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Analysis of the relationship between expenditure on oil imports and public spending on selected social services in Kenya

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Abctract. Since independence, oil imports in Kenya have been rising mainly to sustain the nascent transport, manufacturing, energy, agriculture and maritime sectors among other uses in the country. The growth in the country's oil import bill has however been closely related to public spending in the health and education sectors which experienced shocks owing to the growth in expenditures apportioned to the rising volume of oil imports. Given the significance of the social pillar of the Kenya Vision 2030 and the inconsistency in the progress towards achieving the Sustainable Development Goals, which is inherent in the Kenya Vision 2030, understanding the linkages between the aforementioned trends in expenditures can help in explaining the progress towards attaining the education and health facets of the social pillar. The purpose of this study was to analyze the relationship between aggregate expenditure on oil imports and public spending on health and education. The data used was time series data sourced from Kenya National Bureau of Statistics, Central Bank of Kenya and World Bank. The study employed granger causality and correlation analysis. Based on standard Chi-square tests and F-tests, the findings of the study revealed that there exists bi-directional causality between government expenditure on health and aggregate expenditure on oil imports on one hand; and a unidirectional causality running from government spending on education to aggregate expenditure on oil imports on the other hand, both in the long-run and short-run. It is therefore recommended that the government should define what is deemed economically sustainable in regard to government expenditure on health as a proportion of the exchequer budget. It should also put in place policies that will institute reasonable margins for government expenditures on health and education to adjust as a measure to keep the rising oil import bill in check.
Keywords. Public spending, Causality, Oil price shock.
JEL. D61, H12, H51, H52, Q48.

1. Introduction

While the Kenya Vision 2030 stands out as the preface of the country's success stories, its achievement largely depends on the relative weights attached to the political pillar, economic pillar and social pillar. The pillars are however interwoven in a manner that can

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lead to policy conflicts should there lack a balanced approach in assigning priorities to the three pillars (Republic of Kenya, 2007). For instance, many oil producing and exporting countries like Nigeria, Ghana and Saudi Arabia produce oil in large quantities but the economic situation and the politics surrounding oil exploitation ends up injuring the welfare of the masses who end up being poorer than before oil was exploited in these countries. This is due to the overarching rent seeking activities, corrupt practices, wars and conflicts (Di John, 2007).

In the case of oil importing countries like Kenya, the interwoven nature of the political, economic and social factors is centered around aggregate expenditure on oil imports as this may put pressure on the proportion of the exchequer budget that is allocated to health and education respectively. This may result in significant trickle down effects on the welfare of the country's population (Holzmann, 1990).

Like many resource-rich economies which do a very poor job in providing education and health care for the citizens owing to resource curse, resource-scarce economies like Kenya are faced by the challenge of providing affordable health care and quality education to the citizens in the face of the high and rising oil import bills (Ross, 2001; Sachs & Warner, 2001; Patrick, 2012; Karl, 2007). This might be echoed by the perpetually rising oil import bills in the country.

Besides political instability, corruption, war, union activities, and the increase in the number of workers employed by the public service commission, the variations in the growth rates in public spending on health and education (shown in figure 1.1) may also be attributed to the high and rising expenditures on oil imports. It is worth noting that the total expenditure of oil imports consists of the importation of crude oil and other petroleum products by all economic actors in the energy sector including the Government and private companies like Shell oil company, Vivo energy Kenya, Libya oil Kenya Limited (Oilibya), and Total Company Limited.

For many decades, petroleum has been viewed as the major driver of manufacturing, transport and the overall industrial activities in Kenya. It is also used by farm machinery in the agricultural sector and as a power source for households and businesses. The massive energy requirement in a country that has no oil makes oil imports an integral component in the country (Mureithi, 2014). The high and growing oil reliance automatically makes oil an inevitable impetus to the macro economy now that Kenya has predominantly been known as a net oil importer over the years.

The increase in aggregate expenditure on oil imports is not only pegged on the inevitable increase in the volume oil imports but also on global oil price shocks and exchange rate fluctuations. These dynamics have an eventual effect on the domestic economy in regard to the allocative pressure exerted on government revenue. This pressure may be channeled either through inflation that is caused by increasing global oil prices and

exchange rate fluctuations or through a rise in the volume of oil imports based on the perpetually increasing oil demand.

Despite the essence of government expenditure in keeping the macro economy afloat, there has been a slowdown in addressing the healthcare and education expenditure needs which are necessary in order to keep the country at pace with the Sustainable Development Goals. This slowdown is illustrated in the following Figure 1.

Since this study focuses on the pressure exerted on government revenue in regard to public spending on health and education and the counter-effects in the country, it was of great importance to estimate the causal relationship that can go a long way in explaining the relationship between oil import bill, government expenditure on health and government expenditure on education (Lu, *et al.*, 2010). Therefore, this study focused on the expenditures on oil imports into the country in aggregate terms.

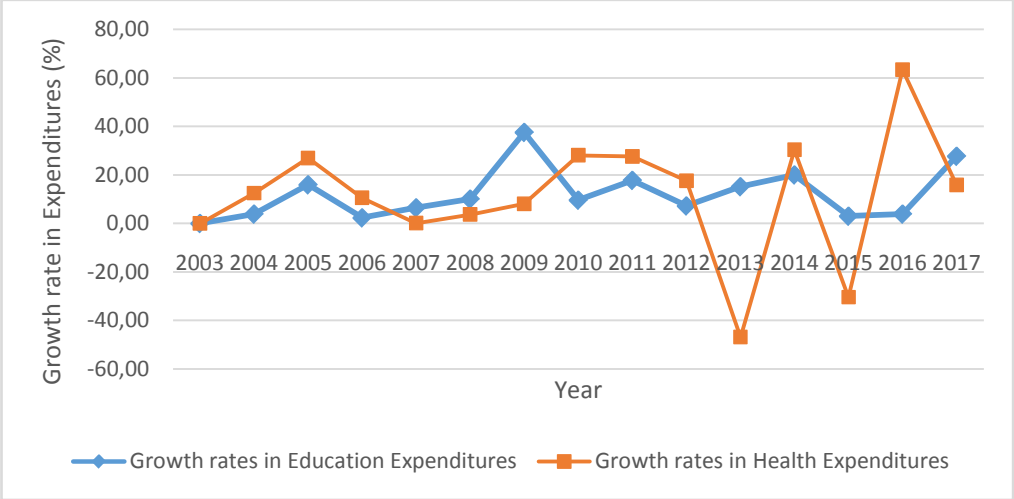

Figure 1. *Trends in Annual Growth Rates in Health and Education Expenditures*
Source of data. *Annual Economic Surveys and Statistical Abstracts*

2. Literature review

Nurudeen & Usman (2010) used a disaggregated analysis to investigate the effects of government expenditure on economic growth by the co-integration and Vector Error Correction Model (VECM). The study considered total capital expenditure by the government, transport and communication expenditures, and health and education expenditures as the key variables. The findings reveal that the economy grows with an increase in government expenditures on health, transport and communication hence a need to increase the capital and recurrent expenditures including education expenditures which has a negative effect on economic growth. This study recommended a boost in funding to anti-corruption agencies in order to tackle the much escalated corruption in public offices.

