SCHOOL OF POSTGRADUATE STUDIES

THE RELATIVE IMPACT OF PETROLEUM IMPORTS ON LONG TERM NATIONAL DEBT: THE ZAMBIAN CASE (1980- 2019).

BY

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A Thesis submitted to the School of Post Graduate Studies for the Degree of the Doctor of Philosophy in Economics

2022

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DECLARATION

I, Joseph D.B. Chibwe do hereby declare that the work in this Thesis is mine, and has not been submitted for a Doctor of Philosophy (Ph.D.) degree to the University of Lusaka or any other University. All that knowledge acquired from other scholars has been acknowledged and cited in the places where they appear.

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SUPERVISORS' RECOMMENDATION

I have read and checked the Thesis written by Mr. Joseph D.B. Chibwe and do hereby confirm that it meets the minimum set standards of the University of Lusaka. I, therefore, recommend for the purpose of award of Ph.D.

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UNIVERSITY APPROVAL

I…….....and on behalf of the University of Lusaka do hereby confirm that I have read and examined the Thesis written by Mr. Joseph D.B. Chibwe supervised by Eng. Dr. Richard Kasongo Mwale and Dr. Lubinda Habazoka. I, therefore, approve/not approve this research work.

Full Name……..

Signature…….....

Date……

DEDICATION

A special dedication is due to my entire family, My Mother, Rosemary M. Chibwe, the 'Teacher' my Late Father Sebastian Mutale Chibwe, the 'Farmer' / 'Anglo American Electrician', my Wife Sheila and Daughters Mukuka and Sheila and my brothers Victor Kapelembe, Andrew Changwe, Fr. Lawrence Chanda, Francis Chitalu and Sister Mary Ntekwa.

ACKNOWLEDGEMENTS

All due regards are in order to my research supervisor Eng. Dr Richard Kasongo Mwale for the enduring encouragement toward the accomplishment and the conscientious guiding in the writing of the Thesis. I would not be grateful if I did not equally acknowledge my wife Sheila Kamanga Chibwe for the patience and support in this study.

Most sincerely, I also wish to thank my Supervisor Dr. Lubinda Habazoka for the "Technicality" guidance in the accomplishment of the study.

I would not be sincere if I did not pass my sincere gratitude to Professor Seth Akutson for his professorial and constructive criticism and for his professional encouragement to this study. There are so few of the like of him.

My sincere gratitude goes to the University of Lusaka management team for their partial bursary and support staff for their encouragement to staff for the attainment of further education

MOTIVATION

The motivation for studying for a Doctor of Philosophy (PhD) Degree program was not just to attain education at the highest level but to embark on a practical quest to contribute to energy solutions. This is because personal opinion and experience has revealed the otherwise controversial point that, countrywide, there have been relatively little attempts to analyse just how much the dependence on petroleum imports have impacted the economic progress or growth and the resulting debt situation. If at all these efforts have been in existence then the study was limited in finding evidence on any attempts to do so. This general national approach of regarding the import expenditures on petroleum inputs as given and thus cannot be mitigated was the motivating factor for the enquiry into this petroleum debt analysis in this research.

World-wide the advanced countries have found a need to move to green energy, though, apparently, petroleum imports do not necessarily give them any national debt contributions or problems. Petroleum is very necessary for physical production, locomotion and is a multiplier factor in the Zambian economy given the wide investments put in this sector. It is the study's sincere hope that this could contribute to the quest for cheaper and efficient energy sources, not only domestically, but equally worldwide.

ABSTRACT

National debt has been identified as a major economic problem affecting the developing world in general where vital national resources are diverted from developmental functions to meeting debt obligations in interest and principal repayments. A multiplicity of literature portraying the causes of the debt build up have tended to bring out petroleum imports as one key contributor to third world indebtedness. The study's rationale is that since petroleum products and the implied derivatives are a universal input for production, it is necessary to know if it at all it has had an impact on the Zambian national indebtedness and to know the direction and magnitude. Notably, there has not been many, if not any, country-specific research work which have been done to study the Zambian case by analysing the relative impact of petroleum imports on national debt as a Decomposed General Macroeconomic Theory Non- Linear Stationary Markov Switch Process

The study analysed this national indebtedness proposition by studying the relative impact of the Zambian petroleum imports on its national debt as a decomposed general macroeconomic theoretical process utilizing a time-varying two state multivariate Markov-Switching Autoregressive Model (MSAR) with Zambian national debt as the dependent variable and petroleum imports, non-petroleum imports, Government expenditures, gross capital formation, exports, private final consumption and GDP as the regressors, using secondary annual time series data from the 1980 to 2019from the COMSTAT – AFDB data bank. Construct validation of the study was performed through the plotting the kernel density estimate which approximated to normal density showing that the model residuals were normally distributed which was further confirmed by the Shapiro- Wilk lognormal testing of the residual distribution, Long run cointegration relationship of the model variables was evaluated using Johansen's tests for cointegration at second difference which showed a long run cointegration of the variables. The Markov Switch Model's transition probabilities revealed that the model followed a Markov chain with the probability of the national debt being in state 1 in a given year and remaining in state 1 in the following year and the probability of the national debt being in state 1 in a given year and shifting to state 2 in the following year, summing to unity. The Markov Switch Model's State Duration approximated that state 1, the dormant state, typically persisted for about 1.27 years while state 2, the expansive state, persisted for about 1.4 years.

The study established statistically significant long run national debt reducing effects to have come from petroleum imports, GDP, gross capital formation and private consumption expenditures in both the dormant and expansive states of the model. Statistically significant long run national debt increasing effects were brought out to have come from Government expenditures and national exports in both states of the model. It was only from non-petroleum imports that results were statistically insignificant and inconclusive. The study recommended among others things that the Government or the petroleum authorities must seek cheaper sources of petroleum so as to reinforce the debt reducing economic multiplier effects in order to further reduce national debt in the long run. It must further promote gross capital formation whether local or through foreign direct investment to concretise the debt reducing impact aspects of investment. Additionally the Government must curtail debt increasing expenditures where and when possible to limit the extent to which national debt has been rising as a result of non-controlled expenditures. The Government must further isolate the exports or export sectors which have had national debt increasing characteristics so as to reduce national debt through these channels.

Keywords: *Petroleum Imports, National Exports, Government Expenditure, Gross Capital Formation, Markov Switch Auto regression Model*

DEFINITION OF TERMS

▪ **National Debt:** This is the total amount of money which a country's government has borrowed. It is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. Total national debt is measured as a share of total GDP (WB, 2020).

▪ **Debt Service** is the sum of principal repayments and interest actually paid in foreign currency, goods, or services on long-term obligations of public debtors and long- term private obligations guaranteed by a public entity. Debt service is measured here as a share of total GDP.(Ibid)

- **Oil consumption** is the annual level of crude oil national consumption (in 1000 metric tons) (Trading Economics, 2020).
- **Net Energy Imports** are calculated as energy use less production, and is measured in oil equivalents. (Ibid)
- **Trade Openness** is the sum of total exports and imports as a proportion of GDP (Our World in Data, 2017).
- **Size of Economy** is the natural log of GDP measured in constant US$ (Dynan, 2018).
- **Growth** is the annual percentage change in GDP measured in constant US$ (Ibid).
- **Change in Liquidity** is the change in reserves as a proportion of GDP (Saxegaard Magnus, 2006) .
- **Democracy** a system of governance established by the whole population or all the eligible members of a state, typically through elected representatives. It is measured as a 20 point scale ranging from non-democracy (-10) to democracy (10). The scale was developed by Ted Gurr and can be downloaded from http://www.cidcm.umd.edu/inscr/polity/ (Marshall, Jaggers, and Gurr 2003).
- **Balance of payments:** An accounting of all of a country's international transactions for a given time period, usually one year. A country is said to have a balance of payments deficit if the payments out of the country exceed the payments (credits) into the country (Carbaugh, 2009)
- **Capital flight:** Large financial capital outflows from a country. Typically prompted by increased uncertainty, fear of default or, especially, by fear of devaluation or big

disparity between the domestic real interest rate and the world real interest rate (Corporate Finance Institute, 2015 to 2021).

- **Current account**: This is a record of a nation's transactions with the rest of the world, specifically its net trade in goods and services, its net earnings on cross-border investments, and its net transfer payment over a defined period, such as a year or a quarter. A country is said to have a current account deficit if its payments to the external economies exceed its inflows (Carbaugh, 2009).

- **Debt Sustainability:** The ability of a debtor country to service its debt on a continuing basis and not go into default (Ibid).
- **Deflationary economic policy:** A policy designed to cause a fall in the general level of prices mainly to boost aggregate demand.
- **Disequilibrium:** An untenable state of an economic system, from which it may be expected to change.
- **Dollar-denominated debt:** Refers to the fact that external debts expressed in US dollar terms, which means the value of the debt varies with the exchange rate or the strength of the dollar.
- **Dutch Disease:** Economic phenomenon where the rapid development of one sector or industry of an economy precipitates a decline or adverse effects on other industries. It is primarily associated with the new discovery or exploitation of a valuable natural resource and the unexpected repercussions that such a discovery can have on the overall economy of a nation. This usually leads to an appreciation of the local currency thereby making exports uncompetitive. It is so named after the economic effects of natural gas discoveries in the Netherlands, and most commonly applied to effects of exports in natural resource extractive industries with windfall profits.
- **Economic volatility:** The extent to which an economic variable, such as prices, exchange rates, or revenues, moves up and down over time.
- **Exchange rate appreciation (depreciation):** A rise (fall) in the value of a country's domestic currency on the exchange market, relative either to a particular key foreign currency or to a weighted average of other currencies.
- **Foreign (or International) reserves:** The assets denominated in foreign currencies, IMF Special drawing Rights, IMF Reserve positions and gold, held by a country's central bank.

- **Liquidity:** The capacity to turn assets into cash, or the amount of assets in a portfolio that have that capacity to represent cash in a transaction. With cash itself being the most liquid asset.
- **Oil import - dependence:** Refers to either the degree to which a country's total imports are dominated by imports of oil, or the share of national income comprising expenditures on oil imports.
- **Oil price shocks:** An unexpected upward or downward change in the price of oil. Typically refers to the acute increases in the price of oil in 1973 due to the OPEC oil Cartel's export embargo and in 1979 due to uncertainties surrounding the Iranian revolution.
- **OPEC:** Organization of Petroleum Exporting Countries is an intergovernmental organization of 13 countries founded on 14 September 1960 in Baghdad by the first five members and has since 1965 been headquartered in Vienna, Austria, Current members are Algeria, Libya, Nigeria, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, United Arab Emirates, Venezuela, and Indonesia. Ecuador was a member till 1992 and Gabon was a member till 1994.
- **Petrodollars:** Refers to the profits made by oil exporting countries when the price rose during the 1970s, and their preference for holding these profits in U.S. dollar-denominated assets, either in the U.S. or in Europe as Eurodollars. The banks in turn lent a portion of these to oil-importing developing countries, which used the loans to buy oil.
- **Solvency:** Refers to the ability to pay all legal debts. A country is considered solvent if the rate of growth of its income exceeds the rate of growth of its debts.
- **Speculative attacks:** In any asset market, this refers to a surge in sales of the asset that occurs when investors expect the price of the asset to drop.
- **Special Drawing Rights (SDRs):** This is an international reserve asset created by the IMF to supplement the official reserves of its member countries, originally intended within the International Monetary Fund (IMF) as a sort of international money for use among central banks. The SDR is not a currency but a transferable right to acquire another country's currency. Defined in terms of a basket of 5 currencies (The US Dollar, the British Pound Sterling, The Euro, The Japanese Yen, The Swiss Franc and the Chinese Yuan), it plays the role of international balance of payments settlements in that form of a unit of international account.
- **Spot market:** A market where financial instruments, such as commodities, currencies, or securities, are traded for immediate delivery where delivery is the

exchange of cash for the financial instrument as compared or contrasted to a forward or futures market in which the exchange takes place in the future.

- **Terms of trade:** The relative price of a country's exports compared to its imports.
- **Personal Disposable Income:** This is Personal Income less Personal Taxes and Nontax Payments to the government.
- **National Private Consumption:** consists of the goods and services bought by households. It is divided into three subcategories: nondurable goods, durable goods, and services.
- **The Marginal Propensity to Consume:** This is the percentage of net private disposable income that private consumers remain with to spend on goods and services.
- **The Marginal Propensity to Save:** This is the proportion of income that a consumer spends on the savings as opposed to consuming it. It is technically defined as $\frac{\Delta S}{\Delta Y}$ where S is savings function while Y is the disposable income that produced the savings.
- **National Taxation Revenue:** This is government income obtained from all corporate and none corporate bodies or entities either directly from corporate or private incomes or indirectly through the purchase of local and/or foreign goods and services.
- **Government Purchases:** These are goods and services bought by the governments. This category includes such items as military equipment, national infrastructure, and the services that government workers provide but excluding transfer payments to individuals, such as social security and welfare. This is because transfer payments reallocate existing income and are not made in exchange for goods and services and as such are not part of GDP.
- **Private Saving**: This is personal disposable income minus consumption.
- **Public Saving:** This is government (Tax) revenue minus government spending. (If government spending exceeds government revenue, the government runs a budget deficit.
- **National Savings:** This is the output (or National Income) that remains after the demands of consumers and the government have been satisfied. It is the sum of private savings and public savings.
- **National Investment:** consists of goods bought for future use. Investment has three subcategories: business fixed investment, residential fixed investment, and inventory investment. Business fixed investment is the purchase of new plant and equipment by firms. Residential investment is the purchase of new housing by households and landlords. Inventory investment is the increase in firms' inventories of goods (if

inventories are falling, inventory investment is negative). In economics theory National Investment equals National Savings.

- **Net Exports:** These involve trade with other countries and represent the value of goods and services exported to other countries minus the value of goods and services that foreigners export to the domestic country. Net exports represent the net expenditure from abroad on domestic goods and services, which provides income for domestic producers. This also represents credit net investment income.

- **Factor Prices:** These are the amounts paid to the factors of production; the wages workers earn and the rent the owners of capital collect.

- **The Nominal interest:** This is the interest rate net of inflation. It can also refer to the advertised or stated interest rate on a loan, without taking into account any fees or compounding of interest.
- **The Real interest rate:** This is the domestic nominal interest rate corrected for the effects of inflation**.** The real interest rate measures the true cost of borrowing and, thus, determines the quantity of investment.

The World Interest rate: This is the real interest rate as determined by external markets or economies and as such determines the movement of international capital for international investment. In economic theory it is assumed that domestic the real interest rate equals the world Interest rate for optimal cross country investments.

CHAPTER ONE: INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 Introduction

Chapter one provides an introduction and a foundation to the study where the research overview, background and research problem are outlined. In addition, the Chapter presents research objectives and hypotheses to solve the statement of the problem. It also highlights the significance, the scope, related research(es), assumptions, and limitations and delimitations of the study. Furthermore the definition of key research terms are outlined.

Petroleum is a key driver of industry not only in Zambia but world over. It has created massive business value chains in the upstream, midstream and downstream segments all of which are intricately attached to the international business financing industry in multiple ways (EIA, 2021). If we were to look at the multiplier effects of the Petroleum Industry on the Zambian economy it would, not surprisingly, be quite large because the importation of petroleum oil dominates all other single commodity import expenditures forming a major part of Zambia's import bill, with the bill being reported at $504,747,000 in 2019 amounting to 0.05% of the world total (Energy Regulation Board, 2018). Increased economic activities in the country made demand to be on the upswing, increasing by 36 per cent, from 2009, with total final product consumption reaching 1,344,908 metric tons in 2018. (Ibid).

However certain scholars have attached the importation of petroleum to the ever growing developing countries' national debt problem. Economic analysts like Cline (1984) had posted the oil price shocks of 1970's and 1980's eras as the origin of the debt burden of non-oil developing countries where he estimated that developing countries lost around $141 billion in higher interest payments, lower export receipts, and higher import due to these oil shocks. This resulted in deterioration of the terms of trade which had severe impacts on the Balance of Payments (BoP) positions of the non-oil developing countries and consequently pointing to this as the source for the indebtedness as the developing countries sought to balance their BoP positions and domestic budgets (Bacon, 2005). However regardless of all these facts petroleum imports have been on the increase in the Zambian context, if not in the world context, which of course then underpins the vital nature of petroleum not just in terms of being an energy source but equally a commercial product with vast corporate investment

undertakings. This study undertakes a General Macroeconomic Theory approach to try and isolate the relative impact that petroleum imports have had on the Zambian national debt from 1980 to 2019.

1.2 Background

Quite a number of reasons abound on the causal factors of world indebtedness. However it is a daunting task to find debt related country specific reasons or studies for the many different nation worldwide. Despite this fact, however, on a global scale there have been attempts to account for the global indebtedness of different groups of countries either continentally of regionally.

Dawood, et al (2021) investigated the determinants of external debt in 32 Asian developing and transitioning economies for the period 1995–2019, using the generalized method of moments (GMM), which is capable of dealing with potential endogeneity problems. The results showed that in both the short and long-run, economic growth and investment reduce external debt, whereas exchange rates, trade, and government expenditure increase external debt. Diagnostic tests confirmed the reliability and consistency of the findings, which should be taken into account by policymakers for policy formulation and implementation. Based on these empirical findings, relevant policy implications aimed at reducing external debt in the selected Asian developing and transitioning economies, were provided for policy consideration.

Barro (1979), theoretically and empirically, argued, that temporary increases in national income tended to play a counter cyclical role on debt in the US, and equally that there occurred an expected positive effect of inflation on debt. This point to factors pointing to debt from a totally different angle from our study.

Eichengreen and Portes (1986) using the data for 23 countries for the period 1930-1938 performed both cross-section and panel data analysis. This study indicated that there was an insignificant effect of export instability and degree of openness on external debt. Only the log of gross domestic product (GDP) per capita was found to have significant effect on external debt. On panel data regression, all variables except export variability turned out to be statistically significant.

Hajivassiliou (1987), using data for 79 developing countries from 1970 to 1982 estimated the determinants of demand for and supply of national loans. He addressed

the problem of heterogeneity by introducing an error-components structure in the model. The effect of total debt service to export ratio, import to GDP ratio, interest and principal to export ratio was positive on demand for borrowing, while the effect of real GDP per capita was negative. The study identified that the existing foreign exchange reserves can serve as an alternative to external debt but equally pointed that high debt obligations are accompanied by high demand for new funds.

Tiruneh (2004) using a panel data study for sixty heavily indebted poor countries and non-heavily indebted less-developed countries explored the demand for external borrowing in the 1980s and 1990s. The estimation results of the random and fixed effects model for pooled data of 1982-1998 showed that capital flight, debt service payments, the imports to GDP ratio, income per capita, and the growth rate of GDP were the key determinants of the demand for external borrowing. The cross-section pooled time-series analysis for heavily indebted poor countries indicated that sluggish economic growth, high past debt service payments, income instability and demand for foreign exchange to finance their import bills, were the main reasons for external borrowing. He suggested that poor nations should seek debt relief and maintain sound debt management strategy to avoid debt crises.

Colombo and Longoni (2009), covering a study period from 1970 to 2000, analyzed the determinants of long term external debt for a large sample of developing countries of which 61 were developing countries on the HIPC programme. In addition to the standard economic variables, the study additionally included socio-political factors in the model to explain the level of external debt of the developing countries. The study found that external debt was positively correlated to the level of economic development, the degree of openness and the level of education. The external debt was equally found to be higher in those countries that had more flexible exchange rate system. The financial depth and inflation equally had positive effects on external debt. It was equally found that a higher degree of institutional quality allowed developing countries to take on more external debt. The more open and competitive the nation's electoral system was, the more it positively affected external debt showing that the higher the transparency of a nation's electoral system and the higher the political stability the more it is likely to be rewarded by international financial markets.

Forslund et al. (2011) identified the determinants of public debt in a large sample of developing and emerging market-countries. The data set consisted of an unbalanced

panel of 1558 observations covering 104 countries for the 1990-2007 period. The study found that financial deepening and GDP had a significant positive effect on public debt, while past debt and real exchange rate depreciation had a significant negative effect on public debt. The study did not find any significant effect of inflation, current account, the sub-prime mortgages banking crisis default, openness, debt contraction, and debt explosion on public debt in the full sample.

Bittencourt (2013) investigated the determinants of external debt in South America, covering the period 1970-2007. The estimation results of principal component and dynamic panel data analysis confirmed that economic growth had the ability to significantly reduce the debt in the region. The other important determinants as suggested by the literature, such as inflation, inequality or executive (better checks and balances) did not present the expected nor clear-cut estimates on external debt. However, the authors come up with the conclusion that these results could not be generalized

Waheed (2017) investigated the macroeconomic determinants of external debt in petroleum exporting and importing countries using panel data of 12 oil and gas exporting and 12 petroleum importing countries covering the period 2004-2013. The study identified eight macroeconomic factors that significantly affect the external debt of petroleum exporting and importing countries. The panel data estimation results for petroleum exporting countries showed that increased economic growth, foreign exchange reserves, general government revenue, petroleum prices, and domestic investment were the important factors in reducing external debt. The current account deficit, general government expenditures and inflation were the main factors responsible for the accumulation external debt of these countries. The policy makers in these countries were advised to focus particularly on reducing current account deficits and inflation in order to reduce external debt. Moreover, these countries needed to increase the general government revenue and cut expenditures as this would have the strong effect in reducing external debt.

The major lesson learnt from this study was the importance of avoiding particular generalization for external debt accumulation factors for petroleum exporting and importing countries because the effect of different macroeconomic factors can be different in these two groups of countries.

Appiah – Kubi et al (2022) investigated the key determinants of the direct and indirect impact on the rising level of public debt in Africa from a panel of 47 African nations for the period 2000–2018. Using the generalized method of moments (GMM) and fixed effects two-stage least squares methodological approach, the study confirmed that a rise in the corruption level led to an increase in the public debt in Africa. The findings additionally indicated that government investment enhanced the positive and significant association with public debt levels in the sampled countries while government consumption and tax revenue had a significant negative relationship with the levels of public debt in Africa. Lastly, their results revealed that military expenditures has a positive but insignificant relationship with public debt levels in Africa. In terms of policy recommendation, their study suggested African countries should intensify the fight against corruption and strengthen political and governance institutions that will help reduce public debt levels and promote economic growth and development.

For other schools of thought, rising debt is merely from lack of proper economic management. The Export Oriented Growth mode of scholars propose that inflows of foreign resources, when and if managed properly and re-invested in capital generating projects can see the LDCs to the "take off" stage where building of productive capacity and kick-starting of economic growth can then take place with relatively reduced debt. This is because the increase in domestic productive potential, thus generated, can attract foreign investment and increase the level of domestic savings which can reduce borrowing eventually reducing outstanding debt. This appears to be the case for the 'tiger' economies in Southern Asia, such as Singapore, Hong Kong, South Korea, and Taiwan (Rogoff, 1990).

Primary commodity dependence had also come under the limelight as one of the causes of the debt problem where heavy dependence on primary commodities and problems associated with low economic growth and foreign debt has been mentioned as challenges to the Millennium Development goals. The declining trends in "prices and high volatility" of "traditional" export commodities have worsened the poverty in LDCs over the last two decades. A review by the IMF and World Bank noted that the "lower export earnings owing mainly to declining commodity prices as leading causes of the deterioration of the debt indicators in Heavily Indebted Poor Countries" (Tabova & Gilbert, 2004).

In their "Commodity Prices And Debt Sustainability" study presentation, Tabova & Gilbert (2004), noted that "a number of Highly Indebted Poor Countries (HIPCs) which have reached the HIPC "completion point" have found that, despite the agreed debt reductions, their debt levels remain unsustainable, either because of reductions in the prices of their commodity exports or because of higher oil import prices". They took note of the 2002 IMF-World Bank review which concluded that one of the two main causes of deterioration of debt indicators for HIPC countries in 2001 was "lower export earnings owing mainly to declining commodity prices". Lower average exports accounted for over 50% of the deterioration of the HIPC debt service indicators and export prices declined by an average of 4.8% for HIPC countries which experienced a deterioration in debt indicators against only 1.1% for those which did not.

Petroleum oil shocks, are believed to have contributed to a considerable balance of payment deficits among oil importing countries thus creating the need for borrowing (Swaray, 2005). Writers like Bacon (2005) claimed that the impact of oil price rises was normally felt through the net position of the Balance of Payments and the subsequent contraction required in the economy to restore the equilibrium This is because current account deficits could only be temporarily financed by running down reserves or selling of foreign assets and it is usually in this manner that large payments imbalances were financed. The impact of the shock is proportional to the percentage change in petroleum prices multiplied by the ratio of the net imports of the petroleum and petroleum prices to GDP.

Hasanli & Ismayilo (2018), in their study "Econometric Model of Dependence Between the Oil Prices, and the Global National Debt Level and Oil Production", concluded that a rise in oil prices results in growth of the world national debt where they found that a 1% growth in oil prices increased the volume of foreign debt to World GDP by 3.17%.

According to the International Energy Agency (IEA, 2004), the cost of fuel imports relative to GDP is particularly high in Africa where, for instance, in 2000, Sub Saharan African countries spent 14% of their GDP on fuel imports meaning that sharp fluctuations in oil prices can lead to big shifts in the current account balance – often amounting to more than 1% of GDP. This leads to acute economic adjustments involving notable reductions in domestic consumption because these countries do not have easy access to international capital markets to finance the transient increases in

the current account deficits.

The vulnerability of oil-importing developing countries to higher oil prices is further compounded by their relative inability to efficiently cross to using alternative fuels, whose prices may increase at a much lower pace compared to those of petroleum fuels. In addition, the inflating of the oil-import bill undermines the trade balance and drives up price indices much more in developing countries, given the fragility of economic management institutions and investor confidence. In addition, acute currency depreciations in developing countries', tends to deteriorate the terms of trade which is normally symbolised and often magnified by slumps in capital inflows. This subsequent depreciation of local currencies against US dollar also pushes up national debt servicing cost.

Nkomo (2006), noted that in determining the magnitude of oil shocks to the economies of Southern Africa, it is imperative to analyse the differing constituents of the vulnerability, the crude oil price movements and the relationship between energy and development. Due to the constraints energy consumers and producers face in their energy consuming appliances which tend to be fixed in the short-run, it becomes difficult to shift to less oil intensive means of production in response to higher oil prices.

Hence "oil price shocks increase the total import bill for a country largely because of the huge increase in the cost of oil and petroleum products" (Ibid). Much as can be pointed out that energy consumption is an indicator of industrial progress of a nation and the standard of living for its people, it is equally important to realise that rapid economic growth requires increases in the consumption of commercial energy. At the most aggregated level, within many countries, there almost is a perfect positive correlation between energy consumption and economic performance (as measured by GDP).

On the other hand, however, the irony of the petroleum to debt relationship is that it is not only on the side of the petroleum importing countries that the debt problem exists. It equally exists on the petroleum exporting developing countries. Kretzmann & Nooruddin, (2009), in their study "Drilling into Debt - An Investigation into the Relationship Between Debt and Oil", brought out, among their key findings, that increases in oil production resulted in expanded debt levels as there existed a strong

and positive relationship between oil production and debt burdens which naturally meant that the more oil a nation undertook to produce, the more debt it tended to accumulate.

Additionally increases in debt size could somehow tend to be predicted by increases in oil production where, for instance," doubling a nation's annual production of crude oil predicted to increase the size of its total national debt as a share of GDP by 43.2 per cent" . Similarly, the same change was predicted to increase a nation's debt service burden by 31 per cent. In the case of Nigeria, for instance, where the government planned to increase oil production by 160% by 2010, the past trends indicated that Nigeria's debt could thus be expected to increase by 69%, or $21 billion over the following six years.

