EFFECTS OF PRICES BEFORE AND AFTER TAX, AND INCOME PER CAPITA ON TOBACCO CONSUMPTION IN KENYA: COINTEGRATION APPROACH

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DECLARATION

The Declaration by the Student

This thesis is my original research work, all the materials used to develop this thesis were duly acknowledged and never been presented for examination in any other institution.

Edwin Kipyego Kipchoge

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SC/PGM/025/2014 **Date**

Declaration by University Supervisors

This thesis has been submitted with our approval as University supervisors.

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DEDICATION

First and foremost, this work is dedicated to Almighty God, secondly, I dedicate this to University of Eldoret School of Science and specifically to the department of Mathematics and Computer Science for giving me an opportunity on this programme. I dedicate this work to my lovely wife Valentine Jepkoech Tarus, Daughter June Jelagat, my brother Albert Kimutai and Mathew Kipkoech Bartilol, and the entire family at large for their academic, financial support and encouraging me in pursuing this degree. More dedications to my particularly good longtime friends Daniel Tuitoek, Silas Kiprono Samoei, Thomas Mosbei and Cornelius Serem for their unreserved support, prayers and inspiration, their spiritual, wise inspiration, mentorship, and academic foundation.

ABSTRACT

Smoking of cigarette is regarded as one of the most cause of deaths among other factors in the world. It is also a causative agent of the various cancerous diseases. It is by fact though preventable, the major cause of cancer deaths in the entire world. Governments and stakeholders such as nongovernmental organizations worldwide have and still draining huge amount of money into institutions with an aim to fight to menace, which is associated to smoking of tobacco. The war to fight this menace is still on and the enemy is taking the lives of our beloved brilliant and potential individuals playing a significant role in developing Kenya economically. In an event that Kenya would decide to lose hope on the fight against this vice, there will be escalation with each passing year of tobacco deaths. Therefore, the general objective of the study was to find out and analyze the relation between tobacco prices both before and after tax and income per capita on tobacco consumption in Kenya. Longitudinal research design analysis approach was used covering the sampled period 1980 to 2016. The data used were extracted from economic surveys and published statistical abstracts by Kenya Bureau of Statistics. Augmented Dickey Fuller and Phillips Perron conventional unit root tests were used. From the results, the data exhibited unit root at levels but became stationary after the first difference. Zivot Andrews and Clement Montanes Reyes unit root tests were used to check if the time series variables had some major structural breaks at some time(s). There was a cointegration of -0.6868 Johansen's cointegration equation implying that there was a deviation from long run equilibrium and this prompt the use of Vector Error Correction Model (VECM) in estimating the model. The VECM results showed tobacco prices had a negative and significant effect on tobacco use in Kenya with coefficients and their respective p-value -85.846 (0.017) and -167.655(0.000) for price of tobacco before and after tax respectively. Income per capita positively and significantly affected the tobacco smoking with coefficient of 19.353 and p- value of 0.000 less than 5 per cent significant level. The roots of companion matrix showed the model used was stable. Langrage Multipliers test confirmed that there was no autocorrelation among the independent variables. It is recommended from the findings that the government through policy formulation on tobacco pricing taxation to reduce cigarette smoking and ensure a healthy nation thus promoting productive economy in general. This also can assist government in acquisition of more revenue for their annual budgets.

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LIST OF ACRONYMS

ADF	Augmented Dickey & Fuller
AIC	Akaike Information Criterion
AO	Additive Outlier
ARDL	Autoregressive Distributed Lag
Ce	Cointegrating Equation
CMR	Clemente-Montañés-Reyes
COMESA	Common Market of East and South Africa
COPD	Chronic Obstructive Pulmonary Disease
DGP	Data Generating Process
Du	Dummy
EAC	East African Community
FPE	Final Prediction Error
GoK	Government of Kenya
GYTS	Global Youth Tobacco Survey
HQC	Hannan-Quinn Criteria
IILA	International Institute for Legislative Affairs
KNBS	Kenya National Bureau of Statistics
KPSS	Kwiatkowski Phillips Schmidt & Shin
LL	Log likelihood
LM	Langrage Multipliers
LR	Likelihood Ratio
MoH	Ministry of Health

Parms	Parameters
SBIC	Schwarz Bayesian Information Criteria
SDG	Sustainable Development Goals
USA	United State of America
VAR	Vector Autoregressive
VAT	Value Added Tax
VECM	Vector Error Correction Model
W.H. O	World Health Organization
ZAT	Zivot Andrews Test

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CHAPTER ONE

INTRODUCTION

1.1 Overview

This section of the study covers the background information, problem statement of the study, hypothesis formulation, objectives, and the study area

1.2 Background Information

In most countries around the world, the leading cause of various cancerous diseases which has led to numerous deaths and it can be prevented is smoking of cigarette. Cigarette is just but one of the products among many of the tobacco crop. Despite the health, effects associated with this vice people continue consuming and more new smokers are increasing at an alarming rate especially the youth from the rural regions. Among students covered by the(Nikaj & Chaloupka, 2013), the smoking prevalence among the youth aged 13-15 years was 7% for all, 4% for girls and 9.6% for boys. This high prevalence rates consumption of tobacco would be projected to be even higher in the future. Tobacco caused disease has killed about 6000 and more of Kenyans while adults still using the tobacco and its products each day are more than 2,737,000 (Eriksen, Mackay, & Schluger, 2016). Kenya national Bureau of Statistics (2014) reported that more than a quarter of the total population of Kenyans is smokers or either used to smoke tobacco products. Some of the diseases attributed to smoking effects are Tuberculosis, Chronic Obstructive Pulmonary Disease (COPD), heart diseases, cardiovascular diseases, lung cancer, upper aero digestive tract cancers, and Urinary tract infections among others. Some of mechanisms that cause structural change in the human respiratory and increases the chance of the disease is smoking of the tobacco products. Smoking is also causes viral and bacterial infections (Arcavi & Benowitz, 2004)

Meeting the objective of Sustainable Development Goals of the Kenyan policy formulations requires a state with sober and healthy society in order to steer economic growth. Apparently, the Kenyan government spent a huge chunk of money on health approximately 34.7 billion in 2013/2014 for preventive and curative health services and much of it on the Non-Communicable Diseases (World Health Organization, 2013). Having this in mind, the Kenyan Government applied the Tobacco Control Act to discourage tobacco products consumption and generally increase tax revenue. On the retail price of cigarettes, the World Health Organization recommends a tax rate of 75% , (Mozaffarian et al., 2015) but currently, the rate runs at 35% tax rate on the retail price. This is an indication that there is still a huge gap for the government to step up. Increasing taxation on tobacco to at least 75% of cigarette retail prices would significantly lead to an increase in prices of cigarette and other product of tobacco, which would in effect prompt several current tobacco users with no option other than to quit smoking, and again deter a number of youths from consuming its products. In the end, this leads to reduced mortality rate and diseases caused by tobacco use.

Taxation on all tobacco and its products will eventually and consistently reduce the potential tobacco substitute. The different reflection in the objectives of the government and the constraints the face is the variability in the tobacco excises (ILA, 2015). In order to implement and enforce a well-designed tax system, the tax administration agency should have a qualified technical and human capacity, also be able as well to examine the system in case of structural and policy changes. Transparency in administration and tax structure simplicity reduces costs in terms of compliance, administration and opportunities that may lead to higher tax avoidance and tax evasion (ILA, 2015).

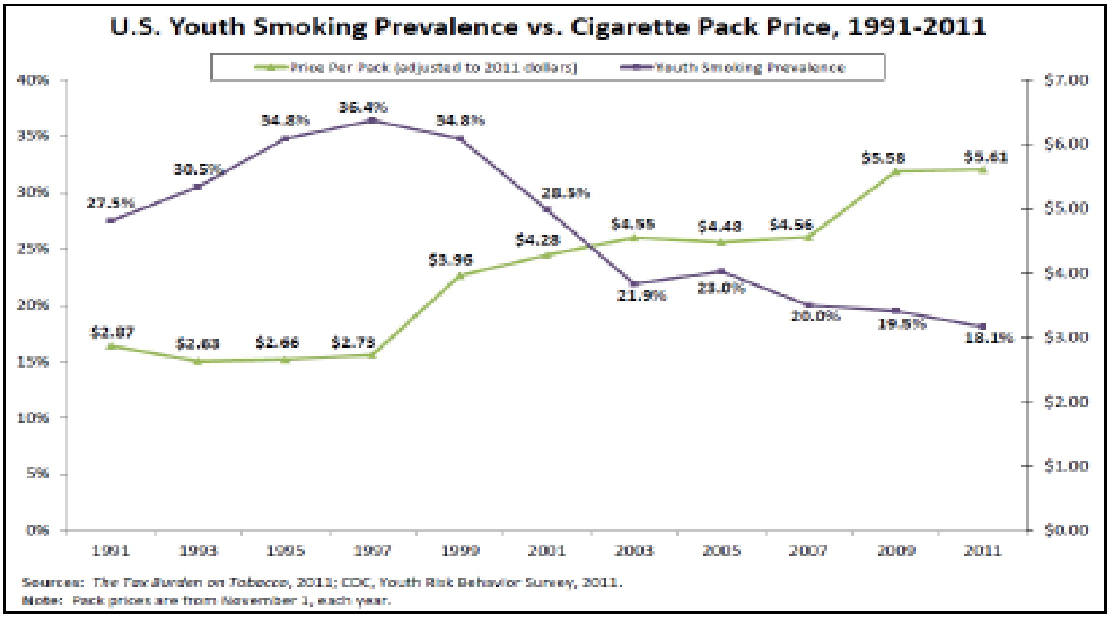


Figure 1. 1: Prevalence versus Cigarette Pack Price among the US Youth Smoking, 1991-2011

***Source: The Tax Burden of Tobacco* (Boonn, 2012).**

The figure 1.1 above shows graphical presentation of how close the youth cigarette smoking prevalence and the cigarette price per pack in the United State of America. Youth smoking rate declined when prices were increased in the period 1990s and 2000s, but smoking rate increased between the year 2003 and 2005 when prices decreased. A slight price increase between the year 2005 and 2007 corresponded to a decrease in the rate of smoking among the youth. In the report, the study found approximate 62 percent federal tax rate on cigarette increase in 2009 substantially had an immediate effect among the youth in smoking of cigarettes. The change in percentage of students reported smoking the previous 0ne moth decreased between 9.7 and 13.3 percent immediately as a result of increased tax, which between 220,000 and 287,000 was estimated to be fewer current tobacco users among school students in May 2009 (Boonn, 2012).

If the Kenyan Government can take same cause of action, the trend on tobacco utilization will also follow suit as indicated in the case of US. However, there may be differences in social, political, cultural, structural, and economic standards between Kenya and US. Despite this, tobacco consumption analysis always exhibits a similar inelastic demand curve considering prices *ceteris paribus*. (Adioetomo & Djutaharta, 2005a).

1.3 Problem Statement

Most of the studies that have been done on tobacco pricing and taxation majorly focused on the demand analysis and price elasticity.(Hidayat & Thabrany, 2010) study incorporated a dynamic demand with myopic addiction behavior of cigarette smoking in Indonesia. Their study results provided support for myopic addiction. They recommended that excise taxes rather than a major source of government revenues; it can more likely in the long run act as an effective tobacco control. International Institute for Legislative affairs studied on an effective implementation of the tax price and taxation of tobacco products in Kenya.

However, their study case brought out the key factors affecting the magnitude of an increase in tax, which were, the industry percentage change in prices (net-of-tax), demand price elasticity and the long-run effects on health. With all its harmful effect to health, it is interesting that most people continue to use cigarettes and other tobacco related products despite government and other stakeholder campaigns to discourage. It is in relation to the foregoing background that this study aims at establishing the effect of tobacco prices before tax, prices after tax and income per capita on tobacco consumption.

The findings of this research provided insights to model formulation that will ease taxation of tobacco in the country and in turn, health institutions.

1.4 The Objectives of the Study

1.4.1 The General Objective of the Study

The study aimed at investigating and analyzing the significant effects of tobacco prices before tax, tobacco price after tax and income on consumption of tobacco products in Kenya.