Olabisi & Oloni (2012) did an analysis of the composition of public expenditure and the effects of the public expenditure components on economic growth spanning from 1960 to 2008. The study used VAR in the determination of the relative weights assigned to different expenditure components in regard to the considerations of urgent needs of the country. That is, welfare. According to the findings, education expenditures did not enhance economic growth due to corrupt practices, rent seeking activities and unemployment among others. Health and water expenditures on the other hand enhance economic growth.

Mureithi (2014) did a quarter-annual analysis based on the Johansen-Juselius co-integration and VECM approach to study the causes of oil import volatility and the subsequent effects on GDP growth rate. The results indicated that causality from GDP growth rate to oil import volatility was present and positive while OPEC oil production indicated the opposite of this relationship. On the other hand, the causality from oil import volatility to GDP growth was present and negative. However, an increase in expenditures on oil imports leads to increased GDP growth regardless of the expenditures on health and education.

Hasnul (2015) used the Ordinary Least Square technique to analyze the effects of government expenditure on economic growth for forty five years from 1970.The result for the time series analysis indicated that there is a negative correlation between government expenditure and economic growth. This follows from the findings that there is no statistical significance between expenditures on health, education, defense and operation and economic growth.

In a study examining the effects of oil revenue on public expenditure and economic growth rate in Nigeria for the period spanning 1980 to 2012, Aregbeyen & Kolawole (2015) employed OLS, VECM and Granger Causality. According to this study, oil revenue Granger causes both public spending and economic growth. Conversely, there was no causality between economic growth and public spending in the country. While changes in oil revenues can be used as a proxy to oil import bill, the public expenditure components (Health and Education) have not been decomposed to allow for further analysis on the expenditure components.

Ademola, Olasode, Raji, Adedoyin (2015) employed simple regression models in an annual time series analysis on the causality and empirical relationship between crude oil price and inflation from 1982 to 2011.The results on the empirical analysis showed that public spending on health and education has a positive relationship with economic growth but does not capture the feedback mechanism between expenditures on oil imports and health and education expenditures majorly because Nigeria is an Oil producing and exporting country.

The study best informs this research since it focuses on oil-importing countries. It however limits this study by the speculative factor which is not tenable in Kenya's situation owing to successive political conflicts in the country, rent seeking activities and corruption practices. While this study

can capture the expenditure on oil imports, it doesn't encompass the effects on the oil import-induced effects on expenditures in other sectors.

3. Research methodology

In achieving the objectives specified in this study, the design adopted was non-experimental in nature since statistical estimation did not rely on the manipulation of any variable to influence outcome. It instead followed a descriptive approach to analyze the patterns of expenditure between public spending on health and education and the oil import bill in aggregate terms.

3.1. Empirical Model and Estimating Procedures

In testing for causality between the expenditure variables of interest, this study employed models adopted by Kosimbei (2002); Hiemstra & Jones (1994); and Hoffman *et al.,* (2005).

The relationship between the aggregate expenditures on oil and government expenditures on health and education is given by the following equations (1) and (2).

$$EXH_t = \propto_0 + \propto_1 EXO_t + ROP_t + XR_t + \mu_t \quad (1)$$

$$EXE_t = \beta_0 + \beta_1 EXO_t + ROP_t + XR_t + \mu_t \quad (2)$$

Where:

EXH_t= Government expenditure on health in time t

EXO_t = Aggregate expenditure on oil imports in time t

EXE_t = Government expenditure on education in time t

ROP = Real oil price

XR = Real exchange rate

Specification of Granger causality model can be done by extending equation (1) and equation (2) by including the lags of both the left-hand side and right-hand side variables as follows:

$$EXH_t = \propto_{10} + \sum_{i=0}^{k} \propto 1i(EXO)_{t-i} + \sum_{j=1}^{k} \beta 1j(EXH)_{t-j} + \sum_{m=0}^{k} \theta 1m(ROP)_{t-m} + \sum_{n=0}^{k} \rho 1n(XR)_{t-n} + \mu_t \quad (5)$$

$$EXO_t = \propto_{20} + \sum_{i=1}^{k} \omega 2i(EXO)_{t-i} + \sum_{j=0}^{k} \psi 2j(EXH)_{t-j} + \sum_{m=0}^{k} \varphi 2m(ROP)_{t-m} + n=0k\sigma 2n(XR)t-n+vt \quad (6)$$

$$ROP_t = \propto_{30} + \sum_{i=0}^{k} \partial 3i(EXO)_{t-i} + \sum_{j=0}^{k} \emptyset 3j(EXH)_{t-j} + \sum_{m=1}^{k} \gamma 3m(ROP)_{t-m} + n=0k\tau 3n(XR)t-n+\varepsilon t \quad (7)$$

$$XR_t = \propto_{40} + \sum_{i=0}^{k} \pi 4i(EXO)_{t-i} + \sum_{j=0}^{k} \vartheta 4j(EXH)_{t-j} + \sum_{m=0}^{k} \varrho 4m(ROP)_{t-m} + n=1k\varpi 4n(XR)t-n+\epsilon t \quad (8)$$

$$EXE_t = \propto_{10} + \sum_{i=0}^{k} \propto 1i(EXO)_{t-i} + \sum_{j=1}^{k} \beta 1j(EXE)_{t-j} + \sum_{m=0}^{k} \theta 1m(ROP)_{t-m} + \sum_{n=0}^{k} \rho 1n(XR)_{t-n} + \mu_t \quad (9)$$

$$EXO_t = \propto_{20} + \sum_{i=1}^{k} \omega 2i(EXO)_{t-i} + \sum_{j=0}^{k} \psi 2j(EXE)_{t-j} + \sum_{m=0}^{k} \varphi 2m(ROP)_{t-m} + n=0k\sigma 2n(XR)t-n+\nu t \quad (10)$$

$$ROP_t = \propto_{30} + \sum_{i=0}^{k} \partial 3i(EXO)_{t-i} + \sum_{j=0}^{k} \emptyset 3j(EXE)_{t-j} + \sum_{m=1}^{k} \gamma 3m(ROP)_{t-m} + n=0k\tau 3n(XR)t-n+\varepsilon t \quad (11)$$

$$XR_t = \propto_{40} + \sum_{i=0}^{k} \pi 4i(EXO)_{t-i} + \sum_{j=0}^{k} \vartheta 4j(EXE)_{t-j} + \sum_{m=0}^{k} \varrho 4m(ROP)_{t-m} + \sum_{n=1}^{k} \varpi 4n(XR)_{t-n} + \epsilon_t \quad (12)$$

By estimating models (9), (10), (11) and (12) above, causality between aggregate expenditure on oil imports and government expenditure on education was tested since the two expenditure variables were integrated of different orders hence preempting the need for cointegration tests.

