# Effect of increased reliance on specific excise on the consumption of cigarettes

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**List of Acronyms**

| | |
|---|---|
| EMR | East Mediterranean Region |
| EU | European Union |
| FCTC | Framework Convention for Tobacco control |
| FE | Fixed Effects |
| GDP | Gross Domestic Product |
| IMF | International Monetary Fund |
| ITC | International Tobacco Control |
| OLS | Ordinary Least Squares |
| PPP | Purchasing Power Parity |
| RE | Random Effects |
| SEAR | South East Asian Region |
| WHO | World Health Organization |
| WPR | Western Pacific Region |

**ABSTRACT**

Research has shown that specific tax is more effective in discouraging the behavior of smoking than ad valorem tax. This paper makes use of panel data on 39 countries to investigate the impact of increased reliance on specific tax on cigarette consumption. The data used includes 21 countries, from six WHO regions, that increased their reliance on specific tax between 2008 and 2016. The fixed effects and random effects models are employed to estimate the extent to which a change in the specific share of excise tax changes the per capita consumption of cigarettes. According to the results, a one percent increase in the share of specific tax is associated with a 0.16 percent decline in per capita consumption. The findings support the assertion that increased reliance on specific tax results in a more significant decline cigarette consumption. The paper recommends that policymakers should aim to implement a health-driven taxation policy which entails a heavy reliance on specific tax on cigarettes and other tobacco products. However, it is essential to keep in mind that reliance on specific tax may only be useful when adopted with along with other strategies of tobacco control such as combating illicit trade.

**Key Words**: Specific tax, Ad valorem tax, cigarette consumption

## INTRODUCTION

Cigarette taxation plays a significant role in tobacco control. According to the World Health Organization (WHO) report on global tobacco epidemic 2008, raising taxes to increase the price of cigarette is considered the most efficient and cost-effective means to reduce cigarette consumption (WHO, 2008). Article 6 of WHO's Framework Convention for Tobacco Control (FCTC) encourages parties to implement policies that improve public health through the taxation of tobacco products. Some countries (such as The European Union, Pakistan, Norway, and United States, etc.) have adopted such policies. A health-driven taxation policy aims to increase the retail prices of cigarettes, especially for low-priced brands(International Agency for Research on Cancer, 2011). The principle of using excise tax as a tobacco control strategy is simple. An increase in the excise tax leads to a rise in retail prices of cigarettes which ultimately reduces consumption (Sullivan & Dutkowsky, 2012). Many studies have supported the negative correlation between prices and consumption and it is not contested (Chaloupka et al., 2000; Chiou & Muehlegger, 2014). To a large extent, the effectiveness of taxation in reducing smoking depends on the structure of the excise tax.

Excise taxes may be levied as specific or ad valorem tax. Specific tax is independent of price, and it is imposed based on quantity (e.g., per pack or weight) whereas ad valorem tax is imposed as a percentage of value (manufactures price or retail price) (Chaloupka, Yurekli & Fong, 2012). The structures of the excise tax systems may be classified into three categories; specific only, ad valorem only and mixed system (a combination of both). Countries adopting these structures may implement a uniform tax rate on all cigarettes or use a tiered system where different tax rates are imposed on cigarettes based on specific characteristics (e.g., brand, length, whether a filter is present, or price). The choice of excise structure may have a significant impact on how smokers and manufacturers react to increased taxation.

The two main factors- related to the excise tax structure- affecting the effectiveness of increased taxation are substitution and tax avoidance. Brand-substitution is a concept used to describe one of the price minimizing strategies used by smokers in response to increased prices. It entails the switch from premium brands to low-priced brands. A study by Choi et al. (2011) evaluated the price minimizing behaviour of smokers using data on seven hundred eighteen smokers from the Minnesota Adult tobacco survey. The results of the study show that 78% of the smokers used at least one price minimizing strategy to save money on cigarettes and 32% of these

smokers changed to cheaper brands in response to the resulting increase in the cost of smoking(Choi et al., 2012). In cases where the tax is dependent on the price of cigarettes, a significant price gap between brands provides opportunities for tax avoidance as producers are encouraged to flood the markets with cheaper brands to avoid higher taxes (Emmanuel Guindon et al., 2014). The presence of these factors (substitution and tax avoidance) depends on, among others, the structure of the excise tax imposed on cigarettes.