Commodity dependence, oil price shocks and general economic malaise because of lack of proper economic management, are brought out as some of the general contributing factors to LDC's indebtedness. Commodity dependence related debt tends to come out when the terms of trade deteriorate for the exporting countries. However there are times when commodity prices improve, and export revenues improve but we may still see the debt stocks rising. We had in recent times seen petroleum pricing falling world-wide but debt stocks either remained the same at the least and mostly still rising for countries like Zambia. The question then remains as to what factors could be underlying this debt generating process.

Zambian national debt had been on the increase from US$2.2 Billion in 1980 to an approximate US$19.7 Billion in 2019. This is despite the MDRI and HIPC initiatives that reduced Zambia's national debt from around US $7.1 billion to around US $500 million, the national debt continued to mount (Kamwanga, et al., 2018). The study wished to analyse the Zambian petroleum to national debt problem from the General Macroeconomic Theory point of reference. The General Macroeconomic theory identifies national income as being a composite total of final consumer spending, government spending, investment spending (Gross Capital formation) and net exports, where the net exports are the difference between the nation's total exports and total imports. When we relate net exports to total national income less absorption we have the net exports identity where net exports will depend on the difference between national income and the sum of total government, consumer and investment consumption which will be the national savings. The investments consumption will depend on the real interest rate (r) which equal the world real interest rate (r*), our net

exports will also depend on the world real interest rate (r*). The trade balance will depend on the fiscal policy through Government purchases and taxation (savings) and will also depend on the level of investment at the world real interest rate and the net exports which will equally be governed by real exchange rates (ϵ); (Mankiw, 1992).

Consequently then the net exports will equal to the National Savings when there is a balance of payments. But with a balance of payments deficit the difference between Net exports and National Savings will equal to the National Debt that the small open economy (Like Zambia) will owe to the external economies when it fails to transfer enough goods, services, physical and financial assets to the external economies. This residual or deficit is a capital account transaction representing all the inflows and /or outflows to compensate or complement it. If we now separate the imports into the respective petroleum imports and other non-petroleum imports we have identified the macroeconomic variables used in our time series to isolate the relative impact of petroleum imports on national debt in the Zambian case. These are Private Consumption expenditure GDP, Government expenditures, Gross Capital Formation, Exports, Imports (Petroleum and Non- Petroleum). (See pages 95 -97 for a detailed analysis)

In the Zambian case preliminary analysis showed that despite the increase in national debt there had equally been seen increasing magnitudes of the salient General Macroeconomic economic variables which are GDP, Government expenditures, Gross Capital Formation, Exports, Imports (Petroleum and Non- Petroleum), and equally Private Consumption expenditure (Refer to the graphed data on Pages 32-39).

The problem of the relationship between petroleum prices or petroleum expenditures and national debt is not that much a new problem world - wide but is somewhat novel to the Zambian case in that we have not seen much direct or deliberate studies done on the Zambian economy. The majority of the studies mentioned above, though comprehensive are mostly panel data evaluations dealing with a cross section of nations at a time but not bringing out specific petroleum imports to national debt case of any particular nation in the General Macroeconomic Theory decomposition context. As mentioned by Waheed (2019), the major lesson learnt from the studies is the importance of avoiding particular generalization for external debt accumulation factors for petroleum exporting and importing countries.

However the problem in the petroleum to debt contexture has had parallel but logically equivalent studies that are based on relationships between petroleum expenditures or energy prices and economic growth rates.

Hence the study found it expedient to fully establish if at all the claims that petroleum imports have been the source of the Zambian national debt are valid claims in view of petroleum's vast investment domain in the upstream, midstream and downstream segments. The study applied the General Macroeconomic Theory at a decomposed level, to analyse the ***relative*** impact of Petroleum Imports on the Zambian National debt relative to six already mentioned macroeconomic variables using the Markov Switch Autoregressive Model (MSAR) with real exchange rates and real interest rates as the intermediate variables.

With real exchange rates and real interest rates as the intermediate variables, the study undertook a preliminary analysis of the form of data for the variables in the model which were:

- National Debt (DEBT)
- Gross Domestic Product (GDP)
- Other Imports of goods and services (IMPOTH)
- Petroleum Oil imports (IMPPET)
- Exports of goods and services (EXP)
- Gross fixed capital formation (Inv)
- General government final consumption expenditure (Govt)
- Household final consumption expenditure (CONS)

The study's approach was to see the time series graphical relationship among the concerned regressor variables in relationship to the regressand (National Debt). This was to see what sort of model would adequately explain the relationships among the model variables.

1.2.1 National Debt to Total Petroleum Imports graphical Outlook

As can be seen in figure 1.1 the main variable of interest for this study, petroleum imports were graphed against the total national debt levels from 1980 to 2019 with petroleum imports rising from US$197m in 1980 to multiple fold of US$2,07 Billion in 2019 (COMSTAT, 2020).

The same period saw national debt rising from US$2.3 Billion in 1980 to an approximate US$19.7 Billion in 2019 (Ibid). This was despite debt levels falling from around US$7.5 Billion in 2004 to a minimum level of around US$ 2.3 Billion in the 2003, 2004 period due to the HPC/MDRI intervention.

The outlook showed a relatively low percentage share of the petroleum imports to national debt in value terms though the interesting outlook was that despite the peaks and falls of external debt, the petroleum imports figures had been steadily rising throughout the period of analysis.

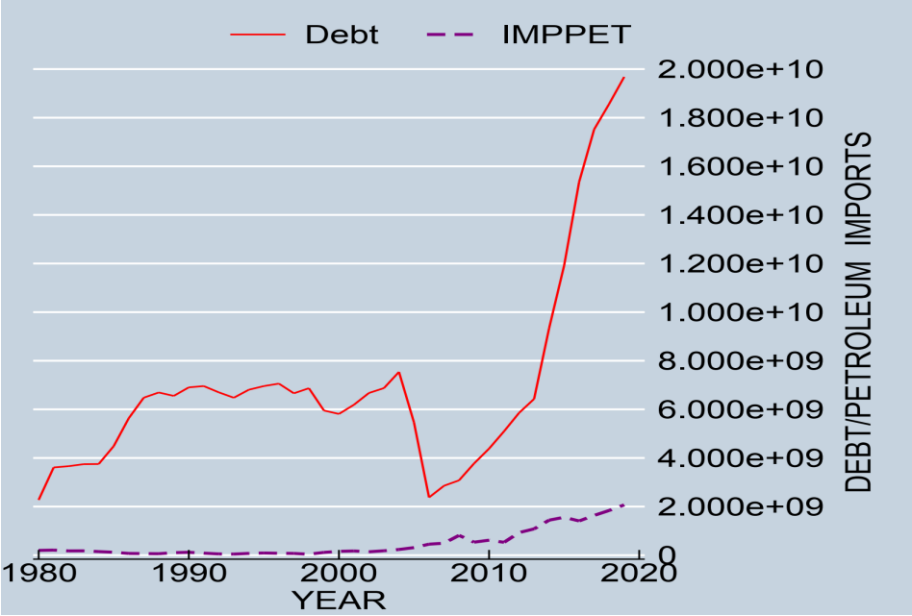

Figure 1.1: National Debt to Total Petroleum Imports Graphical Relationship
Data Source: African Development Bank/COMSTAT Databank (2020)

Graphed in Stata 15

1.2.2 The National Debt/ GDP Graphical Outlook

Figure 1.2, revealed the long run time series graphical relationship between Zambian national debt and the Gross Domestic Product (GDP) for the period 1980 to 2019.

GDP figures showed the levels rising from US$ 4.3 Billion in 1980 to relatively high levels of US$27.2 Billion in 2019 (Ibid). The graphed data revealed that from the early 1990s to the some years after 2000 national debt was over 100% of GDP until after the HIPC/MDRI multilateral debt relief. It then fell but started mounting after 2006 and had been quite a high value percentage of GDP reaching to over 70% of GDP by 2019. Whether GDP had been pulling up debt was however not the objective of this study.

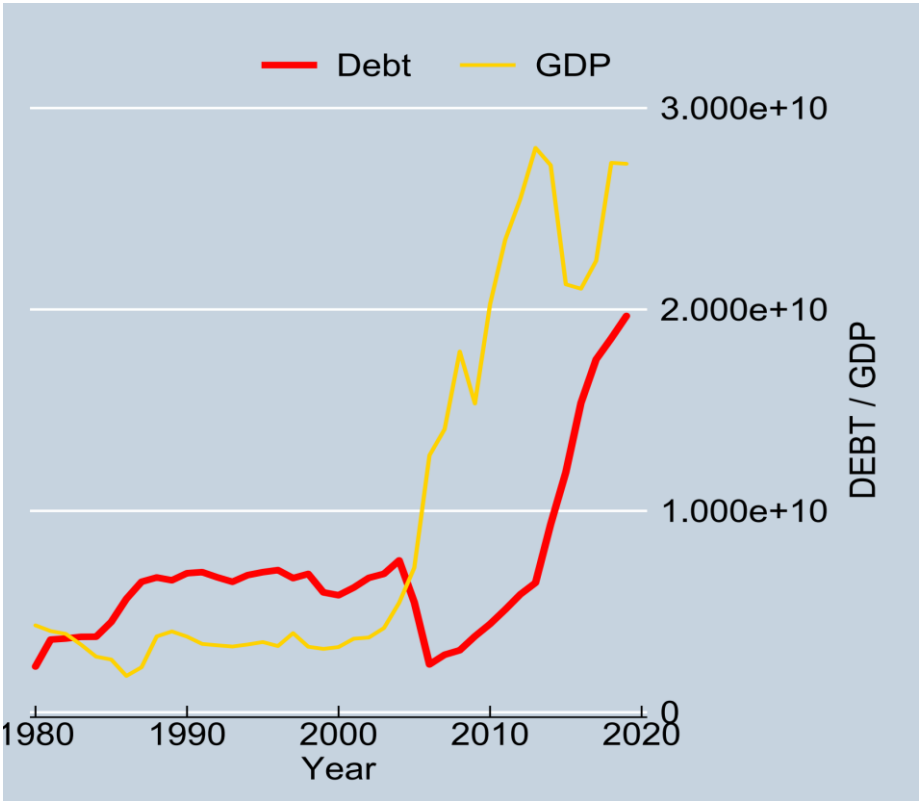

Figure 1.2: National Debt to GDP Relationship

Data Source: African Development Bank/COMSTAT Databank (2020)

Graphed in Stata 15.

1.2.3 The National Debt to Government Expenditure Graphical Relationship

Government Expenditure levels which were around US$514.8 Million in 1980 had seen colossal increments making expenditures to reach levels of US$2.5 Billion in 2019 (ibid).

The graphical presentation in Figure 1.3 showed Government Expenditure to have been consistently under the national debt values for the entire study period though tending to rise sharply after the HPIC/MDRI period. This showed how much government spending had been restricted in the pre HPIC/MDRI period. This could be due to the debt servicing obligations which had really constrained government spending. The National Debt/ Government Expenditure relationship is however not the underlying relationship for this study but more of a comparative analysis.

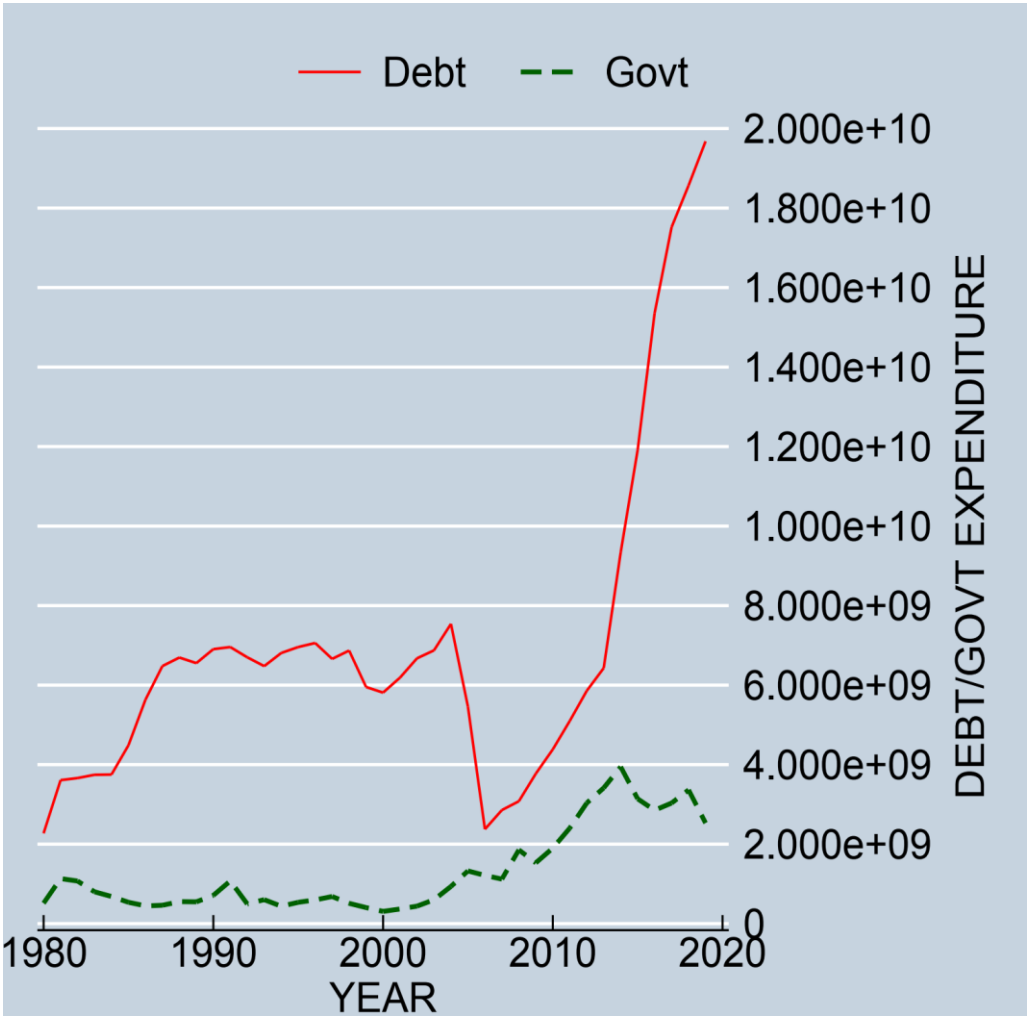

Figure 1.3: National Debt to Government Expenditure Graphical Relationship.

Data Source: African Development Bank/COMSTAT Databank (2020)

***Graphed in Stata 15*.**

1.2.4 National Debt to Non-Petroleum Imports Graphical Relationship

Other imports (Non-Petroleum) registered an expenditure level of US$ 746 Million in 1980 rising to a level of around US$7.6 Billion in 2019 (Ibid). Figure 1.4 presented the graphical relationship between other non-petroleum imports and external debt. The non-petroleum presented a relatively low percentage of national debt in the pre HIPC/MDRI debt relief period but came to transient rises above the national debt levels after the debt relief but peaked off after 2013 and tended to fall off after 2013. They afterwards tended to rise with debt hence putting an unclear picture as to whether the other imports are debt dependent or the other way around.

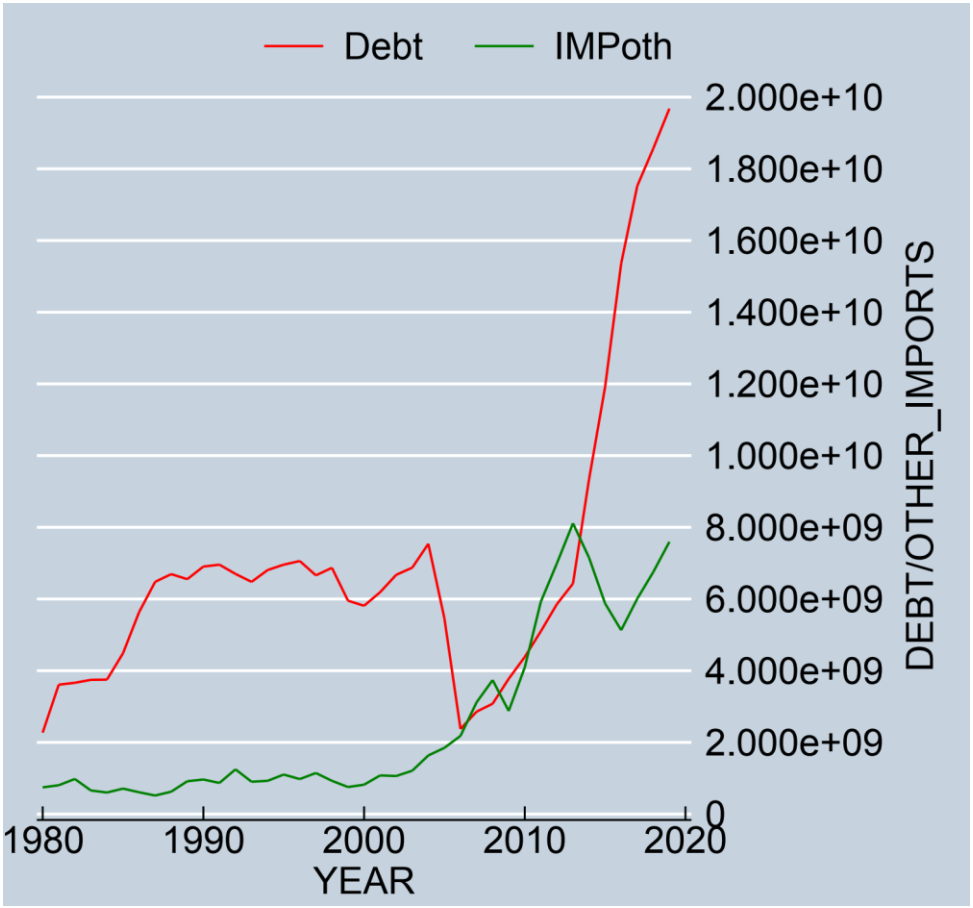

Figure 1.4: National Debt to Other Imports Relationship.

Data Source: African Development Bank/COMSTAT Databank (2020)

Graphed in Stata 15.

1.2.5 The National Debt Total Gross Capital Formation Graphical Relationship

Gross capital formation was around US$443 Million in 1980 rising to a peak of US$11.2 Billion in 2018 and then falling down US$9.7 Billion in 2019. Figure 1.5 is the graphical presentation of gross capital formation and national debt which graphically points to the former having been a very small percentage of the latter for the entire pre HIPC debt relief period but coming to rise to over 100% of debt in the post HIPC debt relief period and seemingly pulling up debt with it until after around 2015 when it fell below the national debt levels.

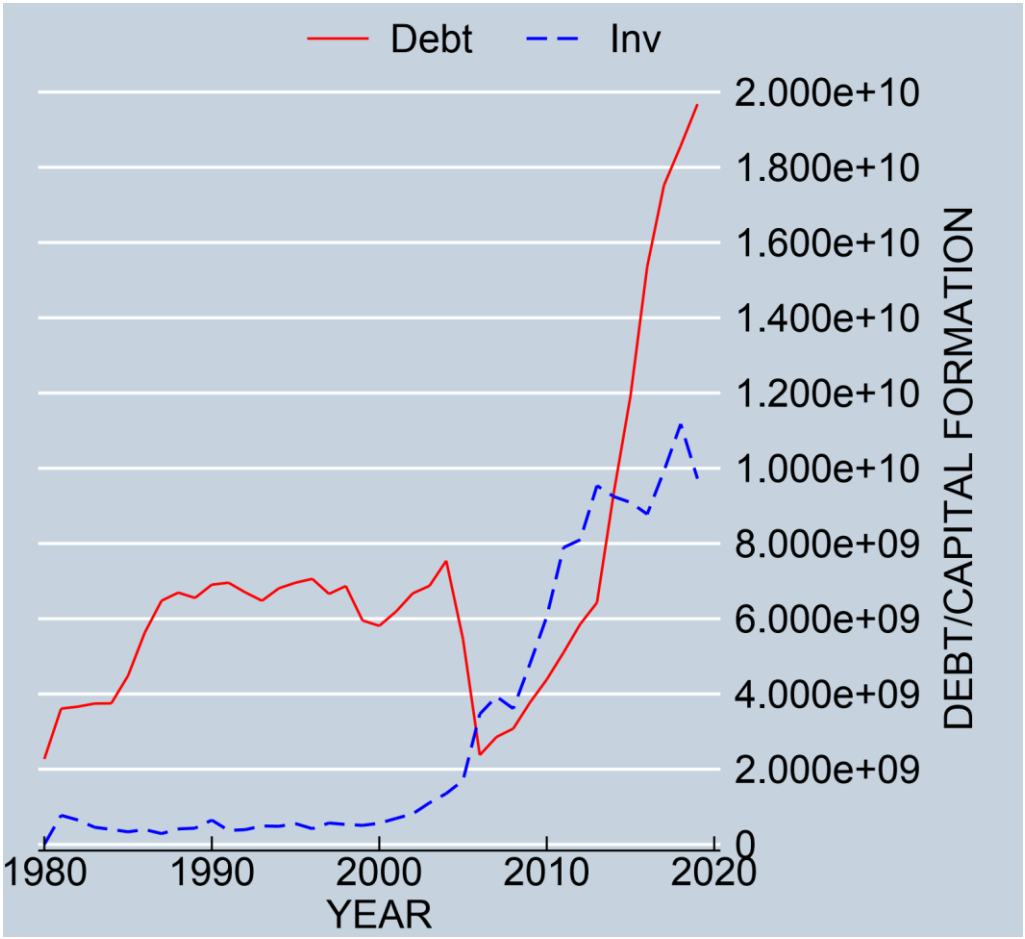

Figure 1.5: National Debt to Gross Capital Formation Relationship

Data Source: African Development Bank/COMSTAT Databank (2020)

Graphed in Stata 15.

1.2.6 The National Debt to Aggregate Consumption graphical Outlook

Aggregate consumption is one variable which registered a value of US$ 2.18 Billion around 1980 and then through a series of rises and falls recorded a value of around US$12.6 Billion in 2019. Figure 1.6 showed the national debt to aggregate private consumption relationship. The graph revealed that aggregate consumption expenditures were well below the national debt levels in the pre HIPC/MDRI debt relief period but came to rise well over 100 % of the debt levels thus seemingly pulling up the national debt with it but peaking off around 2013 and falling off afterward. This makes the aggregate consumption and national debt relationship a challenging aspect if you are to look for a causal relationship. However this was not the study's objective.

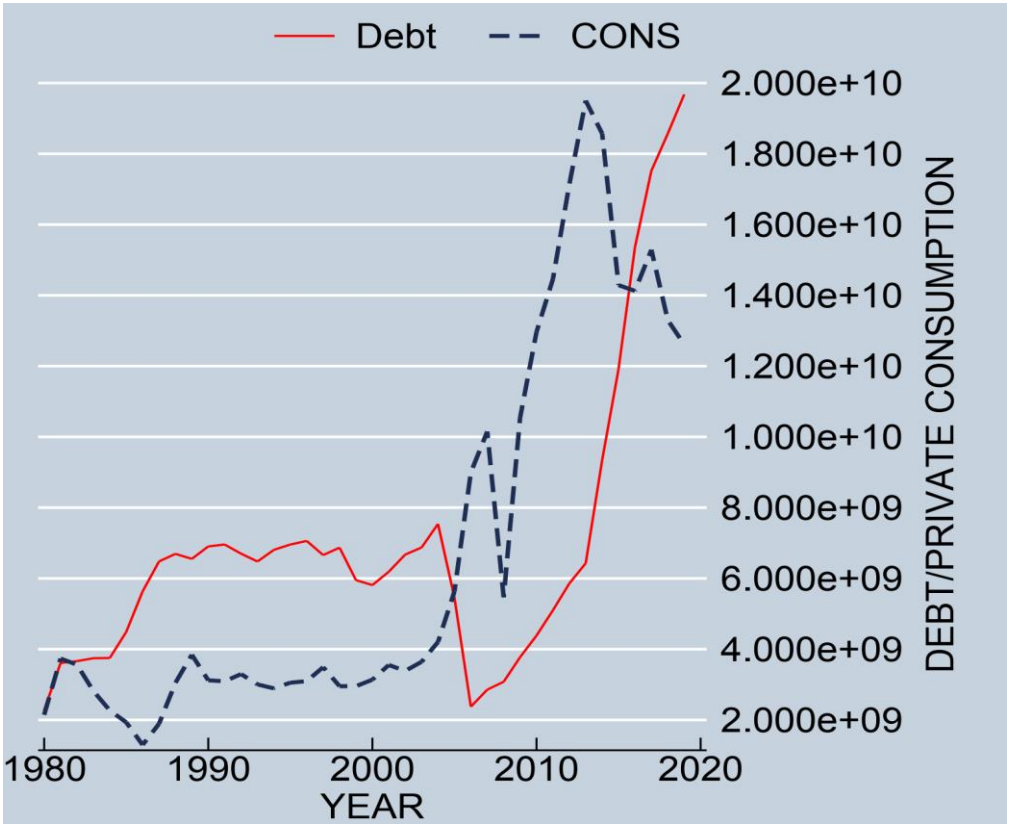

Figure 1.6: National Debt to Aggregate Consumption Relationship

National Debt to Gross Capital Formation Relationship

Data Source: African Development Bank/COMSTAT Databank (2020)

Graphed in Stata 15.

1.2.7 The National Debt to Total Exports graphical Outlook

Zambian national exports registered a moderate value of US$ 942 Million in 1980 peaking off in 2013 at a value of around US$ 11.6 Billion and then falling off to a low US$ 7.4 Billion in 2016 before rising to a value of US$ 10.2 Billion in 2019. The total national debt to total exports graphical relationship was graphed as shown in figure 1.7 and it showed that total debt was over 100% of total exports for the entire period before the HIPC/MDRI debt relief point. After this point, however, the total exports rose to over 100% of the national debt seemingly pulling up the debt with it and peaking off in the 2014/15 period and falling off below the debt levels afterward. This presents an obvious causal problem between these two variables as to which could be causing the other because debt seems to be suppressing exports in the pre HIPC/MDRI debt relief period but in the post period exports and national debt rises together with exports seemingly pulling up debt with it. But even after exports had stopped rising the debt continued to rise.

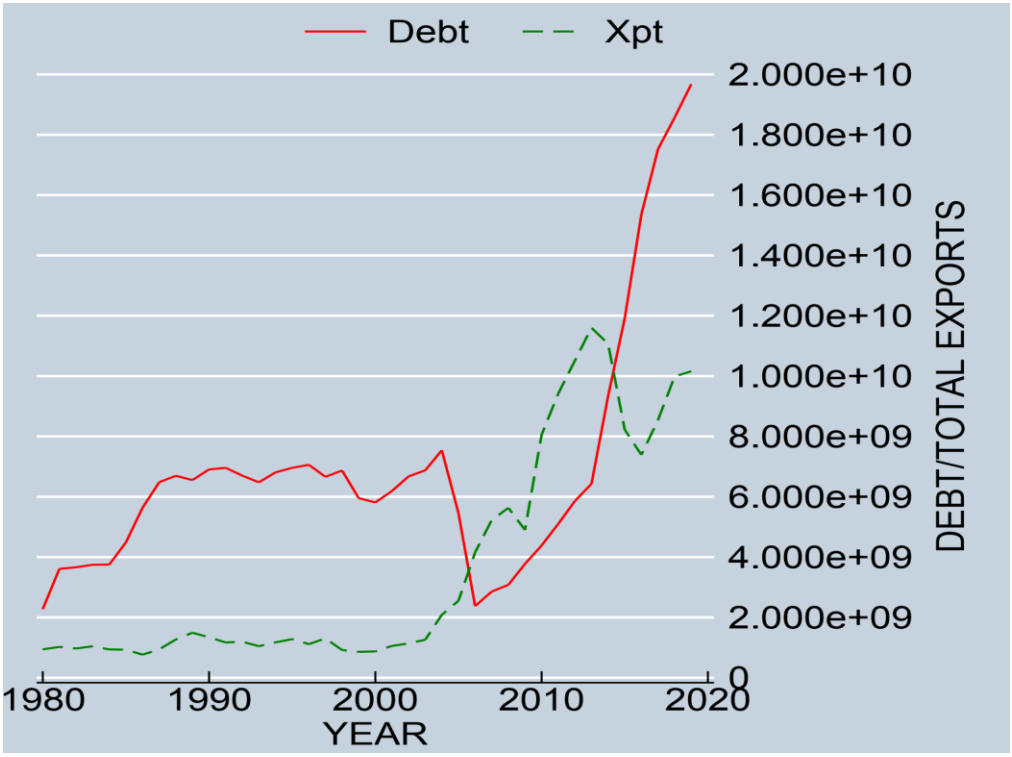

Figure 1.7: National Debt to Total Exports Relationship

Data Source: African Development Bank/COMSTAT Databank (2020)

Graphed in Stata 15.