On the other hand, presence of cointegrating equations in the system (Between government expenditure on health and aggregate expenditure on oil imports) required that an Error Correction Model be specified as follows (see for example Kosimbei, 2002).

$$\Delta(EXH_t) = \beta_0 + \sum_{i=0}^{k}(\propto i\Delta(EXO)_{t-i}) + \sum_{j=1}^{k}(\delta j\Delta(EXH)_{t-j}) + \sum_{m=0}^{k}(\rho m\Delta(ROP)_{t-m}) + \sum_{n=0}^{k}(\tau n\Delta(XR)_{t-n}) + \lambda_1 ECT_{t-1} + \eta_t \quad (13)$$

$$\Delta(EXO_t) = \gamma_0 + \sum_{i=1}^{k}(\omega j\Delta(EXO)_{t-i}) + \sum_{j=0}^{k}(\psi j\Delta(EXH)_{t-j}) + \sum_{m=0}^{k}(\varpi m\Delta(ROP)_{t-m}) + \sum_{n=0}^{k}(\pi n\Delta(XR)_{t-n}) + \lambda_2 ECT'_{t-1} + \nu_t \quad (14)$$

$$\Delta(ROP_t) = \sigma_0 + \sum_{i=0}^{k}(\partial i\Delta(EXO)_{t-i} + \sum_{j=0}^{k}(\emptyset j\Delta(EXH)_{t-j}) + \sum_{m=1}^{k}(\vartheta m\Delta(ROP)_{t-m}) + n=0k(\theta n(XR)t-n)+\lambda 3ECT''t-1+\varepsilon t \quad (15)$$

$$\Delta(XR_t) = \varrho_0 + \sum_{i=0}^{k}(\zeta i\Delta(EXO)_{t-i}) + \sum_{j=0}^{k}(\chi j\Delta(EXH)_{t-j}) + \sum_{m=0}^{k}(\Phi m\Delta(ROP)_{t-m}) + n=1k(\kappa nXRt-n)+\lambda 4ECT'''t-1+\mu t \quad (16)$$

Where ECT, ECT', ECT'' and ECT''' error correction terms are represented by residuals of equations 13, 14, 15 and 16.

In the first step of Granger causality, the null hypothesis was $\alpha_i = \lambda_1 = 0$,, $\omega j = \lambda_2 = 0$, $\partial i = \lambda_3 = 0$ and $\zeta i = \lambda_4 = 0$ for all i and j (see for example Kosimbei, 2002). If the null hypothesis would not be rejected, there was no need for further testing since this indicates that there is no causality in any direction. Further steps would thus follow in case the null hypothesis would not be accepted.

For a stationary series, a correlation model was expressed by equation (17) and (18) as shown.

$$\mathrm{Corr}_{\mathrm{EXO,EXH,ROP,XR}\ (t_1,t_2)}(\tau) = \int_{-\infty}^{\infty} \mathrm{EXO(t).EXH(t).ROP(t).XR(t+\tau)}\,\partial \mathrm{t}. \quad (17)$$

$$\mathrm{Corr}_{\mathrm{EXO,EXE,ROP,XR}\ (t_1,t_2)}(\tau) = \int_{-\infty}^{\infty} \mathrm{EXO(t).EXE(t).ROP(t).XR(t+\tau)}\,\partial \mathrm{t}.. \quad (18)$$

Where:

$Corr_{EXO,EXH,ROP,XR}(t_1,t_2)$= Correlation between the aggregate expenditure on oil imports, government expenditure on health, real oil price and real exchange rate in time 1 and time 2 respectively,

$Corr_{EXO,EXE,ROP,XR}(t_1,t_2)$= Correlation between the aggregate expenditure on oil imports, government expenditure on education, real oil price and real exchange rate in time 1 and time 2 respectively,

τ= Expected correlation coefficient between the variables.

3.2. Definition of Variables and Measurement

Education expenditure ($GEXE$): Consists of all capital and recurrent expenditure made by the government for pre-primary through tertiary education. It was measured by the absolute values of annual government expenditures in education.

Health expenditure ($GEXH$): It consists of all expenditure made by the government for hospitals, clinics, and public health affairs and services for medical, dental and paramedical practitioners; for medication, medical equipment and appliances; for applied research and experimental development. It was measured by the absolute values of annual government expenditures in health.

Aggregate Expenditure on Oil imports (EXO): It consists of all expenditure made by the government and non-government bodies for importing crude oil and petroleum products in the country. It was measured by the absolute values of annual expenditures on oil imports.

Real Oil Price (ROP): This is the price of oil after accounting for the effects of inflation. It is measured by the average annual measure of the dollar value of the Dubai spot price (in US$) per barrel of oil.

Exchange Rate (XR): This is the average of a country's currency relative to another major currency. It is measured by the annual average of the Kenya Shillings per US dollar

3.3. Data Type and Source

This study employed time series secondary data from 1963 to 2017 on the aforementioned variables of interest. Data for aggregate expenditure on oil imports, government expenditure on health, and government expenditure on education and was sourced from Kenya economic surveys and statistical abstracts. Data on real exchange rate and annual oil prices were sourced from the Central Bank of Kenya and World Bank respectively.

3.4. Time Series Properties

For Granger causality and correlation Analysis to proceed, the data on aggregate expenditure on oil imports, real exchange rates, oil prices and government expenditure on health and education were tested for stationarity using the Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) unit root test. This was to ensure that the data fits the model and that

the estimation procedure does not produce spurious results which would yield misleading (Kosimbei, 2002).

In the case where the pairs of variables were integrated of the same order, a cointegration test was conducted using the Engle and Granger's Residual Based test approach as in Gujarati (2008). The cointegration test was important in determining whether to employ Vector Autoregressive Models (VAR) or the Vector Error Correction Models (VECM) in testing for causality between pairs of economic variables (Kosimbei, 2002). That is, an indication of cointegration in the system called for the specification of an Error Correction Model (ECM) (Engel & Granger, 1987). On the other hand, lack of cointegrating equations would have warranted the specification of a VAR model.

3.5. Data Analysis and Results Interpretation

Since there was presence of cointegration equations, the relationship between expenditure on oil imports and government expenditure on health was determined by estimating equations (13), (14), (15) and (16). Granger causality test (1969, 1980) accounts for whether previous changes in expenditure on oil imports (EXO) explain the present or future values of government expenditure on health (EXH)and vice-versa. As it tests for the direction of causality, it concurrently tests for endogeneity which gives an insight on whether estimations should be executed simultaneously or simply using a single equation.