Uniform specific tax is associated with relatively higher prices especially for lower-priced brands (Shang et al., 2014). Therefore, uniform tax reduces the incentives for smokers to switch to lower-priced brands because it ensures that there is a smaller price gap between lower-priced and premium brands. A further advantage of uniform specific taxation is that it is easier to implement and administer because it is based volume and not price. However, the value of the specific tax can be eroded by inflation if not adjusted regularly. Ad valorem tax, on the other hand, is associated with more significant price gaps between low and premium brands and thus, consumers are encouraged to consume cheaper brands. Its dependence on value makes ad valorem tax is more challenging to implement and manage(International Agency for Research on Cancer, 2011). Furthermore, under the ad valorem tax producers may be encouraged to produce low priced brands as a way avoiding higher tax from high priced brands.

Countries differ in the structure of cigarette excise tax. Most developed countries tend to use specific tax except the European Union (EU) member countries (Shang et al., 2014). EU member countries are required by the European Commission to implement a mixed tax system comprising an element of both specific and ad valorem (Cnossen, 2012). However, although member countries commit to this requirement, EU countries differ in their degree of reliance on specific or ad valorem tax. Most developing countries, on the other hand, tend to rely more on ad valorem and mixed tax systems (Shang et al., 2014)

A change in excise tax structure towards more reliance on specific tax may be essential to the effectiveness of health-driven taxation policy. Such a system will not only increase prices but also reduce the price gap between premium brands and low-priced brands. High reliance on specific tax will help to prevent cigarette users from switching to low priced brands in response to a tax increase. However, the price of such a move is that it increases the tax burden on the lower price brands and reduces the burden on premium brands. Some countries have made changes to their excise tax structures towards higher reliance on specific tax (World Health Organization, 2010, 2015). Some nations that previously relied solely on ad valorem tax have

either changed to specific only or mixed system whereas those using a mixed tax system have increased the specific component of excise tax and are relying less on ad valorem tax. To the best of our knowledge, there is no study that has explored the association between cigarette excise tax structure and cigarette consumption. This paper contributes to the literature by estimating the magnitude of the decrease in consumption resulting from increased reliance on specific excise tax using data of countries from six regions.

The rest of the paper is structured as follows. The review of literature about tax structure and its effect on price are presented in section 2. Section 3 details the information on the data and methodology used for the analysis. The results and discussions are presented in section 4. Section 5 presents the discussion and conclusion.

## LITERATURE REVIEW

The effect of different excise tax structures on cigarette prices has received a lot of attention in the literature on tobacco control(Chaloupka et al., 2010; Chaloupka, Kostova & Shang, 2014; Liber et al., 2015). While authors differ in the methodologies used to conduct their studies, they tend to draw similar conclusions. The typical finding is that specific uniform tax is the most effective tax structure in reducing cigarette consumption (Chaloupka, Kostova & Shang, 2014; Liber et al., 2015)

Using data on 21 EU countries, Chaloupka et al. (2010) examined the effect of excise tax structure on cigarettes prices. The aim of the study was to compare the effect of a tax increase in countries with a high proportion of ad valorem tax against those that relied more on specific tax. The results of the study indicate that an increase in excise taxation is associated with a higher price gap between premium and lower-priced brands in countries with a higher share of ad valorem tax. The effects of a higher price gap between brands may promote the consumption of cheaper brands as highlighted by Choi et al. (2011). The study found that while high reliance on specific tax is the most effective way of reducing cigarette consumption, its effectiveness depends on the manufactures market power. The effect of an increase in specific excise tax disappears as the degree of concentration increases. However, this finding contradicts the findings of Linegar and Van Walbeek (2016) who found that low levels of competition in the cigarette market are associated with a higher specific excise tax pass-through (Linegar & van Walbeek, in press).

Shang et al. (2014) used data on 16 countries from the International Tobacco Control Policy Evaluation (ITC) Project to study the distribution of cigarette prices under different tax structures. Countries with similar income levels were pared as well as those that levied an identical total excise tax. The study employed the two-sample comparison test to compare the mean and variance of self-reported cigarette prices. The findings of the study indicate that countries with tax structures deviating from uniform specific taxation are characterized with price distributions associated with high variability. The results illustrate that countries that rely heavily on ad valorem tax are associated with greater price variability around the median. Among the mixed taxation systems, countries relying more on ad valorem tax tend to have a greater price variability than those with a greater reliance on specific tax. Furthermore, the results show that, unlike uniform tax structures, tiered tax structures are associated with cigarette prices that are skewed more towards lower prices (Shang et al., 2014). Based on these

results, the authors concluded that cigarette tax structures that depart from uniform tax structure are associated with opportunities for tax avoidance and brand switching.

A similar study was conducted by Chaloupka et al. (2014). The objective of this study was to compare the price variability under each tax structure using brand-specific data on the average prices of cigarette brands. According to the findings, price variability was high in countries with ad valorem uniform taxation, mixed uniform taxation, and tiered structures as compared to those with only specific uniform taxation. Likewise, Liber et al. (2014) studied five Southeast Asian countries and compared countries with ad valorem tax to those with multitier specific tax. Like the findings of other papers, countries with ad valorem tax structures (Cambodia, Lao PDR, and Vietnam) had more price variability than those with multitier specific tax structures (Indonesia and the Philippines).