1.4.2 The Specific Objectives of the Study

The following are the specific objectives of the study;

i. To investigate the significant effect of price before tax on tobacco consumption in Kenya.
ii. To evaluate the significant effect of price after tax on tobacco consumption in Kenya.
iii. To establish the significant effect of increase in per capita income on consumption of tobacco in Kenya.
iv. To investigate the presence of cointegrating relationship between tobacco prices, income and tobacco consumption in Kenya.
v. To check the presence of major structural breaks on tobacco consumption in Kenya

1.5 Hypothesis Formulation

H_{01}: There is no significant effect of tobacco price before tax on consumption of tobacco in Kenya

H_{02}: There is no significant effect of tobacco price after tax and consumption of tobacco in Kenya

H_{03}: Increase in income per capita has no statistical significant effect on consumption of tobacco in Kenya.

$H_{04:}$ There is no cointegrating relationship between tobacco prices, income and tobacco consumption in Kenya.

$H_{05:}$ There is no major structural break on tobacco consumption in Kenya

1.6 Justification of the Study

There has been a rampant increase in cases of cancer and cancer deaths which have been attributed to smoking. This study contributes to the fight against tobacco consumption in order to counter the increasing mortality rate and minimize cost of treatment and rehabilitation by both the government and individuals. The study results improve and commend on the use of the models and methods that were used. Moreover, results of this study will be utilized to forecast the well-being of the economic status and provide for amendments in case of tobacco control in the economy. Finally the study findings will provide a base of reference for other future researches.

1.7 Scope of the Study

This research tested for price elasticity of tobacco and tobacco consumption in Kenya. The study also used vector error correction model to estimate model. The research employed time series research design covering the period 1980 to 2016 and the data used were mainly secondary data. The tobacco consumption (in tons) was the dependent variable and personal disposable per capita income, and tobacco prices (before and after tax) are independent variables. For this model set up all variables were endogenous.

1.8 Assumptions and Limitations

The study used secondary data, from research institutions, internet and published statistical abstracts by Kenya National Bureau of Statistics. The secondary data acquired and extracted were reliable because it was collected and maintained by reputable institutions therefore, the issue of manipulation or alteration were avoided.

CHAPTER TWO

EMPIRICAL LITERATURE REVIEW

2.1 Overview

This is the part of the study that covers literature on other related studies and theoretical framework

2.2 Related Studies

Kenyan government has been on the pool of the fight against tobacco consumption due to a proposed excise duty bill, which was proposed to simplify the excise system and further to uniform specific excise in 2015, but the tiered specific excise system was reinstated through an amendment bill proposed by parliament. However, if the implementation on the proposed bill on the excise duty bill 2015 on the uniform specific excise was initiated, then Kenya would be at the forefront as a country with a consistent tobacco tax system. Consequently, there would be a significant benefit to Kenya from both reduced smoking and eventually growth of revenue through regular upward adjustment of the excise tax rate in line with income growth and inflation. However, reinstating the tiered specific excise, as proposed by the Amendment in Kenya would constitute a backwards step as it leads to a reversal of recent benefits achieved by the uniform tax system. Furthermore, greater losses would be incurred in public health through higher levels of tobacco use and its effects as well as low revenue for the government of Kenya in the long run(Abdullah, Driezen, Quah, Nargis, & Fong, 2015).

According to (Hidayat & Thabrany, 2010), the global burden of tobacco-related disease illnesses is significantly attributed from Indonesia. From this study, the smoking prevalence increased from 53.4 to 63.2 per cent in 1995- 2001 and also again to 63.1 per cent in 2004 among males aged 15years and above. There were also an increased among adult females from 1.7 percent in 1995 to 4.5 percent in the year 2004 prevalence of smoking. Overall, there were an increased number of cigarettes smoked from 33 billion pieces in 1970 to 217 billion pieces in 2004. Indonesia, being the fourth world wide the largest populated country, it was fifth ranked the largest consumer of tobacco products in 2002 consuming approximately 183 billion cigarettes sticks behind China 1.72 trillion cigarettes, United States of America, 463 billion sticks of cigarettes, Russia, 376 billion sticks of cigarettes and finally Japan, 299 billion sticks of cigarettes (Ahsan & Wiyono, 2007) (Hidayat & Thabrany, 2010).

A study by(Adioetomo & Djutaharta, 2005) reported that in Indonesia, 90 per cent of active users used cigarettes at their homes when the children were around; in return of this behavior, these children had a higher chances of infections such as pulmonary diseases (Hidayat & Thabrany, 2010).

To reduce tobacco consumption (Wakefield et al., 2000) tobacco prices increment is one of several strategies used. Those countries with high-income has evident that increasing taxes on cigarettes and its tobacco products significantly followed by massive reductions in cigarette smoking. Furthermore, these reduction changes reflects a combination of increased taxation, decreased consumption of tobacco use among its continuing users and also reduced rates of new smokers. According to study by (Wakefield et al., 2000) the range from approximate -0.25 to -0.5 estimates cigarette demand in terms of price elasticity in high-income countries while estimates for price elasticity from low-income countries and middle-income countries are doubled from: −0.50 to −1.00. It is evident that taxation on tobacco and its products in counties with low income is an efficient reducer of cigarette smoking. In addition, price changes in tobacco affects youth in using cigarette more than adults and because children and adolescents make a relatively larger population, the reduction portion in tobacco usage is relatively high. For health policy, increased taxes significantly impacted on cigarette use where both smoking behaviors and incomes were on the rise.

The International Institute for Legislative Affairs report suggested that in order to manage consumption of tobacco, promote public health and in the end raising revenue, then the governments have that potential by raising tobacco taxation. Excises taxes are the most significant of all tobacco-product taxes, for achieving reduced consumption of tobacco use because applying them uniquely to tobacco products raises the prices other products relative to the price of goods and service. The relative high price reduces the market share they are uniquely applied to tobacco products and thus raise the prices of these products relative to the prices of other goods and services. Relatively higher price increase reduces the cheap cigarette market that can be achieved by a single-rate specific taxation.

Moreover, taxation specifically depends on the structure of every industry and the consumed product characteristics, adjustment on attributes specification to a desired level that can raise the required revenue can be achieved by the government imposing an ad valorem tax (ILA, 2015). Their study further presented the smoking prevalence according to sex and age. The measure captured in the study was 25.53% of male adults (15 years and above) in Kenya and 1.5% of female adults of the similar age bracket as the men. The study concluded that tobacco consumption and smoking prevalence will drop if tobacco tax is increased and revenues from the excise taxes on cigarettes, value added tax and other related taxes would increase the retail prices. The magnitude of the impact of tax increase was affected by some factors mentioned earlier which partly form the basis of this study.

(Cameron, 1998) reviewed demand for cigarettes his results showed considerable and statistically significant agreement on inelastic price response that in the long run was much greater. In his study, it was also showed that, on balance, there were negative and significant effects of health scares. The evidence on the advertisement effects of this study was inconclusive but there was decrease in demand due to cigarettes smoking in public places were restricted. Presently, in demand analysis, the Rational Addiction Model is considered primitive compared to Partial Adjustment Model. Consequently, the model has received an uncritical response which the study found to be common with the earlier work. The results obtained can be questioned since the longitudinal time-series studies were estimated without referring more to the literature on co integration. In addition, the Rational Addiction Models according to Cameron (1998) have acute problems encountered with implausible discount rates and insignificant price terms.

Study by (Hu & Mao, 2008a) in China revealed that an increase of RMB 1 specific excise tax on a pack of cigarettes tobacco taxation and its potential impact analysis increased government revenues by US$ 7.9 billion, which saved approximate 3.4 million lives, also reducing medical cost by US$ 325 million. It would also generate an estimated productivity gain of US$ 1.2 billion for the Chinese economy (Hu & Mao, 2008).

(Adioetomo & Djutaharta, 2005), Simulations showed that a 10 percent tax increase on cigarettes per pack in Indonesia increased prices of cigarettes by 4.9 percent which consequently reduced consumption of cigarettes by closely 3 per cent, and the revenues from taxation increased by 6.7 percent. Ceteris paribus, assumption of no included significant switching on tobacco products with tax levels and prices. The tobacco use slight increased in total average household expenditures from 4.6 percent to 4.7 percent despite the decrease in total consumption. An increase of 50 percent tax would have raised 27.5 percent tobacco taxation revenues (Adioetomo & Djutaharta, 2005)

(Chaloupka et al., 2010) research showed that increasing cigarette price by 10 percent leads to 3.4 percent reducction of cigarette consumption in India, while a 9.2 and 8.5 percent reduction on tobacco consumption in rural and urban india respectively would be experienced due to 10 percent rise in bidi prices. This prices increase would be translated to a 1.7 percent in youth cigarette prevalence and 11.7 percent decrease in bidi smoking (Glynn, Seffrin, Brawley, Grey, & Ross, 2010).

2.3 Theoretical Framework

The theory of demand and the price effect are discussed in this section

2.3.1 Theory of demand

In economics, demand is the quantity of a good(s) or service(s) that a consumer(s) is willing and able to buy at a given price in a given time period(s). Individual demands vary with utility attached on a specific goods or services. The law of Demand states that there is an inverse relationship between the price of a good and demand ceteris paribus. Basically, with an increase in prices, we expect a contraction of demand.

There are several other factors which also influence the demand for commodities, that is, prices of close substitutes, income of the consumers, taste and preferences, among others. Ceteris paribus allows us to isolate each variable in a study. For instance, this study will explore the price effects and per capita income on demand of the cigarette thus the basic demand function will show the prices of cigarettes before and after tax in relation to quantity demanded by consumers (patients). This can be illustrated simply as;

$$consumption_p = f(Price_{bt}, Price_{at}, Income_p)$$

$$consumption_p = \beta_0 + \beta_1 Price_{bt} + \beta_2 Price_{at} + \beta_3 Income_p$$

Where $Consumption_p$= Total consumption by patients,

$Price_{bt}$= Prices of tobacco before tax, $Price_{at}$= Prices of tobacco after tax,

$Income_p$ = Per capita income and β_s = the slope parameters or the coefficients of the model

2.3.2 Price Effect

Effect of changes in price varies with different types of commodities. The changes always influence the consumer’s optimal choices. The study of marginal rate of substitution incorporates the demand function.

The graphs below shows the relationship of quantity demanded and changes in prices ceteris paribus.