In this study, Granger Causality was tested by estimating a linear equation between aggregate expenditures on oil imports and government expenditure on health followed by an F-test. If there occurs a joint significance of the variables, then aggregate expenditures on oil imports Granger causes government expenditure on health such that the past values of aggregate expenditures on oil imports help in explaining the present and future values of government expenditure on health. In determining whether the government expenditure on health granger cause aggregate expenditures of oil imports, a reverse of the linear equation would be run. The following were the hypothesis for equations (13), (14), (15) and (16):

$$H_0 = \propto_i = \rho_m = \tau_n = 0, i = 1,2, \dots \dots \dots, k \quad (19)$$

$$H_0 = \psi_j = \varpi_m = \pi_n = 0, i = 1,2, \dots \dots \dots, k \quad (20)$$

$$H_0 = \partial_i = \emptyset_j = \theta_n = 0, 1,2, \dots \dots \dots, k \quad (21)$$

$$H_0 = \zeta_i = \chi_j = \Phi_m = 0, 1,2, \dots \dots \dots, k \quad (22)$$

This was for all i and j, using standard F-test or Wald test. For instance, if at least one coefficient $\propto_i$ is statistically different from zero, then government expenditures on health granger causes government expenditures on oil imports; likewise, if at least one coefficient ψ_j would be statistically different from zero, then government expenditures on health are granger caused by aggregate expenditures on oil imports. If the null

hypotheses in equations (19), (20), (21) and (22) are both rejected, then there is a bi-directional causality and both variables are related to past effects of each another. This is referred to as a feedback system. The bivariate Granger causality test however requires pairs of variables be stationary hence a test for stationarity was conducted.

The second objective was to estimate the relationship between aggregate expenditure on oil imports and government expenditure on education. This was achieved by estimating equations (9), (10), (11) and (12). Granger causality test was done to account for whether previous changes in expenditure on oil imports (EXO) explain the present or future values of government expenditure on education (EXE) and vice-versa. If there occurs a joint significance of the variables as indicated by F-tests, then aggregate expenditures on oil imports Granger causes government expenditure on education such that the past values of aggregate expenditures on oil imports help in explaining the present and future values of education. A reverse of the linear equation was run to determine whether government expenditure on education granger cause aggregate expenditures of oil imports. The hypothesis for equations (9), (10), (11) and (12) was given as follows:

$$H_0 = \propto_{1i} = \theta_{1m} = \rho_{1n} = 0, i = 1,2, \ldots\ldots, k \quad (23)$$
$$H_0 = \psi_{2j} = \varphi_{2m} = \sigma_{2n} = 0, i = 1,2, \ldots\ldots, k \quad (24)$$
$$H_0 = \partial_{3i} = \emptyset_{3j} = \tau_{3n} = 0 \; i = 1,2, \; \ldots\ldots, k \quad (25)$$
$$H_0 = \pi_{4i} = \vartheta_{4j} = \varrho_{4m} = 0, i = 1,2, \ldots\ldots, k \quad (26)$$

This is for all i and j, using standard F-test or Wald test. For example, f at least one coefficient $\propto_{1i}$is statistically different from zero, then government expenditures on education granger causes government expenditures on oil imports; likewise, if at least one coefficients ψ_{2j} is statistically different from zero, then government expenditures on education are granger caused by aggregate expenditures on oil imports. If the null hypotheses in equations (3.23) - (3.26) are rejected, then there is a bi-directional causality and both variables are related to past effects of one another. Correlation analysis was done by estimating equation 3.18 in a similar manner as the first objective.

4. Empirical results and discussions

4.1. Descriptive statistics

From the above Table 1, the average annual government expenditure on education was Kshs 65,056.11 million while the average annual government expenditure on health was Kshs 13,665.36 million. In contrast, the average annual expenditure on oil imports was Khs 63,168.59 million while the average annual oil price and exchange rate was USD 29.508 per barrel and Kshs 40.740 per USD respectively.

Table 1. *Summary of Descriptive Statistics*

	Aggregate Expenditure on Oil Imports	Government Expenditure on Education	Government Expenditure on Health	Real Oil Prices	Exchange Rate
Mean	63168.59	65056.11	13665.36	29.508	40.740
Median	9356.200	13738.96	3458.200	18.1	22.922
Maximum	335676.7	415395.1	71851.74	108.9	103.374
Minimum	167.160	136.200	61.080	1.21	6.961
Std. Dev.	98414.91	100470.9	19210.09	29.509	33.900
Skewness	1.635	1.832	1.581	1.396994	0.354
Kurtosis	4.361	5.514	4.444	4.05643	1.477
Obs.	55	55	55	55	55

Source: *Computed From Research Data*

There has been a perpetual rise in oil prices from a minimum of USD 1.21 per barrel at independence to a maximum of USD 108.9 per barrel within a 55 year period. A similar trend is seen for exchange rates which rise from a minimum of Kshs 6.961 per USD to a maximum of Kshs103.374 per USD within the same period. This trend basically captures the oil price shocks and exchange rate variations which define the expenditure patterns on oil imports, government expenditure on health and government expenditure on education (Maina, 2015).

Government expenditure on education was highest followed by the country's expenditure on oil imports. This can be attributed to the fact that human development drives all the other sectors of the economy which thrive and improve by investing in the education sector (Maina, Nyandemo & Kioko, 2016). A work force which is well educated and trained also increases efficiency in health care hence further reducing health care expenditures by the government (Savić, 2018).

Similar effects are experienced on oil imports where average expenditures on oil imports are lower than education at Khs 63,168.59 million due to such efficiency gains which are drawn from the education sector. This further explains why the minimum expenditures on oil imports and government expenditure on health care are lower at Kshs 167.16 million and Kshs 68.01 million respectively. The average annual expenditure on oil imports was also notably high at Khs 63,168.59 million in absolute terms owing to the rise in oil-reliant production activities in the manufacturing, transport, health, education sectors among others (Cheserek & Mugalavai, 2012; Were, 2016).

Government expenditure on education has the highest standard deviation of Kshs 100,470.9 million followed by expenditure on oil imports at Kshs 98,414.9 million. This can be explained by the expenditure shocks which are exacerbated by the need to increase educational infrastructure, books and other activities needed to sustain free primary education, secondary and tertiary education. The high standard deviation can also be attributed to corrupt practices by high ranking public officials (Cheserek &

Mugalavai, 2012). The high variation in oil import expenditures is however not due to varying global oil prices and exchange rate fluctuations as one would suppose. It is rather due to the increased oil demand in the country owing to its great necessity as a complementary good (Mureithi, 2014). Aggregate expenditure on oil imports, government expenditure on education, government expenditure on health, exchange rate and oil price are all positively skewed and highly peaked. They are therefore asymmetrically distributed.

4.2. Stationarity test results

Before reporting the results, stationarity tests were conducted and the results presented in the following Table 2.