## DATA

The objective of the paper is to provide empirical evidence of the extent to which increasing reliance on specific tax affects the consumption of cigarettes. To achieve this, the paper makes use of panel data on 39 countries. The decision of the number of countries to consider in the study was based on the data availability of the period 2008-2016. Data on Per Capita cigarette consumption was available for more than 100 countries. However, for most of these countries, the data could only go as far as 2012. The lack of consumption data for the period 2013-2016 disqualified these countries from being considered in the study. Furthermore, data on tax structure was not available for most the countries. Countries without tax data were also not considered. Only 39 countries had all the required data covering the period of interest.

The data frequency is yearly and the period of study is 2008 to 2016. The main variables of the study are; total per capita cigarette consumption and the specific share of total excise tax (calculated as specific tax ÷ [specific tax and ad valorem tax]). The specific share variable is a value between zero and one where zero means ad valorem only system, one is specific only, and a value between zero and one represents a mixed tax system. Other variables considered in the study include Gross Domestic Product (GDP) and the dollar price of cigarettes. The data was collected from many sources. Data on cigarette consumption and smoking population data were obtained from a series of country-specific reports, by ERC, which contains detailed information about the cigarette market. Tax and nominal price (US dollars) data, based on the Most Popular Brand (MPB), were collected from table 9.1.0 of WHO reports on global tobacco epidemic (2017). Information on excise structure was also derived from these tables. Finally, the Purchasing Power Parity (PPP) adjusted GDP data was obtained from the data portal of the International Monetary Fund (IMF).

The 39 countries come from six different WHO regions. These regions include; the South-East Asia Region (SEAR), Africa, the Americas, West Pacific Region (WPR), East Mediterranean Region (EMR) and Europe. The countries in the study can be classified into two broad categories. The first is a group of 12 countries that have changed their excise tax structure towards more reliance on specific tax in the study periods (2008 - 2016). These countries are characterized by at least one of the following; a change from ad valorem only to specific only, a change from ad valorem only a mixed tax, an increase in the specific component while reducing the ad valorem component or increasing the specific tax while leaving the ad valorem component unchanged. The second group includes 19 countries that were added as controls. These countries either did not change their excise tax structure or changed it by reducing

reliance on specific tax. From this point forward, "category one" will be used to refer to countries that changed their tax structure towards high specific tax whereas "category two" will be used to describe countries that did not make this move. Table 1 lists the countries that belong to category one.

| | | Excise structure change | |
|---|---|---|---|
| **Region** | **Country** | **Previous structure** | **New structure** |
| Africa | Congo | Ad valorem only | Mixed tax system |
| | Mozambique | Ad valorem only | Specific Only |
| | Zimbabwe | Ad valorem only | Specific Only |
| America | Chile | Ad valorem only | Mixed tax system |
| | Peru | Ad valorem only | Specific Only |
| EMR | Jordan | Mixed tax system | Specific Only |
| | Morocco | Mixed tax system | Higher specific share within a mixed tax system |
| | Pakistan | Mixed tax system | Specific Only |
| EUR | Denmark | Mixed tax system | Higher specific share within a mixed tax system |
| | Greece | Mixed tax system | Higher specific share within a mixed tax system |
| | Ireland | Mixed tax system | Higher specific share within a mixed tax system |
| | Latvia | Mixed tax system | Higher specific share within a mixed tax system |
| | Netherlands | Mixed tax system | Higher specific share within a mixed tax system |
| | Slovenia | Mixed tax system | Higher specific share within a mixed tax system |
| | Sweden | Mixed tax system | Higher specific share within a mixed tax system |
| | Turkey | Ad valorem only | Mixed tax system |
| | Ukraine | Mixed tax system | Specific Only |
| SEAR | India | Mixed tax system | Specific Only |
| | Myanmar | Ad valorem only | Specific Only |
| WPR | Laos | Ad valorem only | Mixed tax system |
| | Malaysia | Mixed tax system | Specific Only |

Table 1: Countries that changed their tax structure towards higher reliance on specific tax

The three African countries in table 1 all previously relied on ad valorem only. Mozambique and Zimbabwe changed their tax structures to specific only while Congo switched to a mixed taxation structure. Congo introduced the specific tax in 2014, towards the end of the study period, and it experienced just a slight decrease in the percentage of ad valorem tax from 15.48% in 2008 to 14.77% in 2016. Mozambique made a complete shift to ad valorem tax by 2010 and then increased its percentage of specific tax from 12% in 2010 to 14.86% in 2016. Zimbabwe, on the other hand, switched to specific only by 2012 and then slightly increased its percentage of specific tax from 20% to 22.86%. Tax data on these countries reveal that the excise tax does not form a significant proportion of the retail price. For instance, the average total excise tax (ad valorem + specific tax) in the study period was 17.47% and 11.06% respectively.