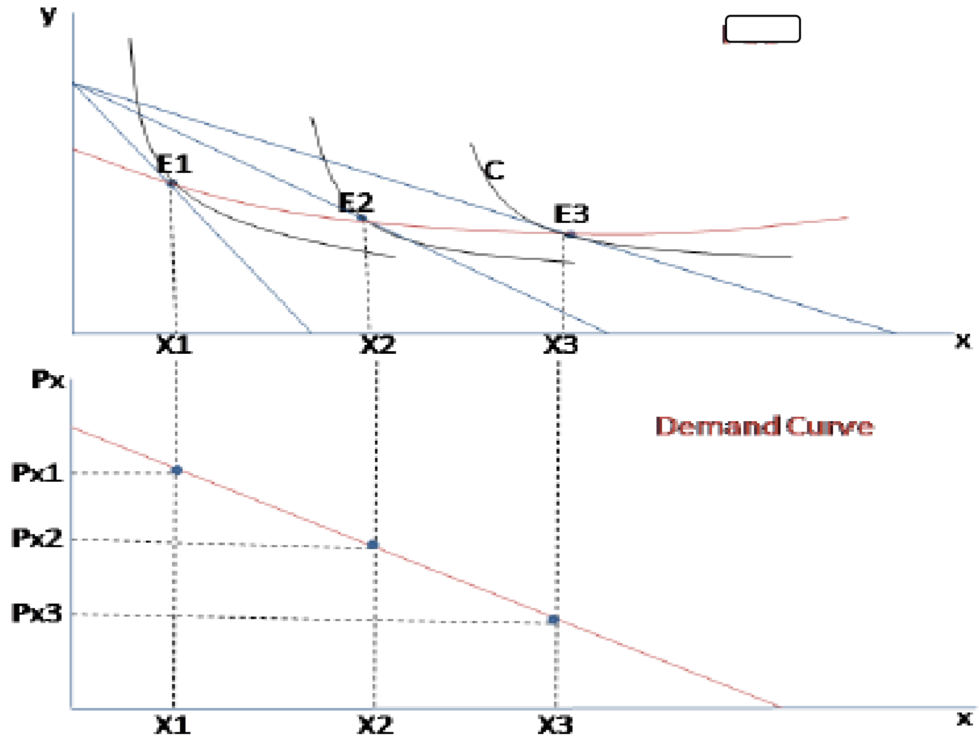
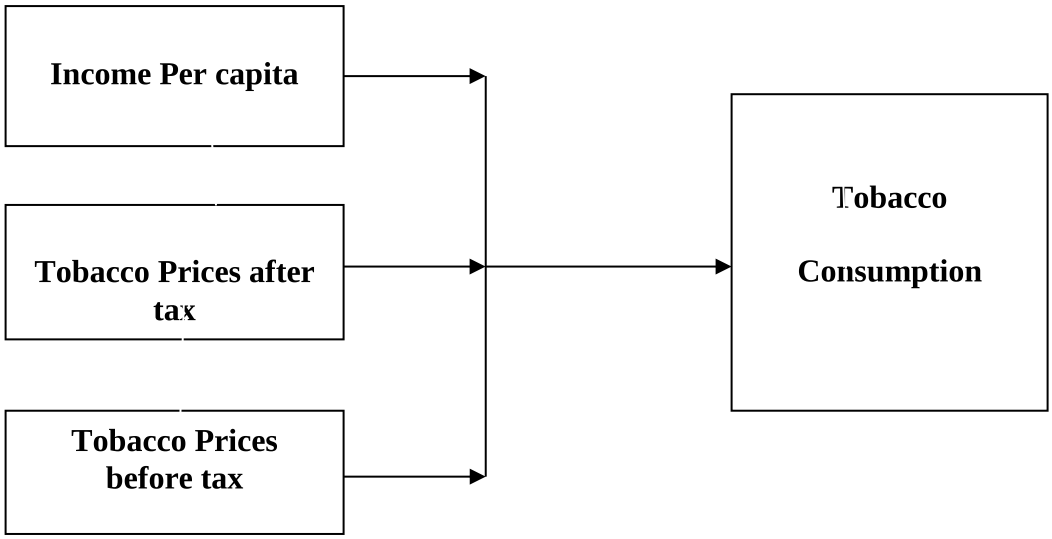


Figure 2. 1: Price Effect

Source: owner's interpretation.

2.4 The Conceptual Framework of the Study Variables

Independent Variables **Dependent Variable**



Source: Author Own Conceptualization

Figure 2. 2: The Conceptual Framework, 2021

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

This section highlights the description of sources of data and variables to be used and also presents the econometric framework and Partial Adjustment Model estimated.

3.2 Data Collection

The study utilized secondary data. Descriptive statistics will summarize and describe data while inferential statistics enabled the researcher to provide an opinion based on the data about the economy. All the data used in this research were collected from statistical abstract publications in Kenya National Bureau of Statistics and economic surveys.

3.3 Data Analysis

The secondary data collected, cleaned, and analyzed using sophisticated statistical software STATA version 13. Descriptive statistics in this case were carried out to have summary and description of the data while inferential statistics were further used to enable the researcher to provide an opinion based on the data about the economy end Tobacco Control. Vector error correctio model used to estimate parameters after evaluation of Johansen's cointegration which confirmed presence of long run relationship

3.4 Preliminary Tests

The following tests were done in the process of time series modeling.

3.4.1 Tests the Presence of Unit Roots

The first step any longitudinal data analysis is to obtain the time series plots or graphs for each univariate data set. The curves were used to indicate the nature of the Data Generating Process (DGP). All data in DGP exhibit three types of graphs according to the stochastic process that happens by chance.

The next step was to conduct the presence of unit root test for in every data used to check for properties of stationarity. These tests were guided by the DGP. The null hypotheses tested were ***H_{01}:*** There were unit root, that is, the variables were not stationary. There are several tests for stationarity but in this case only two tests were used; First. the Augmented Dickey Fuller tests and secondly the Phillips Perron unit root tests.

3.4.2 Testing Stationarity using Augmented Dickey and Fuller

This test was carried out on nested time series model to accommodate serial autocorrelation, auto covariance and covariance. The model estimated was as follows;

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{p} \propto_i \Delta Y_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots 3.1$$

Where ΔY_t : Represents first difference of each variable β_1: Represents the intercept $\beta_2 t$: Represents the time trend; δ: Represents the co-efficient of the lagged variable. The "P" represents the Optimum lag length and were selected by; AIC selection criteria and SBIC selection criteria. If $\delta > \delta_t$, null hypothesis is rejected.

3.4.3 Testing Stationarity using Phillips Perron Test

The test modifies the ADF test to accommodate serial correlation. The null hypothesis is that the data contains unit root against the hypothesis that their data is stationary. The model form estimated was as follows.

$Y_y = \delta_t \ + \ \gamma Y_{t-1} + \gamma_1 \Delta Y_{t-2} + \cdots + \gamma_p \Delta Y_{t-p} + \varepsilon_t$……………………………………3.2

Where;Y_y : Represents the current value. δ_t: Represents the intercept.γ: Represents the co-efficient of the lagged variable.ε: Represents the stochastic error term (white noise process). P: Represents the optimum lag length selected by AIC and SBIC.

If the variables exhibited non stationarity properties, then the next step is to difference each univariate series. The differenced variables were plotted to see if they had become stationary. After plotting, each stationarity test was carried out on differenced variables. If it is confirmed that the differenced variables have achieved stationary property, the process of differencing is stop and concluded that variables are have achieved the integration property of any order denoted *I(1).*

3.5 Structural Breaks

A typical assumption when performing analysis of a standard longitudinal data is the stationarity of the series, meaning that the mean, the variance and the covariance does not change over specified time interval or they change within certain range. That is, the series satisfies the following conditions.

$E\ [y_t] = \mu_y$ ………………………………………..………………………………...3.3

$Var\ [y_t] = E\ [(y_t - \mu_y)^2] = \delta_y^2$…………………………………..…………………3.4

$Cov\ [y_t, y_{t+k}] = E\ [(y_t - \mu_y)\ (y_{t+k} - \mu_y)] = \gamma_k$…………………………………........3.5

The issue was that, when structural breaks were present then these conditions do not hold; either there was a change in the mean or variance or both at a point in time(s). This would have an effect on the inference analysis and forecasting. Therefore, to overcome this scenario, the following tests below were employed to check the presence unit roots with major structural breaks by using STATA statistical software. These are;

Zivot Andrews test proposed by Zivot & Andrews (1992) and Clement Montanes and Reyes test proposed by Clemente Montañés &Reyes (1998) were used. Their models that were estimated are as follows.

3.5.1 Zivot Andrews Test with One Structural Breaks

Series exhibiting shocks in conventional unit root tests yields misleading results. Thus, the Zivot Andrews test was used in the analysis. It selects the break point as the outcome of the estimated procedure. The test has a null hypothesis that there is a unit root versus the alternative hypothesis that there is one-time structural break. This test has three models; Model 1 allows a one-time change in the level of the series; Model 2 allows a one-time change in the slope of the trend function of the series and the Model 3 allows both changes. The following three regression equations corresponds to model 1, model 2 and model 3.

Model 1: $\Delta Y = \upsilon + \beta_t + \alpha Y_{t-p} + \psi DU_t + \sum_{i=1}^{p} C_i \Delta Y_{t-i} + \varepsilon_t$……......……………….3.6

Model 2: $\Delta Y = \upsilon + \beta_t + \alpha Y_{t-p} + \gamma DT_t + \sum_{i=1}^{p} C_i \Delta Y_{t-i} + \varepsilon_t$……...................………3.7

Model 3: $\Delta Y = \upsilon + \beta_t + \alpha Y_{t-p} + \psi DU_t + \gamma DT_t + \sum_{i=1}^{p} C_i \Delta Y_{t-i} + \varepsilon_t$..........…… ….3.8

Where DU_t and DT_t are mean and trend shift respectively for a break dummy variable. Each possible break point causes a shift: $T_B (1 < T_B < T)$. This is formally stated as:

$DU_t = \begin{cases} 1 \; if \; t \geq T_B \; and \\ 0 \quad otherwise \end{cases}$……………………….…………………………………..….......3.9

$$DT_t = \begin{cases} t - T_B \; if \; t \geq T_B \; and \\ 0 \qquad otherwise \end{cases} \quad \ldots\ldots 3.10$$

Where p the optimum lags selected for each break point determined by one of the selection information criteria. The null hypothesis for this test is α = 0, implying there is presence of a unit root with drift and that it excludes any structural break points versus the alternative hypothesis is α < 0, indicates trend- stationary of the series with an unknown one-time break. Thus, equations 3.3, 3.4 and 3.5 will sequentially be estimated and T_B will be chosen to minimize the one-sided student t-statistic for testing the null hypothesis; $\hat{\alpha} = 0$

3.5.2 Clemente Montañés and Reyes Test with Two Structural Breaks

The Zivot Andrews considers only one major structural break in the data even though there are more breaks present. Therefore, in order to overcome this issue, Clemente-Montañés-Reyes (1998) suggested that the test be carried out. This representation of the null hypothesis is as follows H_0 against alternative that is H_1:

$$H_0 : Y_t = Y_{t-p} + \psi_1 DTB_{1t} + \psi_2 DTB_{2t} + \varepsilon_t \quad \ldots\ldots 3.11$$

$$H_1 : Y_t = \mu + \omega_1 DU_{1t} + \omega_2 DTB_{2t} + \varepsilon_t \quad \ldots\ldots 3.12$$

In equation (3.8) and equation (3.9), DTB_{it} is referred to as the pulse or dummy variable and it is equivalent to 1 if $t = TB_i$+1 and 0 otherwise.

Furthermore, $DU_{it} = 1 \; if \; TB_i < t \; (t = 1,2 \ldots)$ and 0 if this assumption violated. The time periods TB_1 and TB_2 represents the modification of the mean. It can be simplified further with the assumption that $TB_i = \Psi_i T \; (i = 1,2)$ where $1 > \Psi > 0$ while $\Psi_1 < \Psi_2$

Clemente Montañés and Reyes (1998). The following equation 3.13 is performed for test of unit root in the case where an innovative outlier contained two structural breaks.

$$Y_t = \mu + \xi Y_{t-p} + d_1 DTB_{1t} + d_2\, DTB_{2t} + d_3 DU_{1t} + d_4 DU_{2t} + \sum_{i=1}^{p} C_j \Delta Y_{t-p} + \varepsilon_t \text{ ………… 3.13}$$

This equation is normally used to estimate through simulated t-ratio minimum value. In the identification of all the breaks points, the simulated t-ratio value will be used if the autoregressive parameter is constrained to unity (1)

The estimate asymptotic distribution according to Clemente Montanes & Reyes (1998) is derived when $\Psi_2 > \Psi_1 > 0 : 1 > \Psi_2 - 1 > \Psi_0 : \Psi_1$ and Ψ_2 obtained interval values that is, $[(t+2)/T, (T-1)/T]$ by appointing the largest window size. Furthermore, $\Psi_1 < \Psi_2 + 1$ is used to show purged repeated periods where break points existed. To test the unit root hypothesis, an approached two-steps to explain additive outliers in a situation where shifts are in a good position In the first step, the following equation is used for estimation when the deterministic variable is eliminated.

$$Y_t = \mu + d_5 DU_{1t} + d_6 DU_{2t} + \hat{Y} \text{ ……………………………..…………….…………… 3.14}$$

Furthermore, the search for a minimum t-ratio is done in the second stage and the $\Psi = 1$ hypothesis is tested with the following equation:

$$\hat{Y}_t = \sum_{i=1}^{T} \phi_{1i} DTB_{1t-1} + \sum_{i=1}^{T} \phi_{2i} DTB_{2t-1} + \psi \hat{Y}_{t-1} + \sum_{i=1}^{T} C_i \Delta \hat{Y}_{t-1} + \varepsilon_t \text{ …………..…….………….. 3.15}$$

To ensure that the minimum $MIN t^{i0}_{\psi\ t}(\Psi_1, \Psi_2)$ converged, a dummy variable is included in the estimated equation for estimation:

$$MINt^{i0}_{\psi\ t}(\Psi_1, \Psi_2) \rightarrow \inf_{\gamma} = \wedge H / [\Psi_1(\Psi_2 - \Psi_1)^{0.5} T^{0.5} \ldots\ldots 3.16$$

3.6 Determination of Optimum Lag Length

This must be done because using more lag lengths reduces the degree of freedom, moreover, using few lags introduces auto correlation and multicollinearity. Using the AIC or SBIC, the model form that estimated as follows;

$$IC_P = \ln\left(\frac{\varepsilon^1 \varepsilon}{T - P_{max+k^x}}\right) + \left(P + K^X\left(\frac{A^X}{T - P_{max-k^x}}\right)\right) \ldots\ldots 3.17$$

Where.