Table 1. *Unit root test Results*

Unit Root Tests	Variables	ADF test Statistic		PP Test Statistic		
		Statistics	Critical value	Statistics	Critical value	
	Aggregate expenditure on oil imports	-1.710	1%= -4.137 5%= -3.495 10%= -3.177	-1.571	1%= -4.137 5%= -3.495 10%= -3.177	Not Stationary
	Government Expenditure on Health	-1.938	1%= -4.137 5%= -3.495 10%= -3.177	-1.743	1%= -4.137 5%= -3.495 10%= -3.177	Not Stationary
	Government Expenditure on Education	16.156	1%= -4.145 5%= -3.499 10%= -3.179	8.655	1%= -4.137 5%= -3.495 10%= -3.177	Not Stationary
	Exchange rate	-2.006	1%= -4.137 5%= -3.495 10%= -3.177	-2.043	1%= -4.137 5%= -3.495 10%= -3.177	Not Stationary
	Oil Prices	-2.462	1%= -4.141 5%= -3.497 10%= -3.178	-2.289	1%= -4.137 5%= -3.495 10%= -3.177	Not Stationary
Unit Root Tests at First Difference	Aggregate Expenditure on Oil Imports	-2.381	1%= -4.149 5%= -3.501 10%= -3.180	-7.232	1%= -4.141 5%= -3.497 10%= -3.178	Stationary
	Government Expenditure on Health	-5.512	1%= -4.149 5%= -3.501 10%= -3.180	-9.868	1%= -4.141 5%= -3.497 10%= -3.178	Stationary
	Government Expenditure on Education	0.259	1%= -4.149 5%= -3.501 10%= -3.180	-2.939	1%= -4.141 5%= -3.497 10%= -3.178	Not Stationary
	Exchange rate	-5.016	1%= -4.145 5%= -3.499 10%= -3.179	-6.665	1%= -4.141 5%= -3.497 10%= -3.178	Stationary
	Oil Prices	-5.191	1%= -4.145 5%= -3.499 10%= -3.179	-6.432	1%= -4.141 5%= -3.497 10%= -3.178	Stationary
Unit Root Test at Second Difference	Government Expenditure on Education	-11.550	1%= -4.153 5%= -3.502 10%= -3.181	-3.220	1%= -4.145 5%= -3.499 10%= -3.179	Stationary

Source: *Computed From Research Data*

From the unit root tests' results, aggregate expenditures on oil imports, government expenditure on health, exchange rate and oil prices were all non-stationary at levels. They were therefore tested for unit root at first difference where they all achieved stationarity as summarized in table 2.

These results heightened the possible presence of valuable long-term equilibrium relationships since cointegrating relationships can only exist where variables are stationary at first difference (Kosimbei, 2002). On the other hand, government expenditure on education was non-stationary both at levels and at first difference but stationarity was achieved at second difference.

4.3. Relationship between expenditure on oil imports and government expenditure on health

This section discusses the results on the relationship between aggregate expenditure on oil imports and government expenditure on health.

4.3.1. Correlation analysis results

Correlation analysis was done to determine the direction and strength of the relationship between aggregate expenditure on oil imports, government expenditure on health, exchange rate and oil prices. The correlation tests results are presented in the following Table 3.

Table 3. *Correlation Matrix*

		d(Aggregate Exp. on Oil Imports)	d(Government Exp. on Health)	d2(Government Exp. on Education)	d(Exchange Rate)	d(Oil Price)
d(Aggregate Expenditure on Oil Imports)	Coefficient	1.000				
	t-statistics	-----				
	Probability	-----				
d(Government Expenditure on Health)	Coefficient	0.326*	1.000			
	t-statistics	2.460	-----			
	Probability	0.017	-----			
d2(Government Expenditure on Education)	Coefficient	0.440*	0.184	1.000		
	t-statistics	3.496	1.333	-----		
	Probability	0.001	0.188	-----		
d(Exchange Rate)	Coefficient	0.001	-0.034	-0.095	1.000	
	t-statistics	0.004	-0.241	-0.684	-----	
	Probability	0.997	0.811	0.497	-----	
d(Oil Price)	Coefficient	0.243	0.063	0.098	-0.156	1.000
	t-statistics	1.789	0.449	0.704	-1.131	-----
	Probability	0.080	0.655	0.485	0.264	-----

From the results of the correlation analysis presented as a matrix in table 3, at stationarity, government expenditure on health and exchange rate move in the opposite direction as shown by the negative sign on the correlation coefficient (-0.034). This means that as the Kenya shilling losses ground against the US dollar (that is, an increase in the exchange rate) by one percent, government expenditure on health falls by 3.4 percent and vice-versa *ceteris paribus*. This is a however a weak correlation but cannot be deemed negligible owing to the inherent welfare implications that it may bear (Lu, *et al.*, 2010). The fall in government expenditure on health with rising exchange rate is occasioned by the fact that importing medical equipment and services in the health sector become more expensive forcing the government to seek sustainable alternatives. This relationship is in line with Pilbeam (1992) where savings and imports are considered as leakages

from the spending stream. On the other hand, government expenditure on health is positively correlated with oil prices with a correlation coefficient of 0.063. That is, a percentage increase in oil prices is associated with 6.3 percent increase in government expenditure on health and vice versa *ceteris paribus*. Oil price shocks and exchange rate fluctuations might be mildly reflected in aggregate expenditure on oil imports which increases by 32.6 percent following a percentage increase in government expenditure on health and vice versa ceteris paribus. This is in consonance with the findings of Hitzemann &Yaron (2016) who focused on welfare costs of oil price shocks in relation oil production changes rather than oil import bill.

4.3.2. Distributional test results

Distributional tests were also conducted on the variables using skewness and kurtosis. Based on the results of the descriptive statistics in table 1, government expenditure on health, aggregate expenditure on oil imports, exchange rate and oil prices were all positively skewed. On the other hand, the results on kurtosis showed that with the exception of exchange rate which was platykurtic at 1.477 indicating a large standard deviation, government expenditure on health, aggregate expenditure on oil imports and oil price were leptokurtic at more than 4 with a sharp peak. This was an indication of a smaller standard deviation.

4.3.3. Granger causality test results

The table that follows presents the granger causality test results between aggregate expenditure on oil imports and government expenditure on health.

Table 4. *Granger Causality Test Results between Aggregate Expenditure on oil imports and Government Expenditure on Health*

Null Hypothesis	Chi-square	P- Values
Aggregate expenditure on oil imports does not Granger cause Government expenditure on health	23.768*	0.000
Government expenditure on health does not Granger cause Aggregate expenditure on oil imports	20.560*	0.000

Note: *denotes rejection of the null hypothesis at 0.05 significant level.
Source: *Computed From Research Data*

Table 4 shows that the Chi-square statistic for the granger causality from aggregate expenditure on oil imports to government expenditure on health was significant at 0.01 significance level. Similarly, the Chi-square statistic for the granger causality from government expenditure on health to aggregate expenditure on oil imports was also significant at 0.01 significance level. This indicates the existence of bi-directional causality in the sense that aggregate expenditure on oil imports granger causes government expenditure on health and vice versa *ceteris paribus*. Similar results were found by Patrick (2012) where oil exploitation dampened the healthcare state in developing countries. According to Patrick (2012), a lower spending on oil imports leads to less government commitment towards healthcare and the overall welfare of citizens. This follows from the assumption that oil production essentially means low importation of oil

(Lu, *et al.*, 2010). Opposite results were however reported by Mureithi (2014) who indicated that the expenditures inherent in oil import volatility negatively affects GDP growth rate.

