6339]
	Smk	-0.0156*** [0.0044]	-0.0024 [0.0096]	0.0009 [0.0257]
	Size of Household	0.0028*** [0.0002]	-0.0020 [0.0013]	0.0046** [0.0018]
	Sex of Household Head	0.0106*** [0.0016]	0.0065* [0.0035]	0.0010 [0.0079]
	Age of Household Head in Years	-0.0003*** [0.0000]	-0.0002*** [0.0001]	-0.0003* [0.0002]
	lnM	-0.2922*** [0.0184]	-0.0181 [0.0879]	-0.4457*** [0.1075]
	lnM_sq	0.0111*** [0.0008]	-0.0003 [0.0037]	0.0179*** [0.0045]
	Fixed effect	-0.0708*** [0.0029]	-0.0219*** [0.0079]	-0.0078 [0.0175]
Health	Constant	0.2776*** [0.0697]	0.1128 [1.4313]	1.5231 [1.6591]
	Smk	0.0015 [0.0029]	0.0358 [0.0260]	-0.0014 [0.0673]
	Size of Household	-0.0043*** [0.0001]	-0.0149*** [0.0034]	-0.0136*** [0.0048]
	Sex of Household Head	-0.0087*** [0.0010]	-0.0272*** [0.0096]	-0.0703*** [0.0206]
	Age of Household Head in Years	0.0002*** [0.0000]	0.0025*** [0.0002]	0.0026*** [0.0005]
	lnM	-0.0569*** [0.0120]	-0.0633 [0.2381]	-0.2864 [0.2815]
	lnM_sq	0.0032*** [0.0005]	0.0046 [0.0099]	0.0139 [0.0119]
	Fixed effect	-0.0125*** [0.0019]	-0.0007 [0.0213]	-0.0362 [0.0458]
Energy	Constant	0.8464*** [0.0708]	0.5183 [0.5822]	1.4308** [0.5705]
	Smk	0.0025 [0.0029]	-0.0133 [0.0106]	-0.0005 [0.0231]
	Size of Household	-0.0003** [0.0001]	-0.0010 [0.0014]	0.0021 [0.0017]
	Sex of Household Head	0.0021** [0.0010]	0.0037 [0.0039]	0.0133* [0.0071]
	Age of Household Head in Years	0.0001** [0.0000]	-0.0002* [0.0001]	-0.0001 [0.0002]
	lnM	-0.1289*** [0.0122]	-0.0757 [0.0969]	-0.2348** [0.0968]
	lnM_sq	0.0053*** [0.0005]	0.0032 [0.0040]	0.0101** [0.0041]
	Fixed effect	-0.0268*** [0.0019]	-0.0189** [0.0087]	-0.0415*** [0.0158]
Transportation	Constant	-0.3609*** [0.0536]	0.0429 [0.3952]	-0.1941 [0.4434]
	Smk	0.0048** [0.0022]	-0.0030 [0.0072]	0.0033 [0.0180]
	Size of Household	-0.0019*** [0.0001]	-0.0037*** [0.0009]	-0.0016 [0.0013]
	Sex of Household Head	0.0017** [0.0008]	0.0081*** [0.0027]	0.0105* [0.0055]

	Age of Household Head in Years	0.0000** [0.0000]	-0.0001 [0.0001]	-0.0002* [0.0001]
	lnM	0.0620*** [0.0092]	-0.0040 [0.0658]	0.0405 [0.0752]
	lnM_sq	-0.0024*** [0.0004]	0.0003 [0.0027]	-0.0018 [0.0032]
	Fixed effect	0.0005 [0.0015]	0.0028 [0.0059]	0.0037 [0.0123]
Recreation Activities	Constant	-0.0846*** [0.0270]	-0.3367* [0.1990]	-0.0237 [0.1579]
	Smk	0.0084*** [0.0011]	-0.0017 [0.0036]	0.0021 [0.0064]
	Size of Household	0.0000 [0.0001]	-0.0003 [0.0005]	0.0005 [0.0005]
	Sex of Household Head	0.0007* [0.0004]	-0.0016 [0.0013]	0.0033* [0.0020]
	Age of Household Head in Years	0.0000*** [0.0000]	-0.0001*** [0.0000]	0.0000 [0.0000]
	lnM	0.0138*** [0.0047]	0.0576* [0.0331]	0.0005 [0.0268]
	lnM_sq	-0.0006*** [0.0002]	-0.0024* [0.0014]	0.0001 [0.0011]
	Fixed effect	0.0043*** [0.0007]	0.0010 [0.0030]	0.0108** [0.0044]
Communication	Constant	0.0334 [0.0438]	-1.0033** [0.4212]	-0.3286 [0.3891]
	Smk	-0.0005 [0.0018]	-0.0120 [0.0077]	0.0064 [0.0158]
	Size of Household	-0.0014*** [0.0001]	-0.0010 [0.0010]	0.0005 [0.0011]
	Sex of Household Head	0.0037*** [0.0006]	0.0057** [0.0028]	0.0011 [0.0048]
	Age of Household Head in Years	-0.0001*** [0.0000]	-0.0003*** [0.0001]	-0.0004*** [0.0001]
	lnM	-0.0168** [0.0075]	0.1616** [0.0701]	0.0460 [0.0660]
	lnM_sq	0.0012*** [0.0003]	-0.0064** [0.0029]	-0.0015 [0.0028]