The Americas and the Western Pacific Region (WPR) each have only two countries belonging to category one. Chile used the ad valorem only taxation system in 2008 and 2010, but by the year 2012, it had switched a mixed tax system by introducing the specific component. Chile reduced its percentage of ad valorem from 60.4% in 2008 to 30% in 2016 and increased the portion of specific tax from 3.28% in 2008 to 43.16% in 2016. In Laos, excise tax does not account for a significant part of the cigarette price. Nevertheless, it also increased its reliance specific tax by moving from an ad valorem only to a mixed taxation system. This change happened by the year 2010. After the introduction of the specific tax in 2010, the percentage ad valorem tax decreased from 2.29% in 2010 to 1.64% in 2016, and the percentage of specific tax increased from 2% in 2010 to 7.14% in 2016.

As shown in table 1, most of the category one countries belong to the European region. Most of these countries belong to the European Union, and as such, they are required to maintain a mixed tax system by law. Among the EU member countries, some countries experienced a drastic decrease in their reliance on the ad valorem component as a percentage of the retail price. For instance, Netherland decreased its ad valorem component from 20.52% in 2008 to 0.83% in 2016. Similarly, Sweden and Denmark experienced an ad valorem reduction from 39.2% and 20.8% in 2008, respectively, to 1% in 2016. Other EU members only experienced a slight decrease in the ad valorem component and still had a relatively more significant percentage of ad valorem tax by the year 2016. For example, Latvia decreased the rate of ad valorem tax from 32.2% in 2008 to 25% in 2016. Ukraine is the only non-EU member country, in the European region, which is part of the category one nations. Unlike the EU members,

Ukraine was able to switch from a mixed tax structure to specific only taxation by reducing its ad valorem component from 20.8% in 2010 to 0% in 2013 through to 2016.

Only two countries in the South East Asian Region (SEAR) are part of the category one nations. Table 1 shows that India changed its tax structure from the mixed taxation system to specific only whereas Myanmar changed from ad valorem only to specific only taxation. According to the data, although India gradually reduced its ad valorem component to 0%, the ad valorem component was minimal for the entire study period. In 2008, the ad valorem component accounted for 0.85% of the retail price. This percentage dropped to 0.72% in 2010 and to 0% in 2016. Initially, Myanmar increased its ad valorem component of cigarette price from 25% to 50%. However, by 2016, the specific tax was introduced and accounted for 35.29% of retail price whereas the percentage of ad valorem tax decreased to 0%.

The Eastern Mediterranean region has three countries belonging to category one. Jordan and Pakistan changed from a mixed taxation system to specific only. In 2008, Jordan relied heavily on ad valorem tax as it accounted for 25% of the retail price but the percentage reduced to 0% in 2014. Pakistan's reliance on ad valorem, on the other hand, was relatively low. Pakistan decreased the ad valorem component from 3.8% in 2008 to 0% in 2014. Morocco maintained its mixed taxation system but reduced its reliance on ad valorem tax from 50% in 2008 of the retail price to 10% in 2008 and increased specific tax from 0.5% in 2008 to 45.56% in 2016.

## METHODOLOGY

Panel data, also known as cross-sectional time-series or longitudinal data, consists of a set of repeated observations of the same cross-sectional unit (e.g., a country). One of the main advantages of using panel data for economic research is that, unlike the conventional time-series or cross-sectional data, panel data is made up of both a cross-sectional component and time series component (Hsiao, 2007). The cross-sectional component reflects the differences between entities whereas the time-series component reflects how an entity changes over time. A researcher may, therefore, focus on the observed differences between countries considered in the study or how an observed variable for a country changes during the study period. A large set of repeated observations may also provide the researcher with a large dataset allowing for analysis with better estimates of the parameters under consideration. Furthermore, panel data provides the researcher with many unique data points which help in increasing the researcher's degrees of freedom to explore the variables and the relationship between them.

Economic researchers employ various types of techniques to analyze panel data. These may include fixed effects, random effects, and pooled OLS regressions (Baltagi, Bresson & Pirotte, 2003). Multiple regression techniques may also be used for panel data. However, they are not considered optimal because the coefficients tend to suffer from omitted variable bias. This problem arises when there is an unobserved variable affecting the dependent variable which cannot be controlled for.