Since there is no direct link to this study, however, the study assumed that the economy grows following an increase in government expenditure on health (Nurudeen & Usman, 2010). Expenditure on oil imports does not granger cause government expenditure on health according to Mureithi (2014) and Nurudeen & Usman (2010).

From this analysis, one can infer that as more money is spent to import oil to drive, sustain and improve the health sector, healthier kenyan citizens import more oil to sustain the growing economy as well. Thus, expenditure on oil imports and government expenditure on health are not independent of each other (Blomstedt, *et al.*, 2018).

The following table shows the results for granger causality between aggregate expenditure on oil imports and exchange rates.

Table 5. *Granger Causality Test Results between Aggregate Expenditure on Oil imports and Exchange rate*

Null Hypothesis	Chi-square	P- Values
Aggregate expenditure on oil imports does not Granger cause Exchange rate	10.947*	0.012
Exchange rate does not Granger cause Aggregate expenditure on oil imports	2.287	0.515

Note: *denotes rejection of the null hypothesis at 0.05 significant level.
Source: *Computed From Research Data*

The results reported on table 5 shows that the expenditure on oil imports granger causes exchange rates as the exchange rates adjusts so as to offset the effects of the rising oil import bill in the country (Pilbeam, 1992; Taylor & MacDonald, 1989). This can be attributed to the fact that oil is not only a necessary good but also a complementary good in virtually all the sectors of the economy. Therefore, an appreciation in the domestic currency cushions such sectors from the adverse effects of rising oil import bills. On the other hand, there is no causal relationship running from exchange rates to aggregate expenditure on oil imports. This finding underscores the centrality of oil imports in driving the economy of Kenya as a necessity resulting in the inelastic nature of oil demand which keeps growing through time (Mureithi, 2014). The following table presents the granger causality test results between government expenditure on health and exchange rates.

Table 6. *Granger causality test results between government expenditure on health and exchange rate*

Null Hypothesis	Chi-square	P- Values
Government expenditure on health does not Granger cause Exchange rate	10.212*	0.017
Exchange rate does not Granger cause Government expenditure on health	4.330	0.228

Note: *denotes rejection of the null hypothesis at 0.05 significant level
Source: *Computed From Research Data*

From Table 6, government expenditure on health granger causes exchange rates. The exchange rates adjust so that the importation of medical equipment and services by the government may be more affordable (Pilbeam, 1992). This follows from the importance of healthcare in the country. On the other hand, exchange rate does not granger cause government expenditure on health. This captures the supply inelasticity inherent in the sensitivity of government expenditure on health in relation to welfare (Blomstedt, *et al.*, 2018). This is to say that in the face of high and unfavorable exchange rates, the government cannot adjust its spending on health since health is central to welfare. Adjusting government spending on health might compromise on the health of the Kenyan population. Therefore, government expenditure on health and exchange rates are not independent of each other.

The following table shows the granger causality between oil prices and aggregate expenditure on oil imports.

Table 7. *Granger causality test results between oil prices and aggregate expenditure on oil imports*

Null Hypothesis	Chi-square	P- Values
Oil price does not Granger cause Aggregate expenditure on oil imports	2.977	0.395
Aggregate expenditure on oil imports does not Granger cause Oil price	2.333	0.506

Note: *denotes rejection of the null hypothesis at 0.05 significant level.
Source: *Computed From Research Data*

Table 7 shows that aggregate expenditure on oil imports and oil prices are independent of each other since there are no causal relationships between them. The fact that aggregate expenditure on oil imports is not granger caused by oil price shocks shows that oil demand is inelastic to changing global oil prices. On the other hand, in line with the findings, Kenya's position as a price taker in regard to global oil prices cannot allow aggregate expenditure on oil imports to granger cause global oil prices. It is simply illogical (Mecheo & Omiti, 2003). Therefore, in contrast to the findings by Maina (2015), global oil price shocks cannot be transmitted to the domestic economy through aggregate expenditures on oil imports. This may be attributed to measures by the government to cushion the economy from the adverse effects of rising global oil prices (Musgrave & Peacock, 1967).

Table 8 that follows presents the granger causality test results between oil prices and government expenditure on health.

Table 8. *Granger causality test results between oil prices and government expenditure on health*

Null Hypothesis	Chi-square	P- Values
Government expenditure on health does not Granger cause Oil price	12.433*	0.006
Oil price does not Granger cause Government expenditure on health	6.315	0.097

Note: *denotes rejection of the null hypothesis at 0.05 significant level.
Source: Computed From Research Data

According to the results reported in table 8, oil prices does not granger cause government expenditure on health. Therefore, oil price shocks cannot curtail the progress towards achieving universal healthcare, Kenya Vision 2030 and ultimately the sustainably development goals (Republic of Kenya, 2007; Republic of Kenya, 2018).

4.3.4. Error cointegration and correction tests results

Since aggregate expenditures on oil imports, government expenditure on health, exchange rate and oil prices are stationary at first difference, cointegration test was used to determine the possible existence of long term relationships between them. Johansen-Juselius test for cointegration was used in this study and the cointegration test results are summarized in the following table 10.

Table 9. *Johansen test co-integration results*

Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	Critical value (0.05)	Prob.**	Max-Eigen Statistic	Critical value (0.05)	Prob.**
None	0.787	115.153*	47.856	0.000	80.503*	27.584	0.000
At most 1	0.407	34.650*	29.797	0.013	27.208*	21.131	0.006
At most 2	0.119	7.443	15.495	0.527	6.607	14.265	0.537
At most 3	0.016	0.835	3.841	0.361	0.835	3.841	0.361

Notes: *denotes rejection of hypothesis at the 0.05 significant level; Max-Eigen and Trace tests indicate that 2 equations are co-integrated at the 0.05 significant level
Source: *Computed From Research Data*

Table 9 shows that there exists a long-run relationship between aggregate expenditure on oil imports, government expenditure on health, exchange rate and oil prices. On the basis of these results, the Vector Error Correction Models (VECMs) specified in equations (3.13), (3.14), (3.15) and (3.16) were estimated and used to test for granger causality between government expenditure on health, aggregate expenditure on oil imports, exchange rate and oil prices.

The following table 10 shows coefficients, t-statistics and p-values for the cointegrating equation in the ECM. The p-values were used in testing the statistical significance of the coefficients. The estimates in the tables are essentially the vector error correction model estimates.