1.2.8 The National Debt to All Regressor Variables Graphical Outlook

All the variables were finally graphed together to show the general graphical picture so to appreciate the supposed graphic relationship before econometrically evaluating them. This is illustrated in figure 1.8.

1.2.9 General Observation on the Graphical Exposition

As observed in figure 1.8 the graphed information on the concerned variables bring out one interesting property among the variables which is that from 1980 to the HIPC/MDRI debt relief point National debt was above all the concerned variables in the study. During this period the functions cycles are of relatively low frequencies. But from the HIPC/MDRI period onward, the concerned model variables, except Government spending and petroleum imports, rise above the debt levels are relatively pronounced functional cycles with relatively deepened frequencies and the functions seem to be more or less exponential. After around 2015 all the variables fell below the debt levels, though at increased amplitudes or magnitudes but the pattern tends to correspond to the pre HIPC/MDRI period but the variables are relatively nonlinear.

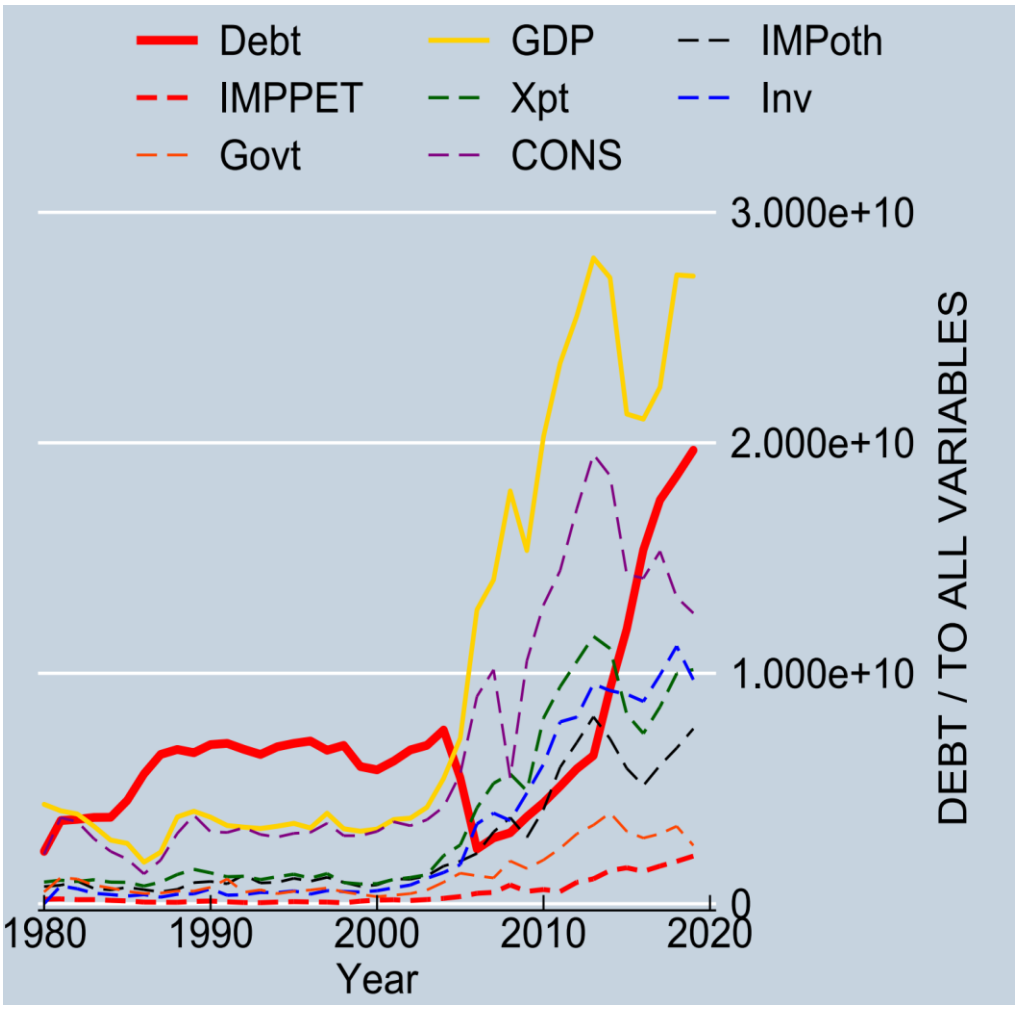

Figure 1.8: National Debt to all the Variables Relationships

Data Source: African Development Bank/COMSTAT Databank (2020)

Graphed in Stata 15.

The graphical data exposition on the study variables bring up a puzzling outlook seeing that they were all below the national debt levels in the pre HIPC/MDRI period but, with the exception of petroleum imports and government expenditures, have the magnitudes that exceeded the national debt for some years and then tended to all fall below the national debt levels after some time. This raises questions then that, on the assumption that if petroleum imports were the causal variable for the Zambian debt, could it have been the sole variable? How can there be a write off of all the other macroeconomic variables' impact on the Zambian national debt when all these variables have been seen to be increasing over the period of the study?

1.3 Statement of the Problem

Hasanli & Ismayilo (2018), using Log linear data applied OLS, and concluded that a rise in oil prices results into the growth of the world national debt, where they found that a 1% growth in oil prices increased the volume of foreign debt to World GDP by 3.17. But they fall short of isolating any particular country. Kretzmann & Nooruddin (2009), used a cross-national time-series analysis using a Generalized Method of Moments (GMM) and a comparative Least Squares Dummy Variable (LSDV) estimator model to examine the relationship between oil and debt where they found that increasing oil production led to increasing debt for the countries in their sample. Their study is not country specific and did not in any way apply the nonlinear approach Markov Switch approach. Nkomo (2006), using the Bacon and Mattar methodology, established that SADC countries were heavily reliant on imported crude oil such that there could just be a relationship between the extreme dependence on crude oil imports and the debt burden that the SADC countries are currently carrying. Most other studies referred to earlier are panel data studies which do not separate the sample countries' data and equally acknowledge the need to minimise generalizations from their findings Bittencourt (2013). We do not see a country specific approach even in Nkomo's approach and equally no orientation toward a decomposition of General Macroeconomic variables as a nonlinear model. The preceding review makes a clear gap in the literature concerning the analysis of the process of the petroleum to debt relationship in the Zambian case. Additionally available studies do not account for the petroleum to debt relationship as a Markov Switch nonlinear stationary process of decomposed General Macroeconomic Theory variables. This is a significant shortcoming in an economy that has experienced at a continued build-up of national debt despite the debt relief it obtained during the HIPC/MDRI intervention and consequently, then, the timeliness of the study as it captures how the significant macroeconomic variables that have been impacting the national debt.

1.4 Research Objectives

The following are the main and specific objectives of the study and the assumed research hypotheses.

1.4.1 Main Objective

The main aim of this study's was to determine the effect, direction and magnitude of petroleum imports on the Zambian national debt ***relative to the other general macroeconomic variables***.

1.4.2 Specific Objectives

The specific objectives of the study in the mentioned time period are then generally summed up as follows:

(I). Evaluate the extent to which crude petroleum imports impacted Zambian national debt in the period of the study.

(II). To evaluate the extent to which non - petroleum imports impacted the Zambian national debt in the period of the study.

(III). To determine the impact that exports had on the Zambian national debt in the period of the study.

(IV). To evaluate the effect of gross domestic product [GDP], on the Zambian national debt in the period of the study.

(V). To investigate the impact of gross capital formation on the Zambian national debt in the period of the study.

(VI). To evaluate the effect of government expenditure on the Zambian national debt in the period of study.

(VII). To investigate the impact of private domestic consumption on the Zambian national debt in the period of the study.

1.4.3 Research Hypotheses

In order to statistically or econometrically ascertain the significance of the research parameters or coefficients in explaining the validity of their impact on external debt, the research adopted the following null and alternate hypotheses:

H0a: Crude Petroleum imports had no impact on the Zambian national debt.

H1a: Crude Petroleum imports had an impact on the Zambian national debt.

H0b: Non - petroleum imports had no impact on the Zambian national debt.

H1b: Non - petroleum imports had an impact on the Zambian national Debt.

H0c: Exports had no impact on the Zambian national debt.

H1c: Exports had an impact on the Zambian national debt.

H0d: Gross domestic product [GDP] had no impact on the Zambian national debt.

H1d: Gross domestic product [GDP] had an impact on the Zambian national debt.

H0e: Gross capital formation had no impact on the Zambian national debt.

H1e: Gross capital formation had an impact on the Zambian national Debt.

H0f: Government expenditures had no impact on the Zambian national debt.

H1f: Government expenditures had an impact on the Zambian national debt.

1.5 Significance of the Study

In the first place the significance of the study was highlighting the adequacy of the Markov Switch Auto Regressive Model econometric tool in analysing general non-linear macroeconomic variables in their non-levels stationary states. This is a very significant contribution to the knowledge of analysing non-linear economic variables which are integrated of the second order I(2). To the researcher's knowledge, the use of the Markov Switch Auto-regression model in measuring the relative impact of petroleum imports in a decomposed General Macroeconomic variables approach on the Zambian economy has not been done before, so this approach presents an opportunity to enhance the country's understanding of the governing dynamics underlying petroleum imports on the national debt situation. Secondly the significance of this study was the need to determine some major macroeconomic factors contributing to the country's debt dependence as this indebtedness affects the country's resource distribution in as much as repayments have to be done which then impacts the economy in multiple ways through macroeconomic variables like the ever depreciating domestic currency, increasing price levels and the persistent balance of payments deficits which eventually contribute to the numerous impoverishing aspects of indebtedness.

Petroleum oil being a major import expenditure has been widely associated in many studies to be a GDP growth inhibitor and a very potential candidate for the growing indebtedness of multiple LDC's with Zambia, as a landlocked non-oil producing country being no exception. The study's results were necessary to determine if petroleum imports, despite their wide utilization in wide production processes could have had a positive impact on external debt. The fact that petroleum imports were shown in the study to have had a negative impact on national debt was a pointer to much misunderstood macroeconomic variable which should then be a motivation to have much energy oriented policies in the country for dynamic economic growth.

Additionally for the past 50 years plus, since independence, Zambia has never had a policy oriented approach of putting up either public or private market driven technologically based efforts to reduce the dependence on organic fuel resources as a

way of powering the economy as is being done in the developed world where serious efforts are being made to move the transportation sector away from petroleum dependency towards being electric power dependent to reduce the cost of transportation and have a cleaner environment.

It is further hoped, as was proposed by Kretzmann and Nooruddin (2009) that the study can assist in the removal of political, financial, and practical impediments to the development of alternative national energy resources to petroleum by the private sector. More generally it is aim of the research to encourage Zambia as a nation to adopt appropriate policies in establishing the necessary climate to foster private sector investment in alternative energy in the energy sector.

Furthermore the study's significance is that it may assist in the efforts of the expansion and diversification of global energy supplies to enhance the security of alternative energy supplies and reduce OPEC market power over oil prices which result in very unfair terms of trade, for developing countries, due to the instability of the real exchange rates. This can assist structural adjustment in many countries with balance of payments disequilibria due to oil import costs that threaten their positive participation in the international economy, including their ability to service their debts to the private commercial banking network (ibid)

1.6 Scope of the Study

This study focused on the impact of petroleum imports on the Zambian macroeconomic identity and its current and capital and financial accounts of the nation's Balance of Payments and the resulting long run debt position through any related transmission mechanism and not on any other macro variable(s) which are not represented, data wise, in the above two theoretical and practical presentations as referred to in 1.4.2 (ii) above. The data sourced for the study ranged from 1980-2019 of which the main credible sources were the COMSTAT /AFDB data archives on Zambian economy. The focus on this period is based on the fact that it covers both the one party participatory era of centrally planned economy with more or less fixed exchange rates a closed economy without free capital flow and the multi-party market oriented economy era which provided an open economy with market determined floating exchange rates and relatively free flow of international capital.

1.7 Delimitations and Limitations of the Study

The study covered Zambian national economy as defined by its coverage in its yearly national budgets and balance of payments in view of its consumption of petroleum oil and its external debt. It further covered other contributing or controlling factors to the national debt namely other Zambian import and export expenditures, national private investment, government purchases, private consumption expenditures, national income or GDP, real interest rates, and real foreign exchange rates.

The study's major limitation was lack of salient case studies on petroleum imports and national debt in the Zambian case in particular and the world in general. Most studies undertaken, as far as the author is concerned, are studies on GDP and Debt. Most studies on petroleum and debt are cross sectional ones where the authors do general studies relating to groups of countries and generalize from their findings.

The study's additional limitation was the data on real exchange rates, real interest rates and data on government taxation revenues for the period of study – particularly the period before 1995 or the one party state era of the country's political history. This made the study to drop these variables for dependable data analysis.

1.8 Research assumptions

The following are the assumptions that this study adopted or under which it was conducted:

(I). The study assumed Zambia as economically small and open where the balance of payments adjustments takes place through the market determined real exchange rates, the real interest rates are equal to the world interest rates and there is free movement of financial resources in and out of the official reserve account. In addition as a small nation Zambia's level of demand is unable to influence the price of the foreign product like petroleum.

(II). The national economic grow was impacted from mobilization of long term capital and the export of commodities whose world market prices are prone to external shocks.
(III). The national economic growth was also impacted by trade in imports of goods and services whose prices are determined by externally influenced real exchange rates.

(IV). The Zambian debt being analyzed was that total incurred as the principal amounts and the accruing interest but this accruing interest was not be taken as one of the regressor variables to be analyzed in this study.

(V). The transmission mechanisms through which oil prices have an impact on real economic activity included both supply and demand channels. The supply side effects were related to the fact that crude oil is a basic input to production, and consequently an increase in oil price leads to a rise in production costs that induces production entities to lower output through the adverse impact on investment. On the demand-side oil price changes affect consumption and investment where consumption is affected indirectly through its positive relation with disposable income. The magnitude of this effect is in turn stronger the more the shock is perceived to be long-lasting. In addition, oil price changes influence foreign exchange markets and inflation, giving thus rise to indirect effects on real activity which included national debt (Ghalayini, 2011).

1.9 Chapter outline

Chapter one has provided a background to study where the research problem is outlined, as well as research aims and objectives frame worked. It also incorporated the scope, related research, assumptions and limitations. Chapter two reviewed literature pertaining to the variables under study especially their regressive, correlative and causal relationships. The main focus was on oil imports and debt with particular emphasis of their nature on a global view, the African view, the SADC view and then the Zambian view. Chapter three focuses on the conceptual framework which were the main theoretical underpinnings on which the research is premised, thereby fitting the research gap into existing theories. The theories on resource driven and institutions economic growth are discussed. The conceptual framework presented the researchers perception of the relationship under study and employed both purely theoretical reasoning as well as diagrammatical presentation to express the perceived relationships. Chapter four explains the methodology employed in this study. Empirical literature pertaining to the methodology used is also reviewed. The limitations of the methodology as well as those of the whole study are discussed with ways of managing the deficiency of the methodology being explained.

Chapter five presents the data of the variables under study, analysis of the data and finally the findings of the analysis and focused on the presentation and discussion of findings. It also examines the impact of oil imports on the Zambian national debt implied by the findings in chapter four. Finally, Chapter six discusses the results where the meaning of the causal relationships are explained and their implications on policy discussed. The extent of compatibility between causal relationships and existing policies is also analysed. Chapter seven brings out the research findings out of the theoretical, mathematical and statistical abstraction into practical applicability. Chapter

eight summarized and concludes the thesis. It brings out the conclusions and recommendations pertaining to the advised policies or policy reforms. Finally, the chapter highlights limitations encountered by the study and also identifies areas for further research

1.10 Chapter Summary

Chapter one has brought out the background to the study where the various theoretically proposed reasons for the developing countries' indebtedness are brought out with reasons ranging from the underdevelopment and dependence theories, commodity prices and oil price shocks from the oil exporting countries like the OPEC cartel and the inefficient economic management of the developing countries.

The main research objective was premised on the ground that answers to this problem could provide some solutions to the reduction of the high indebtedness of the Zambian economy. This can be by way of looking for means of overcoming this petroleum contribution to the nations' long term debt if any. The main objective was reinforced by the specific ones which sought to not only look at the contribution of the petroleum imports to the nation's but to look at other control variables as well in terms on the entire set of variables in the nation's balance of payments as defined in the Macroeconomic relationship for a small open economy. Statistically the validity of these relationships were questioned through the complementing null and alternate hypotheses which had to be proven by the probability of the econometric variables' coefficients being equal to zero being rejected or not.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter explores the preliminary and empirical literature pertaining to the petroleum imports and national debt and the implied control variables as specified under the other factors in the specific objectives. The purpose of this chapter is to look the topical issues to try and espouse literature around the topic and with the extra intent of appreciating established knowledge about the variables concerning the study so as establish the gaps to guide towards the positions the study was supposed to fill. It further looked at the history of the Zambian debt situation and the existing challenges in meeting the debt requirements. The chapter's explored the connection of the nation's petroleum import to its national debt situation by looking not only at its experience per se but also at the experiences that other countries in similar or near similar economic positions have had through the studies that have been conducted by scholars worldwide, continental wide, regional wise and country specific wise and then see the ontological gap that could be filled to fulfil the study's objectives.

2.2 Overview of Petroleum Importation

Petroleum, or crude oil, is a non-renewable fossil fuel used as a source of energy in many sectors of any many economies. Petroleum products include gasoline (Petrol), diesel fuel, kerosene, jet fuel, petrochemical feedstock, waxes, lubricating oils, and asphalt and bitumen. The Petroleum industry is one of the world's largest industries with a huge chain of business executives, engineers, students, government officials, regulators, professionals and the general public working in the industry. The world petroleum industry is categorized into three segments. There is the upstream segment dealing with the business of oil and gas exploration and production. Then there is the midstream segment engaged in transportation and storage and then the downstream segment investment in refining and marketing (EIA, 2021). All these segments are intricately related to the international business financing industry in multiple ways.

It is estimated that 30 billion barrels are consumed globally each year, primarily by developed nations. Oil also accounts for a significant percentage of energy consumption

regionally from 32% for Europe and Asia, 40% for North America, 41% for Africa, 44% for South America and 53% for the Middle East (Muspratt, 2019).

2.2.1 Petroleum Imports

World petroleum imports cannot be understated due to the importance of oil as an energy input into multiple sectors of the world economies. According to Workman (2020) global purchases of imported crude oil came to a total of US$1.056 trillion in 2019 reflecting strong demand from 117 countries (See Table 8.4 in Appendix). In his estimates the overall count of the cost of crude oil imports in US dollars for all importing countries grew by 25.5% since 2015 when crude oil purchases were valued at $841.6 billion. However he noted that year over year, imported crude oil fell by -12.1% from $1.201 trillion for 2018 worldwide.

When doing a continental metrics comparison, Workman reported that Asian countries bought the highest dollar worth of imported crude oil during 2019 with purchases costing $572.5 billion amounting to 54.2% of the global total. European nations came in second place at 28.2% while North America accounted for 13.9% of worldwide crude oil imports. Smaller percentages were imported into Latin America at 1.5% excluding Mexico but including the Caribbean. Africa accounted for 1.1% followed by Oceania at 1.1% from Australia and then New Zealand (Ibid).

On a country by country analysis based on total cost, 15 countries (See Table 8.4 in Appendix) purchased 85.2% of all crude oil imported in 2019 among which, the fastest-growing markets for crude oil since 2015 were: China increasing up to 77.7%, India up to 41.4%, The United Kingdom up to 33.2% and Singapore up to 33.1% (Ibid).

Despite these big volumes in petroleum trade which implicitly implies big multiplier effects and in the concerned economies and increased profits for the oil dealers there seems evidence of the economic and socio-environmental effects of high and rising oil prices on African countries. Of course there is the well-known significant increases in the petroleum prices leading to worldwide economic recessions, such as the 1973 and 1979 energy crises. In many African countries, governments faced a considerable dilemma: how much of the increase in petroleum prices they should “pass through” to consumers. The negative effect of rising oil prices is of course, then, potentially large for net oil-importing countries. In principle, the net effect for net oil-exporting countries should be relatively positive, because the positive aspects of the price rises

tend to balance off the downside price rises. The importance of petroleum for African nations and the marked tendency for significant oil price volatility were presented in the background of chapter one. The impact of high oil prices is likely to be even more drastic in countries that are exceedingly dependent on petroleum and/or have constrained ingress to international capital markets.

For many developing countries, the increase in oil prices has made formative reform of the domestic petroleum pricing system a crucial constituent of their macroeconomic stratagem. Although in some countries oil price increases may have been partly offset by exchange rate movements (where the U.S. dollar has depreciated), they also have had considerable socioeconomic impacts. Many governments have not been so eager to transfer the impact of increases in international oil prices on to consumers because of the high likelihood of social resistance to an economic programme that could hurt the majority poor. However, when and if they do not transfer the higher price burdens to their consumers, these countries tend to experience notable fiscal burdens, which, in cyclical set of circumstances, could potentially force the governments to reduce on macro social expenditures.

In the African net oil-importing countries, high oil prices have an adverse impact on businesses, consumers, and the government budget, to name a few. As a result, these net oil-importing countries see their terms of trade deteriorate jeopardizing their balance of payments positions and possibly leading to lower economic growth than in the absence of the oil shock. In the context of this study, the subsequent outlook then is to analyse if these adverse petroleum import prices and volumes also impinge on their levels of the respective countries' national indebtedness with Zambia being one such country in particular.

2.2.2 Petroleum Sector in Zambia

The importation of petroleum crude oil dominates all other single commodity expenditures and forms a major part of Zambia's import bill, with the bill being reported at $504,747,000 in 2019 amounting to 0.05% of the world total. (ibid) Petroleum is a key driver of industrial activity. Due to increased economic activities in the country, national consumption was on the upswing, increasing by 36 per cent as from 2009 with total final product consumption reaching 1,344,908 metric tons in 2018 (Energy Regulation Board, 2018). Petroleum provides a vital upstream, midstream and

downstream sector value chain involving exploration and production, infrastructure such as transport (pipelines, access to roads, rail and ports etc.), storage facilities and then refining and marketing. The petroleum industry in the country is of a vital nature encompassing a range of different activities and processes which jointly contribute to the transformation of underlying petroleum resources into end products to be used as inputs by industrial and private customers. These different activities are inherently linked with each other within or across individual firms, and within or across national boundaries.

But the petroleum oil imports come in at a price. Zambia exports mainly copper for its foreign exchange reserves and imports a host of other products of which the most outstanding is petroleum oil with fuel imports, as a % of merchandise imports, being reported at 14.14 % in 2018, according to the World Bank collection of development indicators, compiled from officially recognized sources (Trading Economics, 2020).

The Zambian Energy Ministry's petroleum demand estimators base their analyses on a base case where the petroleum demand growth is compared to the copper price and copper output (Ministry of Mines Energy and Water Development, 2014). Hence seeing the generally global poor performance of copper prices it should be expected that oil demand will always be ahead of copper prices and output indicating a debt promoting scenario.

As observed by UNCTAD (2011), in importing countries petroleum oil imports typically account for a large share of foreign exchange expenditures. Furthermore, taxes on oil consumption contribute importantly to fiscal revenues. When the sector constitutes a significant share of the domestic economy, be it in production or consumption, there inevitably will exist strong incentives to impose comprehensive state involvement or even direct state control, in order to secure both political and financial advantages. Petroleum is frequently portrayed as strategic and thus too important to be left to the market (Chinambu, 2011). The fact that imports typically account for a large share of foreign exchange expenditures and the involvement of the government in the international procurement process might implicitly point to a contribution to the existing foreign debt which is, of course, incurred in foreign exchange as the study wanted to find out.

For instance, in the Zambian case, The Ministry of Mines Energy and Water Development (2014) reported that up until then, Zambia had met demand for oil products through crude oil imports via Tanzania through the 1,710 kilometres Tazama pipeline, comprising 954 kilometres of 8" diameter and 798 kilometres of 12" diameter looped pipelines, which is old and corroded. The pipeline running from Dar es Salaam to Ndola was designed for a lifetime of 25 years but was now over 40 years old. Their expert view was that maintenance and repair costs on the pipeline would increase at a rate requiring significant funding, eventually outreaching new pipeline costs. Thus the only feasible option was pipeline replacement with two (2) replacement options to provide security of supply to 2030 and beyond. Option 1 was to replace the existing pipeline with a new 12" crude pipeline, either over 2-3 years or 6 years at estimated capital costs of $989m (2.5 years) or $1.06 billion (6 years) using the traditional welding construction methodology or $668m (1.3 years) or $735m (6 years) using ZAP-LOK construction approach apparently favoured by many pipeline companies today. For Option 2, the estimated capital cost of replacing the crude pipeline with an oil products pipeline using the traditional welding methodology is $1.03 billion (2.5 years), and using ZAP-LOK the cost is $707m (1.3 years).

In this study's view, whichever way the government would opt for as a replacement method, financing would be required for consultancies and construction and that might point to potential additional national debt arising from petroleum consumption.

2.3 National Debt

National debt is defined as that component of a country's debt that is owed to domestic and foreign lenders, who may be private lending entities like private commercial banks, foreign governments, or multilateral international financial institutions like the World Bank or the International Monetary Fund. These loans (principal amount) with the related interest payments, must usually be repaid in the foreign currency in which the loan was acquired (Kenton, 2021). The International Monetary Fund's (IMF) guide to debt statistics defines Gross external debt, at any given time, as the outstanding amount of those actual current, and not contingent, liabilities that require payment(s) of principal and/or interest by the debtor at some point(s) in the future and that are owed to non-residents by residents of an economy (Panizza, 2008) . The most notable sources of external debt are the Paris Club of Creditors, London Club of Creditors, Multilateral Creditors like the IMF and the World Bank, Promissory Note Creditors,

which are the refinanced uninsured trade arrears and Bilateral and Private Sector Creditors like those from the Euro Currency Market.

Domestic debt is the debt that the domestic government owes the local creditors in terms of short and long term securities. It normally comes by as a result of the domestic government failing to meet their budget deficits with foreign budget support assistance.

Public and publicly guaranteed debt comprises long-term external obligations of public debtors, including the national government, Public Corporations, State Owned Enterprises, Development Banks and Other Mixed Enterprises, political subdivisions (or an agency of either), autonomous public bodies, and external obligations of private debtors that are guaranteed for repayment by a public entity. It is denominated in U.S. dollars.

Government guaranteed or publicly guaranteed debt refers to the domestic and national debt guaranteed by Central Government. It comprises the domestic and national debt liabilities, the servicing of which is contractually guaranteed by Central Government.

This study defines debt as the total debt stock outstanding to official creditors denominated in foreign currencies (particularly the US dollars) for the entire period of the study. This may be domestic debt as long as it is US Dollar denominated or to be repaid in foreign currency. As such the data gathered was not just for the national debt stock but all public and publicly guaranteed debt.