Our study aims to estimate the extent to which increasing reliance on specific tax changes per capita cigarette consumption. To do this, we estimate the model below:

$$log(cons\ per\ capita) = \alpha + \beta_1 log(price_{it}) + \beta_2 specificshare_{it} + \beta_3 \log(GDP_{it}) + \beta_4 Region_i + \varepsilon_{it} \qquad (1)$$

We estimate equation one by regressing consumption per capita on price, the specific share of the excise tax, GDP per capita and region. Our variable of interest is the specific share. The specific share variable is a value between zero and one, where zero represents a country using ad valorem only taxation, and one means that a country imposes only specific taxation on cigarettes. The coefficient on this variable will provide an estimate of the magnitude of the change in cigarette consumption resulting from increased reliance on specific tax. According to the economic theory of demand, we expect the price to have a negative relationship with consumption per capita. GDP per capita is expected to be positively related to consumption per capita because an increase in income results in an increase in the expenditure on all goods

including cigarettes. The regional dummies are incorporated into the equation to control for differences between regions. To estimate equation one, the paper employs three estimation methods which are widely used in panel literature. These include, pooled OLS, Random Effects and Fixed effects estimation methods. Tests will be conducted to choose the best estimation method.

### The pooled OLS Estimator

The simplest panel data technique is the pooled OLS regression. This technique ignores the cross-section and time series nature of the dataset. Equation two shows the structure of the pooled OLS model.

$$log(cons\ per\ capita) = \alpha + \beta_1 log(price_{it}) + \beta_2 specificshare_{it} + \beta_3 \log(GDP_{it}) + \beta_4 Region_i + \mu_{it} \qquad (2)$$

Equation two assumes that the error term (μ) is independent across each entity (i) and time (t), E (μ) =0 and var (μ) = $\delta^2$ (*i.e.* $\mu \sim N(0, \delta^2)$ *iid*). This implies that for any given entity (x), there is no serial correlation between observations and the errors are not heteroskedastic. However, ignoring the structure of panel data by assuming constant coefficients entails that most advantages of panel data are lost. Furthermore, the assumption that the errors are identical and independently distributed (*iid)* may lead to biased results. However, since the assumption of the model meets those of a classical regression model, the model is efficiently estimated by Ordinary Least Squares (OLS).

Most applied economic studies that are based on panel data make use of pooled OLS as a starting point of their empirical analysis. Similarly, this paper will begin the analysis of panel data with the results from pooled OLS model despite its potential bias. The most reliable results, however, will be obtained from the fixed effects and random effects models which are considered to be suitable techniques for panel data. The main difference between these two techniques is based on the assumptions they make about the error term in the model.

### Fixed effects and Random Effects

The estimation methods used in the paper are the random effects model and the fixed effects model. To understand the difference between the two models, consider the following model structure:

$$log(cons\ per\ capita) = \alpha + \beta_1 log(price_{it}) + \beta_2 specificshare_{it} + \beta_3 \log(GDP_{it}) + \beta_4 Region_i + \varepsilon_{it}$$

Where $\varepsilon_{it} = \alpha_i + \eta_{it}$ (3)

In model three, $\alpha_i$ is the individual specific effect and $\eta_{it}$ is the common error term. The individual specific effect varies across cross-sectional unit but constant over time whereas the error term varies both across time and units. The main assumption that differentiates fixed effects from random effects models is whether the $\alpha_i$ may be correlated with $x_i$ (the cross-sectional unit) or not. Unlike the random effects model, the fixed effects model assumes that the unobserved individual effect is correlated with the explanatory variables. In the fixed effect model, the estimated coefficients cannot be biased because the model omits all time-invariant variables. However, unlike the fixed effects model where the intercept absorbs all time-invariant variables, the random effects model enables the researcher to include time-invariant explanatory variables (Gardiner, Luo & Roman, 2009). The advantage of using the random effects model is that it allows for the analysis of the role played by time-invariant variables (Baltagi, Bresson & Pirotte, 2003). For instance, the random effects model will provide coefficients for the regional dummies in equation three whereas the fixed effects model will eliminate them from the model. However, it is worth noting that elasticity estimates obtained using Random effects and fixed effects are usually smaller than typically found in country estimates (Blecher, 2008).

The F-test will be used to test the significance of the random effects model, and the Breusch-Pagan LM test will be used to test the significance of the fixed effects model. If both models are significant, the Hausman (1978) test will be used to choose between random and fixed effect. The pooled OLS model will be considered the most preferred model where the random and fixed effects are both insignificant.

The Hausman (1978) test is an accepted model to choose between random and fixed effects models. The null hypothesis is that the coefficients obtained by the random effects model are the same as those from the fixed effects model. The rejection of the null hypothesis entails that the coefficients of the random effects model are biased and inconsistent due the violation of the Gauss Markov theorem. The rule of thumb is, use fixed effects if the null hypothesis is rejected; otherwise, and use the random effects model.