Table 10. *Error correction model estimates*

Variables		D(Government expenditure on health)	D(Expenditure on oil imports)	D(Exchange rate)	D(Oil prices)
Cointegrating Equation (Error CorrectionTerm)	Coefficient	-2.624*	2.401	0.002*	0.001
	t-statistic	[-3.403]	[0.770]	[2.836]	[0.301]
	p-values	0.002	0.446	0.007	0.765
D(Government expenditure on health) (-1)	Coefficient	1.995*	0.108	-0.002*	0.000
	t-statistic	[3.382]	[0.045]	[-2.742]	[0.141]
	p-values	0.002	0.964	0.009	0.888
D(Government expenditure on health) (-2)	Coefficient	2.054*	3.039	-0.001*	0.001*
	t-statistic	[3.911]	[1.432]	[-3.128]	[1.196]
	p-values	0.000	0.161	0.003	0.239
D(Government expenditure on health) (-3)	Coefficient	0.456	1.324	-0.001*	0.001
	t-statistic	[1.215]	[0.873]	[-2.822]	[0.704]
	p-values	0.232	0.388	0.008	0.486
D(Aggregate expenditure on	Coefficient	-0.122	-0.029	0.000*	-0.000

oil imports) (-1)	t-statistic	[-1.219]	[-0.072]	[3.115]	[-0.546]
	p-values	0.231	0.943	0.004	0.588
D(Aggregate expenditure on	Coefficient	-0.259*	-0.449*	0.000*	-0.000
oil imports) (-2)	t-statistic	[-4.761]	[-2.039]	[-1.219]	[-1.219]
	p-values	0.000	0.049	0.037	0.231
D(Aggregate expenditure on	Coefficient	-0.017	0.006	0.000	-0.000
oil imports) (-3)	t-statistic	[-0.260]	[0.022]	[1.183]	[-1.158]
	p-values	0.796	0.983	0.245	0.254
D(Exchange rate) (-1)	Coefficient	-27.844	267.914	0.212	0.058
	t-statistic	[-0.172]	[0.420]	[1.279]	[0.161]
	p-values	0.864	0.685	0.209	0.873
D(Exchange rate) (-2)	Coefficient	-159.213	-16.966	0.025	-0.088
	t-statistic	[-1.006]	[-0.027]	[0.154]	[-0.251]
	p-values	0.321	0.979	0.879	0.804
D(Exchange rate) (-3)	Coefficient	-270.106	-849.701	0.247	-0.094
	t-statistic	[-1.758]	[1.368]	[1.563]	[-0.274]
	p-values	0.087	0.180	0.127	0.786
D(Oil Prices) (-1)	Coefficient	-272.868*	-215.068	-0.151	0.070
	t-statistic	[-2.332]	[-0.455]	[-1.255]	[0.269]
	p-values	0.025	0.652	0.217	0.790
D(Oil Prices) (-2)	Coefficient	-83.615	-383.693	-0.050	-0.089
	t-statistic	[-0.641]	[-0.728]	[-0.373]	[-0.305]
	p-values	0.525	0.471	0.711	0.762
D(Oil Prices) (-3)	Coefficient	-22.889	759.724	0.204	0.196
	t-statistic	[-0.188]	[1.540]	[1.632]	[0.723]
	p-values	0.852	0.132	0.111	0.474
Constant	Coefficient	71.479	3793.495	2.579*	1.403
	t-statistic	[0.081]	[1.059]	[2.835]	[0.711]
	p-values	0.936	0.297	0.007	0.481

Source: Computed From Research Data

According to table 11, the previous year's deviations from long run equilibrium is corrected in the current year at an adjustment speed of 262.4 percent *ceteris paribus*. This extreme percentage reflects the government's commitment and effort in safeguarding the welfare of the citizens by cushioning the country's healthcare from harmful oil shocks and exchange rate fluctuations which may have trickle down effects on the welfare of Kenyans (Lu, *et al.*, 2010). These dynamics in expenditure may have considerable implications in regard to the progress towards the Kenya Vision 2030, universal healthcare and the Sustainable Development Goals (Republic of Kenya, 2007; Udo & Effiong, 2014).

A percentage change in aggregate expenditures on oil imports in the previous one, two and three years is associated with a decrease in government expenditure on health by an average of 0.122 percent, 0.259 percent and 0.017 percent respectively in the present year *ceteris paribus*. In spite of the statistically insignificant coefficients for the previous one and three years respectively, these dynamics brings to light the diversionary aspect of government expenditures which are channeled to oil importation so as to satisfy the rising oil demand at the expense of health expenditures (Mureithi, 2014).

On the other hand, a percentage change in exchange rates in the previous one, two and three years is associated with a decline in government expenditure on health by an average of 27.844 percent, 159.213 percent and 270.106 percent respectively in the present year *ceteris paribus*.

However, only the coefficient for exchange rate changes in the previous three years (-270.106) is statistically significant at 0.05 significance level. Further, a percentage change in global oil prices in the previous one, two and three years is associated with a decrease in government expenditure on health by an average of 272.868 percent, 83.615 percent and 22.889 percent respectively in the present year *ceteris paribus.* All the coefficients are statistically insignificant. This extreme percentage value shows the importance of oil prices and exchange rates in shaping the health spending patterns (Maina, 2015; Mureithi, 2014 & Ndungu, 2013; Pilbeam, 1992; Taylor & MacDonald, 1989).

Finally, the present year's exchange rates mildly responds to a percentage change in aggregate expenditures on oil imports in the previous one, two and three years respectively *ceteris paribus*. This is because the coefficients are about (0.000) percent on average *ceteris paribus*. However, only the coefficient for the previous three years' changes in oil import bill is statistically insignificant.

In regard to the relationship between aggregate expenditure on oil imports and government expenditure on education, the above results and discussion suggest that aggregate expenditures on oil imports granger cause government expenditure on health and vice versa. This is called bi-directional causality. However, neither aggregate expenditure on oil imports nor government expenditure on health is granger caused by either oil prices or exchange rates. This partially dispels questions on whether oil price shocks and exchange rate fluctuations, which were assumed to be inherent in the rising oil import bill, leads government expenditure on health. The partiality in dispelling the above question arises from the fact that lack of granger causality between variables cannot be necessarily interpreted as lack of a cause and effect relationship (Lutkepohl, 2005). This assertion by Lutkepohl (2005) supports the cause and effect relationships given by the results in Table 9. It also noteworthy that since there were two cointegrating relationships between the variables as shown by the Max-Eigen and Trace test statistics given in Table 8, granger causality tests had to be conducted using the Chi-square test statistic only after estimating the error correction model.

4.4. Relationship between aggregate expenditure on oil imports and government expenditure on education

This section discusses the relationship between expenditure on oil imports and government expenditure on education. This objective was achieved by estimating equations (9), (10), (11) and (12).

4.4.1. Correlation analysis results

In determining the direction and the strength of association between government expenditure on education, expenditure on oil imports, oil price shocks and exchange rate, only stationary values of the variables were considered. From table A6 in appendix B, there was a positive correlation of (0.440) between government expenditure on education and expenditure

on oil imports *ceteris paribus*. This indicated that a percentage increase in aggregate expenditure on oil imports leads to a 44 percent increase in government expenditure on education and vice versa *ceteris paribus*. This correlation was considered to be moderate since it lies between 0.40 than 0.59 (Evans, 1996; Cohen, West & Aiken, 2014). There was also a very weak positive correlation of 0.098 between government expenditure on education and oil price shocks at *ceteris paribus*. This is to say that all other factors held constant, as global oil prices increase by one percent, government expenditure on education increases by 9.8 percent. On the other hand, a percentage increase in the exchange rate (depreciation) results in a 9.5 percent decline in government expenditure on education. This is a negative correlation which means that as the dollar becomes more expensive, government expenditures on the importation of materials, equipment and services in the education sector declines as the government seeks other alternatives to contain costs.