2.3.1 Causes of National Debt

The causes of national debt vary. There is general feeling from scholars that certain governments or leaders have the careless or irresponsible politico-socio- economic execution of national administrative functions (Bacon, 2005). International Economics thinkers pose the point that developing countries generally face limited productive use of domestic resources with low levels of export earnings and declines in the flow of concessional assistance and consequent greater reliance on costly commercial borrowing. They additionally face deterioration in the terms of trade for their primary exported products (Carbaugh, 2009). It has been the conviction of many economic writers that the steep rise in national debt burden of the developing countries arose

from the 1970's is on account of the aggravation of BOP deficit by petroleum oil crisis which brought persistent inflationary pressures on the developing economy (Economicsdiscussion.net, 2021). It is from the last reason that this study undertook the challenge of attempting to find out if this reason could be equally valid in the Zambian case.

2.3.2 Global Debt

According to Reuters (Ranasinghe, 2021) the Institute of International Finance (IIF) reported that global debt rose to a new record high of nearly $300 trillion in the second quarter of the year 2021. Total debt levels, which included government, household, corporate and bank debt, rose $4.8 trillion to $296 trillion at the end of June 2021. The rise in debt levels was reported to highest among the emerging markets, with total debt rising $3.5 trillion in the second quarter of 2021 to reach almost $92 trillion.

China the fastest growing economy saw a sharper rise in its debt levels compared with other countries, while emerging-market debt excluding China rose to a level of $36 trillion in the second quarter of 2021, driven by a rise in government borrowing. The United States had debt accumulation of around $490 billion with household debt increasing at a record rate (Ibid).

The IIF further found out that of the 61 countries it monitored, 51 recorded a decline in debt-to-GDP levels, mostly on the back of a strong rebound in economic activity but that in many cases the recovery had not been strong enough to push debt ratios back below pre-pandemic levels. The total debt-to-GDP ratios excluding the financial sector were below pre-pandemic levels in just five countries: Mexico, Argentina, Denmark, Ireland, and Lebanon while globally, household debt increased by $1.5 trillion in the first six months of 2021 to $55 trillion (Ibid).

The study further analyzed data on global debt in the form of the central government's debt as percentage to GDP from the International Monetary Fund for the year 2019 and the findings are presented below. In the case where central government's debt data was not available general government debt was used which was equally as representative. The entire presentation of the debt levels can be seen from Table 10.1 in Appendix III.

2.3.2.1 North America

Data from the IMF showed the North American Central governments having an average debt level of 67.4% of GDP with America leading the figure at 92.57% and Canada having national debt at 36.82 % (Mbaye, et al., 2019).

2.3.2.2 South America

Of the eighteen (18) South American countries whose data was available, the average debt to GDP ratio computed was 48.03% with the highest being recorded for the state of Belize at 105.08% and the lowest being Paraguay at 21.1%. The rest of the countries were at debt levels ranging from 90.38% for Argentina to 23.2% for Peru (Ibid).

2.3.2.3 Asia

A total of thirty three (33) Asian nations were looked at from the Asia Major and Asia Minor. The average debt to GDP ratio for this group of nations was at 49.81% with the highest being Japan's at 201.39% and the lowest being the state of Brunei Darussalam at 2.35%. The rest of the nations' debt to GDP ratios ranged from 129.29% for Singapore to 22.79% for 6.13% for Afghanistan (Ibid).

2.3.2.4 Europe

The forty one (41) European countries whose data was looked at averaged at 54.35% of debt to GDP ratio with Greece being the highest at 189.92% and Estonia being the lowest at 9.62%. The rest of the remaining thirty nine (39) nations' debt to GDP ratios ranged from 135.34% for Cyprus to 14.39% for Norway (Ibid).

2.3.2.5 Oceania

Data from the thirteen (13) Oceania nations revealed an average debt to GDP ratio of 33.30% with the State of Nauru having the highest ratio of 61.99% while the Solomon Island recorded a lowest ratio of 8.91%. Data from the remaining eleven (11) countries revealed debt to GDP ratios ranging from 49% for the Fiji Islands to 11.93% for Timor-Leste Islands (Ibid).

2.3.2.6 The African Perspective

The study equally analysed the available data on African countries segmented into North West East, Central African regions and the SADC group of countries. The findings are presented in the following contexts.

2.3.2.6.1 North Africa

The five (5) North African nations looked at, Algeria, Egypt, Mauritania, Morocco and Tunisia averaged debt to GDP ratio of 53.45% with Egypt having the highest at 83.8% and Algeria recording the lowest at 40.28%. The remaining three (3) nations ranged from 72.73% for Tunisia to 58.12% for Mauritania (Ibid).

2.3.2.6.2 West Africa

The study further looked at debt to GDP ratios for nineteen (19) West African countries where the average value was 54.80% with Cape Verde Islands recording the highest debt to GDP ratio of at 124.98% and Nigeria, surprisingly, recording the lowest at 26.46% (29.14% at general government). The remaining seventeen nations ranged from 80% for the Gambia to 34.8% for Guinea (Ibid).

2.3.2.6.3 East Africa

For East Africa, seven (7) countries debt to GDP ratios were looked at and the group's average was 72.84% with Eritrea recording the highest value of 189.3% with Uganda and Djibouti recording the lowest values at 38.23% and 38.47% respectively. The remaining four ranged from 73.07% for São Tomé and Príncipe to 51.36% for Rwanda (Ibid).

2.3.2.6.4 Central Africa

Eight (8) Central African nations were analysed in terms of their Debt to GDP ratios and their average value was found to be 77.92%. Sudan topped the Debt ratios at 200.37% while Chad was the lowest at 44.29%. The rest of the 6 nations ranged from 83.67% for The Congo Republic to 47.18% for the Central African Republic (Ibid).

2.3.2.6.5 SADC

For the seventeen (17) group of nations making up the Southern African Development Community (SADC), the average debt to GDP ratio was found to be 51.8% with Angola having the highest at 109.21% followed by Mozambique at 104.38% and then Zambia at 91.9%. The lowest ratios were recorded by Botswana at 14.74%, DRC Congo at 14.75% and The Comoros at 25.24%. The remaining twelve (12) nations had debt to GDP ratios ranging from 77.7% for Mauritius to 38.2% and 38.42% for Eswatini and Madagascar respectively (Ibid).

2.3.2.6.6 The Caribbean

The twelve (12) analysed group of nations from the Caribbean region recorded an average debt to GDP ratio of 65.68% with the Barbados recording the highest ratio of 118.83% followed by Jamaica at 94.28%. Kiribati recorded the lowest debt ratio at 18.34%. The remaining nine (9) nations had ratios ranging from 84.47% for Antigua and Barbuda to 39.58% for the Dominican Republic (Ibid).

2.3.2.6.7 The Mid-East

From the thirteen (13) Mid-East nations whose data was analysed, the average debt to GDP average was 60.62% with Lebanon having the highest ratio at 174.48% followed by Bahrain at 103.36%. The lowest debt ratios were recorded by Kuwait at 11.77% Saudi Arabia at 22.79% and the United Arab Emirates (UAE) at 27.27%. The remaining eight (8) nations had ratios ranging from 78.02% for Jordan to 34.64% for West Bank and Gaza (Ibid).

2.3.2.6.8 Zambia's Debt

From the 1970's after the "Zambianization" of the Zambian economy through nationalization of the production sector and the aiding of Southern African Freedom wars, their occurred a depletion of the foreign reserves that the colonial government left behind and the start of Zambia's indebtedness, initially through the International Monetary Fund (IMF) which steadily grew until reaching unsustainability in the 1990s.

(Kamwanga, et al., 2018), reported that the debt relief efforts of the Highly Indebted Poor Countries (HIPC) and Multilateral Debt Relief (MDR) initiatives saw a reduction of the country's debt stock from US$ 7 billion in 2001 to US$ 934 million in 2006. This released financial resources in terms of debt servicing and contributed to the growing fiscal incentives for investment in the key areas of the Zambian economy while at the same time contributing to a more favourable outlook for economic development across the country and opening up more access to developmental funds on international capital markets including private ones (Ibid)

The African Forum for Debt and Development (2018) reported that as a proportion of GDP Zambia's national debt increased from 18.9% in 2010 to a never seen before proportion of 52.5 % by end of 2019. Zambia debt in 2019 was standing at US$13.5 Billion representing 52.5% of the GDP of which 70% (US$9.5 billion) was national

debt and 30**%** domestic debt (US$ 4 billion). From 2012 to 2015 Zambia issued Eurobonds worth US$3 billion maturing in 2022, which had implications on debt sustainability with Zambia slowly moving from being a medium risk of debt distress country to a high risk of debt distress position. The national debt now included US$3 billion in Eurobonds, compared to US$1.9 billion (8% of GDP) at end-2011, which now accounted for 70% of total public debt. The issuance of international sovereign bond saw a shift in Zambia's national debt creditor composition with the commercial creditors (bonds) composing more than half (52%) of the external debt. The present value of public and publicly guaranteed national debt as a share of GDP had risen gradually, from 34.5% in 2019 to 44.3% of GDP in 2020 and would sustained at that level up to 2022 before gradually falling below the 40% threshold in 2024 (AFRODAD, 2018).

The increasing debt stock in Zambia implied a rising debt burden with the most notable worry being debt servicing significantly becoming unsustainable. Sustainability analysis put Zambia at a high risk debt distress and increasing fiscal deficits especially given that the Eurobonds repayments are due in 2022 and 2027 (Ibid).

The IMF and the World bank (2019) reported that the nation was faced with liquidity pressures stemming from large national debt payments and debt service on public and publicly guaranteed debt including foreign-held long term debt which was projected to reach $1.6 billion in 2019 having increased from about $1 billion in 2018 and which was much larger than the then existing foreign exchange reserves levels as of May 2019 (See Figure in Appendix). A total of $4.9 billion (principal + interest) was due to external creditors over 2019-2021 period, of which US$4.6 billion was on already disbursed debt (IMF & IDA, 2019).

The debt burden for developing oil importing nations is an ever increasing manifest of the problems being faced by their respective governments in their day to day managing of their economies. For the Zambian case, as was noted in the background of the study, there was debt well before the MDR and HIPC initiatives just like it continued after that. The position taken by this study was to try to isolate the role that petroleum imports have played in this ever burgeoning debt position. Being a 100% importer of petroleum oil (at 0.05% of the world total as of 2019) it was of interest to if this fact played a role in this ever increasing debt burden or was just a minor purchase (at 14.14% of the total

commodity imports as at 2018) which is just one of the many imported commodities the nation buys from the external world.

2.4 Empirical Literature- Impacts of Petroleum Imports on National Debt- (A Global Perspective)

The study then looked at some of the empirical studies that have been done and worldwide on this debt to oil scenario to try to explain the connection existing among the variables defined in this study and national debt through any macroeconomic variables of their choice. The study further looked at national evidence from selected countries worldwide. This was done by specifically taking a global comparative perspective from the six continents. The study looked at the comparative studies and evidence from selected North and South American countries, European, Asian, North, West and East African countries, SADC countries and finally on the Zambian perspective.

2.4.1 Debt and Petroleum – North America (The U.S.A and Canada)

Barro (1979) had, theoretically and empirically, argued, that temporary increases in national income had tended to play a counter cyclical role on debt in the US, and equally that there occurred an expected positive effect of inflation on debt. He constructed a public debt theory in which the Ricardian invariance theorem was valid as a first-order proposition but where the dependence of excess burden on the timing of taxation implied an optimal time path of national debt.

A central proposition was that government deficits had to be varied so as to maintain the expected constant levels of tax rates. This behaviour implied a positive effect on national debt issue from temporary increases in government spending (a countercyclical response of debt to temporary income movements), and a one-to-one effect of expected inflation on nominal debt growth. There was no mention of petroleum price movements in Barro's analysis which makes petroleum imports an unlikely variable to account for the USA's national debt

From the developed countries' perspective, Barsky and Killian (2004) noted that though Economists have for a long time been curious about empirical evidence that suggests that oil price shocks may be closely related to macroeconomic performance

and that mainline empirical literature findings have supported the idea that economic growth is generally negatively affected by increases in the energy prices, this could not be the case for the United States of America.

The argument was that though oil price shocks may have long-term consequences for economic growth, notably that the rise in the price of oil in 1974, and 2002 had been blamed for the reduced national productivity, the underlying problem was that the cost of energy was too small a percentage of GDP to explain the reduced productivity. As a result, some economists had turned their attention towards alternative channels of transmission that impacted through some other macro variables which effected on national productivity, one of them being that higher oil prices tended to make energy-inefficient capital obsolete resulting in none unmeasured declines in the capital stock, which reflected like a reduction in productivity when data was collected. However, the two authors argued, there was no empirical support for that idea and as such though a number of additional and more elaborate arguments had been advanced that in principle might establish a link from oil prices to changes in national productivity, none of these models had solid empirical support (Ibid).

Being the fifth-largest producer of natural gas and the sixth-largest producer of oil in the world, Canada has had the opportunity to provide oil and natural gas to meet demand internal demand and driving economic growth. Canadian oil and natural gas provided $108 billion to Canada's gross domestic product (GDP) in 2018, supported almost 530,000 jobs across the country in 2019 and provided $8 billion in average annual revenue to governments for the period 2016 to 2018. But it is also a high importer of petroleum products As of the year 2020 Canadian national debt stood at Cad$2,858,222 million of which petroleum was of, apparently, none significance (Trading Economics, 2020).

Hence we do not see any tangible evidence of Canadian debt being significantly being influenced by petroleum imports.

2.4.2 Debt and Petroleum – South America (Brazil and Chile)

A notable South American country with a long history in indebtedness is Brazil. From as far back as the 1960s the external capital inflow rose dramatically with Brazil being the fourth largest recipient of external resources from 1964-1967 with public and

private rising from $3.2 billion 1964 to $4.4 billion at the end of 1969 (Lemo & Coelho, 2010). It is reported that the country experienced very high economic growth rates but with considerably outstanding national debt growth not necessarily bringing risks to the Brazilian economy. This situation began reversing however in 1973, due to the sudden rise in oil prices. With the increased oil prices the Eurocurrency petrodollars liquidity increased which saw developing countries like Brazil having more borrowing capacity resulting in even more national debt being accumulated from 1974 to 1980, which led to the early debt crisis in the next decade with the share of public debt to total national debt rising from about 50% to nearly 70%.(ibid)

With the second oil shock, between 1979 and 1980, what was brought about was a remarkable rise in debt servicing as a result of increases in the interest rates fanned by the US Federal Reserve, in their attempts to bring down inflation in the USA. Consequently indebted developing countries started failing to swerve international capital to the financing of their economic programs. Consequently there was a quick and massive decline of international reserves which saw Brazil's balance of payments changed switching from a $4.3 billion surplus to a $3.2 billion deficit. This phase saw Brazil's national debt situation becoming critical, in which external constraints started dictating the direction of the domestic economy and as such this national debt bottleneck would no longer be a potential problem but an actual constraint to economic growth (ibid).

As such from the history of Brazil's public debt with advances and setbacks, with its debt profile having experienced considerable variations, reflecting changing economic conditions we can somehow see the petroleum effect on its national debt position. Nonetheless, being a petroleum exporting country, improvements on Brazil's national debt position are indisputable (ibid).

Another South American Country worth borrowing examples from is Chile a typical copper exporting country like Zambia but unlike Zambia, Chile has a relatively small petroleum production base though quite low in comparison to other South American oil producers. As such it is also a net oil importer of petroleum products with Chile imported approximately 4.1 billion U.S. Dollars' worth of petroleum in 2019.

When the first oil shock occurred in December 1973 with a rise in crude oil prices from under $4 a barrel to over $11 a barrel, there was an imposition of adverse movements

in the terms of trade on oil-importing countries that, in magnitude, depended upon the importance of oil in their total imports. Chile was one of the countries which experienced the biggest adverse shock in the magnitude of terms-of-trade shocks in terms of GDP over the two years (1974 and 1975) with copper prices dropping in 1974. (Little, et al., 1994).

Chile's public national debt was at US$ 209,504.82 million in September 2020. The International Monetary Fund in 2018 reported that Chile's gross public debt to GDP ratio had risen over 20 percentage points over the previous ten years as Chile underwent a 3 percent of GDP loss in copper revenues starting from 2011, due to falling copper prices (International Monetary Fund, 2018). However, with regard to the study at hand, there is not much concrete evidence of Chilean debt being significantly being influenced by petroleum imports**.**

On a general South American analysis Bittencourt (2013) investigated the determinants of external debt in the young democracies of South America between 1970 and 2007. The data set covered the period 1970–2007 and all nine South American countries that transitioned from political dictatorship to full democracy in the late 1970s (Ecuador), 1980s (Argentina, Bolivia, Brazil, Chile, Peru, and Uruguay), and early 1990s (Guyana and Paraguay). In addition, most of these countries experienced hyperinflationary episodes during the period (the only exception is Paraguay) and growth had collapsed. Using a pooled OLS model or dynamic panel time-series data analysis he regressed the general government ratio of external debt stocks to GDP (DEBT) on economic growth (GROWTH), trade openness relative to GDP (OPEN), ratio of the liquid liabilities to GDP (M2), the inflation rates (INFLAT), population (POP), urbanization (URBAN), constraints on the executive (XCONST), government shares to GDP (GOV), income inequality (INEQ) and the lag of general government ratio of external debt stocks to GDP (DEBT- l) and the error terms such that:

$$DEBT_{it} = \lambda_i + \mu_t + \alpha GROWTH_{it} + \beta OPEN_{it} + \gamma M2_{it} + \delta INFLAT_{it} + \varepsilon URBAN_{it}$$

$$+ \zeta XCONST_{it} + \eta GOV_{it} + \theta POP_{it} + \iota INEQ_{it} + \kappa DEBT\text{-}1 + v_{it.}$$

The estimation results of principal component and dynamic panel data analysis confirmed that economic growth had the ability to significantly reduce the debt in the region. The other important determinants as suggested by the literature, such as inflation, inequality or executive (better checks and balances) did not present the

expected nor clear-cut estimates on external debt. So generally, with the exception of Brazil, we do not see much impact of petroleum imports on South America.

2.4.3 Debt and Petroleum – Asia (China, India and Pakistan)

We then referred the study to some empirical facts to some specific countries in Asia to see some empirical data based explanations concerning the oil price /expenditure relationships with debt**.**

In the " Impact of oil price on economic growth: a study of Bric nations" the author employed an empirical analysis to examine the impacts of oil price on GDP of the four largest fast growing emerging economies Brazil, Russia, India and China known collectively as the BRIC countries using a sample of observations from 1987 to 2014 (Negi, 2015). Using Ordinary Least Square (OLS), The Fixed Effect Model (FEM) through the Hausman test, to find out impact of petroleum oil price on GDP, the result showed that, overall, the price of oil had a positive relationship with GDP. The negative coefficient values of China and India showed that, increases in price of oil had a negative relationship with GDP while positive coefficient values of Russia and Brazil depict the positive impact of increased oil Prices on GDP.

Hence the observed opposing results within the same data set showed that for Brazil and Russia, which principally oil exporting countries are, higher oil prices related positively with GDP while the opposite was the case for China and India which are oil primarily importing nations. Although this is not primarily an oil to debt scenario there was sufficient room to expand the argument that this relationship when extended to oil importing developing countries like Zambia could explain the high debt levels being experienced due to high oil expenditures.

In their paper "Energy prices and economic growth in Pakistan", the researchers empirically examined the impact of energy prices on economic growth in Pakistan using various channel variables where a macro econometric model was estimated using Generalized Method of Moments (GMM) estimation technique using quarterly data for the period 1991–2011 (Arshad, et al., 2016).

The study indicated that the overall effect of energy prices on growth is negative, confirming results from existing empirical literature for Pakistan. They found evidence

that high energy prices decreased real interest rates, investment and stock prices. They also decreased the real value of local currency, put pressure on government expenditures and increased unemployment in the country (Ibid).

It was further revealed that energy prices positively affected output growth through their impact on real interest rate and government consumption, while they negatively affected output growth through investment, stock prices, real exchange rates and unemployment. Most of the effect of energy prices on economic growth were captured by stock prices, real exchange rates, government consumption and unemployment. In turn, real interest rates and investment captured a small effect of energy prices on economic growth. The study highlighted that to improve economic growth, policy makers in Pakistan had to design appropriate policies to control energy prices and to plan energy conservative policies that would motivate the exploration of alternative energy sources to meet high energy demand in Pakistan (Arshad, et al., 2016)

The study established that for Pakistan, the impact of high oil prices revealed itself through real interest rates and government consumption, investment, stock prices, the real exchange rate and unemployment with real interest rates and government consumption impacting negatively on national productivity while the remaining variable impacted positively. In this research the variables of interest were real interest rates and government consumption, and investment because our study included these variables in the model in order to capture their effect on national debt in the Zambian case. It was of interest to see if the impact on GDP (and the underlying debt) would be the same as that of Pakistan which is an equally indebted country.

2.4.4 Debt and Petroleum – Europe

In same regard Yetkiner and Berk (2013) attempted to derive and test the role of energy prices on economic growth for a group of countries, comprising Australia, Austria, Belgium, Canada, Denmark, France, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, and the United Kingdom where they used data on real GDP per capita, energy consumption per capita and composite energy prices for the period 1978 to 2011.

The model revealed that the growth rate of energy prices had a negative effect on the growth rates of energy use and real GDP. This was consistent with the results obtained

by Van Zon and Yetkiner (2003), in a similar study where the same model placed energy as an input in the intermediate goods sector and the theoretical relationships between energy prices and economic growth and energy consumption tested empirically using error-correction based panel cointegration tests and panel Autoregressive Distributed Lag (ARDL) approach on annual data of composite energy prices, GDP per capita and energy consumption per capita for the fifteen countries for the period between 1978 and 2011.

The approach found significant cointegration between energy prices and real GDP per capita as well as between energy prices and energy consumption per capita. Moreover, long-run elasticity estimates revealed a negative and significant impact of composite energy prices on both GDP per capita and energy consumption per capita.

This study had an indirect bearing on the problem being investigated in this research in the significant and negative impact of energy prices on GDP per capita though composite energy prices were used where there was no separation from petroleum energy prices. The general direction was that the negative impact on GDP could indirectly hinted a positive impact on debt or debt service.

Hence a common trend emerged for the negative impact of rising oil prices and hence expenditures on GDP performance of many nations in the developed world. Though Barsky and Killian (2004) argued on the contrary in their earlier study for the United States, subsequent studies like the ones by Yetkiner and Berk (2013) tended to overrule their arguments when wide cross section based studies were done. But the above quoted studies did not really narrow into the oil price – debt problem that this study wished to establish. They were however quoted because there is always an underlying factor of similarity between reduced national productivity and national external debt. Zambia having quite somehow similar macroeconomic variables but different in form and magnitude could be having similar or different results in the impact of oil price changes on GDP and as implied, national external debt. This study desired to establish that fact.

2.4.5 Debt and Petroleum – Oceania (Australia and New Zealand)

To get a wider view of the petroleum to national debt scenario the study further looked at the position of two typical Oceania countries which are Australia and New Zealand.

According to the CEIC Data (CEIC, 2020), Australia's National Debt reached US$1,700,271.4 Billion in Jun 2020 accounting for 124.0 % of the country's Nominal GDP in 2019, compared with the ratio of 122.6 % in the previous year with the Current Account recording a surplus of US $11.6 billion and Foreign Direct Investment (FDI) increasing by US$1.6 billion. The country's direct Investment abroad expanded by US$727.6 million while its Foreign Portfolio Investment fell by US$16.1 billion.

But according to the sources from the treasury there is no indication of the debt having any major component(s) which are petroleum related though Australia being a producer of petroleum oil, is a major importer as well (Marco, et al., 2010). Its debt is a composite of other factors like the Commonwealth Government Securities (Treasury Bonds) and other factors which are historical like the Second World War effort.

According to Statistics New Zealand (Statistics New Zealand, 2018), the country had a Net national debt of US$ 138.9 billion in the year 2015 whose major composites were Government borrowing, Inter-Company Borrowing and Banks Overseas Borrowings. The country's oil and gas sector was reported to be contributing over US$2.5 billion to Gross Domestic Product (GDP), with the Government collecting an approximate US$650 million in royalties and tax from the sector annually, and oil exports are totalling around US$750 million per year. Hence the study didn't find any directly evident national debt components arising from petroleum imports.

2.4.6 Debt and Petroleum – The African Perspective

In order to establish more knowledge in the study area, review of literature shifted attention to African countries in view of the fact that not many of them are oil exporting countries and the few oil exporting countries are still embroiled in a lot of debt and have relatively high poverty levels.

2.4.6.1 North Africa – Morocco, Egypt and Tunisia

The first country to look at was Morocco which is a relatively very small producer of petroleum. Morocco holds a petroleum production ranking of being 97th in the world and accounting for about 0.000% of the world's total reserves and hence a net importer (Worldometer, 2020). According to the Moroccan World News bulletin, Morocco's national debt was recorded at $34 billion by the third quarter of 2019. The statistics showed that the North African country had been faced an with an external debt of more than $30 billion in 2014 which had been gradually increasing throughout the following six years to reach nearly $36 billion in 2019 and then reduced to just a bit more than

$35 billion in the second quarter of 2019, to move downward slightly to $34 billion by the third quarter.

The study found no hard evidence of Moroccan debt being dependent on petroleum prices. In his report on Moroccan debt levels. Abuzaid (2011) noted that in countries such as Morocco debt service became the main reason for new borrowing which sustains real interest rates at high levels such that as the stock of debt grows at these compounded rates, debt service tends to exceed new borrowing and when this exceeds the amortization component of the debt service the debt stock continues to grow (Abuzaid, 2011).

Another North African country the study took an interest in was Egypt. According to Trading Economics (2020) Egyptian national debt in decreased to US$111.3 billion in the first quarter of 2020 from US$112.7 billion in the fourth quarter of 2019. Previously the Central bank had been reporting that the national debt was $29.6 billion between July 2018-March 2019 after the receipt of received four billion dollars from the International Monetary Fund (IMF), four billion dollar bonds from foreign investors, a $2.9 billion supplier and buyer credit, and $13.6 billion from Club de Paris (Independent, 2020). Egypt in terms of oil production was ranked 27th in the world and exporting 25% of its total production.

The sources of Egyptian debt are not so much revealed though some sources claim that they could be due to the religious political upheavals which tend to rock the country's social atmosphere. Nevertheless it was found that no corresponding empirical evidence existed to link Egyptian national debt to petroleum import prices. The study by Abuzaid (2011) however gave a common reason as that which was noted for Morocco which was that of debt service.

Belguith (2015) offered an econometric investigation of the macroeconomic determinants of public debt in Tunisia using Vector Error Correction Model (VECM) for the period 1986-2015. His dataset comprised annual macroeconomic data for Tunisia, over the period 1986-2015.

His empirical analysis based on the final equation estimated in the model was given as:

$$\text{Debt}_t^j = \text{GDPgrowth}_{t-1}^j + \text{gfcf}_t^j + \text{tgdp}_t^j + \text{INFL}_t^j + \text{DB}_t^j + \text{rir}_t^j + \mu_j + \delta_j + \varepsilon_{jt}$$

Where public debt-to-GDP growth rate was regressed on GDP growth, lagged GDP, Gross fixed capital formation (gfcf), openness (tgdp), inflation (infl), budget deficit (Db), real interest

rate (rir). The dependent variable in the analysis was the public debt-to-GDP growth rate. It also included the μ_j the country-specific fixed effects and δ_j time-fixed effects and ε_{jt} the unobservable error term. The VECM was specified as:

$\text{Debt} = \alpha_0 + \alpha_1 \text{tce}_{-1} + \sum_{i=1}^{k} \beta_i \Delta \text{Db}_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta \text{gfcf}_{t-1} + \sum_{i=1}^{k} \delta_i \Delta \text{rir}_{t-1} + \sum_{i=1}^{k} \varepsilon_i \text{infl}_{t-1} + \sum_{i=1}^{k} \theta \text{tgdp}_{t-1}$ with tce_{-1} being the error correction model.

The results of the full sample analysis revealed that inflation and gross capital formation (investment) reduced the value of public debt. However, real interest rate, budget deficit and trade openness increase public debt. The study showed that the budget deficit was the most important determinant of public debt in Tunisia.