When, X=1, K^X is the random walk with Trend: X=2, is the random walk with trending drift: X=3, it represents the random walk with drift: A^X Is for AIC: $\ln(T - P_{max-k^x})$ Is for SBIC

3.7 The Partial Adjustment Model

This model comprised of static part describing how the desired consumption of tobacco is determined, and secondly the dynamic part explaining the partial adjustment process:

$$y_t^* = \alpha_0 + \alpha_1 x_t + u_t \ldots\ldots 3.18$$

$$y_t - y_{t-1} = \lambda(y_t^* - y_{t-1}) \ldots\ldots 3.19$$

Where y^*, is the tobacco consumption desired level. The substitution of the expression y* into other equation, the following obtained equations are estimated:

$$y_t = \alpha_0\lambda + (1 - \lambda)y_{t-1} + \lambda\alpha_1 x_{it} + \lambda u_t \ldots\ldots 3.20$$

In a generalized autoregressive dynamic lags model (ARDL), this equation can be estimated as follows:

$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 x_{it} + \beta_3 x_{it-1} + v_t$ 3.21

In the case where partial adjustment has occurred, then the following restrictions would be imposed.

$\beta_3 = 0$

Additionally, one can get parameter estimates contained desired level of y and the adjustment parameter λ from the original equation in the above case:

$\beta_1 = (1 - \lambda) \Rightarrow \lambda = (1 - \beta_1)$.. 3.22

$\beta_0 = \alpha_0\lambda, \beta_2 = \alpha_1\lambda$

The speed of adjustment is measured by the estimated adjustment parameter λ and it lies between 0 and 1. Values closer to 1, confirm presence of high speed of adjustment. Linter Dividend-Adjustment Model is one kind of the examples of the model.

3.8 Co-Integration

Johansen Multivariate Co-Integration technique was used to estimate Co-Integration to find out if variances of the model were Co-Integrated. The model estimated as follows;

$\Delta Y_t = \alpha\beta Y_{t-1} + \sum_{i=1}^{P} \phi_i^x \Delta Y_{t-i} + \delta_0 + \varepsilon_t$..3.23

Where, ΔY_t is the dependent variable, α , is the degree of convergence (or rate of) long-term relationship. β' is the co-efficient for the long-term relationship and ϕ_i^x is the vector of n by n and will show short term relationship.

3.9 The Vector Error Correction Model (VECM)

If the variables under study are stationary and are co-integrated, it requires fitting, estimation, and interpretation of the vector error correction to investigate the magnitude of short- term and long-run relationship. The vector error correction model is one of examples of a short-term dynamic model usually used in modeling of economic and financial longitudinal focusing. They are normally expressed in first difference.

$(\Delta y_t = y_t - y_{t-1})$……………………………………………………………… 3.24

In exception of the error correction term, can also be based on the autoregressive dynamic lag model. The derivation can also be from ARDL model with addition of specific restriction.

$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 x_{it} + \beta_3 x_{it-1} + v_t$………………..…………………..…..….. 3.25

To produce the error correction model, first y_{t-1} term is subtracted from both sides of the ARDL equation:

$y_t - y_{t-1} = \Delta y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 x_{it} + \beta_3 x_{it-1} - y_{t-1} + v_t$………………..……3.26

Where, *i* =1, 2, and 3 whereby, 1, 2, and 3 represent our dependent variables, per capita income, prices of tobacco (before tax and after tax).

Then x is expressed in a first difference form. It involves addition and subtraction of $\beta_2 x_{it-1}$ from the right-hand side of the equation 3.26.

$\Delta y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 x_{it} - \beta_2 x_{it-1} + \beta_3 x_{it-1} - y_{t-1} + \beta_2 x_{it-1} + v_t$…………… 3.27

Collecting terms gives:

$\Delta y_t = \beta_0 + \beta_2 x_{it} + (\beta_1 - 1)y_{t-1} + (\beta_2 + \beta_3)x_{it-1} + v_t$……………….....……… 3.28

To produce the error correction mode, there is an assumption that the coefficient of y_{t-1} is equal to less the coefficient of x_{it-1} . This implies that:

$\beta_1 - 1 = -(\beta_2 + \beta_3)$…………………………..……………………………….. 3.29

$\beta_1 + \beta_2 + \beta_3 = 1$

For an application of error correction (ECM) model to be justified, the total sum of the coefficient excluding the constant must be equal to sum to the one in the ARDL model. Usually, the ECM is written with τ as the coefficient on the error correction term. That is;

$\Delta y_t = \beta_0 + \beta_2 \Delta x_{it} - \tau(y_{t-1} - x_{it-1}) + u_t$……………………………………….. 3.30

$\tau = -(\beta_1 - 1) = (\beta_2 + \beta_3)$……………………………………………………..… 3.31

The above ECM is the representation of the short-run relationship between dependent variable *y* and each of the independent variable *x*. The long-run relationship will be formed, it is assumed that the variables grow at a constant rate g instead of assuming all differenced terms equal 0,. This gives:

$g = \beta_0 + \beta_2 g - \tau(y^* - x^*)$ ……………………………………...……………….. 3.32

$\tau(y^* - x^*) = \beta_0 + (\beta_2 - 1)g$……………………………………..………………. 3.33

$y^* = \frac{\beta_0 + (\beta_2 - 1)g}{\tau} + x^*$………………………………………………………………… 3.34

If the original model is: $y_t^* = kx_t^*$ which in logs form is; $\log y_t^* = logk + logx_t^*$. Thus, anti-logging the above long-run expression becomes:

$$k = \exp\left(\frac{\beta_0 + (\beta_2 - 1)g}{\tau}\right) \quad \text{3.35}$$

The *k* term is interpreted as the long-run relationship between dependent variable *y* and some independent variable *x*. i.e. *y* in this study is consumption of tobacco products and *x* is consumer's real income (per capita income, prices of tobacco before and after tax), *k* would be the average propensity to consume from real income.

CHAPTER FOUR

RESULTS AND INTERPRETATION

4.1 Overview

In this section, summary descriptive results such as mean, variance, standard deviations and inferential statistics were presented using tables and graphs.

4.2 Descriptive Results

The results presented in table 4.1 are the summary descriptive of the data under this study. Descriptive analysis statistically is analyzed in order to have an understanding of the general overview of the data. From the table 4.1, the average value of the price before tax was found to be Ksh.40.70784, with the minimum value of Ksh.4.68 and the maximum of Ksh.79.23.

Table 4. 1: Descriptive Results

Variables	Obs	Mean	Std. Dev.	Minimum	Maximum
Year	37	1998	10.82436	1980	2016
Price after tax(Ksh)	37	52.83351	42.13039	7	150
Price before tax(Ksh)	37	40.70784	29.15913	4.68	79.23
Income per capita(Ksh)	37	588.2929	351.1647	223.3348	1455.36
Consumption (tonnes)	37	12598.3	5632.06	2738	25000

Source: Authors Computation. STATA Output.2021

The price after tax was found with the mean of Ksh.52.83351 and with minimum Ksh.7 and maximum value of Ksh.150. Income per capita was also found to be with a mean of

588.2929, standard deviation of 351.1647 and also the minimum value and the maximum value of Ksh.223.3348 and Ksh.1455.36 respectively. The total tobacco consumption in Kenya from the year 1980 to 2016 was again found to be with the average of 12598.3 tonnes, minimum 2738 tonnes and maximum of 25000 tonnes.

4.3 Correlation Analysis

For the researcher to understand the degree and the direction of causation among the study variables, the correlation analysis was done. Results presented by table 4.2 shows a correlation matrix of the relationship and that there was a positive correlation between dependent (consumption) variable and the independent variables (price before tax and income per capita).

Table 4. 2: Results of Correlation Matrix

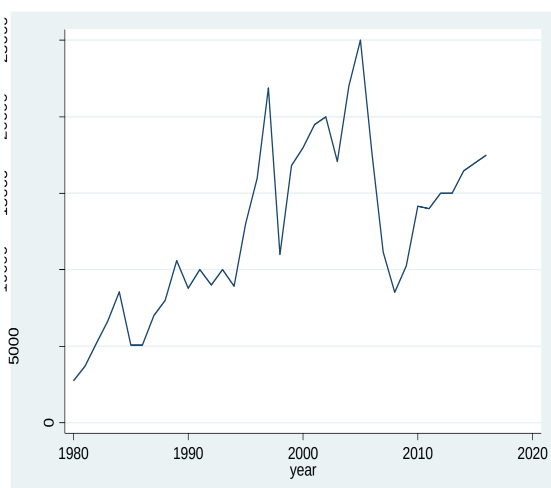
	Consumption	**Price before tax**	**Price after tax**	**Income per capita**
Consumption	1.0000			
Price before tax	0.6630	1.0000		
Price after tax	-0.5701	0.8776	1.0000	
Income per capita	0.3085	0.7668	0.9228	1.0000

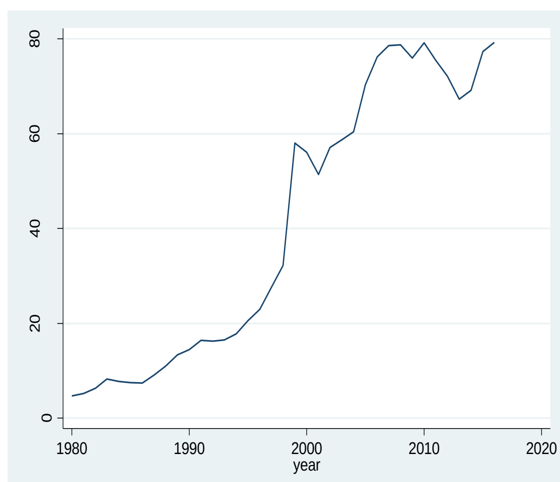
Source: Authors' STATA Output. 2021

However, there was a negative (-0.5701) association between consumption and price after tax. This signifies that after imposing tax on tobacco prices, the amount of tobacco use reduces. Moreover, the correlation between consumption and price before tax, and with Income per capita was found to be positive with Pearson correlation coefficient (ρ) 0.6630 and 0.3085 respectively. The correlation between price before tax to price after tax and income per capita was 0.8776 and 0.7668 respectively. There was also a strong association between income per capita to price after tax with $\rho = 0.9228$.

4.4 Univariate Properties of Time Series Variables

Before specification and estimation of the econometric models, all the time series variables under study were plotted. An inspection of visual plot of each variable showed that the tobacco consumption exhibits trends with drift whereas others study variables such as price before tax, price after tax and income per capita exhibited exponential trend. An exponential trend exhibits constant proportional growth, (Hamilton, 1994). Therefore, for these variables the current change in the variable was a constant fraction of the current value of the specified variable. These variables were specified to follow a unit root the result was that the rate of growth of the series followed a stationary stochastic process. This implied that the overall trend and the deviations from trend had a proportional variance to the current level.