4.4.2. Distributional test results

In regard to the distribution of government expenditure on education, the results on skewness and kurtosis in table 1 show that government expenditure on education was positively skewed to the right by 1.832. It was also leptokurtic at 5.514 with a sharp peak as an indication of a small standard deviation.

4.4.3. Granger causality test results

Since government expenditure on education was integrated of order 2, granger causality test results were directly achieved by twice differencing it and first differencing expenditure on oil imports, oil prices and exchange rate. The results are presented in table 4.10 that follows.

Table 11. *Granger causality test results between government expenditure on education and aggregate expenditure on oil imports*

Null Hypothesis	F-statistic	P- Values
Aggregate expenditure on oil imports does not Granger cause Government expenditure on education	0.395	0.676
Government expenditure on education does not Granger cause Aggregate expenditure on oil imports	6.820*	0.003

Note: *denotes rejection of the null hypothesis at 0.05 significant level.
Source: Computed From Research Data

Table 11 shows that there is no causal relationship running from aggregate expenditures on oil imports to government expenditure on education as government expenditure on education granger causes aggregate expenditures on oil imports. This unidirectional causality means that being a fundamental human right, education is relatively inelastic to aggregate expenditures on oil imports and is therefore irresponsive to oil-induced pressure.

On the other hand, the causality running from government expenditure on education to aggregate expenditure on oil imports simply means that government expenditure on education leads to an increase in aggregate expenditures on oil imports through increased demand for oil imports. The

increase in aggregate expenditures on oil imports following a rise in government expenditure on education may be attributed to growth in oil dependent sectors like transport and manufacturing which employ a well-educated work-force (Were, 2016). This finding is contrary to the assertion by Wiseman & Peacock (1967) and Herenkson (1993) who suggested that government expenditure on education responds to the pressure exerted by oil to avoid or mitigate the effects of social upheavals and not the otherwise.

The results on granger causality between exchange rate and government expenditure on education are presented in the following table 13.

Table 12. *Granger causality Test Results between Exchange rate and Government Expenditure on Education*

Null Hypothesis	F-statistic	P- Values
Government expenditure on education does not Granger cause Exchange rate	0.356	0.702
Exchange rate does not Government expenditure on education	0.840	0.438

Note: *denotes rejection of the null hypothesis at 0.05 significant level.
Source: Computed From Research Data

Since education is one of the priority sectors in the country with serious implications on welfare, table 12 shows that government expenditure on education and exchange rate are independent of each other since there is no causal relationship existing between them.

Table 14 below shows the granger causality test results between oil prices and government expenditure on education.

Table 13. *Granger causality test results between oil prices and government expenditure on education*

Null Hypothesis	F-statistic	P- Values
Oil price does not Granger cause Government expenditure on education	0.670	0.517
Government expenditure on education does not Granger cause Oil price	3.593*	0.036

Note: *denotes rejection of the null hypothesis at 0.05 significant level.
Source: Computed From Research Data

With no causality running from oil price shocks to government expenditures on education contrary to earlier speculations drawn from Musgrave & Peacock (1967), table 13 shows that government expenditures on education granger causes global oil prices in a situation that negates the priori expectations. This is because government expenditure on education being a domestically determined aspect, it can rarely granger cause oil prices which is a globally determined phenomenon (Restrepo, 2011).

The above results and discussion relating to the relationship between aggregate expenditure on oil imports and government expenditure on education suggest that government expenditure on education granger cause aggregate expenditures on oil imports. On the other hand, aggregate expenditure on oil imports does not granger cause government expenditure on education. This is therefore a unidirectional causality which is neither informed by oil price shocks nor exchange rate fluctuations. This is because there are no granger-causal relationships running from oil prices

and exchange rate to either government expenditure on education or aggregate expenditure on oil imports. Therefore, it is highly unlikely than the oil shocks inherent in the rising oil import bill can cause government expenditure on education. This is to say that aggregate expenditure on oil imports cannot curtail the progress towards the sustainable development goals and the Kenya Vision 2030. The fact that government expenditure on education was integrated of order two did not warrant testing for cointegration. Therefore, the standard F-test was used to test for granger causality since neither vector autoregressive nor error correction models could be utilized for estimation.

5. Conclusion

On the basis of the empirical findings, the study concludes that aggregate expenditure on oil imports and government expenditure on health are positively correlated with a statistically significant correlation coefficient. In addition, there is a presence of a bi-directional causal relationship between expenditure on oil imports and government expenditure on health in Kenya. Therefore, the study concludes that aggregate expenditure on oil imports influences government expenditure on health in view of the big four agenda and sustainable development goals. On the other hand, government expenditure on health influences aggregate expenditure on oil imports.

Aggregate expenditure on oil imports and government expenditure on education are positively correlated with a statistically significant correlation coefficient. With a unidirectional causality running from government expenditure on education to aggregate expenditures on oil imports, this study concludes that aggregate expenditures on oil imports has no influence on government expenditure on health but increases following an increase in government expenditure on health.

In regard to the correlation between oil prices and government expenditure on health, the correlation coefficient is positive and statistically insignificant. Therefore, on the basis of the granger causality results, the study concludes that oil price shocks do not influence government expenditure on health. However, there is a likelihood of health expenditures increasing following an increase in oil prices.

The correlation between oil prices and government expenditure on education is represented by a positive correlation coefficient which is also weak and statistically insignificant. This is however coupled by a unidirectional causality running from government expenditure on education to oil prices. Therefore, the study concludes that despite the possible increase in government expenditure on education with increasing oil prices, government expenditure on education does not respond to oil price shocks.

With a negative correlation existing between exchange rate and government expenditure on health, the correlation coefficient is statistically insignificant. Also, there is presence of unidirectional causality running

from government expenditure on health to exchange rate. Therefore, this study concludes that exchange rate fluctuations does not influence government expenditure on health but an increase in government expenditure on health can possibly lead to a fall in exchange rates.

Finally, exchange rate is negatively correlated to government expenditure on education with a statistically insignificant correlation coefficient. The two variables are however independent of each other since there are no causal relationships between exchange rate and government expenditure on education. Based on the negative correlation coefficient, the study concludes that an increase in exchange rates can possibly lead a decrease in government expenditures on education. However, exchange rate fluctuations don't cause government expenditure on education. Neither does government expenditure on education cause exchange rates.

It is therefore recommended that besides defining what is deemed economically sustainable in regard to government expenditure on health as a proportion of the exchequer budget; the government should also put in place policies that will institute reasonable margins for government expenditures on health and education to adjust as a measure to keep the rising oil import bill in check. The government should formulate policies that will cushion exchange rates from adverse adjustments to the detriment of the foreign exchange market in regard to terms of trade.

In light of the diversionary aspect of government expenditure portrayed by the error correction model estimates in table 10, the government should reduce aggregate expenditures on oil imports so as to release funds for healthcare.

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