Hence our study did not equally find a petroleum imports component in Tunisian national debt.

2.4.6.2 West Africa – (Nigeria and Ghana)

Where existing literature puts a controversial picture in which a nation's resources fail to give the expected boost to the developmental needs of a country is the case of Nigeria. Kretzmann and Nooruddin (2009) noted that for the largest crude oil producer in Africa oil revenues have apparently not reached the majority of Nigeria's citizens. The World Bank estimated that 80% of revenues from Nigeria's oil industry accrue to only 1% of the general population. The revenue windfall from the first oil shock in the 1970's led to significant increases in government expenditures which were designed to expand infrastructure and improve non-oil productive capacity as well as to finance imports of capital-intensive technology and industries necessary for industrial development.

The global fall in oil prices and the rise in global interest rates in the early 1980s brought about a rapid increase in the existing debt stock, and a fall in from oil export revenues from US$23.4 billion in 1980 to less than $10.2 billion in 1983. On the other hand debts obtained during the oil price boom in the 1970s came due. In the global oil glut of the 1980s, Nigeria was severely over- indebted. Kretzmann and Nooruddin noted that the government was incapacitated from handling the crisis as a result of the external constraints brought by the structural adjustment, political realities and the internally socially entrenched corruption. This made all the required adjustments for debt handling to be continuously postponed making the country credit worthiness to fall.

As such when Nigeria's attempts to acquire more debt from the international market were turned down by the cautious external creditors, it sought IMF assistance and for over the following twenty years, from 1985 to around 2005, Nigeria's debt policies were never consistent. Being not able to service its national debt made Nigeria to temporarily put off all national debt payments, leading to a rapid pile up of national debt arrears such that even after resuming and putting a cap on its annual debt servicing payments these payments still leaves the country in arrears.

The Nigerian public debt report, released by the Debt Management Office (DMO), revealed that Nigeria's total debt stock as at June 2020 stood at US$85.9 billion showing an 8.31% increase when compared $79.3 billion recorded in March 2020. The breakdown showed that total national debt stood at $31.47 billion accounting for 36.65% of the total debt stock, while domestic debt represented 63.35% of the total debt (Oyekanm, 2020). As of 2019 Nigerian debt service bill was around US$5.1 billion (WB, 2020)

According to Kretzmann and Nooruddin (2009) comparing Nigeria's high levels of debt to its vast petroleum and natural gas reserves there are two proposed reasons as to Nigeria's inability to reschedule its debt at more favourable terms. Firstly is the reason of export diversification inability which has made Nigeria's terms of trade to be a shadow of the price of oil such that given high oil prices, the high oil revenues tend to disguise the underlying structural problems with Nigeria's economy. But, when the oil prices fall, there is inability for Nigeria to effectively manage the resultant economic crises. Secondly, but inseparable from the first point, the perceived economic risk for Nigeria is quite high which is shaped by an apparent inability of the government to adjust to the high real interest rates that the oil price squeeze impacts on the oil export dependent nations occasionally.

So for the Nigerian situation the national debt problem is quite petroleum price dependent but like or unlike the Zambian situation the Nigerian one seems "Dutch Disease" oriented where oil price rises bring about booms which bring about reductions in other sectors productivities such that when the oil prices fall the other sectors have no effective export revenue capabilities forcing the government to resort to borrowing due to excess revenue decreases and the carried over debt burden exhibited by debt servicing.

Another West African country, where literature was reviewed, is Ghana a gold, cocoa and oil exporting country. The Ghanaian central bank reported the country's national debt to have increased to around US$24 billion in the second quarter of 2020 from around US$22.9 billion in the first quarter of 2020. The national debt service figure for Ghana as of 2019 was US$1.9 billion (WB, 2020)

As of 2016 the Jubilee Debt Campaign was reporting Ghana as being in a debt crisis despite having had significant amounts of debt cancelled in the previous decade resulting into the country spending almost about 30% of government revenue in national debt payments each year but with these huge payments being made possible by Ghana being more indebted with more loans from institutions such as the International Monetary Fund (IMF) being used to pay the interest payments on previous debts to lenders, whilst the overall size of the debt, naturally, increases. (Jubilee Debt Campaign, 2016)

This debt crisis for Ghana's was seen as being the result of the incipient increase in lending and borrowing transactions resulting from the discovery of petroleum oil in Ghana in 2011 and the fall in commodity prices where more money was borrowed after the fall in the price of oil and other commodities since 2013.

The Jubilee Debt Campaign further underscored the Ghanaian return to a debt crisis as being underlain by continued dependence on commodity exports, as well as irresponsible borrowing and lending where new debts do not generate sufficient revenues to enable them repayment of the debts.

So as with its neighbouring oil exporting country, Nigeria, Ghana seems to have been caught up in the petroleum – debt nexus as a result of the petroleum price "Dutch Disease" oriented where oil price rises bring about booms are seconded with price falls which make the repayment of previous debts on to be possible with further debts.

There is a contra similarity in the West African states debt crises with the Zambian debt crisis in that they all tended to rise after the debt pardon. With the Western African countries, however, there is a noticeable pattern of debt levels tending to be directly or indirectly related to the oil export prices. But with the Zambian situation the study was

as yet to make a decisive conclusion of whether the country's debt position as concerned petroleum import prices.

Edo, Samson & Emina, A. (2010) in their "Comparative Analysis of the Effect of Oil Price Increase on Economies of ECOWAS Countries", sought to establish and balance the effects of oil price increase in ECOWAS countries' economies and found mixed results. The results from the impulse responses or the results from shocks showed that the increase reduced household consumption in four countries, marred economic growth in five countries, expedited inflation in seven countries, and raised exchange rates in all the countries thus bringing rapid deterioration of the current account balances to nine countries.

The debt variance decomposition estimates exhibited highly intensive impact concentration on one variable in eight countries while in the remaining three countries the impact was fairly spread across all the variables. It was as such imperative for countries that were highly reactive to oil price increases, and indeed all ECOWAS countries, to prospect into alternative sources of energy such as coal, ethanol, gas, solar energy, etc. which could significantly mitigate the adverse effect of oil price increases in these countries**.**

The mixed results from this study could be explained by the fact that within ECOWAS countries were a mixture of oil importing and oil exporting countries.

2.4.6.2 East Africa – (Kenya, Uganda and Ethiopia)

The study further sought comparative scenarios in the petroleum - debt nexus by looking at one particularly outstanding country, economy wise, which is Kenya. According to CEIC Data Kenya's National Debt reached US$33.0 billion in Jun 2020, compared with US$ 32.8 billion in the previous month with the composition of Kenya's debt changing significantly through increased borrowing from external commercial sources such as Eurobonds and from loans from commercial banks (CEIC, 2020).

The share of national debt from multilateral lenders such as the World Bank and the African Development Bank had reduced significantly such that between 2012 and 2019, the share of debt from external commercial sources to the total debt grew from 3

percentage points to 18 percentage points among all the debt sources. During this same period debt from multilateral donors dropped by 10 percentage points. This was quoted to be the most significant change in Kenya's national debt structure (Kinuthia & Rugo, 2020). As concerns the country's debt service in 2019/18, Kenya's debt service was reported to be excessively comprising domestic debt repayments amounting to 69 percent of the total as compared to 31 percent for external debt. Gradually, however, this position shifted significantly in 2018 with the share of national debt servicing rising from 31 percent to 48 percent.

Despite Kenya having recently discovered oil deposits in 2012 and making its first exports in 2019 (Akwiri, 2019), the study found no notable evidence of Kenya's national debt being dependent on petroleum oil prices. This is probably because the share of the cost of expenditures on petroleum is relatively not that large due to Kenya's geographical proximity advantage to the Mid-East, the source of their petroleum and the non-landlockedness of the East African country which makes the land transportation oil price component much lower.

The study looked at yet another East African country which is landlocked, in this case, and this is Uganda a coffee exporting country but which of late has had proven petroleum deposits of about 6.5 billion barrels with at a minimum of 1.4 billion estimated to be economically recoverable, though tangible exports have yet to begin. As of 2019 the World Bank reported Uganda's national debt to be around US$ 13.97 billion (WB, 2020).

Mbire and Atingi (1997) attributed the rise in the growth of Uganda's debt to the world petroleum price shocks originating from the 1970s through the increase in petroleum import prices due to oil shocks, the deterioration in the terms of trade and the resulting fall in export earnings compounded by the growth in debt arrears brought about by the decline in coffee prices which not only greatly affected the foreign reserves earning capacity but the sustenance ability of the servicing of national debt obligations. In addition the national debt position was further exacerbated by highly expansionary fiscal deficits and high levels of donor financed development expenditures (Mbire & Atingi, 1997).

Hence the study saw an indication of Uganda's national debt being influenced by petroleum prices to some extent and though this was not the only cause it was one of the contributing causes.

Odhiambo et al, 2020 examined the impact of oil prices on the short and long run economic growth of seven low-income oil-importing sub-Saharan African (SSA) countries, namely Ethiopia, Gambia, Mali, Mozambique, Senegal, Tanzania and Uganda, using Panel-Auto Regressive Distributive Lag (P-ARDL). Their results revealed that oil prices did not have a significant impact on economic growth in the short run for the group, but had a negative significant impact in the long run, though the short-run country coefficients showed that oil prices had a significant but mixed effect on economic growth in all the seven countries.

Using the Non-linear Autoregressive Distributed Lag (NARDL) model, the authors also examined the asymmetric effect of oil price on economic growth by decomposing oil prices into negative and positive changes which had the advantage of examining both the long-run and short-run asymmetric effects of real oil prices on growth. It was found that a decrease in oil prices had a positive and significant impact on growth, while oil price increases has a significant negative effect. In addition the error correction terms were negative and statistically significant for both the pooled mean group (PMG) and five of the countries in the short-run country coefficients. It was recommended, therefore, that it would be important for policymakers to explore and implement efficient energy policies and employ technological advancement policies to mitigate oil price risks, especially in the long run (Ibid)

Though not a direct oil import to debt study, economic growth changes are usually a good proxy for nations' debt positions with increasing growths indicating decreasing debts and vice versa. The above study is a good indication of the oil debt nexus for oil importing African countries and was be a fitting comparative example for the Zambian scenario in our study where rising oil prices are expected to negatively impact the economy and increase the national debt while declining oil prices would be expected to work in the opposite direction**.**

Beyene and Kotosz (2015) using an ARDL model examined the macroeconomic determinants of the external indebtedness of Ethiopia between 1981 and 2016, using the two and three-gap models as a theoretical framework and an autoregressive

distributed lag bound testing approach. They identified the macroeconomic variables: the savings-investment gap (S–I), the trade deficit (TRDEF), the budget deficit (BDDEF), debt service (DSR), the growth rate of major advanced countries (GRMAC), inflation (INF), trade openness (OPPN), and GDP growth rate (GDPGR)

Their ARDL model took the form:

$$\Delta ED_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \, \Delta ED_{t-1} + \sum_{i=0}^{q} \delta \, \Delta (S-I)_{t-1} + \sum_{i=0}^{r} \gamma \, \Delta TRDEF_{t-1} + \sum_{i=0}^{s} \mu \, \Delta BDDEF_{t-1} + \sum_{i=0}^{t} \rho \, \Delta DSR_{t-1} + \sum_{i=0}^{u} \varphi \, \Delta GRMAC_{t-1} + b_0 ED_{t-1} + \sum_{i=0}^{v} \omega \, \Delta INF_{t-1} + \sum_{i=0}^{w} \sigma \, \Delta OPPN_{t-1} + \sum_{i=0}^{x} \tau \, \Delta GDP_{t-1} + b_1 (S-I)_{t-1} + b_2 TRDEF_{t-1} + b_3 BDDEF_{t-1} + b_4 DSR_{t-1} + b_5 GRMAC_{t-1} + b_6 INF_{t-1} + b_7 OPPNF_{t-1} + b_8 GDP_{t-1} + v_t$$

Where, b_1, b_2, b_3, b_4, b_5, b_6, b_7, and b_8 were the long-run multipliers, α_0 was the drift (constant term), and the coefficients of lagged values of differences of the variables show the short-run dynamic structure. Furthermore, Δ was the first difference operator, while p, q, r, s, t, u, v, w and x were the lag orders of the ARDL model using Akaike information criterion (AIC) Schwarz - Bayesian information criteria (SBC)..

The results revealed that in the long run, the savings-investment gap, trade deficit, fiscal deficit, and debt service had a positive and significant impact on external indebtedness. However, the growth rate of gross domestic product, trade openness, and inflation negatively and significantly affected the external indebtedness of the country.

From this study we, equally, do not see any petroleum related variable(s) contributing to the Ethiopian indebtedness. However we see the growth rate of gross domestic product negatively and significantly affecting the external indebtedness of this country.

2.4.6.3 Debt and Petroleum – SADC (DRC and Zimbabwe)

As a further effort in the search for evidence of the petroleum import prices on external debt, the study looked at SADC countries in the African Central and Southern regions**.** The first country the study looked at was the Democratic Republic of Congo (DRC). The DRC is not just an oil exporting country but has also a wide range of mineral exports ranging from copper to high value mineral like diamonds, gold, oil, tin, tantalum, tungsten, zinc phosphates and uranium. The World Bank reported that the DRC's national debt fell from around US$12.3 billion in 1995 to around US$5.4 billion in 2019 (WB, 2020) with the national debt to GDP ratio falling from around 283.91% in 1999 to 11.85% in 2019 (The Global Economy, 2020). This showed a remarkable decline in national debt probably made possible by the huge foreign reserves earnings

by the DRC with the Initiative For The Transparency of Extractive Industries (EITI) reports revealing foreign exchange revenues from the mining sector exceeding those of the petroleum oil and natural gas sectors in 2010 with 63% of the US$875 million being generated from the mining sector. In addition this sector generated US$1.68 billion in 2019, accounting for 17,40% of GDP, 55,16% of total government revenues, 99,3% of total exports and a quarter of total employment (EITI, 2020).

The DRC is one of Africa's earliest petroleum producer with operations beginning in 1972 and is ranked the fifth African producer, after Nigeria, Angola, Gabon and Equatorial Guinea. It had an output of 81.7 million barrels in 2003 with guaranteed reserves of 1.5 billion barrels. The oil sector used to account for half of GDP and 80 per cent of total export earnings, dominated the economy until of late that the minerals sector has dominated (ibid). However the commodity boom of 2007 was disturbed by decades of political instability, military conflict, corruption, looting and mineral smuggling which decimated the mining sector, and with this having been the DRC's engine of economic growth, left large liabilities for its state-owned enterprises (SOEs) to the government. Hence in spite of the country's vast natural resources it was estimated that about 63% of the 75 million Congolese citizens lived below the poverty line of less than one dollar per day as of 2012. (World Bank Group, 2015).

Hence the national debt that the DRC might have cannot be so much associated with import prices of petroleum but rather to the non-productive and unstable political and military conditions coupled with the kleptocratic state of affairs in the running of the productive sectors of the economy. It would be misleading to pick much conclusions as to the relationship between petroleum prices and national debt in the case of the DRC.

The other SADC state that the study picked for some insights in the petroleum prices to petroleum nexus is Zimbabwe because its landlockedness similarity with Zambia. The African Forum and Network on Debt and Development (AFRODAD) reported Zimbabwe's national debt to have increased to US$14.324 Billion in 2019 from US$13.134 Billion in 2018 (AFRODAD, 2018)

With the end of the liberation war the Zimbabwean government took over the colonial Rhodesian government's debt estimated around US$700 million. Faced with post war reconstructions and the drought for the first decade the national debt rose to ZW$7

billion by 1989 due to the country borrowing at high interest rates from the International Bank for Reconstruction and Development (IBRD) due to Zimbabwe being categorised as a middle income economy. In 1991 the government of Zimbabwe sought economic liberalization of the economy at the advice of the International Monetary Fund (IMF) and the World Bank (WB) which contributed to the government accumulating a total of US$4.750 Billion in debt (Ibid).

The 2000 decade marked the beginning of the defaulting in debt obligations by the Zimbabwean government resulting into the disqualification from the lines of credits in respect to the international financial institutions and the western countries making the Zimbabwean government to turn to domestic borrowing which saw the domestic debt increasing to ZW$15.9 trillion in 2005 with the macroeconomic environment being dominated by hyperinflation, stagnated GDP growth, increasing unemployment and political instability which further fuelled the Zimbabwean public debt to US$4.1 billion around 2006 with slightly 50 percent of that attributed to arrears. Domestic debt was US$276 million as of 2012. However, as of 2018 the total public debt was estimated around US$18 billion with both external both external and domestic debt showing an increasing trend with domestic debt being 50 percent of the total public debt (Ibid).

The 2019 International Debt Statistics showed that China accounted for nearly one quarter of the combined national debt stock of low- and middle- income countries at end 2017. With respect to the African continent national debt stock, China accounted for slightly above 20 percent of the national debt stock as of 2017 which in the case with Zimbabwe China investment accounted for 32.67 percent of the national debt stock as of December 2018 (Ibid).

The major reasons for Zimbabwe's national debt have been the fiscal space challenges which have been associated with poor governance, shrinking annual revenues and international isolation from the western countries in form of sanctions which has led to ever increasing public debt.

This however does not rule out the impact of petroleum prices on the Zimbabwe's debt because the Research Department at the African Development Bank (AFDB) developed a model to quantify the impact of high oil prices on oil-importing and oil exporting African economies based on a dynamic stochastic general-equilibrium model of a small

open economy particularly adapted specifically to the context of oil and African economies with sufficient flexibility to represent virtually any African country like Zambia. It was particularly, configured to describe oil importers and oil exporters, credit constrained economies and those that have access to international financial markets, and countries with flexible, managed, and fixed exchange rate regimes where the economy consists of households, firms, a government, and a monetary authority with four types of goods: final, composite non-oil, oil, and intermediate goods (African Development Bank & ESMAP, 2009).

The median oil-importing economy was calibrated such that oil imports represent roughly 13 percent of total imports and 5 percent of total GDP in the steady state. (Typical of the Zambian scenario at 14.14%). The results of the model discussed the impact of a doubling oil prices on the main macroeconomic variables both in the case of a median oil-importing economy and a median oil-exporting economy where the variables of interest were output, consumption, inflation, real exchange rate, government budget deficit, and foreign debt with simulations performed under both a fixed exchange rate regime and a managed float. In all simulations, the oil price shock was assumed to be persistent, with a first-order autocorrelation coefficient of 0.85, as estimated from the data

Under complete pass-through, there were only minor differences in the response of output, consumption, inflation, and, to a lesser extent, foreign debt across the two regimes. The gain from letting the nominal exchange rate float was much more apparent under zero pass-through. For example, output initially increased by almost 2 percent (as opposed to a decline of 1 percent under a fixed rate regime) following the rise in the price of oil, and the cumulative loss after five years is barely over 1 percent (as opposed to a loss of 5 percent under a fixed rate regime). This smaller output loss was explained as being due to the larger depreciation of the real exchange rate relative to the case with pegged nominal exchange rates. Under a managed floating exchange rate regime, the nominal exchange rate is, to a certain extent, free to adjust, thereby acting as a shock absorber. In principle, therefore, the adverse effects of high oil prices should be less severe under a floating exchange rate regime compared to the case with fixed exchange rates. (See Tables 10 and 11 in Appendix I)

This model's generalized simulation captured the increase in debt for the median African oil importing country at 11% to 12% after a five year span given a 100%

increase in the price of oil but does not deal with the Zambian scenario specifically to allow us to make a concrete conclusion as to the exact relationship between Zambian oil expenditures and debt in relation to other macroeconomic variables not covered in the model but as already explained the model was dealing with a typical representative median oil importing economy and as such would be quite indicative of the Zambian case as well. The study aimed at verifying such possibilities.

For the SADC region the studies done in the oil debt nexus are relatively few and the ones done look at a collection or group of countries and seldom for individual countries like Zambia per se. The most notable study done was by Nkomo (2006) in his "The impact of higher oil prices on Southern African countries" who noted that most Southern African countries are completely dependent on imported oil as a primary energy source and as a consequence highly vulnerable to oil price shocks with oil price increases having outstanding impacts on the nations' levels of real gross GDP and economic performance because the oil price increases reduce the nations' output, altering expenditure and production structures thus shifting the economies to a lower economic growth path.

His analysis looked at energy and development to understand the economies being discussed in relation to the price of crude oil and then showed his methodology for looking at vulnerability. The Southern African countries considered all fell within the Southern African Development Community (SADC) and for the most part, his observations ranged from 1994, when South Africa won its first democratic elections, to 2003 as determined by data availability. His study covered Angola, DRC Congo, Malawi, Namibia, Swaziland, Zimbabwe, Botswana, Lesotho, Mozambique, South Africa and Tanzania.

He used the Bacon and Mattar (2005) methodology, to determine the magnitude of the oil price shock; thus:

$OV = (M_L * P_L) / GDP$ …….(1)

$= P_L * (M_L / \square L_u) * (L_u / \square E_u) * (E_u / GDP)$……(2)

Where:

OV = Oil vulnerability

M_L = Volume of net oil imports (oil consumption minus oil production)

GDP = Gross domestic product

P_L = Price of oil

L_u = Total oil use

E_u = Total energy use

Manipulating expression (1) brings out the following ratios that allow the estimation of oil vulnerability sub components, thus:

- M_L/L_u for oil import dependence
- L_u/E_u for dependence of oil as an oil resource
- E_u/GDP for energy intensity
- L_u/GDP oil intensity

For oil import dependence, except for Angola and the DRC, all the countries were highly exposed to vulnerability to oil shocks with estimated ratios $M_L/L_u = 1$, indicating that they were 100% reliant on imported crude oil. This heavy dependence or reliance on imported oil was further meshed with other country specific factors that revealed the impact of the oil shock and the limited resources for the countries to cope with it. Using data collected he hinted that this could be why "most of Southern Africa suffered from high external debts, high levels of human deprivation and income inequality and that almost all these countries have a significant proportion of their population below the poverty datum line of US $2 a day. These in turn implied that the low levels of economic growth in these countries could further be constrained to accelerate development and to achieve significant poverty reduction levels.

Nkomo further went on to evaluate the vulnerability ratios for dependence of oil as an oil resource, energy intensity and oil intensity which for large part are not so necessary for this study. But the underlying theme the study picked from Nkomo's findings was that for the SADC countries in general there could be a relationship between the extreme dependence on oil imports and the debt burden that they are currently carrying. This is what this study intended to verify in the Zambian case because in Nkomo's study the Zambia case apparently was omitted.

2.4.6.4 Debt and Petroleum – An African Overview

Appiah – Kubi et al (2022) investigated the key determinants of the direct and indirect impact on the rising level of public debt in Africa from a panel of 47 African nations utilizing panel data from forty-seven (47) countries from 2000–2018. The sampled African countries for the study included Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic (CAR), Chad,

Comoros, Congo (the Democratic Republic of the), Congo (Republic of the), Cote d'Ivoire, Egypt, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia and Zimbabwe.
Their functional model took the form:

$PBDTit = \beta 0 + \beta 1(CORR)it + b2(GOVIN)it + \beta 3(GOVC)it + \beta 4(MEX)it + b5(TAXR)it\beta 5(Control\ Var)it + \varepsilon i.$

Where their variables were defined as:
i- Selected countries of observation:. t - period of observation: 2000 . . . 2018, b0 - Intercept, PBDTit - Public Debt, CORRit - Level of Corruption, GOVINit -Government Investment, GOVCit - Government Consumption, MEXit - Military Expenditure, TAXRit - Tax Revenues Control Varit - a vector of control variable and εit - error/disturbance term.

Using the generalized method of moments (GMM) and fixed effects two-stage least squares (IV-FE) methodological approach the study confirmed that a rise in the corruption level led to an increase in the public debt in Africa. The findings additionally indicated that government investment enhanced the positive and significant association with public debt levels in the sampled countries while government consumption and tax revenue had a significant negative relationship with the levels of public debt in Africa. Lastly, their results revealed that military expenditures has a positive but insignificant relationship with public debt levels in Africa. In terms of policy recommendation, their study suggested African countries should intensify the fight against corruption and strengthen political and governance institutions that will help reduce public debt levels and promote economic growth and development.

Though Zambia was in this sample the study did not have petroleum imports or any petroleum oriented explanatory variable to link to the Zambian national debt. However the study did have an aggregate consumption proxy in government consumption and did mention that additional variables such as government expenditure were added to the baseline specification. So in as much as was seen, this study with such a wide sample set of African countries, did not have petroleum imports or prices as a notable variable to influence African national debt – Zambia included.

All the above studies tend to suggest that for non-oil exporting countries, generally, oil price increases and the resulting increased oil import expenditures tend to work out of favour with their level of economic development. From all the studies, however, there is none that undertakes to particularly pinpoint the actual relationship between petroleum oil imports and the level of national debt in the Zambian case which is why this study undertook the task of try to establish the long run relationship between the two macro variables.

Globally in their study "Drilling into Debt - An Investigation into the Relationship Between Debt and Oil", the researchers used a cross-national time-series analysis using a Generalized Method of Moments (GMM) and a comparative Least Squares Dummy Variable (LSDV) estimator model to examine the relationship between oil and debt. To do so, they collected data on 161 countries for the period 1991-2002, and collected further data on 88 developing countries for the period 1970-2000 for use in a statistical model of debt burdens of both oil exporting and importing countries. Their variables of interest in this study were National Debt, Debt Service, Oil Production, Net Energy Imports, Trade Openness, Size of Economy, Growth, Change in Liquidity and Democracy (Kretzmann & Nooruddin, 2009).

Their key findings were that firstly (and surprisingly) increasing oil production led to increasing debt because there existed a strong and positive relationship between oil production and debt burdens exhibiting that the more oil a nation produces, the more debt it tends to generate.

Secondly increasing oil exports led to increasing debt as there existed a strong and positive relationship between oil export dependence and debt burdens showing that the more dependent on oil exports a country is, the deeper in debt it tended to have.

In addition increasing oil exports improved the ability of developing countries to service their debts as there existed a strong and positive relationship between oil exports and debt servicing showing that the global oil economy tends to improve the ability of countries to make debt payments, but at the same time increasing their total debt.

As a fourth finding they reported that increases in oil production tended to predict increases in debt size where, for instance doubling a nation's annual production of crude oil predicted to increase the size of its total national debt as a share of GDP by 43.2 per cent. Similarly, the same change was predicted to increase a nation's debt service burden by 31 per cent. In the case of Nigeria, for instance, where the

government planned to increase oil production by 160% by 2010, the past trends indicated that Nigeria's debt could thus be expected to increase by 69%, or $21 billion over the following six years.

Lastly the study revealed that World Bank programs designed to increase Northern private investment in Southern oil production in multilateral and bilateral "aid" for oil exporting projects in the South had exacerbated, rather than alleviated debt. An examination of those countries where the World Bank Group conducted "Petroleum Exploration Promotion Programs" (PEPPs) revealed that debt levels (in terms of debt-GDP ratios) in those countries were 19% higher than those countries that did not perform this form of structural operation. (Kretzmann & Nooruddin, 2009)

Lastly the study explained that the relationship between debt and oil is most likely caused by the interplay among three factors:

- "Structural incentives for and direct investments in the oil industry by multilateral and bilateral institutions, such as the World Bank Group and export credit agencies."
- "Oil fueled fiscal misconduct both in the North by creditors over eager to lend to nations perceived as oil rich, and in the South by unwise fiscal policies".

Although this study by and large brings out the oil debt nexus problem it was done for oil exporting countries whose debt situations are brought about by international institutional financial misdirection and international fiscal misconduct rather than by the pressure of oil imports. But as was noted in the background and the statement of the problem it brings out that challenge as to whether, then, petroleum can be attributed to be the sole debt generating variable for the petroleum importing developing countries because even for the petroleum exporting developing counties the national debt aspect is there which can then point to other sources as well.