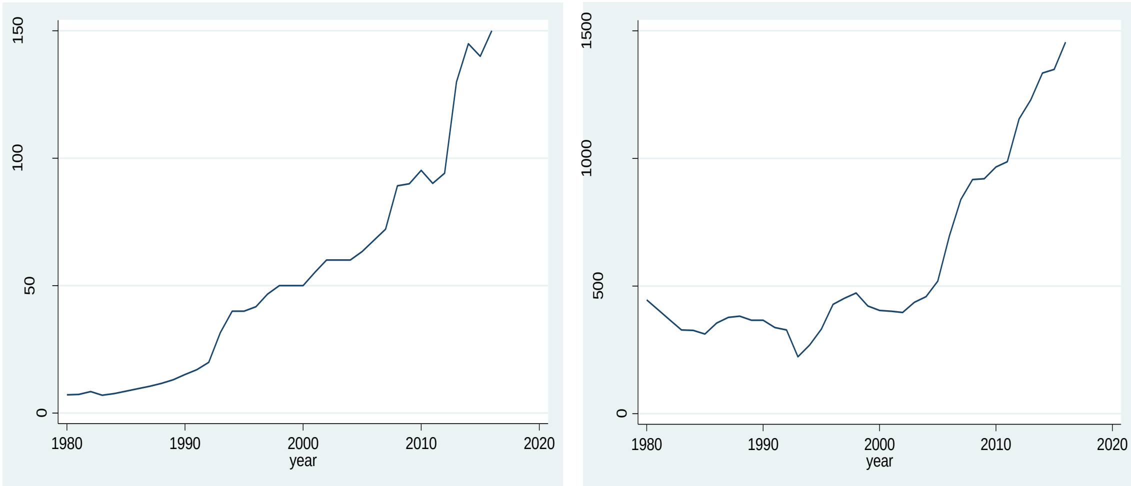


Figure 4. 1: Univariate Properties of Time Series variables

Source: Researcher Data,2021

4.5 Stationarity Tests

First and foremost, before analysis of inferential statistics in the analysis was to obtain the time series plots or graphs for each univariate data set. The curves will be used to indicate the nature of the Data Generating Process (DGP). All data in DGP exhibit three types of graphs according to the stochastic process that happens by chance. The next step conducted was testing the presence of unit root for each variable. The test was in guidance of the DGP. The conventional unit root test used are Augmented Dickey Fuller and the Philips Perron. Furthermore, to test for structural breaks, that is Zivot Andrews tests for one structural break but there is more than one, then Clement Montanes test was employed.

4.5.1 Augmented Dickey Fuller Results

In statistics and econometrics, stationarity or integration of a time series variable is an essential phenomenon because it influences its behavior (Ansari *et al*,.2011). The first test that used was the Augmented Dickey Fuller or ADF test, suggested by Dickey &

Fuller (1979), Dickey & Fuller (1981). Its null hypothesis is that variables contain unit root against the alternative hypothesis that data are stationary.

Table 4. 3: Results for Augmented Dickey Fuller Unit Root Test

	Levels						
	Intercept		**Trend and intercept**		**None**		**Remark**
Variable	**t**	**p**	**t**	**p**	**t**	**p**	
Consumption	-2.2548	0.1916	-2.7109	0.2385	-0.2188	0.6004	Nonstationary
Price before tax	-0.4164	0.8957	-1.8049	0.6814	1.6436	0.9733	Nonstationary
Price after tax	3.0739	1.0000	-1.0579	0.9223	4.6451	1.0000	Nonstationary
Income per capita	2.2981	0.9999	0.2470	0.9974	2.9636	0.9988	Nonstationary
	First Difference						
Consumption	-6.6457	0.0000	-6.5799	0.0000	-6.6494	0.0000	*I(1)*
Price before tax	-5.2392	0.0001	-5.1586	0.0010	-4.6488	0.0000	*I(1)*
Price after tax	-6.6208	0.0000	-6.6554	0.0000	-6.4057	0.0000	*I(2)*
Income per capita	-3.3627	0.0194	-4.9629	0.0027	-2.8282	0.0000	*I(1)*

*The Augmented Dickey Fuller test critical values are as follows -3.627 at 1%, -2.950 at 5% and -2.611 at 10%.

Source: Authors' EViews9 Output. 2021

The results of Augmented Dickey Fuller (ADF) depicted in table 4.3 showed that all the study variables had unit root or simply not integrated at levels(all p-values > 0.05 level of significance) either estimated equation was with intercept, trend and intercept or none. Consumption, price before tax and income per capita variables were integrated or stationary or no unit root after first difference denoted as *I (1)* meaning integrated of order 1. That is all p-values, 0.000, 0.0001, 0.0000 and finally 0.0194 for tobacco consumption, price before tax, price after tax and income per capita respectively were less than 5 percent level of significance while price after tax became stationary after second difference *I(2)*. In this test, since the probabilities were less than 5 percent for 2-sided z-statistic probabilities, then null hypotheses are rejected, and alternative hypotheses accepted.

When variables were first differenced results showed that they became stationary. Therefore, as per Augmented Dickey-Fuller test, it was concluded that the study variables were stationary and its is said that the variables are integrated of order one denoted by *I(1)* and *I(2)* for the price after tax variable.

4.5.2 Phillips Perron Test

The second stationarity test used was Philips Perron test suggested by Phillips & Perron (1988). This test was carried out on the finite sample properties in order to improve and to accommodate more modeling framework (Greene, 2008 and Magee, 2008). It has been shown Monte Carlo simulation that the ADF test power test is very low (Im and Lee, 2009). In a situation where there is high degree of auto correction the Augmented Dickey Fuller test cannot be able to distinguish clearly between non-stationary and stationary series and is quite sensitive to breaks (Im and Lee, 2009). To overcome this limitation and to supplement the ADF test when the data used shows the presence of serial correlation amongst them and are also time dependent, the semi-parametric Phillips-Perron test, which gives robust estimates is used.

Table 4. 4: Phillips Perron Test Results

	Levels						
	Intercept		**Trend and intercept**		**None**		**Remark**
Variable	**t**	**p**	**t**	**p**	**t**	**p**	
Consumption	-2.0868	0.2509	-2.6472	0.2632	0.1702	0.7297	Nonstationary
Price before tax	-0.4479	0.8199	-1.9347	0.6159	1.4898	0.9638	Nonstationary
Price after tax	6.7011	1.0000	-0.7410	0.9614	9.3348	1.0000	Nonstationary
Income per capita	2.2218	0.9999	-0.3184	0.9870	3.4013	0.9997	Nonstationary
	First Difference						
Consumption	-10.744	0.0000	-13.737	0.0000	-7.4157	0.0000	*I(1)*
Price before tax	-5.2392	0.0001	-5.1586	0.0010	-4.6271	0.0000	*I(1)*
Price after tax	-4.7384	0.0005	-8.9673	0.0000	-3.8002	0.0004	*I(1)*
Income per capita	-3.2743	0.0239	-4.3817	0.0071	-2.8168	0.0062	*I(1)*

*The critical values for Philip-Perron test are; -3.627 at 1%, -2.950 at 5% and -2.611 at 10%.
Source: Authors' EViews9 Output. 2021

The table 4.4 presents results for Phillips and Perron stationarity test. The table depicts results that each variable was not stationary or in other words had unit root at levels, thereby agreeing with Augmented Dickey-Fuller test results. However, it disagreed with Dickey-Fuller by showing that price after tax was integrated yet ADF had showed that it was nonstationary when the estimated equation was neither had intercept, or trend and intercept(see table 4.3, p-value 0.9019 at first difference).

The results for Philip and Perron test rejected the stationary property in all the variables at first difference. The Mackinnon p – values after first difference were 0.000 for tobacco consumption, 0.0010 for prices before tax, 0.0000 for the prices after tax and finally 0.0071 for income per capita.

4.5.3 One Structural Break Test Using Zivot-Andrews Unit Root Test

Ben, David & Papell (1997) stated that in the presence of at least one structural break in the trend, there is an important aspect in unit root estimation. Ben, David & Papell (1997) also showed that if the data in question exhibits an upward trending then the power to reject null hypothesis of no break is reduced with increase in critical values.

Table 4. 5: Zivot and Andrews Test

Variable	Observations	t-statistic	Break year
Consumption	28	-6.366	2007
Price before tax	20	-4.882	1999
Price after tax	31	-0.488	2010
Income per capita	27	-2.627	2006

*The test critical values are -5.34 at 1 %, -4.80 at 5 %and -4.58 at 10% levels of significance.
Source: STATA Version 12 Data Analysis Results 2021

In contrast, however, Ben, David & Papell (1997) have shown that there a failure in capturing some useful and technical data characteristics in the estimation of the model without trend if the series exhibits a trend. The results of the Zivot Andrews test in table 4.5 (see also Figure 4.2) showed that there was a structural break in the year 2007 for tobacco consumption and 2006 income per capita this maybe attributed by preelectioneering period and the political instability in the country caused by post-election violence that stuck the country in 2007/2008.

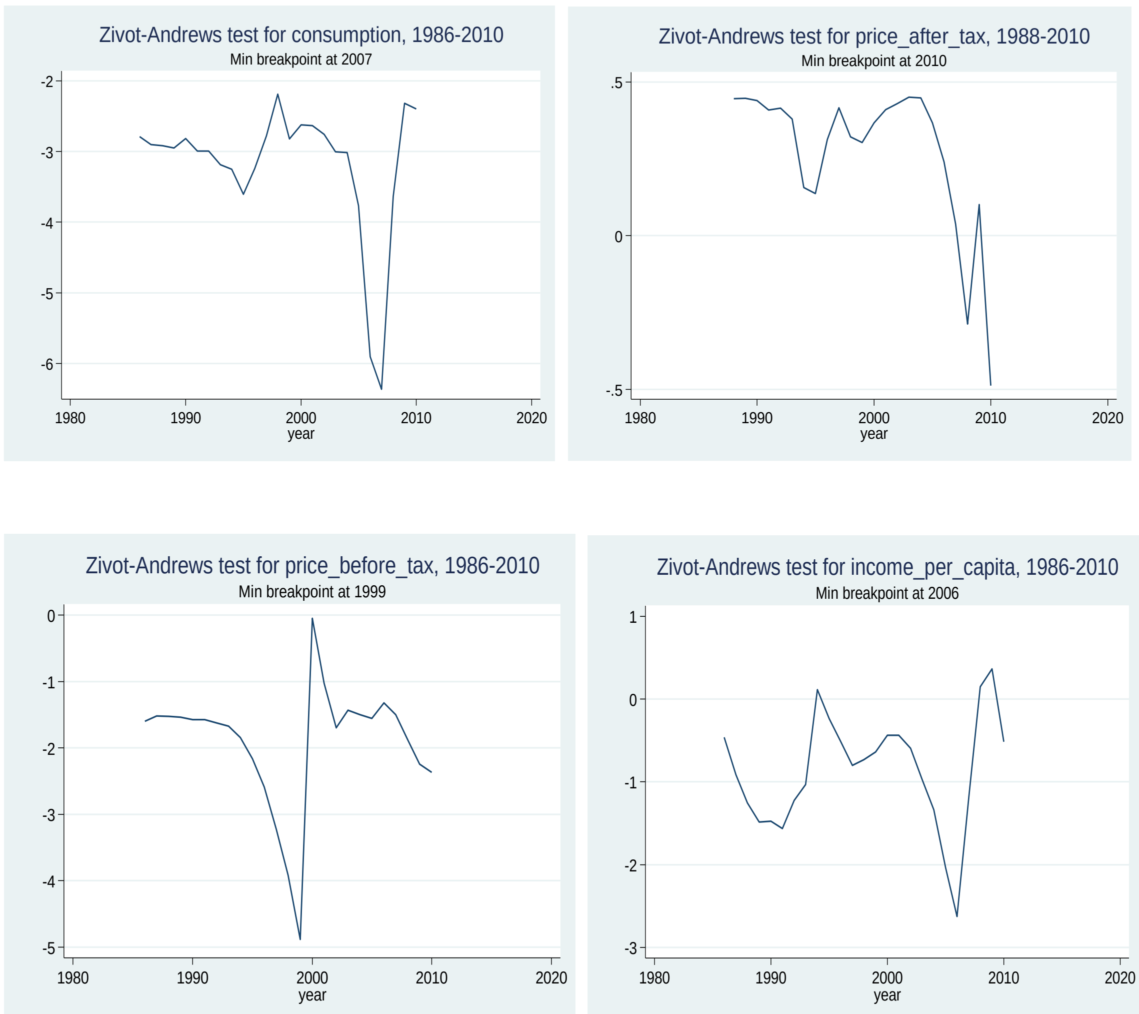


Figure 4. 2: Graphical Representation of Zivot Andrews Test

Source: Author's Data, 2021

There were also breaks in the year 1999 for price before tax and this is the year when the country was undergoing insecurity issues and threats after al Qaeda attack of US embassy headquarters in Nairobi in1998. Furthermore, in the year 2010, there were structural break in the price after tax. The table 4.5 shows that both the consumption, price before tax and income per capita were statistically significant (all |t|>1.96).