## RESULTS

### Descriptive Statistics

Data from all 39 countries indicates a steady increase in average specific share over the entire period. As shown in table 2, average specific share increased from 27% in 2008 to 50% in 2016. The average share of ad valorem tax, on the other hand, has decreased drastically from 72% in 2008 to 48% in 2016. The study period is also characterized by a steady increase in the average retail price of a pack of 20 cigarettes from US$2.05 to US$3.19. There is a downward trend in cigarette use in the entire study period as seen from a decrease in the average per capita consumption from 875.72 pieces per year to 716 pieces per year.

*Table 2: average price, consumption per capita, ad valorem/ specific share*

| Year | Average retail price (for a pack of 20 cigarettes) | Average Consumption per Capita (pieces per year) | Average Specific share (% of total excise tax) | Average ad valorem share (% of total excise tax) |
|---|---|---|---|---|
| 2008 | 2.05 | 748 | 28 | 72 |
| 2010 | 2.27 | 813 | 31 | 69 |
| 2012 | 2.56 | 838 | 39 | 61 |
| 2014 | 3.13 | 759 | 47 | 53 |
| 2016 | 3.19 | 743 | 51 | 48 |

*Table 3: Average prices for category one and category two countries*

| Year | Average retail price (Category 1) | Average retail price (category 2) |
|---|---|---|
| 2008 | 2.64 | 1.28 |
| 2010 | 2.82 | 1.56 |
| 2012 | 3.13 | 1.84 |
| 2014 | 3.58 | 2.54 |
| 2016 | 3.38 | 2.94 |

Table 3 shows the cigarette prices for each of the two categories of countries considered in the study. Both groups experienced an increase in average prices. The average prices of category two increased from US$1.28 to US$ 2.94 whereas the prices for category one increased from US$2.64 to US$3.38. The table also shows that throughout the study period, the average prices of category one were greater than those of category two. Despite the increase in the average prices for both categories, the decrease in average per capita consumption of cigarettes for category two is much less than that of category one as illustrated in fig1. Per capita consumption of category one countries decreased gradually over the entire study period whereas that of category two nations increased from 2008 to 2012 and then decreased gradually between 2012 and 2016. This paper examines the extent to which increased reliance on specific tax results in decreased per capita consumption.