2.5 Emerging issues – Global Debt

In as far as the world debt database revealed for 2019, debt is a global phenomenon with both the rich and poor countries having a certain level of debt. Some rich industrialised countries have debt to GDP ratios of over 100%. These are countries like Japan (201.39%), Singapore 129.29 %, Italy (120.68%), Portugal (129.29%), Singapore (120.68 %), and apparently have the ability to repay while some do not have. Some not non-industrialised countries also have debt to GDP ratios over 100% or just close to 100%. These are countries like Lebanon (174.48%), Cabo (Cape) Verde (124.98%), Sudan (200.37%), Angola (109.21%), Angola (109.21%), Mozambique (104.38%), Angola (109.21 %), Barbados (118.83%), Zambia (91.9%), and Jamaica

(94.28%). These are a mixed case scenario with some of them being petroleum producers and may have the capacity to repay the debts while some of them are not and may not be so debt sustainable pointing to possible default or debt forgiveness for them to eliminate the debt. What is of concern to for this study is to analyse whether the national debts so acquired have a petroleum importation problem in them but particularly for the country of interest which is Zambia.

Another more intriguing matter which many studies have not bothered to analyse is that the debt to GDP ratios may not necessarily point to the petroleum imports as the exact debt causing factor. Looking at the high debt to GDP ratio nations we find that we have a mix of petroleum exporting and non-petroleum exporting countries. Countries like Japan (201.39%), Singapore (129.29%), Greece (189.92%), Italy (130.59%), Belize (105.08%), Sudan (200.37%), Angola (109.21%), Barbados (118.83%) and Bahrain (103.36) are oil producing and exporting countries. But countries like Bhutan (104.4%), Cyprus (135.34%), Portugal (120.68%), Cabo (Cape) Verde (124.98%), Mozambique (104.38%) and Lebanon (174.48%) are non-oil exporting countries. One would be of interest to understand how and why the petroleum exporting countries would have such a high debt to GDP ratios.

Equally an analysis of countries with low debt to GDP ratios (Below 30%) we find a mix of both petroleum exporting and non - petroleum exporting countries. Nations like Azerbaijan (17.7%), Brunei Darussalam (2.58%), Chile (27.91%), DRC Congo (14.75%), Kazakhstan (18.48%), Nigeria (26.46%), Peru (23.2%), Russian Federation (13.11%), Uzbekistan (29.32%), Federated States of Micronesia (17%), Uzbekistan (29.32%), Solomon Islands (8.91%), Bulgaria (25.55%), Czech Republic (28.52%), Denmark (26.45%), Estonia (9.62%), Norway (14.39%), Saudi Arabia (22.79%), and UAE (27.27%) are petroleum exporting countries.

But nations like Afghanistan (6.13%), Kosovo (17.53%), Luxembourg (16.72%), Moldova (24.99%), Paraguay (21.1%), Botswana (14.74%), Cambodia (28.61%), Comoros (25.24%), Taiwan (28.21%), Kiribati (18.34%), and the Marshall Islands (22.63) are non-petroleum producing and exporting countries. One would be of interest to understand how these non-petroleum exporting countries end up with such a low debt to GDP ratios.

Hence the tendency by scholars to make wide conclusive statements on the relationships between debt and petroleum through wide panel data studies encompassing many countries may have misleading consequences and this is the reason why the study was poised to find out if at all Zambia at 91.9% debt to GDP ratio had landed into this position due to petroleum imports.

2.5.1 Emerging issues – Debt and petroleum

What was deduced from the above studies were best interpreted in a case by case interpretational recap. For the North American scenario the cost of energy was too small a percentage of GDP to explain the reduced productivity so as to even link the cost of petroleum to external debt. An analysis of alternative channels of transmission that impacted through some other macro variables which effected on national productivity revealed that one of them being higher oil prices tended to make energy-inefficient capital obsolete resulting in none unmeasured declines in the capital stock, which reflected like a reduction in productivity when data was collected. The two nations (America and Canada) being major oil producers are most unlikely to have had a national debt position being influenced by petroleum imports.

From the Southern American perspective, the position on Brazil somehow reflected the petroleum effect on its national debt position. Nonetheless, being a petroleum exporting country, improvements on Brazil's national debt position were notably indisputable as studies showed a positive relationship between oil prices and GDP. There was no noticeable evidence of Chile, a copper exporting country like Zambia, having petroleum related national debt positions despite Chile being a major petroleum importing country.

The comparative study on the Asian and "Bric" nations, though not a petroleum – debt analysis brought out some mixed results with some of them recording positive relationships between petroleum prices and GDP (and thus probably negative relationships between petroleum prices and external debt) for Russia and Brazil while bringing out a negative relationship for India and China. Similar were the results for Pakistan. The fact that the studies were petroleum price GDP oriented leaves a gap, in this case, on the debt to petroleum price nexus.

The results for the Oceania (Australia and New Zealand) nations brought out a non-petroleum related national debt position which seemed to be typical of most petroleum exporting economies.

The African context brings out a mixed results position with the sampled North African countries Morocco and Egypt bringing out no petroleum related external positions while for the West African sampled countries, Nigeria and Ghana we see a lot of petroleum price related national debt positions though they are petroleum exporters.

In the East African context the two sampled countries equally brought out a mixed result scenario with Kenya having no evidenced petroleum price related national debt while for Uganda indications existed of petroleum prices being one of the major contributing causes of external debt. It remains to be seen how the current discoveries of petroleum deposits in Uganda will impact the country's national debt position.

In the SADC context equally mixed outcomes are brought in the study where for the DRC, a major petroleum exporting country national debt was not so much associated with import prices of petroleum but rather to the non-productive and unstable political and military conditions coupled with the kleptocratic operations of the productive sectors of the economy making it so potentially misleading to emphatically conclude on the relationship between petroleum prices and national debt in the case of the DRC.

The Zimbabwean case is a prolonged one with the underlying causes for Zimbabwe's national debt notably being the fiscal space challenges associated with international isolation from the western countries in form of sanctions, poor and dictatorial governance and shrinking annual revenues which led to increasing public debt. The studies undertaken by Nkomo (2006) and The African Development Bank (2009), though, bringing out a link between petroleum prices and Zimbabwean external debt, tended to be generalized and simulational rather being based on actual data. To conclude that Zimbabwean national debt is mainly petroleum price dependent without undertaking a deliberate analysis of the petroleum import expenditures and the accumulated external debt would be misleading.

Hence the emerging issues point to a mixture of national debt sources some which are petroleum price related and some of which are not. In general the non-petroleum producing nations tend to face occasionally fluctuating oil prices which tend to have

negative or sometimes positive consequences on the major economic variables like interest rates and exchange rates and the terms of trade. Increasing oil prices for some of these countries may exacerbate the national debt problem but not for some others. Equally we have oil exporting countries for whom petroleum prices have a profound impact on the national debt positions, like had been the case for the West African and some South American oil producing countries while for the North American countries it has been argued that for these economies petroleum expenditures are too insignificant to have impacts on national debt positions

2.6 Knowledge gap

As mentioned in sections 2.4 above there is national indebtedness with countries having high debt to GDP ratios and low debt to GDP ratios. For the countries with high debt to GDP ratios we find both petroleum exporting and non-petroleum exporting nations and equally for countries with low debt to GDP ratios we find both petroleum exporting and non-petroleum exporting nations. One would be of interest to understand how some of the non-petroleum exporting countries end up with low debt to GDP ratios and on the converse side one would be of interest to understand how and why some of the petroleum exporting countries end having high debt to GDP ratios.

Consequently it was the study's view that sweeping and generalized conclusions by scholars and researchers on the debt- petroleum nexus through wide panel data studies encompassing many countries should be closely examined. Hence extensive as the study had been in analysing continent wide and regional wide and nation-wide national debt positions in relation to petroleum import related expenditures it could not come across a country- specific study that was aimed specifically at analysing a lengthy period of time series data for the determination of the impact of petroleum imports on national debt for a third world country or particularly an African developing country. The vast literature abounding on the petroleum price impacts are cross sectional studies in relation to GDP or GDP growth rates which are then taken to be proxies for national debt positions in some studies. These generalized studies tend to augment their findings in typical "one glove fits all" context.

The study sought to isolate the Zambian case from the multiplicity of worldwide and regional wide oil importing countries and then compared or contrasted the extent to which national petroleum imports have impacted the nation's national debt in relation to other factors in the Zambian Balance of Payments such as the Exports of other

goods and services, Gross Capital Formation, National income [GDP], Private domestic final consumption, and Government consumption have impacted Zambian external debt. The study thus found a knowledge gap to which it found need to contribute and try to establish the degree to which petroleum import expenditures have impacted the Zambian national debt in relation to the above mentioned macroeconomic variables.

2.7 Chapter Summary

The chapter outlines the literature alluding to the oil expenditure debt nexus from a global continental, regional and country basis. It introduces the main variables namely oil expenditure and the regressand - external debt. It brought out the importance of oil as an energy input into multiple sectors of the world economies with 2019 global purchases of imported crude oil estimated at US$1.056 trillion reflecting strong demand. This demand demonstrated itself in the Zambian case where the importation of petroleum crude oil dominated all other single commodity expenditures forming a major part of Zambia's import bill – estimated at $504,747,000 in 2019 amounting to 0.05% of the world total. It further reveals the petroleum sector as one of the most outstanding sectors in Zambia which necessitates state intervention for control and tax purposes. With Petroleum being a key driver of industrial activity the study was of the inclination to find out if there could have been a connection between the big oil consumption of petroleum in the nation and the ever expanding external debt.

It was further demonstrated in the chapter that worldwide studies suggest that oil exporting economies from the developed world tend to generally gain when oil prices go up in as far as studies linking oil prices and GDP growth is concerned. However for some oil exporting countries in the developing world increasing oil exports tend to go hand in hand with increasing debt as well due to financial impropriety as well as "Dutch Disease " syndrome which tends to put the non-oil sectors in economic malaise.

On the other hand the chapter reveals that, for Sub Sahara African countries, decreases in oil prices tend to have positive and significant impacts on growth, while oil price increases tend to have a significant negative effect bringing forth recommendations that it would be important for policymakers in these countries to explore and implement efficient energy policies and employ technological advancement policies to mitigate oil price risks, especially in the long run.

For SADC countries, within which Zambia would be a potential sample candidate, the complete dependence on imported oil as a primary energy source makes these countries highly vulnerable to oil price shocks with oil price increases having outstanding impacts on the nations' levels of real gross GDP and economic performance due to oil price increases reducing the nations' output, altering expenditure and production structures which shifts the economies toward lower economic growth rates. This could be the reason why most of Southern Africa suffered from high external debts, high levels of human deprivation and income inequality with almost all these countries having a significant proportion of their population below the poverty datum line**.**

The chapter further analysed the global debt to GDP ratios for the year 2019 and brought out the tendency for both oil exporting and non-oil exporting countries to have relatively high debt to GDP ratios and relatively low debt to GDP ratios the reasons for which are country specific and hence would require country specific analysis to pinpoint the real positions. The Chapter equally looked at a wide scale African pooled OLS study where the results from the panel data analysis brings out no link between African national debt and petroleum imports. The Chapter finally ended with emerging issues from the study and expressed its need to fill in the isolated knowledge gap as identified for the global regional and national perspectives.

CHAPTER THREE: THEORETICAL AND CONCEPTUAL FRAMEWORK

3.1 Introduction

This chapter presents the theoretical and conceptual framework where the main theoretical underpinnings upon which the research was premised. It outlines and discusses the fittings of the research gap into existing theories. The conceptual framework of the research, presented the theoretical model of this research thesis focused on presenting the researcher's theoretical perception of the relationship of the variables under study and made use of extra graphical presentations to explain these relationship according to the underlying theoretical frameworks.

3.2 Theoretical Framework

Kombo and Tromp (2014) outlines a theoretical framework as a framework, collection or assembly of ideas based purely on theories making it a collection of reasoned propositions derived from and supported by data or empirical evidence. It accounts for or stands in place of phenomena seeking to clarify why occurrences happen the way they are based on theoretical reasoning. Optionally a theoretical framework may be accounted for as a general set of logically educated assumptions about the nature of an occurrence or phenomena and in order to understand theoretical frameworks an analysis of theories have to be made.

This section invoked certain salient literature connected to the variables so as to learn from them and reveal the gap that this study wants to bridge. The theories on petroleum oil impact on resource driven and/or institution driven economic growth, and implicitly or subsequently on debt were reviewed. The study did as much as possible to cater for each model variable or a collective set of variables with a corresponding theory or theories or empirical study or studies to the best temporal relevance and existence.

3.2.1 The Balance of Payments Theory

The Balance of Payments Theory of exchange rate holds that given a floating exchange rate system (or a managed float for that matter) the price of foreign money in terms of domestic money is determined by the free forces of demand and supply in the foreign exchange market. The demand for foreign currency is a derived demand meaning that it arises from the demand for foreign goods and services (Johnson, 1977). It follows that the external value of a country's currency will depend upon the demand for and

supply of foreign goods and services. Where the demand for foreign goods and services exceeds the quantity of foreign currency that the local currency can buy the result will be a depreciation of the local currency and a fall in the stock of foreign reserves. For the supply of foreign currency to match local demand, there has to be an increase in the export earnings, at favourable terms of trade, and /or an inflow of foreign reserves (currency or money) from the external world to equalize this demand and this will come in form of either aid or, and most notably, debt. This is the monetary view of the balance of payments.

So ideally if a nation has to have a favourable balance of payments position it should always seek to balance its current and financial/capital accounts so that its inflows of financial resources match its out flows. But this is seldom the case. In most cases, even for high oil exporting countries, there occurs balance of payments deficits resulting in resource inflows from the external economies in form of debt. Though a balance of payments deficit may not necessarily be a negative thing if the deficits are a reflection of borrowing for investment purposes for instance, a persistence of balance of payments deficits is reflection of a poorly performing economy and in the case of developing countries like Zambia is an indicator of a debt ridden economy. This could be indicative from the Zambian Central Bank's annual reports from 2011 to 2019 where since from 2014 the country had been having persistent current account or balance of payments deficits. (Refer to tables 8.5 and 8.8 in Appendix).

The Balance of payments theory was adopted because it takes a cardinal role in explaining a country's indebtedness to the external world which is through persistent Bop deficits. It caters for all international transactions for a nation and when the nation's current account records a surplus, then the corresponding capital and financial account has to record a deficit in form of outflows of international reserves to either acquire net assets abroad or liquidate its previous loans or external obligations. When the nation's current account records a deficit then the corresponding capital and financial account has to record a surplus in form of inflows of reserves from external economies in the form of liquidated external assets or loans from external countries or financial institutions. When the balance of payments deficits persist, then a nation goes into indebtedness which was the national debt that is the regressand in the study.

Africa has 38 net oil-importing countries. Analysis of the drivers of national debt stock increases in these countries shows that persistent budget deficits and ambitious public

investment programmes being undertaken by Government such as infrastructure development are some of the major drivers for increases in national debt accumulation. Local currency depreciations and/or devaluations against the US$ and other major currencies in which national debt stocks are denominated in have also resulted in national debt stock increases when converted to local currency terms. In addition for these net oil-importing countries, high oil prices have had an adverse impact on businesses, consumers, and the government budget, to name a few. As a result, the terms of trade for these net oil-importing countries deteriorate which puts their balance of payments positions in a perilous position and possibly leading to lower economic growth and debt than in the absence of the oil shocks (African Development Bank & ESMAP, 2009).

This study would like to analyse the possibility that this internal demand for petroleum oil imports that require foreign exchange supplies (foreign money supplies to meet the domestic excess demand for money) have contributed to the national balance of payments deficits and as such have necessitated or contributed to national debt in the long run in the Zambian case.

3.2.2 The Theory of Debt Distribution Approach

This theory was posed in an attempt to analyse what relationship exists between debt and gross or real capital formation. The theory is of the presumption that though external borrowing induces inter-temporal consumption and distributional effects it does not induce economic growth effects because it aims at raising the level of current consumption rather than that of investments (and thus future consumption) may quite well be an economically rational course of action for borrowing countries (Rainer, 1984). As a result this theory has two consequential effects for the analytical process of indebtedness in developing countries:

In the first place the emerging of the relationships involving credit and the capital flows between capital-exporting and capital-importing countries are a result of varying social rates of time preference in the developing and developed countries and not so much a result of a higher productivity of capital in developing countries. The theory argues that current consumption in developing countries is more important than in the developed industrialized countries and more important than the future debt and interest burdens. (Ibid).

As a second factor, external borrowing can lead to growth losses on a world economic scale, on the basis of the described premises, because the unvaried magnitudes of real capital formation in the borrowing countries may be reciprocated by reduced capital formation in capital exporting countries. This factor however, cannot be taken to be an argument against external borrowing by developing countries because growth maximisation is not a self-justifying or self-proclaiming objective (Rainer, 1984).

Seeing that the much debt obtained by the developing countries had not brought about the required effects, on the reasoning of the above theory Rainer (1984) asked the following questions: Firstly he asked if the current debt problems had resulted from the fact that loans that had been obtained abroad in the past were not productively utilised. Secondly he posed the question of whether, on the assumption that such borrowed capital had in fact been used for consumption, could this be the primary reason for the debt crises? Finally on the assumption that the above two reasons were not valid he then queried what could have been the other factors that could have contributed towards the current debt crisis.

Hence generally the question was on the impact that external borrowing had on real capital formation in developing countries and which were the accompanying growth effects

Taking a sample of several countries Morocco, Guyana, Sierra Leone, Bolivia, Zambia, Peru and Jamaica, some major mineral exporting countries, the regression analyses revealed a significant negative correlation between capital imports and national savings for these countries. Though this still did not affirm causality or direction of causality, further analysis showed that the negative correlation was mainly as a result of the fiscal policy in terms of government budgets where public finances for these countries were extremely mining industry profitability dependent such that prosperity period in the raw materials markets went in tandem with notable additions in public revenue leading to increases in government consumption levels. This resulted into expectations which could only be reduced at the expense of big political unpopularity when and if when export commodity prices fell. As such the reason why many governments looked to national debt was to finance the irreversible current expenditures leading to reductions in government saving (Ibid).

Rainer (1984) noted that mounting interest rates and oil prices, in tandem with a terms of trade deterioration in the successive international economic doldrums, forced countries into crisis borrowing. The loans did not serve so much as to build up investments but rather they served more to compensate for the fall in real incomes as a result of the deteriorated terms of trade so as to stabilise consumption levels or to finance growing government deficits.

Concerning this study, then, was the interest to see what kind of relationship existed between debt and capital formation in the Zambian case due to the assumption of this theory being that we would not expect to see much of an impact between debt and gross capital formation because much of the gross capital formation then would temporal wise be independent of the debt levels because of the inter temporal consumption preference, except maybe, in very complicated time lag relationships or analyses. But the question of what could have been the other factors that could have contributed towards the current debt crisis is where this study puts up the hypothesis that maybe mounting expenditures on the oil imports just could be the missing link in the this debt build up puzzle.

3.2.3 The Asymmetry Theory of Economic Growth

This theory developed, by Mark (1994), Ferderer, (1996) and Balke, (1996), discusses the strength and the asymmetry of the effect of oil price volatility on output growth. A member of this school Ferderer (1996) provided a sufficient detailed reports or asymmetric mechanism between the influence of oil price volatility and output growth by concentrating on three possible ways, counter-inflationary monetary policy, sectoral shocks and uncertainty. From his study, he discovered a statistically significant relationship between increase in oil price and counter inflationary policy responses. This position that Balke, (1996) took was confirmed by the Federer submissions. The theory says monetary policy alone cannot adequately strengthen real impact of oil price dynamics on output growth and that fiscal policy should be incorporated.

Though this study does not deal with inflationary effects on debt per se, it borrows from this theory the logic that counter inflationary monetary policy responses come in to reduce the negative impact of inflation on economic growth when it reaches certain magnitudes. This means there is symmetric response of economic growth to inflation from oil prices up to certain extent but after a certain threshold is attained there begins

the negative impact which trigger the counter inflationary responses which may impact national debt position though fiscal policy. The outstanding aspect about the theory as concerns this study is that declines in economic growth are normally associated with increasing debts for the developing countries. This study sought to enquire if this decline in economic growth, which can contribute to debt, can also be attributed to petroleum imports in the Zambian case.

3.2.4 The Debt Overhang Theory

Multiple literature abounds in the connection between economic growth and external borrowing with the normally expected inverse or negative relationship between foreign debt and investment inevitably ending into diminished capital formation. This is defined as "debt overhang" where the ability of repayment of outstanding debt value falls beneath the signed or book value. Optionally it can be said that Debt overhang is the condition of an organization or country that has existing debt so great that it cannot easily borrow more money, even when that new borrowing is actually a good investment that would more than pay for itself (Muma 2022). As quoted by Abdullahi et al, (2016) several scholars have supported the theoretical case for debt overhang with some of the studies including that of Krugman (1988) and Sachs (1988) and others like Greene and Villanueva (1991), Elbadawi et al. (1997) and Chowdhury (2001) who reaffirmed this theory by coming up with enough evidence to back up the debt overhang phenomenon.

In the highly indebted economies "debt overhang" is taken to be a paramount reason for the distortion and abridging of economic growth as quoted in Sachs, (1989) and Bulow and Rogoff (1990). This slowing down of economic growth arises due to the indebted countries losing their attraction for private investors. In addition the debt servicing uses up the indebted countries' revenues to maximum lengths which causes the abridging of the return to viable economic growth channels as quoted by Levy-Livermore and Chowdhury (1998) who suggested that much as the governments of these countries would undertake structural adjustment programs the adverse effects can still be felt on the general economic performance and economic developmental process.

Arslanalp and Henry (2004) noted that, in any case, debt overhang not only occurs when a country accumulates too much debt but it can equally occur when a country's adverse economic circumstances, such as extreme economic shocks or poor economic

policies, take place which makes it impossible or difficult for the management and discharging of the nation's level of debts and in such unfavourable circumstances, with creditors loan portfolios facing heavier risks, the outcome could be panic among creditors who rush to cash in their portfolio claims, and the possible withdrawal of interest from new debts.

Recent reports had highlighted the controversial act of the Zambian Government appointing a foreign debt consultant (The French Investment Bank Lazard) to advise on "liability management" of the $11bn external debt, a large share (about one-third) of which was owed to China , was an act that had signalled that a restructuring was on the way (The Financial Times, 2020). What happened thereafter was out of the scope of this study. But this could just be an indication, however, of the Zambian economy reaching that Debt Overhang phenomenon where increases in the national productivity due to foreign debt reach the non- linear magnitudes and start impacting negatively on the economy thereby bringing incapacity to produce and repay debts.

This theory however is not of such direct application to our study per se but was a necessary referral point in that was it just possible, then, that high expenditures on petroleum oil for the heavily indebted oil importing countries could just fuse in somewhere along the economic channels to contribute to this debt overhang by way of inhibiting capital formation in alternative energy industries which may just be the alternative to oil imports in the economy?

3.3 The Conceptual Framework

Reichel and Ramsey (1987) as quoted in Kombo and Tromp (2014) defined a conceptual frame work as a tool in research whose purpose is to assist in developing awareness and understanding of the situation under analysis so as to communicate this situation. Optionally it can be outlined as a set of broad or extensive ideas and principles taken from the relevant fields of enquiry which are used to structure a subsequent idea or presentation.

It is useful in providing connections to the literature and the research goals and questions and in contributing to the formulation of the research design. Additionally, it provides reference points for the discussion of literature, methodology and data analysis while equally giving a broad scope to thinking about the research so as to conceptualize the problem to provide a means to link the ideas and the data so as to reveal the deeper

connections involved. Finally, a conceptual framework explains the relationship among interlinked concepts or the possible connections between or among variables so as to provide answers to research questions or research hypotheses.

This section of the study brought out its ontological *Conceptualization*' in form of the abstract model of the macroeconomics phenomena through the constructs of the macroeconomics identity so as to bring out the most salient variables and relations concerning the research paradigm.

3.3.1 The General Macroeconomic Theory

Before presenting the graphical conceptual frame work, the study poses the general Macroeconomic Theory to revise the variables. Zambia being a small open economy is best based on the open economy macroeconomic assumptions that:

Firstly the economic output (Y) is fixed by the factors of production and the input/output production function. Thus

$Y = \overline{Y} = F(\overline{K},\overline{L})$ ……. (i)

Secondly consumption (C) is positively related to disposable income (Y – T) and hence the consumption function is of the Keynesian form:

$C = {}_C(Y - T)$ …….. (ii)

Thirdly investment (I) is negatively related to the real interest rate "r" and hence the investment function, for functionality purposes, takes the form:

$I = I(r)$ …… (iii)

Finally all multiplier effects are ignored in this model because it is specifically petroleum imports centred.

Using the macroeconomic economic identity

$Y = C + I + G + NX$

Where NX are the net exports (X – M); whereby relating net exports to total national income less absorption we have the net exports identity

$NX = Y - (C + G + I)$

Since Y- (C + G + I) represents the national savings we have the relationship

$NX = S_N$

Using the assumptions from (i), (ii) and (iii) above on the condition that the real interest rate (r) equals the world real interest rate (r*), we obtain our net exports identity as being;

$NX = [\overline{Y} - \overline{C} - G - I(r^*)]$

Hence these are the variables determining national net exports and national savings. This implies that the trade balance will depend on the fiscal policy through Government purchases and taxation (savings) and will also depend on the level of investment at the world real interest rate.

Letting national savings (S_N) be represented by $\overline{S}$

Hence $\overline{S}$ = NX

Where NX = [$\overline{Y}$ - $_C(\overline{Y} - \overline{T})$ – G] – I(r*)

Hence our net exports can equally be represented as;

NX = $\overline{S}$

This shows that Net exports are equivalent national savings. The existing fiscal policy will govern whether national savings will increase or decrease. The external world's fiscal policy and monetary policies will govern the world interest rate.

But the net exports are governed by real exchange rates (ϵ); (Mankiw, 1992)

Hence we rewrite this relationship between net exports and real exchange rates as;

NX = NX(ϵ)

Then $\overline{S}$ = NX(ϵ)

Hence with a balance of payments

$\overline{S}$ – NX(ϵ) = 0

But with a balance of payments deficit

$\overline{S}$ – NX(ϵ) = δ

Hence (δ) represent the debt that the small open economy will owe to the external economies when it fails to transfer enough goods, services, physical and financial assets to the external economies. The residual δ or deficit is capital account transaction representing all the inflows and /or outflows to compensate or complement it.

If we now separate the net exports into the respective exports and imports (X – M) we have;

$\overline{S}$ – [X(ϵ) - M(ϵ)] = δ

Which can be re written;

[$\overline{S}$ + M(ϵ) - X(ϵ) = δ

Further separating the imports (M) into petroleum imports (M_{PET}) and non-petroleum imports (M_{OTH}) we have the relationship expanded to;

[$\overline{S}$ – X(ϵ) + M_{PET}(ϵ) + M_{OTH}(ϵ) = δ

Putting back the macroeconomic variables for national savings;

[$\overline{Y}$ - $_C(\overline{Y} - \overline{T})$ – G] – I(r*)] - X(ϵ) + M_{PET}(ϵ) + M_{OTH}(ϵ) = δ

Implying that;

[$\overline{Y}$ - $_C\overline{Y}$ – $\bar{C}$ $\overline{T}$) – G] – I(r*)] - X(ϵ) + M_{PET} (ϵ)+ M_{OTH}(ϵ) = δ

Factoring for GDP,

$[\bar{Y}(1 - C) - \bar{C}\bar{T} - G] - I(r^*)] - X(\epsilon) + M_{PET}(\epsilon) + M_{OTH}(\epsilon) = \delta$

Due to the relative non availability of data on taxation, we eliminated the disposable income notation and simply consider total consumption thus;

$[\bar{Y} - \bar{C} - G - I(r^*)] - X(\epsilon) + M_{PET}(\epsilon) + M_{OTH}(\epsilon) = \delta$

This identified the macroeconomic variables used in our time series petroleum imports to debt model.