4.5.4 Two Structural Breaks Test Using Clement-Montane-Reyes Unit Root Test

The results from Clemente-Montañés-Reyes Double Additive Outlier (AO) unit root test with more than one (in this case two structural breaks) are reported in figure 4.3 and table 4.6.

Table 4. 6: Clemente Montañés Reyes Test Results

Variable	Breaks	Coef.	t-statistic	p-value	Year
Consumption	Du1	9736.3111	6.568	0.0000	1994
	Du2	-1357.5983	-0.891	0.3820	2003
Price before tax	Du1	36.6556	10.816	0.0000	1996
	Du2	25.1263	7.102	0.0000	2003
Price after tax	Du1	45.2620	7.656	0.0000	1995
	Du2	59.4757	7.932	0.0000	2009
Income per capita	Du1	234.1348	4.147	0.0000	1999
	Du2	612.3235	8.523	0.0000	2009

Source: Authors' Computation. STATA Version 12 Output

The table showed that most of significant endogenous determined structural breaks for the variables under investigation corresponded closely to the financial and economic crisis of 1990-1997 GoK (1998) and massive injection of money in the economy in the run-up to the multi-party elections of the year 2002. It can be observed from the table that there was significant structural breaks (Du1) and (Du2) for all of the variables under investigation (all p-values =0.0000 less than 0.05 level of significance), except tobacco consumption in 2003, though there was a structural break but insignificant for unit root test (p-value = 0.3820 > 0.05 level of significance).

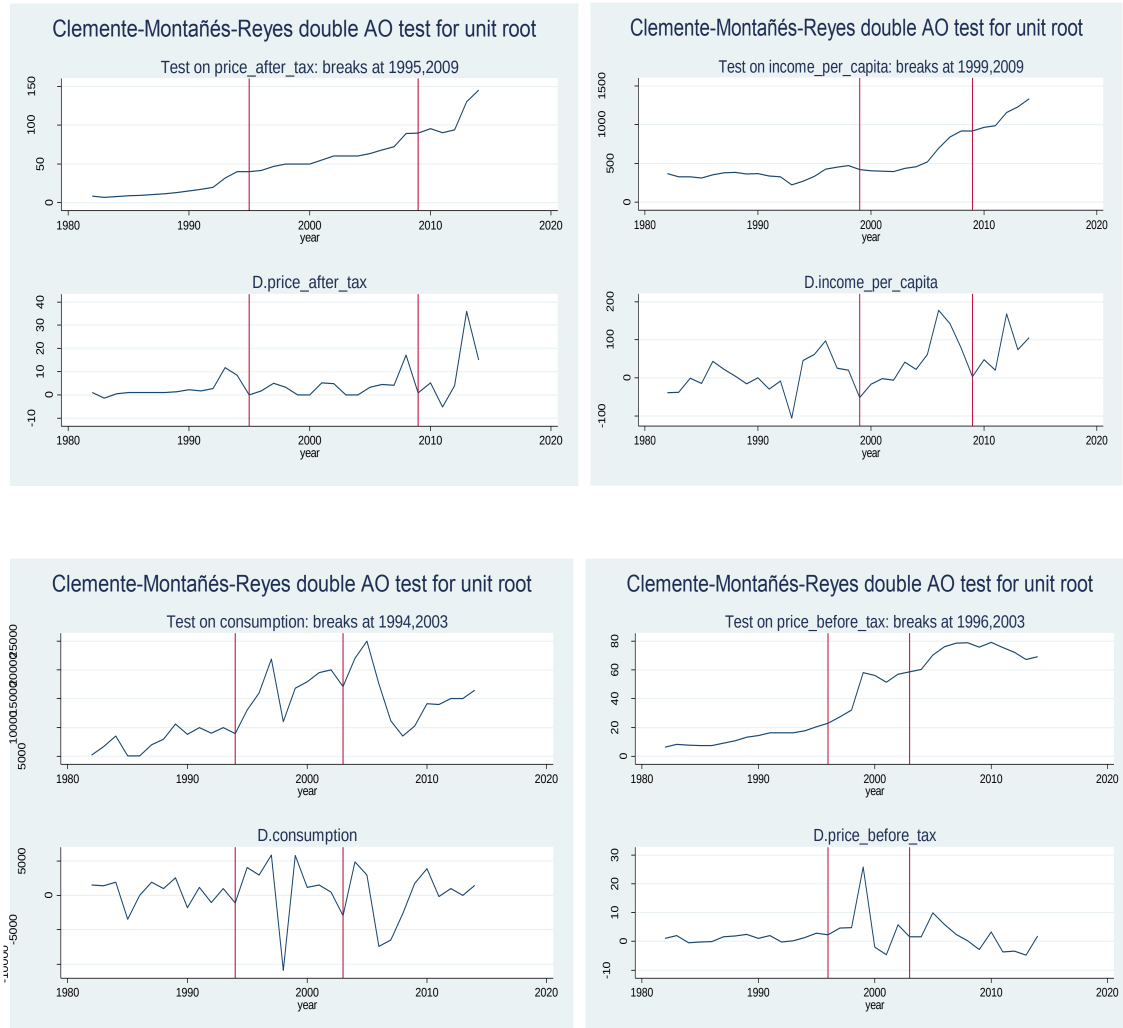


Figure 4. 3: Graphical representation of Clemente Montañés & Reyes Test

Source: Author's Data, 2021

4.6 Determination of Optimum Lags

For a vector autoregressive model (VAR) to be estimated it is always a necessity to determine the optimum number of lag lengths because using more lags consumes degrees of freedom and using very few lags introduces correlation and multicollinearity (Gujarati, 2013). Interpretation of the estimates are substantively influenced by different lag orders, especially when the differences are too large enough. Therefore, selection of the correct lag order for each VAR was the first and vital step in this study. These lag orders are selected by some pre-specified information criterion and are based on in the construction of vector autoregressive estimates. To make decision on this, the following selection criteria were used as shown in table 4.7.

Table 4. 7: Determination of Optimum Lag

Lag	LL	LR	D.f	p	FPE	AIC	HQIC	SBIC
0	-823.864				7.2e+16	50.1736	50.2346	50.355
1	-690.072	267.58	16	0.000	5.8e+13	43.0347	43.3398*	43.9416*
2	-673.228	33.688	16	0.006	5.8e+13	42.9835	43.5328	44.6161
3	-654.074	38.308	16	0.001	5.4e+13	42.7923	43.5858	45.1505
4	-633.571	41.006*	16	0.001	5.3e+13*	42.5194*	43.557	45.6031

*indicates the suggested lag length. Final Prediction Error (FPE), the Schwarz Information Criterion (SIC), the Hannan-Quinn Criterion (HQC), Akaike Information Criterion (AIC), and the general-to-specific sequential Likelihood Ratio test (LR)
Source: STATA Output, 2021

The results in table 4.7 indicated that optimum lags to be selected was two as per Hannan-Quinn (HQIC) and Schwarz Information Criterion (SBIC) while Likelihood Ratio (LR) test, Final Prediction Error (FPE) and Akaike Information Criterion (AIC) indicated that the lags to be used are four as indicated by (*). Since the suggestion by majority of selection criterion was four then used lag length of four.

4.7 Johansen tests for Co-integration

This involved estimation of cointegration relationships between tobacco consumption, price before tax price after tax and income per capita. In cointegration test, there are two approaches used; the trace statistic and maximum eigenvalues are normally used in determination of Johansen cointegration (Cameron and Trivedi, 2005). Based on

Johansen's maximum likelihood procedure, the table 4.8 presented cointegration test results. The cointegration test results in table 4.8 indicates there was cointegrating relationship among the four variables under consideration as indicated by (*) meaning there is one cointegrating equation between them.

Table 4. 8: Co-integration Test Results using Johansen Tests

Maximum rank	**Parms**	**LL**	**Eigenvalues**	**Trace statistic**	**5% critical value**
0	20	-736.73274	.	52.4893	47.21
1	27	-722.78167	0.54941	24.5876*	29.68
2	32	-714.61067	0.37307	8.2452	15.41
3	35	-710.99555	0.18664	1.0150	3.76
4	36	-710.48807	0.02858		

*Indicates the trace statistic at which maximum rank is chosen, LL-Log likelihood, Parms- Number of parameters

Source: STATA Version 12 Output, 2021

4.8 The Vector Error Correction Model

As from the results, there was a co integrating relationship detected between the study variable, it implied that there was an error correction that gradually corrects the endogenous variables to a long run relationship through series of partial short run adjustments (Hussain, 2009). Therefore, it required application of Vector Error Correction Model (VECM) which is an appropriate to evaluate the short run properties of the co integrated series (Greene, 2008). The VECM results in table 4.10 showed that a negative error term (-0.6868) and significant (p value = 0.001) coefficient in cointegrating equation (_ce1) indicating that any form of short-term fluctuations between the price before tax, price after tax and income per capita and the tobacco consumption gave rise to a stable and a long run relationship (presented in table 4.10) between the variables. The magnitude of the error term (-0.6868) coefficient indicated the speed of adjustment with which the variables converge overtime (Hussain, 2009; Lutkepohl, 2005; Hamilton, 1994; Floyd, 2005 and Tsay, 2010).

Table 4. 9: Results of Vector Error Correction Model

		Coef.	**Std. Err.**	**Z**	**p>|z|**	**[95% Interval]**	**Conf.**
D_Consumption							
	_ce1	-0.6868	0.2026	-3.39	0.001	-1.0839	-0.2897
	Consumption L1.	0.16056	0.1868	0.86	0.390	-0.2055	0.5266
	Price before tax LD.	- 01.8651	104.6381	-0.97	0.330	-306.952	103.222
	Price after tax LD.	-00.2453	79.3882	-1.26	0.207	-255.8432	55.3527
	Income per capita	3.1315	10.1239	0.31	0.757	-16.7111	22.9741
	LD.						
	Constant	0.0322	758.8385	0.00	1.000	-1487.264	1487.33

Source: Author's Own Computation. STATA Version 12 Results.2018

4.9 Test of Hypotheses

The results in Table 4.10 showed that the long run equilibrium relationship can be explained by one Cointegration relationship.

$$Consumption = -12847.7 - 85.8457 Price\ before\ tax - 167.6559 Price\ after\ tax + 19.3534 Income\ per\ capita$$

The investigation and analysis of the direct causal effect of the tobacco price, income and the tobacco consumption in Kenya was the main aim of the research. The first objective was hypothesized that there was no significant effect of tobacco price before tax on consumption of tobacco in Kenya. The VEC results in table 4.9 showed that the tobacco consumption had an inverse ($\beta_1 = -85.8457$) and significant ($p - value = 0.017 < 0.05$ level of significance) relationship with price before tax. This means the first hypothesis was rejected and concluded that there was indeed an inverse direct relationship between tobacco consumption and prices before tax. This indicated that a unit change in prices before taxes decreases tobacco consumption by 85 units.

The study also sought to find the significant effect of tobacco prices after tax on the tobacco consumption. The second hypothesis stated there was no significant effect of tobacco price after tax on consumption of tobacco in Kenya. This hypothesis was rejected since the results in table 4.9 shows there was a negative and significant effect of tobacco prices after tax on tobacco consumption wit coefficient ($\beta_2 = -167.6559$) and also highly significant with ($p - value = 0.000 < 0.05$) level of significance. It was therefore concluded that there was an inverse relationship between prices after tax and tobacco consumption in Kenya. The results from cointegrating relation showed that tobacco prices (both before and tax) had an inverse and significant long run relationship with tobacco consumption (negative coefficients) in Kenya. A unit change in prices after tax in other words imposing tax on the tobacco prices reduces tobacco consumption by 167 units.

Lastly, the third hypothesis was formulated as increase in income per capita has no statistical significant effect on tobacco consumption in Kenya for the period under study. This hypothesis was tested and found that income per capita and tobacco consumption had a positive($\beta_3 = 19.3534$) and highly significant($p - value = 0.000 < 0.05$) relationship as shown in table 4.9. The hypothesis was therefore rejected and concluded that increase in income per capita had an effect on tobacco consumption in Kenya. This implies that increasing income per capita by a unit would increase tobacco consumption by 19 units.