*Figure 1: consumption per capita for category1 vs. category two*

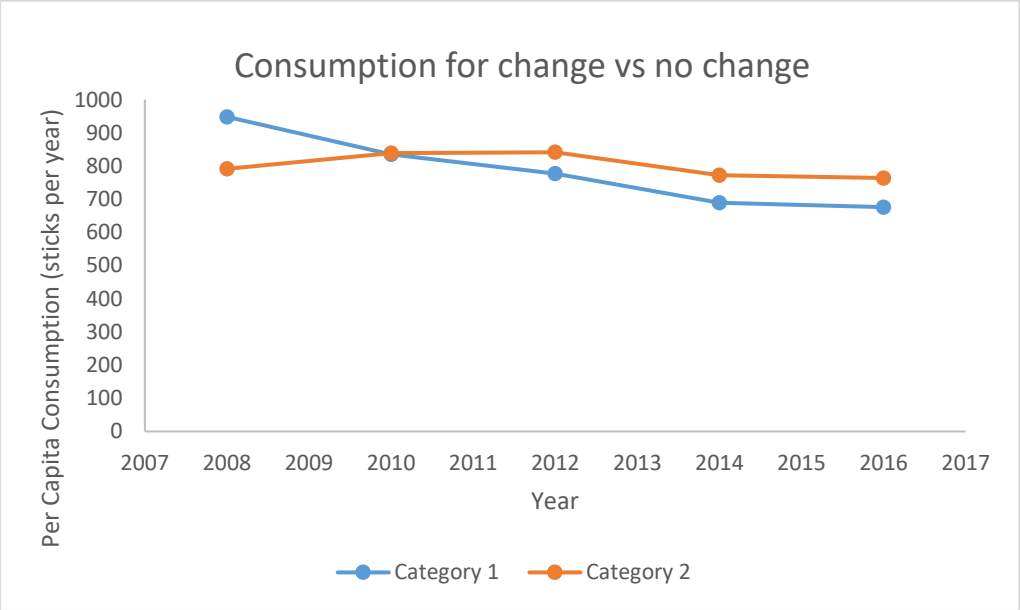

*Figure 2: bar graphs showing per capita consumption from 2008 to 2016*

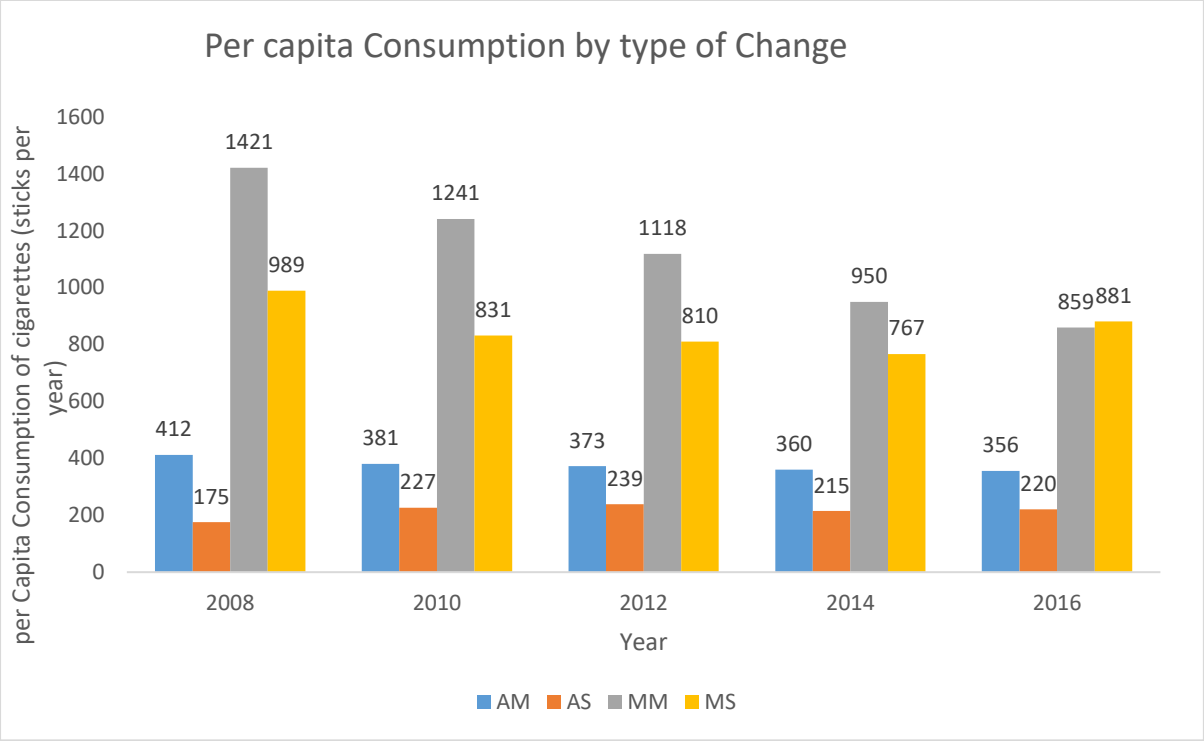


Fig 2 is based on category one countries. In Fig2; AM represents the average per capita consumption of countries that changed their excise tax structure from ad valorem to mixed tax, AS represents the direct switch ad valorem only to specific only, MM represents the increase in specific share within the mixed system, and MS is the change from mixed tax to specific only. The countries that experienced the largest decrease in per capita consumption are those that increased the specific component while maintaining the mixed tax system. These were followed by countries that change their structure from mixed system to specific only. Fig 2 shows that on average, countries that made a direct switch from ad valorem tax only to specific tax only experienced a gradual increase in per capita consumption from 175 in 2008 to 220 in 2016. To estimate the extent to which increased reliance on specific tax reduces cigarette consumption, we employ panel data regressions analysis.

## Empirical Results

The results obtained from the pooled OLS, random effects and fixed effects models are presented in table 4. We first start by reporting the results of the pooled OLS model. The signs on the coefficients are in accord with our expectations. Our variable of interest is the specific share of excise tax. As expected, there exists a negative relationship between cigarette

consumption and specific share of excise tax. According to the coefficient, a one percent increase in the specific share on excise tax results in a 0.32% decrease in per capita consumption. The results confirm the existence of inverse and significant relationship between price and per capita consumption of cigarettes. The coefficient on price indicates that a one percent increase in price translates into a 0.64% decrease in cigarette consumption. GDP per capita is positively related to cigarette consumption such that an increase in GDP per capita by one percent results in a 0.84% increase in per capita consumption. As discussed in the previous section, the coefficients of the pooled OLS model are biased because the model ignores the structure of panel data. However, the model is good to use as a starting point for our analysis. Having reported the results obtained from the pooled OLS model, we now move on to reporting the results of the fixed and random effects models.