3.3.2 Operationalization of the Conceptual Framework (Research Variables)

The suggested relationships among the above macro variables and the theoretical moderating variables are conceptualized and diagrammatically illustrated in Figure 3.1 below where the conceptual framework of the study poses the static theoretical and mathematical model with the specification of the following variables to be analysed:

i) δ denoting national debt marks the model regressand. This variables will depend on the interaction of all the other variables in the model.

ii) MPET denotes petroleum imports expenditures. This is an autonomous market driven variable and depending on the market demand for petroleum

iii) M_{OTH} denotes other imports expenditures. This is an equally autonomous market driven variable and depending on the market demand for external goods and services.

iv) $X(\epsilon)$ denotes all exports income. This is an equally autonomous market driven variable and depending on the demand and supply of goods and services for external markets

v) I(r*)] denotes national investment expenditures at the world interest rate an autonomous variable depending on the supply and demand of Business fixed capital investment, Residential investment and Inventory build-up.

vi) G denotes government purchases. This is endogenous variable depending on Government fiscal policy and other political economy matters.

vii) C denotes national private consumption expenditures. This is endogenous variable depending on the economy's disposable income. (Tax rates)

viii) Y denotes national income GDP. This is endogenous variable depending on the government expenditure, national private consumption expenditures, national investment expenditures and Net exports.

The variables (ii) to (viii) represent the regressor variables with real interest rates (r*) and real foreign exchange rates (ϵ*) being moderating or exogenous variables which were actually assumed to be part of the underlying "invisible Markov Switch process" because of the model adopted and hence these were not part of the real data analysed.

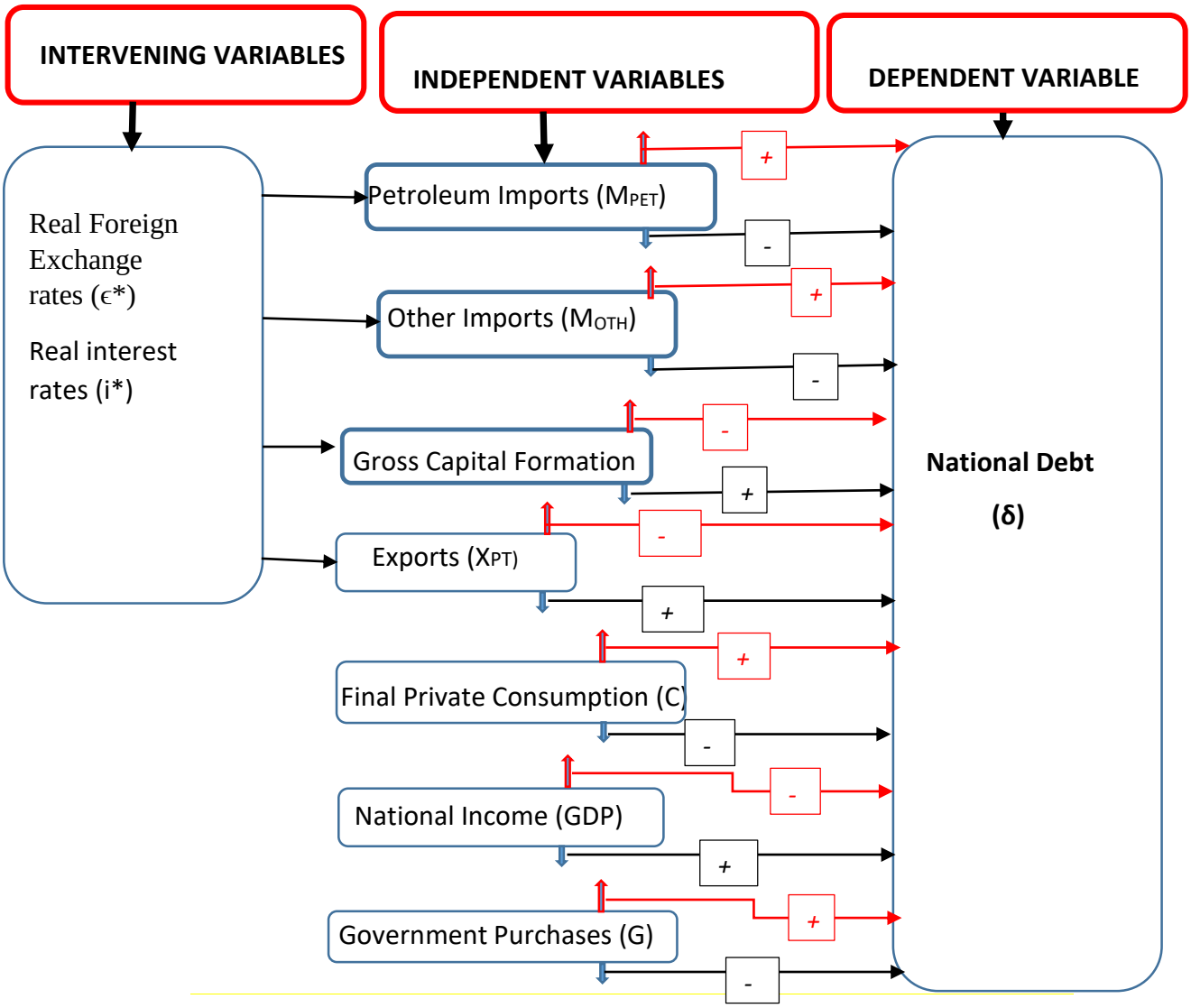

Figure 3.1: Conceptual Framework of relationships among study Variables With Expected Shock Impulse Arrows

Source: Author (2021)

3.3.4 Research Variables Expected Impulse impact on National Debt.

The conceptual framework is developed with impulse response arrows denoting the expected impact of the independent variables on the dependent variable. The upward pointing (Red arrows) are denoting a variable magnitude increasing shock while the downward pointing (Blue arrows) are denoting a variable magnitude reducing shock.

• Should there be a shock impact on the petroleum imports (M_{PET}), from the moderating variables, which moves the imports expenditures upward, it is

theoretically expected that it will have a national debt increasing impact while a shock impact pushing the import expenditures down ward will have a national debt reducing impact.

• Should there be a shock impact on other imports (M_{OTH}) moving the non–petroleum import expenditures upward, it is theoretically expected that this will have a national debt increasing impact while a shock impact pushing the non –petroleum imports downward will have a national debt reducing impact.

• A shock impact on all exports (XPT) moving the national exports upward will be expected to be moving the national debt downward because this should be increasing net exports and hence National savings. The reverse should be the case if the shock impact on all exports (XPT) moving the national exports downward which should have a debt increasing impact.

• Gross Capital Formation (National investment – "Inv") is expected to move in either direction to debt depending on the direction of the intervening variables at home and abroad. Should the shock impact increase Gross Capital Formation the expectation will be a debt reducing impact while any shock from the intervening variables reducing investment is expected reduce absorption and reduces net savings and exports (since NX= S) which will increase national debt in the short run and ideally in the long run as well.

• A shock increasing Government purchases (G) will be expected to be increasing national debt because this will reduce national savings and thus decreasing net exports. On the other hand a Government purchases reducing shock should be expected to be decreasing national debt in the long run.

• A magnitude increasing shock impact on private final consumption (C) is expected to be moving in the same direction and increase national debt because it reduces saving and thus decreases net exports while negative going shock should be having national debt reducing impacts

• Shocks impacting National income (Y) or GDP upward should be expected to be reducing national debt because it should be increasing saving and thus increases net exports But if the shock impact has GDP reducing impacts it will essentially be reducing savings and thus decreasing net exports.

• Real interest rates (r*) are expected to move in either direction to debt depending on the fiscal and monetary interest rate at home and abroad. Since

investments are negatively related to the real interest rate any monetary and or fiscal policy abroad or at home that increases interest rates will cause investments to reduce which increases net exports and reduces debt in which case real interest rates will move in opposite direction to debt (since NX = S). The opposite will apply as any monetary and or fiscal policy abroad or at home that decreases interest rates will cause investments to increase which reduce net exports and increase the debt in which case real interest rates will move in the same direction to debt.

• Real Foreign Exchange rates (ϵ) are expected to move in either direction to debt depending on the market. Should real Foreign Exchange rates appreciate exports will reduce tending to push up debt and vice versa.

However the study takes an exception to explain that the intervening variables are taken to be part of the "invisible underlying Markov Switch Process" in this study because of the relative scarcity of data on real exchange rates and real interest rates for the earlier periods of the study (1980 – 2000) and the resulting variable scale effects due to differences in variables measurements even when the data was logged. Hence the study dropped these two intervening variables in the actual study model.

3.3.5 Chapter Summary

In this chapter segment certain supporting theories are applied to try and explain this oil – debt scenario directly and indirectly. The Balance of payments theory tries to explain the country's net position in view of its external trade and capital flow relationships with the rest of the world.

The Debt Distribution Approach Theory tries to analyse the relationship between debt and gross or real capital formation and is of the proposition that though external borrowing induces inter-temporal consumption and distributional effects it does not induce economic growth effects in the developing world because it aims at raising the level of current consumption rather than that of investments.

The study looked at the Asymmetry Theory of Economic Growth which discusses the strength and the asymmetry of the effect of oil price volatility on output growth where there is claimed to be an asymmetric mechanism between the influence of oil price volatility and output growth by concentrating through, counter-inflationary monetary

policy responses, sectoral shocks and uncertainty channels. In this case it is argued that monetary policy alone cannot adequately strengthen real impact of oil price dynamics on output growth and that fiscal policy should be incorporated because there is symmetric response of economic growth to inflation from oil prices up to certain extent after which the negative impact triggers the counter inflationary responses which may impact national debt position though fiscal policy.

The Debt Overhang Theory was of interest to this study because of its claimed proposition that there exists a relationship connection between economic growth and external borrowing with the normally expected inverse or negative relationship between foreign debt and investment inevitably ending into diminished capital formation where the ability of repayment of outstanding debt value falls beneath the signed or book value. This slows down of economic growth due to the indebted countries losing their attraction for private investors, while in addition, the debt servicing uses up the indebted countries' revenues causing the distortion of the return to viable economic growth channels

Finally the chapter segment brought the conceptual context of the problem in terms of the macroeconomic variables implied in this oil to debt nexus and their expected direction in their impact on external debt. This formed the basis for the operationalization of the conceptual framework which was also presented as a flowchart figure with impulse response arrows showing the expected impacts of the regressors on the regressand culminating from the different shocks on the regressors.

CHAPTER FOUR: RESEARCH METHODOLOGY

4. 1 Introduction

This chapter establishes the research paradigm upon which the whole study was founded on. It further puts forward the research design, research instruments, data collection, tools of analysis and the reliability and validity measures undertaken. It further puts forward the pre regression tests undertaken in the study.

4.2 Research Design

Kombo and Tromp (2014) described a research design as the research structure showing the major parts to be put together to address the cardinal research problem. It is the arrangement of conditionality's for the assemblage and analysis of the relevant information or data for the attainment of the research objectives. The research design referred to the overall strategy that the study chose to integrate the various components of the study in an understandable and logical manner to ensure the effective presentation of the research problem and constituting of the blueprint for the collection, measurement, and analysis of data.

This study's research design was a typically deductive one with correlational and regressive quantitative methods of analysis for a range of data to be analysed for typically highly structured longitudinally large archived sample measurements which sought to determine the relationship between expenditures on petroleum imports and national debt. It further compared or contrasted other general equilibrium variables. The use of archived data led to mixed methods quantitative analysis.

The study was designed to establish the relative impact of petroleum prices on the Zambian external debt. It was quantitatively made to be executed through an econometric model to approximate this petroleum debt relationship while not totally ignoring other macroeconomic variables which naturally may or may not impact debt as well.

In order to determine if the petroleum import bill had been providing a growth stimulating and debt reducing economic transformation of the country or if it had been a developmental or an economic growth constraint contributing to the Zambian national debt the study consulted other studies to see if at all they offered some solutions in view of other economies. Since the other studies did not have a clearly discernible

relationship of the oil expenditure and national debt relationship explicitly relating to the Zambian case, the study had to narrow in to establish what the case was in the Zambian perspective. Hence the study set out the statistically determinable hypotheses to validate the proof that was central to the problem which were as outlined in section 1.4.3.

The study's research design was based on providing the relative position of petroleum in impacting the Zambian debt position by way of decomposing the general macroeconomic theory variables as defined in the specific objectives in 1.4.2 above. The design was then organised in such a way as to gather secondary time series data on the decomposed general macroeconomic theory variables for the study period 1980 to 2019. Consequently then the research design for the data collection was desktop based collection due to the existence of reliable secondary databases. The research design included the determination of the variables' degree of integration which was what determined which time series model could be reliable for the data analysis so as to determine the relative impact of petroleum on the Zambian debt position. If the variables' order of integration came out to be I(0) then the study's design was to use Ordinary Least Squares (OLS) model to analyse the variables. If the variables' order of integration came out to be I(1) with long run cointegration then then the study's design was to use the Vector Error Correction Model (VECM) model for the variables' analysis. If the variables' order of integration came out to be I(1) with no long run cointegration then then the study's design was to use the Restricted Vector Auto Regressive (RVAR) model for the variables' analysis. If the variables' order of integration came out to be a mixed order with I(0) and I(1) level of integration, then the study's design was to use the Autoregressive Dynamic Lag (ARDL) Model with the short run and long run cointegration being determined by the bounds test. However the if the If the variables' order of integration came out to be I(2) then the design was to use a non-linear model like the Markov Switching Regression Model, for which Johansen (1989-1990) had theorized that the main idea was to regard the I(2) models as a non-linear regression models with integrated regressors.

4.3 Research Instruments

This research was fundamentally desk-top based research and such are common when it comes to using time series data as evidenced by studies such as those by Arshad et al (2016), Ghalayini (2011), Negi (2015), and Odhiambo et al (2020). This was because the study focuses on one country and hence depended on official actual archival data

which is more precise and authentic and hence expected to yield more accurate results. Loayaza et al (2004) hinted that desktop researches using data from officially recognised and reliable sources such as the World Bank, IMF and AFDB are much more likely to get accurate results than surveys and other questionnaire based methods.

4.3.1 Data Collection Tools/Techniques

The research was premised mainly on secondary data with collection tools being internet based search and sign up or subscription methods for data downloads. The significant sources of secondary data were from the COMESA/AFDB, the World Bank's World Development Indicators (WDI) and IMF's International Financial Statistics (IFS). It should however be noted that statistics on some of these variables are also available in the Country's Central Bank and Statistical Offices but not for the complete period of study. Additional software data collection tools for analysis were document readers like Foxit Phantom and Acrobat reader for unpacking valuable PDF documents to assist in data analysis procedures. Not to be left out was the valuable internet browser software Chrome based Torch Internet Browser Software which allows for valuable downloads.

4.3.2 Research Variables and Data

The data in this study was mainly secondary data which took a quantitative form describing the dependent, independent and intervening variables. The data type was non logged time series data for the explanatory variables defined and operationalized in 3.3.3 above was downloaded as Microsoft Excel format to be sorted and transposed for export to the STATA (15) software for analysis. The variables data values for the period 1980-2019 were the following:

- National Debt (DEBT)
- Petroleum Oil imports (IMPPET)
- Gross Domestic Product (GDP)
- Exports of goods and services (Xpt)
- Imports of Other goods and services (IMPoth)
- General government final consumption expenditure (Govt)
- Gross fixed capital formation (Inv)
- Household final consumption expenditure (CONS)

4.3.3 Data sources

The data sources for this study were mainly the African Development Bank/ COMESA for the debt and the regressor variable quantities while locally supportive data was also obtained from the Central bank (BOZ) website. Other data sources were independent sources like Trading Economics The World Bank, The IMF, The Bank of Zambia and The Zambia Statistical Agency websites.

4.3.4 Data Collection Methods

The methods for collecting data was through internet queries and downloads from renowned and subscribable databases. The subscribable databases for the AFDB/COMSTAT online databases are not directly accessible. A researcher has to sign in to register and leave a contact e-mail address through which an access link will be sent. Once are logged in through the email link a researcher can then download the selected data through required formats with Microsoft Excel format being the most usable format for the study.

4.3.6 Data Processing Methods

The rearranging, sorting, transposing and the coding of variable names processing of collected data was done through Microsoft (MS) Excel software. The econometric analysis of the data was done through the Statistical Analysis Software (STATA 15) where the MS Excel data was imported and saved to be converted into STATA format. The data was declared as time series for the processes of hypothesis testing, pre and post testing of the model and data validity and reliability, lag length selection, normality and stationarity testing (including differencing for non-stationary data) so as to facilitate the data for Markov Switching model processing because this model, like all time series models, requires data to be stationary. The converted data was also required for the generation of graphic output.

4.4 Reliability and Validity

Reliability and validity are concepts employed to evaluate the standard or quality of a research study. They specify or indicate how well or validly a method, technique or test measures or quantifies a research process. Generally speaking Reliability is about the consistency or consonance of a measure, while validity is about the accuracy or precision of a measure.

4.4.1 Reliability

Research reliability refers to the visible extent to which the same findings can be obtained and replicated using the same research instruments by other interested parties. With a research displaying with high levels of reliability, then other researchers should be able to generate the same results, using the same research methods under similar conditions. According to Babbie (2010), reliability is a concern when a single observer is the source of data, because there is no protection or guard against the impact of that observer's subjectivity. According to Wilson (2010) reliability issues are most of the time closely associated with subjectivity and because it is believed that a researcher taking on a subjective approach towards the study compromises its level of reliability.

The research undertook all the efforts to explain the, research design, the hypotheses posed and the hypotheses testing and validation criteria. It undertook to explain the desired model for analysis and the reasons why. Hence any other researcher undertaking verification purposes will to large extent obtain the same results.

4.4.1.1 Internal Reliability

Internal reliability is that property of evaluation or appraising of the uniformity or regularity of results across variables within a similar evaluation or research test. In this research the internal validity was assured by declaring of the research methods, the research model, the research result validation processes and reliability hypotheses testing procedures. Internal reliability was ascertained in the study by the estimation of Cronbach's alpha (Statistics Solutions, 2021) which is a statistic measuring the internal consistency among a set of items (variables) that are believed to be measures of the same construct and as such correlated with each other and could be formed into some type of scale. Cronbach's alpha for the study indicated a scale reliability coefficient of 0.9733 for the non-differenced variables and 0.7045 for the differenced variables which were good indicators of internal reliability (see Tables 39 and 40 in Appendix III). The Statistics Solutions recommend that a Cronbach's alpha of 0.70 and above is good, 0.80 and above is better, and 0.90 and above is best (Ibid). Hence with the study's Cronbach's alpha lying between 0.7 and 0.9 it is worthwhile concluding that its external reliability was valid.

4.4.1.2 Face Validity

This is basically a qualitative measure of how much a research instrument qualifies to befit the purpose for which a research study is intended. Although it is claimed that face validity can be quantitatively assessed it is usually informally assessed and as such often taken to be a subjective measure. Taherdoost (2016) argued face validity to be the weakest form of validity with a suggestion that it is not a form of validity in the strictest sense of the word.

The study's face validity can be ascertained from the conceptual framework where the his study's regressand variable (National Debt) to the regressor variables structure was empirically established from the existing macroeconomic relationships as established in the balance of payments theory and the national income identity. The chosen regressor variables of goods and services exports, petroleum imports, non-petroleum, Govt. expenditure, household expenditure, gross fixed capital formation and gross domestic product are wide and valid enough to capture Zambia's macroeconomic environment and bring out the country's net external position as evidenced by the dependent variable in the model which is external debt.

4.5 Research Hypothesis Testing

A statistical hypothesis is an assumption about a population parameter and as such hypothesis testing will refer to the formal procedures to accept or reject the assumed statistical hypotheses.

4.5.1 Hypothesis testing about individual regression coefficients

This was based on invoking the assumption that the error terms were normally distributed with a zero mean and a constant variance then used the 't' or "z" test to test a hypothesis about any individual partial regression coefficients in the model. These were the coefficients evaluated when after running our petroleum to debt model.
Our hypotheses as specified in 1.4.3 above are then that;

H0a: $\beta h0a = 0$ implied that the coefficients evaluated for the Petroleum import expenditures were statistically non-significant or as well as nothing and as such

Petroleum import expenditures could not have had no impact on the Zambian external debt.

H1a: βh0a ≠ 0 implied that the coefficients evaluated for the Petroleum import expenditures were statistically significant and as such Petroleum import expenditures had had an impact on the Zambian external debt negatively or positively as indicated by the sign of the coefficient.

H0b: βh0b = 0 implied that the coefficients evaluated for the Non - petroleum imports expenditures were statistically non-significant or as well as nothing and as such Non - petroleum imports expenditures could not have had no impact on the Zambian external debt.

H1b: βh0b ≠ 0 implied that the coefficients evaluated for the Non-Petroleum import expenditures were statistically significant and as such Non-Petroleum import expenditures had had an impact on the Zambian external debt negatively or positively as indicated by the sign of the coefficient.

H0c: βh0c = 0 implied that the coefficients evaluated for the National Exports were statistically non-significant or as well as nothing and as such National Exports could not have had no impact on the Zambian external debt.

H1c: βh0c ≠ 0 implied that the coefficients evaluated for the Exports were statistically significant and as such Exports had had an impact on the Zambian external debt negatively or positively as indicated by the sign of the coefficient.

H0d: βh0d = 0 implied that the coefficients evaluated for Gross domestic product [GDP] were statistically non-significant or as well as nothing and as such Gross domestic product [GDP] could not have had no impact on the Zambian external debt.

H1d: βh0d ≠ 0 Gross domestic product [GDP] implied that the coefficients evaluated for Gross were statistically significant and as such Exports had had an impact on the Zambian external debt negatively or positively as indicated by the sign of the coefficient.

H0e: βh0e = 0 implied that the coefficients evaluated for Gross capital formation were statistically non-significant or as well as nothing and as such Gross capital formation could not have had no impact on the Zambian external debt.

H1e: βh0e ≠ 0 implied that the coefficients evaluated for Gross capital formation were statistically significant and as such Gross capital formation had had an impact on the Zambian external debt negatively or positively as indicated by the sign of the coefficient.

H0f: βh0f = 0 implied that the coefficients evaluated for Government expenditures were statistically non-significant or as well as nothing and as such Government expenditures could not have had no impact on the Zambian external debt..

H1f: βh0f ≠ 0 implied that the coefficients evaluated for Government expenditures were statistically significant and as such Government expenditures had had an impact on the Zambian external debt negatively or positively as indicated by the sign of the coefficient.

4.5.2 Hypothesis Testing for Individual Coefficients

Our test statistic for the parameters or coefficients was:

$$\text{tj} = \frac{\widehat{\beta}_j - C}{s.e(\widehat{\beta}_j)} \sim \text{t}_{\alpha/2,N-K}$$

This test statistic would follow a t distribution with N-K degrees of freedom.

- Where, N is the number of observations, K is the number of parameters and α is the level of significance.
- In case of two tail test the value of the critical t would be $t_{\alpha/2,\text{N}-\text{K}}$

The acceptance/rejection rule is that if the calculated t value (tj) is greater than the critical t (tα/2,N-K), then we reject the null hypothesis (Stock & Watson, 2011).

In practice, though, we do not have to assume a particular value of α to conduct the hypothesis testing as one simply needs to use the MacKinnon's probability value (p value) to see whether the coefficient is statistically significant or not. For this criteria:

- If $p < .001$ then the coefficient will be statistically significant at 1 percent level
- If $p < .05$ then the coefficient will be statistically significant at 5 percent level
- If $p < .01$ then the coefficient will be statistically significant at 10 percent level

4.5.3 Choice of Dynamic (Econometric) Model

The choice of an econometric model was based on the resultant of the stationarity tests as is the universal requisite for time series data. The Augmented Dickey – Fuller test was used due to its treatment of the error terms being serially uncorrelated**.** The study was based on a time series econometric model to be determined after evaluating the level of integration (stationarity) of the data variables at level I(0), or at first difference I(1) or at 2^{nd} difference I(2) and the stationarity of the error terms.

Should all the regressor be integrated of order zero I(0), the error terms be integrated of order zero I(0) then the regressand will be integrated of order zero I(0) then the model could be estimated with a standard distributed lag model.

Should some of the regressors be integrated of order zero I(0) and some of the regressors be integrated of order one I(1), the error terms be integrated of order zero I(0) then the regressand will be integrated of order one (1) or then the model could again be estimated with a standard distributed lag model like ARDL

Should the all the regressors be integrated of order one I(1), the error terms be integrated of order one I(1) then the regressand will be integrated of order one I(1) and as such the regressors and the regressand will be cointegrated meaning that the model could then be estimated with a standard distributed lag model.

Should all the regressors be integrated of order one I(1), the error terms be integrated of order zero I(0) then the regressand will be integrated of order zero I(0) then the model could be estimated with an error correction model such as Vector Auto regression (VAR), Structured Vector Auto regression (SVAR), or Vector error Correction Model (VECM).

Should some of the regressors be integrated of order zero I(0) the model could be estimated with a standard Ordinary Least Squares model with multi cointegration approach. Should and some of the regressors be integrated of order one I(0), and some of the regressors be integrated of order two I(1), the error terms be integrated of order

zero I(0) or of order one I(1), then the model could be estimated with Autoregressive Dynamic Lag Model (ARDL).

4.5.4 Stationarity (Unit Root) Tests: Augmented Dickey-Fuller (ADF) Test and Non Covariance Stationary Time Series

As explained in Gujarat (2008), mean reversion or covariance stationarity is the statistical basis for the estimation and forecasting of time series variables. For Non-stationary time series an alternative that describes well some economic, financial and business data is a random (stochastic) trend and it is revealed that data having such trends may need to be handled in a different way.

The random walk is the simplest example of a non-stationary variable.

$y_t = y_{t-1} + \epsilon_t$ where ϵ_t: WN (0, σ^2) …….. 1

This is described as an autoregressive process of order 1 or an AR(1) process but with the one root of the process, phi (ϕ), equal to one, hence:

$y_t = \phi y_{t-1} + \epsilon_t$, Where ϕ =1…….. 2

What is advised to be remembered is that for covariance stationarity, the roots of the autoregressive lag polynomial must be greater than 1 implying that the inverse roots must be "within the unit circle". As such since the autoregressive lag in the polynomial in (2) has one root equal to one (1), it is said to have a unit root. In this series that there is no tendency for mean reversion, since any error term (epsilon) shock to y the regressand will be carried forward completely through the unit lagged dependent variable (y_{t-1}) (ibid).

The random walk (RW) is covariance stationary when differenced once because from (1)

$y_t - y_{t-1} = y_{t-1} + \epsilon_t - y_{t-1}$ …….3

$\Delta y_t = \epsilon_t$ ……..4

In integrated time series terminology therefore, a time series y_t is integrated of order 1 or I(1) because it has to be differenced once to get a stationary time series. In general a series can be I(d), if it must be differenced 'd' times to get a stationary series. Some I(2) series occur but most common are I(1) or I(0) which are time series that are already covariance stationary without any differencing.

A random walk with drift or stochastic trend is one whose y value equals its previous value plus an additional δ increment each period, Hence:

$y_t = \delta + y_{t-1} + \epsilon_t$ where ϵ_t: WN (0, σ^2) …… 5

It is called a stochastic trend because there still exists some non-stationary random behaviour.

By being non-covariance stationary, Unit Roots can be problematic and as such require some special treatment because statistically, the existence of unit roots makes the OLS estimates of the AR(1) coefficient ϕ to be biased. Secondly they bring about spurious regression results in multivariate model frameworks. Hence to identify the correct underlying time series model, we must test whether a unit root exists or not.