The negative error correction term and statistically significant (p-value = 0.001< 0.05) indicating that there is a cointegrating relationship between the variables of the study implying that the forth hypothesis which stated that there is no cointegrating relationship between tobacco prices, income and tobacco consumption in Kenya was rejected. It further explains that 68.68 percent of deviations are adjusted from lagged differences and it took 1.45 (1/-0.6868) years for the system to come to equilibrium.

Table 4. 10: Results of VECM for a Long Run Relationship

_ce1	Beta	Coef.	Std. Err.	Z	p>|z|	[95% Conf. Interval]	
	Consumption	1	.	.	.	.	.
	Price before tax	-85.846	36.12334	-2.38	0.017	-156.6462	-15.045
	Price after tax	-167.656	42.23488	-3.97	0.000	-250.4347	-84.877
	Income per capita	19.3534	3.62659	5.34	0.000	12.24541	26.4613
	Constant	-12847.7	.	.	.	.	.

Source: Author's Own Computation. STATA Version 12 Results.2021

4.10 Diagnostic Tests

This section presents the diagnostic checks that were done.

4.10.1 Model Stability

This research used Eigen value stability condition to test stability condition of the of used model in estimation of parameters as shown in the table 4.11 and figure 4.4 below.

Table 4. 11: Eigen Value Stability Condition

Eigenvalue	Modulus
1	1
1	1
1	1
0.2698256 + 0.5632429i	0.624539
0.2698256 –0.5632429i	0.624539
0.498641	0.498641
0.288248	0.288248
-0..2561169	0.256117

Source: Researchers compilation from STATA output, 2021

In a kth variable model with r number of co integrating relationships, there will a unit of eigenvalues of k-r companion matrix (Lutkepohl, 2005; Lutkepohl and Kratzik, 2004). The modulus of the remaining r eigenvalues should be and strictly less than one (unity) and also lie inside a unit circle (see figure 4.4) (Lutkepohl, 2005).

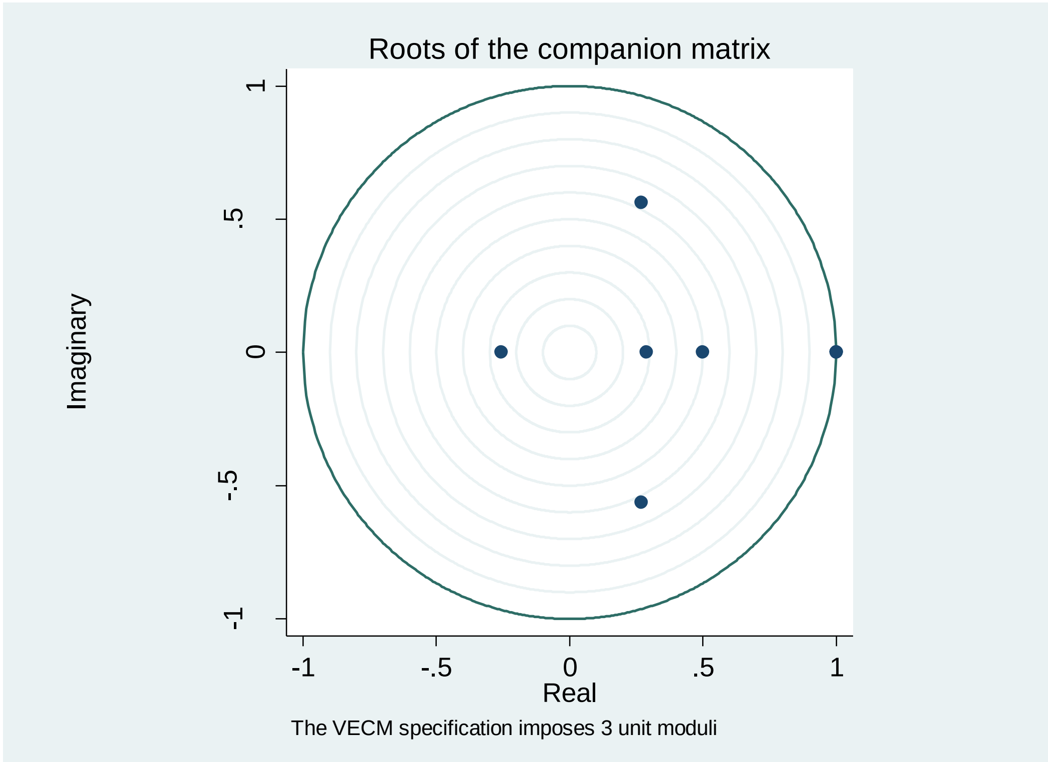


Figure 4. 4: Graph of Roots of the Companion Matrix

*Eigen values on a complex plane. The real eigen values values are on the horizontal axis and the imaginary eigen values on the vertical axis. The referrence circle is the unit circle

Source : Resesearch's Survey, 2021

Graph option was specified and the eigen values was plotted as of companion matrix. From the figure 4.4 of eigenvalues it is shown that none of the remainig eigenvalues appeared closer to the unit circle and thus, indicating that the model was correctly specified and this enabled for the interpretation of the results. The dots represented the eigenvalues that appeared to be within the circle. The results of diagnostic tests indicated that the VECM model used in estimating parameters had a desired model fit and was well specified.

4.10.2 Testing for Residual Autocorrelation

Lagrange Multiplier (LM) is usually used in statistical analysis to detect the presence of residual autocorrelation among independent variables in a time series modeling. In this study, the same approach was used and the results in table 4.12 shows the results of the LM with probability value 0.49147 and 0.37386 at the specified lag order of one and two respectively. The null hypothesis of no residual autocorrelation was tested and concluded that because of results found there was no residual autocorrelation relationship among the residuals of the independent variables.

Table 4. 12: Results Lagrange-multiplier Test Statistic for Residual Autocorrelation

Lags	**Chi-square**	**d.f**	**Prob > Chi-square**
1	15.4568	16	0.49147
2	17.1829	16	0.37386

*H0: No residual autocorrelation at lag order versus alternative hypothesis there is autocorrelation

Source: Authors' computation. 2021.

CHAPTER FIVE

DISCUSSION OF RESULTS

Based on the results, the study can argue that high tobacco prices influence its demand in different ways. First, tobacco price reduces the prevalence in discouraging nonusers from consuming it and can discourage the current user and consequently encouraging them to quit, it also prevents seasonal smokers from turning into regular smokers. Demand of tobacco are determined according to WHO (2017) by consumer disposable income and prices because increase in price causes tobacco consumption to decrease irrespective of the income status of countries. In a low-income setting, increasing income eventually increases tobacco consumption especially the regular smokers thus with growing income, consumers' preference shift to higher priced tobacco products even though cigarette smoking is a major health hazard.

According to public health professionals in China have seen the importance of tobacco control through public health initiative through campaigns in a substantial effort to discourage cigarette consumption. Smoking prevalence is high in China. Over 60 percent of male adults over the age of 15 and adults' females at around 4 percent were regular smokers (Hu, T. W., & Mao, Z. 2002). This is an indication that 320 million Chinese are smoker. This is high given that the Chinese population is high, and this comes as no surprise that China is the leading consumer of tobacco and its products, especially cigarettes.

There has been policy conflict between economic and public health on the benefit of the tobacco production. This evident by the fact that it has been not easy to convince the ministry of finance, economics and trade and the ministry of agriculture on the same.

Further, tobacco production in China is a state-run enterprise that provides substantial revenue for the government. Further, cultivation of tobacco is a leading source of income to farmers of poor economies and this has brought a dilemma to Chinese government in trying to reduce tobacco consumption and also promoting wellbeing of the citizens especially farmers and youth.

In a case of Indonesia, non-clove cigarette manufacturers association stipulated that government regulation about cigarettes and health have been followed to the latter, but these regulations are weak (Djutaharta et al., 2005). Even though the government have used stringent measures such as warning the cigarette commercialization on TVs, the warning duration was short that the people did not properly understand and keep it. The ministry of forestry and research board produced a wide variety of tobacco with low nicotine to minimal two percent compared to preceding tobacco products with high five and seven percent nicotine content (Customs and Excise 2001).

Demand and supply of tobacco change is relatively small in response to price increase and this has made a lee way for the government to increase its revenues through increasing excise tax. A lot of research work have argued that that cigarette and other products of tobacco have had a serious health hazards, and that heavy tax rate have been applied by governments with the aim of protecting the citizen on public health issues (Chaloupka et al. 2000). High increase in tobacco excise tax eventually increases prices. Several research works have shown that price increase will result in cigarette use (Adioetomo et al. 2001). An exceptionally good reason for raising the cigarette excise tax is intended hike government revenues an intuition that tobacco users should at least pay the load they cause to others and the concrete desire is to prevent children and other passive cigarette smokers (Warner et al. 1995).

The major determinants of tobacco prices are raw materials, market factors and the excise tax and the government can increase its revenue through hiking the excise taxes on the tobacco products. According to Adioetomo et al. (2001), an increase of cigarette prices by around ten percent decreased consumption by six percent. Price changes is sensitive to low-income groups especially the young people who have no revenue or if they do so earn less and this shows a greater decrease in tobacco consumption. Excise taxes on cigarettes is the leading or dominates the overall excise taxes and it constitutes about seven percent of the total domestic revenues to governments. And this contribution as been on increasing trajectory in Indonesia. This has been one of the strategies in the department of finance to increase excise taxes as a way of increasing revenues by establishment of cigarette tax policy meant to either change the retail price of induce tax rate. Increasing taxes according to Adioetomo et al. (2001) might not necessarily result in increasing revenues if policies are not well formulated. In this research, ten percent tax increase which consequently raised prices by approximately 5 percent lowered cigarette consumption 3 percent and increase government revenue from excise tax by closely 7 percent.

A research work of Beyer and Yurekli (2000) elaborated that increasing by ten percent tax increase may lead to an increase of government revenue by approximate eight percent and this is strongly supported by inelastic price of cigarette demand. A micro point view of a research in Indonesia concerning cigarette demand a case of households, complimented that the impact of price increases on cigarette consumption might predict the impact tax increases on tobacco use (Adioetomo et al., 2001).

According to Lee et al., (2004) who used ordinary least square (OLS method) on relating tobacco consumption, its retail price and individual monthly income to estimate tobacco elasticities. Results showed a negative price elasticity. This was small (less than one) indicating that demand on cigarette in Taiwan was inelastic and that reduction of the cigarette consumption is done with a strategy of raising domestic cigarette price. It can be speculated that cigarette prices is required to be higher in order to lower consumption enough so that it can be said that indeed it has as strong effects in improving the public health. Another research has found that high excise taxes on cigarettes reduces cigarette consumption (Hu, T. W., & Mao, Z. 2002) such measures are becoming one of the most important means of controlling tobacco Chaloupka et al., 2000; Hopkins et al.,2001 & US Department of Health and Human Services, 2000). Government need to take elasticity of demand into consideration in determining the introduction of excise taxes on tobacco products.

Many of the challenges faced by health organisations in a low- and middle-income countries is increase in the burden of noncommunicable diseases (Guindon, Paraje & Chaloupka, 2015). More than deaths (one third of 34million people) are associated with these noncommunicable diseases. Lozano et al., (2012) opined that use of tobacco risks and is upsettingly high in many Latin American countries such as Chile. Chile has highest smoking rates in the world in the year 2010. Men and women were at 44 percent and 38 percent current smokers, respectively. Total death is associated with tobacco use and it was about 15 percent of all deaths in the year (World Health Organization. 2013).

The Ministry of Health (2011) in Chile argued that increase in prices of tobacco and its products has been found significantly to be the best method of reducing smoking. This appears to that less work has been done using data from Latin American and Caribbean countries. An inclusive review by International Agency for Research on Cancer identified only 6 studies (Jha, P., & Peto, R. 2014). Further, WHO (2013) examined how prices and taxes on tobacco would provide limited quality assessment and methods used and have generally been weak to give a general observation concerning low- and middle- income countriesLMICs except work done by Godfrey et al.2010, Bader et al., (2011) and Guindon (2014), who conducted a quality assessment of individual studies.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSIONS AND POLICY RECOMMENDATION AND SUGGESTION FOR FURTHER STUDIES

6.1 Overview

The section discusses summary of the study findings, the conclusions from the results and policy recommendations based on the findings. The first part gives the introduction, and the following part summarizes of findings and conclusions and policy recommendations based on the findings of the study are presented and finally on the scope and limitation of the study in the last part.