*Table 4: Regression results*

Dependent variable: Log of consumption per capita

| VARIABLES | (1) pooled OLS | (2) Random effects | (3) Fixed effects |
|---|---|---|---|
| Log price | -0.635*** | -0.148** | -0.106* |
| | (0.0884) | (0.0575) | (0.0588) |
| Log GDP | 0.836*** | 0.348*** | 0.277** |
| | (0.106) | (0.104) | (0.115) |
| Specific share | -0.321*** | -0.171*** | -0.163** |
| | (0.117) | (0.0628) | (0.0636) |
| Region (Africa = Base category) | | | |
| 2.AMR | -0.0188 | 0.557 | |
| | (0.244) | (0.452) | |
| 3.EMR | 0.692*** | 1.289*** | |
| | (0.219) | (0.419) | |
| 4.EUR | 0.934*** | 1.557*** | |
| | (0.259) | (0.418) | |
| 5.SEAR | 0.275 | 0.702* | |
| | (0.203) | (0.411) | |
| 6.WPR | 0.662*** | 1.352*** | |
| | (0.228) | (0.436) | |
| Constant | -1.417* | 2.193*** | 3.801*** |
| | (0.797) | (0.827) | (1.019) |
| Observations | 195 | 195 | 195 |
| Hausman Test | | | prob>Chi2=0.0000 |
| Number of countries | | 39 | 39 |

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As mentioned earlier, the fixed effects and random models are different due to the different assumptions that each model makes. Before reporting the results of these models, it is important to assess which model is the most appropriate and preferred to use. The Hausman specification test was used to choose between the two models under the null hypothesis that the individual effects are not correlated with the explanatory variables (Hausman 1978). According to the results of the specification test, the null hypothesis is rejected at 1% level of significance. This means that the fixed effects model is the most preferred model to use.

Since the fixed effects model is the most preferred model, the following interpretation is based on the results from the fixed effects model. Like the pooled OLS model, the signs on the coefficients meet our expectations. However, the coefficients of the fixed effects model are smaller than those of the pooled OLS model. Per capita consumption of cigarettes declines with an increase in the specific share of excise tax. Increasing the share of specific tax by one percent is associated with a 0.16% decrease cigarette consumption. The results also indicate that a one percent increase in the price is associated with a 0.1% decrease in cigarette consumption. GDP per capita has a positive and significant relationship with cigarette consumption such that when GDP per capita increases by one percent, consumption increases by 0.28%. The random effects model also indicate that specific share has a negative and significant relationship with per capita consumption of cigarettes. The empirical results, therefore, provide evidence in support of the proposition in the literature that increasing reliance on specific tax is effective in reducing the consumption of cigarettes.

## DISCUSSIONS AND CONCLUSION

According to the descriptive statistics, the data shows that on average, countries around the world are increasing their reliance on specific tax. The benefit of changing the tax structure towards more reliance on specific tax is best highlighted by fig 1. On average, countries that changed their excise tax structure experienced a drastic reduction in cigarette consumption as compared those that did not make such a change. The results of this paper support the assertion that increased reliance on specific tax is associated with a significant decrease in cigarette consumption. Our study has shown that increasing specific share of excise by one percent reduced per capita consumption of cigarettes by 0.16%. A health driven taxation policy which relies heavily on specific excise tax for cigarettes results can, therefore, improve public health.

The data used in the study indicate that increasing reliance on specific excise tax may not always result in decreased cigarettes consumption. According to section 3 of this study, while the average consumption decreased for category one countries, developing countries that directly changed from ad valorem only to specific only (i.e., Zimbabwe, Mozambique, and Myanmar) experienced an increase in per capita consumption. However, this does not mean that increased reliance on specific tax was not effective in reducing cigarette consumption. As suggested by Chaloupka et al. (2010), this outcome could be a result of the characteristics of the cigarette markets, in these countries, such as the manufactures market power. Furthermore, the data shows that average total excise tax as a percentage of the price for Zimbabwe and Mozambique in the study period was 17.47% and 11.06% respectively. These proportions of total excise tax may have been too small for the tax change to reduce consumption effectively. Finally, in the case of Myanmar, the switch from ad valorem only to specific only happened towards the end of the study period (between 2014 and 2016). It might have been too early to observe the effects of the change in structure.

It is therefore recommended for policymakers to implement a tax based policy which entails a heavy reliance on a specific tax for cigarettes and other tobacco products. However, it is essential to keep in mind that reliance on specific tax may only be effective when adopted with along with other strategies of tobacco control such as combating illicit trade.

One major limitation of the study is that the study period was short and many countries changed their tax structures towards the end of the period under review. Given the fact that policy changes may take some time to produce results, it's possible that some countries had not seen the effect of the change in the study period. For future research, we recommend the replication

of this study but with a more extensive period of study to allow the effects of the structure change to be fully realized.

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