6.2 Summary of Findings

This research determined to examine the significant effect of tobacco prices before tax, prices after tax and finally per capita income on consumption tobacco and it products in Kenya for the period 1980 to 2016 by use of cointegration test approach and estimation of Vector Error Correction Modeling. First, the data was collected, clean and descriptive statistics were carried out to check for outliers. Conventional methods of unit root tests were carried to test whether the data exhibits the stationarity property among each univariate variable, and it found there was unit root at levels. The data used had unit root at their levels but became stationary upon first difference. Further, Zivot Andrews and Clemente Montañés and Reyes test for unit root test with structural breaks was applied. The structural breaks were found out to be variable specific and associated certain economic phenomena. Johansen test for cointegration was further carried out to find out for cointegration and it was the variables were cointegrated hence VECM model was applied. It was concluded from the study that price before tax, price after tax and per capita income affects the tobacco and its products consumption and that there was a long-term relationship adjustment of 1.46 years for variables to come back to equilibrium between the variables as indicated by the negative coefficient cointegrating equation.

6.3 Conclusion

The first hypothesis was to investigate and evaluate the statistically significant effect of tobacco price before tax on tobacco consumption in Kenya. Regression results showed that this variable had an effect on tobacco consumption in Kenya and therefore, the null hypothesis was rejected and concluded that an inverse and statistically significant relationship (negative) existed between these two variables.

The second hypothesized objective of the study was to investigate if there was a significant effect of tobacco price after tax on the tobacco consumption in the region. VECM results showed there was existence of an inverse and significant effect of tobacco prices after taxation on tobacco consumption. Thus the second hypothesis was rejected and concluded that there was a relationship and also a significant between price after tax and tobacco consumption in Kenya. These results imply that any increase in taxation tobacco and its other would lead to a significant decrease in the overall tobacco consumption in Kenya.

The third hypothesis was that increase in per capita income has no significant effect on tobacco consumption in Kenya and from the results it was clearly shown that this variable was important determinant of consumption of tobacco in Kenya. It is an indication that any increase by one unit in income for those using cigarettes leads to one unit increase in consumption of tobacco and its other products in Kenya. Therefore, from the VECM results showed this null hypothesis was rejected and the alternative hypothesis accepted that increase in per capita income would also increase the consumption of tobacco in Kenya.

In this study, increase in cigarette prices reduces cigarette consumption, an additional tax also reduces and would as well generate more revenues. A continuous increase in price is to significantly impact of reducing tobacco consumption. Provision tax increase is should not be proportionately larger than the resulting reduction tobacco use. Revenues from cigarette taxing can be used to reduce deficits of current National Health Insurance and in results reduce death rates caused by diseases caused by smoking. Cigarette price based on the estimated models showed elasticities for example male smokers without income and light smokers would be more sensitive to changes in cigarette prices. Teenagers are affected by prices also affects the teenagers because increasing pricing makes incapacitated to buy the cigarette. It can be concluded that through early preventive education starting from their childhood can be expected to see significant reduction in cigarette consumption.

6.4 Policy Recommendations

The study recommendation based on the findings that government should formulate both long and short-term economic policies that stimulate reduction of tobacco consumption. The results would be useful to the health sector, economists, scholars, and policy makers in understanding the tobacco dynamic demand and the effects of the tobacco products towards economic growth and development. It will enable them to design policies that will ensure not only a healthy country but also enables government to acquire more revenues through taxation and improve overall economy in general.

The simple mechanism government can influence prices tobacco products and alter their consumption is increasing its excise taxes. This research found that increasing excise taxes results in increase in revenue from excise tax. Hiking prices on cigarette prices and other tobacco products may shift current smoker to cheap cigarette or even quit. Though some scholars have argued that high taxes will not necessarily cause less tobacco use and this effect of switching revenues depends on other relative levels of taxes on other products.

The study recommends to the governments formulate and strictly adopt stronger tobacco control measures. Kenya has chance support the idea of adding taxes that have the mutual benefit in reducing consumption as well as having more revenues. Government should consider that continuous impose of excise taxes continuously for a long time would trigger illegal production and smuggling and may require more caution to anticipate possible illegal actions and strong measures to deter them.

6.5 Suggestions for further Researchers

From the scope of the study the following areas are suggested for future researchers;

i. First, there is need to carry out panel data analysis for different countries or economic blocks such as County governments, EAC, COMESA as a result of increasing globalization.

ii. Secondly, it is also suggested that there is need to incorporate other various variables that were not included and use alternative models to analyze the effect of other macro - economic variables on tobacco consumption and taxes in future studies.

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APPENDICIES

APPENDIX I: OPTIMUM LAG LENGTH SELECTION

STATA Command: varsoc consumption pricebeforetax priceaftertax incomepercapita

Selection-order criteria

Sample: 1984 - 2016 Number of obs = 33

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-823.864				7.2e+16	50.1736	50.2346	50.355
1	-690.072	267.58	16	0.000	5.8e+13	43.0347	43.3398*	43.9416*
2	-673.228	33.688	16	0.006	5.8e+13	42.9835	43.5328	44.6161
3	-654.074	38.308	16	0.001	5.4e+13	42.7923	43.5858	45.1505
4	-633.571	41.006*	16	0.001	5.3e+13*	42.5194*	43.557	45.6031

Endogenous: consumption pricebeforetax priceaftertax incomepercapita

Exogenous: _cons

APPENDIX II: COINTEGRATION TEST USING JOHANSEN TEST

STATA Command: vecrank consumption pricebeforetax priceaftertax incomepercapita

```
                    Johansen tests for cointegration

Trend: constant                                     Number of obs =      35
Sample:  1982 - 2016                                         Lags =       2
-------------------------------------------------------------------------------
                                                        5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0      20     -736.73274           .     52.4893    47.21
    1      27     -722.78187     0.54941     24.5876*   29.68
    2      32     -714.61067     0.37307      8.2452    15.41
    3      35     -710.99555     0.18664      1.0150     3.76
    4      36     -710.48807     0.02858
-------------------------------------------------------------------------------
```

APPENDIX III: VECTOR ERROR RESULTS

STATA command: vec consumption pricebeforetax priceaftertax incomepercapita

Vector error-correction model

Sample: 1982 - 2016	No. of obs	=	35
	AIC	=	42.84468
Log likelihood = -722.7819	HQIC	=	43.25886
Det(Sigma_ml) = 1.02e+13	SBIC	=	44.04452

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_consumption	6	3053.18	0.3600	16.31445	0.0122
D_pricebeforetax	6	4.89961	0.3599	16.30454	0.0122
D_priceaftertax	6	6.86879	0.4237	21.32215	0.0016
D_incomepercap~a	6	57.1588	0.4065	19.86036	0.0029

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_consumption						
_ce1 L1.	-.6867729	.2026014	-3.39	0.001	-1.083864	-.2896813
consumption LD.	.1605592	.1867709	0.86	0.390	-.2055049	.5266234
pricebeforetax LD.	-101.8651	104.6381	-0.97	0.330	-306.952	103.2218
priceaftertax LD.	-100.2453	79.38815	-1.26	0.207	-255.8432	55.35266
incomepercapita LD.	3.131472	10.12399	0.31	0.757	-16.71118	22.97413
_cons	.032237	758.8385	0.00	1.000	-1487.264	1487.328
D_pricebeforetax						
_ce1 L1.	.0006563	.0003251	2.02	0.044	.0000191	.0012935
consumption LD.	-.0008936	.0002997	-2.98	0.003	-.001481	-.0003061
pricebeforetax LD.	.1308621	.1679189	0.78	0.436	-.1982529	.4599771
priceaftertax LD.	.118777	.1273988	0.93	0.351	-.13092	.3684741
incomepercapita LD.	-.0205557	.0162466	-1.27	0.206	-.0523984	.0112869
_cons	3.089664	1.217752	2.54	0.011	.7029134	5.476415
D_priceaftertax						
_ce1 L1.	.0004727	.0004558	1.04	0.300	-.0004207	.001366
consumption LD.	-.0001112	.0004202	-0.26	0.791	-.0009347	.0007124
pricebeforetax LD.	-.3346355	.2354063	-1.42	0.155	-.7960233	.1267524
priceaftertax LD.	.0610416	.178601	0.34	0.733	-.2890099	.4110931

```
                 |
 incomepercapita |
             LD. |    .036734   .0227761     1.61   0.107    -.0079064    .0813744
                 |
           _cons |   4.214383   1.707173     2.47   0.014     .8683861    7.560381
-----------------+----------------------------------------------------------------
D_incomepercapita |
            _ce1 |
             L1. |   .0011196   .0037929     0.30   0.768    -.0063143    .0085536
                 |
     consumption |
             LD. |   .0021656   .0034966     0.62   0.536    -.0046875    .0090188
                 |
  pricebeforetax |
             LD. |   .4403213   1.958942     0.22   0.822    -3.399134    4.279776
                 |
   priceaftertax |
             LD. |  -.0008397   1.486234    -0.00   1.000    -2.913805    2.912126
                 |
 incomepercapita |
             LD. |   .5186512   .1895323     2.74   0.006     .1471747    .8901277
                 |
           _cons |   16.18347    14.2063     1.14   0.255    -11.66036     44.0273
----------------------------------------------------------------------------------

Cointegrating equations

Equation           Parms    chi2     P>chi2
-------------------------------------------
_ce1                  3   73.38023   0.0000
-------------------------------------------

Identification:  beta is exactly identified

                 Johansen normalization restriction imposed
--------------------------------------------------------------------------------
           beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------+---------------------------------------------------------------
_ce1            |
    consumption |          1          .        .       .            .           .
 pricebeforetax |  -85.84573   36.12334    -2.38   0.017    -156.6462   -15.04528
  priceaftertax |  -167.6559   42.23488    -3.97   0.000    -250.4347   -84.87701
incomepercapita |    19.3534    3.62659     5.34   0.000     12.24541    26.46138
          _cons |   -12847.7          .        .       .            .           .
--------------------------------------------------------------------------------
```

APPENDIX IV: DATA

YEAR	CONSUMPTION (Tonnes)	PRICE BEFORE TAX(Kshs)	PRICE AFTER TAX(Kshs)	INCOME PER CAPITA (Kshs)
1980	2738	4.68	7.13	446.5744543
1981	3701	5.21	7.34	405.5509672
1982	5212	6.29	8.37	366.2749507
1983	6628	8.27	7	327.8176449
1984	8555	7.73	7.58	326.9364626
1985	5072	7.48	8.58	312.1960254
1986	5076	7.42	9.58	355.2313447
1987	7000	9.05	10.58	377.4184626
1988	8000	10.92	11.58	382.0224053
1989	10590	13.31	13	365.9747535
1990	8800	14.41	15.2	366.3008909
1991	10000	16.43	17	337.1221889
1992	9000	16.23	19.83	328.8393137
1993	10000	16.45	31.5	223.3348006
1994	8920	17.75	40	269.2487013
1995	13000	20.57	40	330.8043302
1996	15980	22.92	41.67	427.9512673
1997	21878	27.51	46.67	452.9848068
1998	11000	32.22	50	473.4327212
1999	16800	58	50	421.4328846
2000	17960	56.05	50	403.9797132
2001	19500	51.43	55.22	401.7763612
2002	20000	57.11	60	395.8493511
2003	17084	58.73	60	436.6875357
2004	22000	60.37	60	458.8843551
2005	25000	70.32	63.37	519.7999346
2006	17605	76.18	67.9	697.0066385
2007	11153	78.56	72.11	839.1081117
2008	8519	78.76	89.22	916.8992515
2009	10260	75.93	90	920.0816252
2010	14156	79.17	95.22	967.3400773
2011	14000	75.55	90.09	987.4453967
2012	15000	72.1	94.1	1155.020582
2013	15000	67.32	130	1229.114798
2014	16450	69.18	145	1335.06458
2015	17000	77.35	140	1349.970144
2016	17500	79.23	150	1455.359765

APPENDIX V: SIMILARITY REPORT

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