To test for Unit root the time series in (4) above implies that;

$y_t = \phi y_{t-1} + \epsilon_t$, Where ϕ =1

Where we want to test whether ϕ is equal to 1. Subtracting y_{t-1} from both sides, we can rewrite the AR(1) model as:

$y_t - (y_{t-1}) = \phi y_{t-1} + \epsilon_t - y_{t-1}$,

$\Delta y_t = (\phi - 1) y_{t-1} + \epsilon_t$ …… 8

This makes the test of ϕ =1 is a simple t-test of whether the parameter on the "lagged level" of y is equal to zero which is called the Dickey-Fuller (D-F) test. If a constant or trend belongs into the equation we must also use D-F test statistic that adjusts for the impact on the distribution of the test statistic

The Dickey-Fuller is generalized into the Augmented Dickey-Fuller test to accommodate the general ARIMA and ARMA models. (Gujarat, 2008)

4.5.5 The Augmented Dickey Fuller Test

If there are higher-order auto regressive or ARMA dynamics that can be approximated by longer auto regressive terms such as, for instance, there existing an AR(3) series, then this can be represented as:

$y_t - \phi_1 y_{t-1} - \phi_2 y_{t-2} - \phi_3 y_{t-3} = \epsilon_t$

which can then be written as just a function of y_{t-1} and a series of differenced lag terms:

$y_t = (\phi_1 + \phi_2 + \phi_3)\, y_{t-1} - (\phi_2 + \phi_3)\,(y_{t-1} - y_{t-2}) - \phi_3((y_{t-2} - y_{t-3}) + \epsilon_t$

Letting $(\phi_1 + \phi_2 + \phi_3) = \rho_1$, $(\phi_2 + \phi_3) = \rho_2$ and $\phi_3 = \rho_3$ ……..… 9

Then $y_t = \rho_1 y_{t-1} + \rho_2 \Delta y_{t-1} + \rho_3 \Delta y_{t-2} + \epsilon_t$ 10

The AR(3) equation in (10) can be written in a backshift operator

$y_t (1 - \phi_1 B - \phi_2 B^2 - \phi_3 B^3) = \epsilon_t$

Therefore the existence of a unit root *B =1* means literally that *B = 1* is a solution of the AR polynomial equation:

$(1 - \phi_1 B - \phi_2 B^2 - \phi_3 B^3) = 0$

There plugging in B = 1

$(1 - \phi_1 - \phi_2 - \phi_3) = 0$

Therefore from (9)

$\rho_1 = \phi_1 + \phi_2 + \phi_3 = 1$

So having a unit root means $\rho_1 = 1$ in

$y_t = \rho_1 y_{t-1} + \rho_2 \Delta y_{t-1} + \rho_3 \Delta y_{t-2} + \epsilon_t$

Or equivalently,

$1 - \rho_1 = 0$ in

$\Delta y_t = (\rho_1 - 1) y_{t-1} + \sum_{j=2}^{p} \rho_j (\Delta y_{t-j-1}) + \epsilon_t$

This is called the **Augmented Dickey-Fuller (ADF) test** as implemented in many statistical and econometric software packages (ibid)

Telling if a unit root exists can be difficult because:

- These tests have *low **power*** against near-unit-root alternatives (e.g. $\phi = 0.95$)
- There are also size problems or false positives because we cannot include an infinite number of augmentation lags as might be called for with moving average (MA) processes.

The null hypotheses (H_0) for unit root test is that there is a unit root while the alternate hypothesis (H_1) differs slightly according to which equation you're using. The basic alternate is that the time series is stationary (or trend-stationary). We adopted this criteria in the study to find out the stationarity status of the time series data used.

4.5.6 Choosing Models and Lags

According to Gujarat (2008) before running an ADF test, it is important to inspect the available data to figure out the appropriate regression model. For example, a nonzero mean indicates the regression will have a constant term. The three basic regression models are:

- No constant, no trend: $\Delta y_t = \gamma y_{t-1} + \nu_t$
- Constant, no trend: $\Delta y_t = \alpha + \gamma y_{t-1} + \nu_t$

- Constant and trend: $\Delta y_t = \alpha + \gamma y_{t-1} + \lambda_t + \nu_t$

The Augmented Dickey Fuller adds **lagged differences** to these models:

- No constant, no trend: $\Delta y_t = \gamma y_{t-1} + \sum_{s=1}^{m} a_s \Delta y_{t-s} + \nu_t$
- Constant, no trend: $\Delta y_t = \alpha + \gamma y_{t-1} + \sum_{s=1}^{m} a_s \Delta y_{t-s} + \nu_t$
- Constant and trend: $\Delta y_t = \alpha + \gamma y_{t-1} + \lambda_t + \sum_{s=1}^{m} a_s \Delta y_{t-s} + \nu_t$

4.5.7. The Augmented Dickey Fuller Test (ADF) Stationarity Test

There is always a need to choose a lag length to run this test and this should be chosen such that the residuals are not serially correlated. There are several options for choosing lags: Minimize Akaike's information criterion (AIC) or Bayesian information criterion (BIC), or an operation of dropping the lags until the last lag is statistically significant. The Augmented Dickey Fuller Test (ADF) was applied to the data using lag order (3) and the results are summarised in the following results from Table 4.

4.5.7.1 Lag Selection Criteria

For lag order selection Akaike Information Criteria (AIC), Hannan-Quinn information criteria (HQIC) and Schwarz Bayesian information criterion (SBIC) criteria for the study data estimated a maximum lag order of 3 years as shown by table 4.2.

Table 4.1: Lag Selection Criteria for Augmented Dickey – Fuller Stationarity

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-6265.03				3.e+141	348.502	348.625	348.854
1	-6043.02	444.02	64	0.000	5.e+137	339.723	340.829	342.891
2	-5892.18	301.69	64	0.000	7.e+135	334.899	336.987	340.881
3	-5699.54	385.27*	64	0.000	4.e+133	327.752*	330.823*	336.549*
4	.	.	64	.	-1.0e+61	.		

Source: Author Using Stata 15

4.6 The Augmented Dickey Fuller Test (ADF) Stationarity Results

The results as evidenced in table 4.3, showed that the test failed to reject the null hypothesis (H0) that there was unit root for all the variables at level I(0) as can be seen from the Mackinnon's p values which are all greater than 0.05 at the 95% significance level. In other words all variables were non-stationary at level.

The results further revealed that the test failed to reject the null hypothesis (H0) that there was unit root for all the variables at 1st difference I(1) apart from the Non-

Petroleum Imports (IMPoth) as can be seen from the Mackinnon's p values which are all greater that 0.05 at the 95% significance level except for the other Non-Petroleum imports. Hence all variables were non-stationary at 1st difference except for all the non-petroleum imports which were stationary at first difference I(1).

Finally The results showed that the test rejected the null hypothesis (H0) that there was unit root for all the variables at second difference I(2) as can be seen from the Mackinnon's p values which are all less than 0.05 at the 95% significance level. In other words all the other variables were stationary at second difference or were integrated of second degree as can be seen from the italicised entries.

The stationarity tests show why the study could not adopt the Ordinary Least Squares (OLS), Vector Auto Regression (VAR), Structural VAR (SVAR) Vector Error Correction (VECM) or Auto Regressive Dynamic Lag (ARDL) and other usual time series models which require stationary at level or at 1st difference or a mix of both level and 1st order integration. The respective stationarity tests may be analysed in Appendix 2.

Casting the dynamic model for this study began with the fact that all the economic variables in the study were not integrated of order zero I(0), but were integrated of order two I(2) and in similar and different time lags ***(See Appendix II for stationarity tests).***

The study's stationarity results turned out to be integrated of 2nd order or I(2). (Refer to Appendix II). This principally meant ruling out the Autoregressive Dynamic Lag (ARDL) model which primarily works efficiently when variables are I(0) or I(1) or a mix of both and effectively non-dependable where some variables are I(2). This meant ruling out the Vector Error Regressive (VAR) model for long run equilibrium if cointegration existed or Restricted VAR if short run equilibrium was to be analysed. This was because estimation of the parameters of the VAR model requires that the time dependent regressand and regressor variables be covariance stationary, with their first two moments being finite and time-invariant and that the model be proven to be stable.

It also meant ruling out the VECM which requires that variables be non-stationary at level but stationary at first difference I(1) if cointegration existed to analyse the long run equilibrium. This is when the regressand time dependent variables (yt) are not

covariance stationary, but their first differences are and similarly that the model be proven to be stable.

Table 4.2: The Augmented Dickey Fuller Test (ADF) Stationarity Results

Variable	Test Statistic Z(t)	5% Critical Value Z(t)	MacKinnon P-value for Z(t)	Integration Order
Debt	-0.658	-2.969	0.8574	I(0)
Debt1	-1.797	-2.972	0.3820	I(1)
Debt2	***-4.284***	***-2.975***	***0.0005***	***I(2)***
GDP	-0.326	-2.969	0.9785	I(0)
GDP1	-2.909	-2.972	0.0443	I(1)
GDP2	***-5.289***	***-2.975***	***0.0000***	***I(2)***
IMPoth	0.368	-2.969	0.9803	I(0)
IMPoth1	***-3.845***	***-2.972***	***0.0025***	***I(1)***
IMPPET	2.976	-2.969	1.0000	I(0)
IMPPET1	-2.285	-2.972	0.1769	I(1)
IMPPET2	***-6.309***	***-2.975***	***0.0000***	***I(2)***
Xpt	-0.131	-2.969	0.9463	I(0)
Xpt1	-2.885	-2.972	0.0472	I(1)
Xpt2	***-3.782***	***-2.975***	***0.0031***	***I(2)***
Inv	0.246	-2.969	0.9748	I(0)
Inv1	-1.766	-2.972	0.9463	I(1)
Inv2	***-5.037***	***-2.975***	***0.0000***	***I(2)***
Govt	-0.731	-2.969	0.8386	I(0)
Govt1	-2.238	-2.972	0.19260	I(1)
Govt2	***-4.082***	***-2.975***	***0.0010***	***I(2)***
CONS	-0.861	-2.969	0.8007	I(0)
CONS1	-2.542	-2.972	0.1055	I(1)
CONS2	***-4.185***	***-2.975***	***0.0007***	***I(2)***

Source: Author Using Stata 15

The Structural Autoregressive Dynamic Lag (SVAR) was deemed not so applicable since the research by its nature didn't have much to deal with policy impact responses where theory is used to place restrictions on the contemporaneous correlations

Additionally the residuals were graphed to further show their long run stationarity by their mean reverting properties in the long run as shown in figure 4.1.

Granger and Newbold (1974) advised that in estimating the dynamic relationship between independent and dependent variables, it is important to get the orders of integration right. If the dependent variable is integrated, then at least some of the regressors must also be integrated, otherwise we would be trying to account for an occurrence or variable that is non-stationary by a set of regressor variables that are not.

Similarly, if the regressand variable is stationary, then it cannot "follow" an integrated regressor variable on its non-stationary state because such a model would or will be miss-specified.

Figure 4.1: Long run Stationarity of the Model Residuals

Source: Author Using Stata 15

A good rule of thumb is not trying to explain something non-stationary with (only) stationary variables or vice versa because any non-stationary regressor will transmit its non-stationarity to the regressand variable which is misleading because you cannot explain a stationary variable with a non-stationary one. Regressions in which the regressand and the regressor(s) are non-stationary lead to misleading conclusions where R^2 and the t statistics are likely to be large even if the underlying variables are not truly related (spurious).

4.7 Model Specification: – The Markov (MS) Switching Auto Regression Model

The choice of the model was necessitated by the fact that all the variables chosen in the study exhibited a second order integration and that the dependent variable underwent a radical structural change after which the variables exploded to relatively higher

magnitudes but still with, relatively frequently, alternating between “Highs” and Lows” in magnitudes.

In discussing business cycles, Lucas (1977) emphasized on the co-movement of important macroeconomic variables. Diebold and Rudebusch (1996) further suggested that a model for business cycles, features the co-movement of economic variables and persistence of economic states. As such a multivariate Markov switching model was suitable because it is able to characterize both of these features.

Johansen (1990) investigated the vector autoregressive processes and discovered the underlying conditions for which the processes are 1(2). He proved a representation theorem for such processes to point to the interpretation of the autoregressive (AR) model as an error correction model.

Johansen (1995) further analysed the statistical analysis of I(2) processes in the context of the vector autoregressive (VAR) model using modified likelihood methods, and was followed by papers by Paruolo (1995, 1998). Regression models of this configuration were utilized by Stock & Watson (1993), and Kitamura (1995). Johansen theorized that the main idea was to regard the I(2) models as a non-linear regression models with integrated regressors. Connected to this study was an essential outcome about the consistency of the maximum likelihood estimator in a general non-linear regression model in an I(2) model with the maximum likelihood estimator existing with probability tending to an I(1) for any continuous restrictions on the parameters provided the process is I(2). The asymptotic distribution of the maximum likelihood estimator in the I(2) model was further proven by Johansen including the result that the super consistent I(2) estimators are asymptotically mixed Gaussian and that the remaining ones are asymptotically Gaussian or, in some cases, even more complicated.

Chung-Ming Kuan (2002) explained the commonality of the application of different time series models to look at the dynamistic attributes of economic and financial variables with outstanding linear models, such as autoregressive (AR) models, moving average (MA) models, and mixed autoregressive and moving average (ARMA, ARFIMA etc.) models being applied. He noted that these became outstandingly popular partly due to their incorporation into statistical and econometrics software packages.
But despite their relative success, Kuan (2002) argued that, are not able to adequately explain numerous nonlinear dynamic structures such as asymmetry, amplitude

dependence and volatility clustering with examples being factors like GDP growth rates typically fluctuating around higher amplitudes and being more persistent during expansions, but being less persistent during contractions and staying non fluctuating at relatively lower amplitudes. For such data, he argued, it would not be so wise to expect a single, linear model to capture or explain such these distinct nonlinear behaviours.

In addition as argued by Reisen, Sena Jnr and Lopes (2001) models like the ARFIMA model tend to suffer misspecification of the error distribution for heavy tailed, skewed and bimodal data variables. Hence Kuan (2002) explained why, as such, there has been a rapid increase in the development of nonlinear time series models as discussed by Tong (1990) and Granger and Teräsvirta (1993).

Kuan (2002) however pointed out that these nonlinear time series models might have their own shortcomings in that their implementation are typically demanding and cumbersome with their nonlinear optimization algorithms tending to easily loop incessantly at local optima in the parameter space (resulting in breaks in execution error in some software algorithms). Secondly the majority nonlinear models are programmed to execute only certain patterns of nonlinear data and hence inflexible suggesting that the success of a nonlinear models largely tends to rely on the data sets to which they were programmed with the exception is the so-termed artificial neural network models which, due to their universal applicability and approximation property, are capable of characterizing any nonlinear pattern in data as outlined by Kuan and White (1994). However Kuan argued that even these models tend to suffer from the identification problem rendering vulnerability in their application.

The Markov Switching Model as introduced by Quandt (1973) and improved by Hamilton (1989), equally termed as the regime switching model, is one of the outstanding nonlinear time series models in the literature. This model applies multiple structures or equations that tends to characterize the nature of time series variable data in different regimes. By allowing for the switching between or among these structures, this model is affordably able to represent or capture more and relatively complex dynamic relations.

A unique characteristic of the Markov switching model is that the switching operation or technique is guided by an apparently unobservable state variable that follows a first-order Markov chain. The Markovian property particularly regulates the current value

of the state variable depending on its immediate or on the spot past value. Consequently a structure prevailing for a random period of time will be replaced by another structure when the switching takes place (Kuan, 2002).

Markov switching regression models have been used with some examples of the applications of this model in economics having been done to investigate the time series asymmetrical behaviour over GDP expansions and recessions (Hamilton 1989) in investigating exchange rates (Engel and Hamilton 1990) and interest rates (García and Perron 1996) and in investigating stock returns (Kim et al. 1998). The time series in all those examples are characterized by data generating processes (DGP) with dynamics that are state dependent where the states may be recessive or expansionary, and/or of high volatility or low volatility.

Smith et al (2005) further reinforced the usage of the Markov Switching Regression Models in that economic systems frequently undergo disturbance (shocks) that shift them to alternative states like nations plunging into recessions, government political regimes switching over different time frames and/or financial markets tending to go into bubbly booms and then crashes with these states tending to exhibit stochastic occurrence and relative dynamism whereby their original occurrence gives indications that they probably will recur.

In the effort to determine or capture such stochastic and probabilistic time based state transitions, the Markov-switching models provide an analytical framework. Hamilton (1989) investigated the U.S. business cycle using the switching models. The term structure of interest rates were analysed by Timmermann (2001) using the Markov switching model while Ang and Bekaert (2002) used the same method to analyse stock portfolio allocation (Ibid).

National debt and petroleum prices and hence their corresponding expenditures in our study have experienced some periods in which their conduct or characteristics seem to dramatically switch in form. All these periods promote the use of regime switching models and quite a number of specifications have been suggested in the literature. Depending on the existing regime, a model classification has to be identified. In our study a two state Markov switch model was employed in order to distinguish between stable or dormant and explosive or expansive phases as has been identified in the background analysis in chapter one.

According to Hamilton (1989, 1990), the MS model can detect changes or switches in parameters, and then put a measure on the lengths of the duration in each state and equally put a measure on the correlations of movements between parameters in each state. In basic specification, the Markov Switching model assumes that deviations of regressor and/or regressand growth from their mean follow a p-th order autoregressive process (Galyfianakis, et al., 2015).

The Markov switching model is therefore suitable for describing correlated data that exhibit distinct dynamic patterns during different time periods. This was why this study chose to use this model to analyse the relative impact of petroleum imports to national debt in the Zambian case as the national debt variable did exhibit distinct dynamic patterns in the post HIPC/MDRI periods just as did the various variables included in the study with petroleum imports being of major concern.

Borrowing from Georgios et al (2015) the regime-switching model aims at allowing for the varying of the behaviour or characteristics in varying the states of nature, while at the same time estimating when there is transition or movement from one state to another. A simple regime switching model would take the form:

Regime 0: $y_t = \mu_0 + \rho y_{t-1} + \varepsilon_t$, $\varepsilon_t \tilde{} N[0, \sigma^2]$ denoting the AR of the variable of concern in the first state;
Regime 1: $y_t = \mu_1 + \rho y_{t-1} + \varepsilon_t$, $\varepsilon_t \tilde{} N[0, \sigma^2]$ denoting the AR of the variable of concern in the second state; where the numbering is quite arbitrary.
Specifying S_t as the regime denoting variable, then the mean can be written as a function of the variable S_t thus:
$\mu(S_t) = \mu_0$, if $S_t = 0$
$\mu(S_t) = \mu_1$, if $S_t = 1$

In the Markov-switching model, the unobserved random variable $S_t$is said to follow a Markov chain, as defined by transition probabilities between the N states:
pi/j = P[S_{t+1} = i / S_t = j] , i, j = 0,….. N-1
Hence the probability of moving from stage j in one period to stage i in the next period, is previous state dependent. Hence since the Markov system has to be in one of the N states, it follows that:
$\sum_{i=0}^{N-1}$ pi/j = 1

Hence if we let P to be the full matrix of transition probabilities this can be represented as:

P = (pi/j)

with the sum of the conditional probabilities summing up to one (1). Hence if we let s = 2, then the probability (P) will be equal to:

	State 1 (t+1)	*State 2 (t+1)*
State 1(t=0)	$p0/0$	$p0/1$
State 2(t=0)	$p1/0$	$p1/1$
Σ	1	1

The probability P0/0 is that probability of the dependent variable staying in state 1 ($S_{t=0}$) at a time t and remaining in that state at the time t +1. The probability P0/1 is that probability of the dependent variable staying in state 1 (t=0) at a time t and shifting to state 2 at the time t +1. The probability P1/0 is that probability of the dependent variable staying in state 2 (t=0) at a time t and shifting to state 1 at the time t +1. The probability P1/1 is that probability of the dependent variable staying in state 2 (t=0) at a time t and stay in the same state 2 at the time t +1.

To sum up the Markov-switching regression models provide an analytical framework of performing a simultaneous analysis of both the regimes shifts and the differential impact of explanatory variables on the dependent variables across the states (regimes).

4.5.7.2 The Markov Switching Auto Regression Model

The auto regression model was chosen over the dynamic regression because of the relative low frequency nature of the data under analysis. Borrowing from Sánchez **(2016),** the dynamics that the Markov Switching Auto Regression specification followed for this study were represented as:

$y_t = \mu_{St} + x_t \alpha + z_t \beta_{St} + \sum_{i=1}^{p} \Phi i, _{St} (y_{t-i} - \mu_{St-i} - x_{t-i} \alpha + z_{t-1} \beta_{St-1}) + \varepsilon_{t,St}$

Where

y_t : is the regressand (National Debt).

$\mu_{St:}$ is the State-dependent intercept.

x_t : is the Vector of exogenous variables with state invariant coefficients α.

z_t : is the Vector of exogenous variables with state-dependent coefficients $\beta_{St.}$

$\Phi i;_{St}$: is the *ith* AR term in state St.

$\varepsilon_{t,St}$ ~iid $N(0; \sigma s^2)$ are the independent, identically and normally distributed error terms with mean 0 and variance σ^2 in state St.

For this study the Markov Switching Auto Regression model was then specified as:

$DEBT_t = \mu_{St} + \alpha GDP_t + \beta_{St} GDP_t + \sum_{i=1}^{p} \Phi i, _{St} (DEBT_{t-i} - \mu_{St-i} - \alpha GDP_{t-i} + \beta_{St-1} GDP_{t-1}) + \varepsilon_{t,St}$

$DEBT_t = \mu_{St} + \alpha IMPOTH_t + \beta_{St} IMPOTH_t + \sum_{i=1}^{p} \Phi i, _{St} (DEBT_{t-i} - \mu_{St-i} - \alpha IMPOTH_{t-i} + \beta_{St-1} IMPOTH_{t-1}) + \varepsilon_{t,St}$

$DEBT_t = \mu_{St} + \alpha IMPPET_t + \beta_{St} IMPPET_t + \sum_{i=1}^{p} \Phi i, _{St} (DEBT_{t-i} - \mu_{St-i} - \alpha IMPPET_{t-i} + \beta_{St-1} IMPPET_{t-1}) + \varepsilon_{t,St}$

$DEBT_t = \mu_{St} + \alpha EXP_t + \beta_{St} EXP_t + \sum_{i=1}^{p} \Phi i, _{St} (DEBT_{t-i} - \mu_{St-i} - \alpha EXP_{t-i} + \beta_{St-1} EXP_{t-1}) + \varepsilon_{t,St}$

$DEBT_t = \mu_{St} + \alpha Inv_t + \beta_{St} Inv_t + \sum_{i=1}^{p} \Phi i, _{St} (DEBT_{t-i} - \mu_{St-i} - \alpha Inv_{t-i} + \beta_{St-1} Inv_{t-1}) + \varepsilon_{t,St}$

$DEBT_t = \mu_{St} + \alpha Govt_t + \beta_{St} Govt_t + \sum_{i=1}^{p} \Phi i, _{St} (DEBT_{t-i} - \mu_{St-i} - \alpha Govt_{t-i} + \beta_{St-1} Govt_{t-1}) + \varepsilon_{t,St}$

$DEBT_t = \mu_{St} + \alpha CONS_t + \beta_{St} CONS_t + \sum_{i=1}^{p} \Phi i, _{St} (DEBT_{t-i} - \mu_{St-i} - \alpha CONS_{t-i} + \beta_{St-1} CONS_{t-1}) + \varepsilon_{t,St}$

This model was simultaneously evaluated using the Stata 15 Markov Switch module.

4.6 Chapter Summary.

The Chapter contained the research methodology and the research design which reintroduced the hypotheses declared in the study and brought forth or explained the criteria to be used in accepting or rejecting them. The research instruments, data collection tools and techniques were further introduced as well as the data analysis tools. The research reliability and validity qualities were reinforced in this Chapter with both the internal and external reliability positions of the study being explained. The choice for the design of the research model was looked at where the choice was dependent on a number of technical criteria with the stationarity and the nonlinear nature of the time series variables being the most critical. The methods for obtaining the estimates of the parameters and the interpretation were also introduced in the chapter as well as the preliminary statistics for validating the authenticity of the independent variables' impact on the dependent variable. The study's Markov Auto regression Model was established in this Chapter.

CHAPTER FIVE: DATA PRESETATION, ANALYSIS AND INTERPRETATION

5.1 Introduction

This Chapter brought out the data used in the study how it was processed, the model used to process it and the results that were obtained. The criteria and methods used to validate the data, the model estimation and the results obtained were also presented.

5.2 Data Statistics

The study collected data for the following variables**:**

- National Debt (Debt)
- Gross Domestic Product (GDP)
- Other Imports of goods and services (IMPoth)
- Oil imports (IMPPET)
- Exports of goods and services (Xpt)
- Gross fixed capital formation (Inv)
- General government final consumption expenditure (Govt)
- Household final consumption expenditure (Cons)

The time series data ranged from the years 1980 to 2019 which was quite a valid presentation as it gave almost 40 years of observed data. Table 5.1 gives some statistics of the data as computed in Stata 15 where the following can be noted:

Table 5.1: Variables Statistics

Variable	Mean.	Std.Deviation	Min	Max
Debt	6.98e+09	4.12e+09	2.27e+09	1.97e+10
GDP	9.95e+09	9.25e+09	1.80e+09	2.80e+10
IMPoth	2.51e+09	2.43e+09	5.18e+09	8.11e+09
IMPPET	4.68e+08	5.71e+08	4.19e+08	2.07e+09
Xpt	3.64e+09	3.69e+09	7.67e+09	1.16e+10
Inv	3.02e+09	3.69e+09	8.44e+09	1.12e+10
Govt	6.71e+09	1.06e+09	3.09e+09	3.95e+10
CONS	6.71e+09	5.46e+09	1.30e+09	1.95e+10

Source: Author Using Stata 15

National Debt (Debt): Table 5.1 shows that national debt ranged from US$2.27 Billion to US$19.7 with a mean value of US$6.98 Billion. The standard deviation for the debt was US$4.21 Billion showing that the maximum National Debt was almost 5 standard deviations higher

Gross Domestic Product (GDP): This ranged from US$1.8 Billion to US$28 Billion with a mean value of US$9.95 Billion. The standard deviation for the GDP was US$9.25 Billion showing that the maximum GDP for the period was about 3 standard deviations higher.

Other Imports of goods and services (IMPoth): These ranged from US$518 Million to US$8.11 Billion with a mean value of US$2.51 Billion. The standard deviation for these was US$2.43 Billion showing that the maximum other Imports for the period was about 3 standard deviations higher.

Petroleum (Oil) imports (IMPPET). Petroleum imports ranged from US$41.9 Million to US$2.07 Billion with a mean value of US$468 Million. The standard deviation for these was US$571 Million showing that the maximum Petroleum (Oil) imports for the period was almost 4 standard deviations higher.

Exports of goods and services (Xpt): These ranged from US$767 Million to US$11.6 Billion with a mean value of US$3.64 Billion. The standard deviation for these was US$3.69 Billion showing that the maximum Exports of goods and services for the period was almost 3 standard deviations higher.

Gross Fixed Capital Formation (Inv): Investment ranged from US$8.4 Million to US$11.2 Billion with a mean value of US$3.02 Billion. The standard deviation for these was US$1.06 Billion showing that the maximum Gross Fixed Capital Formation for the period was almost 11 standard deviations higher.

Government Final Consumption Expenditure (Govt). Government expenditure was ranged from US$309 Million to US$3.95 Billion with a mean value of US$1.3 Billion. The standard deviation for these was US$1.06 Billion showing that the maximum Government expenditure for the period was almost 4 standard deviations higher.

Household Final Consumption Expenditure (Cons): ranged from US$1.3 Billion to US$19.5 Billion with a mean value of US$6.71 Billion. The standard deviation for these was US$5.46 Billion showing that the maximum Household final consumption expenditure for the period was almost 4 standard deviations higher.

5.2.1 Model as 2nd difference stationary mean reverting stationary process.

In figure 4.10 the study plotted the 2nd differenced variables to show the stationary order of the variables. Figure shows the variables with mean 0 and constant variance across the period of study which then justifies the second order processing model adopted.

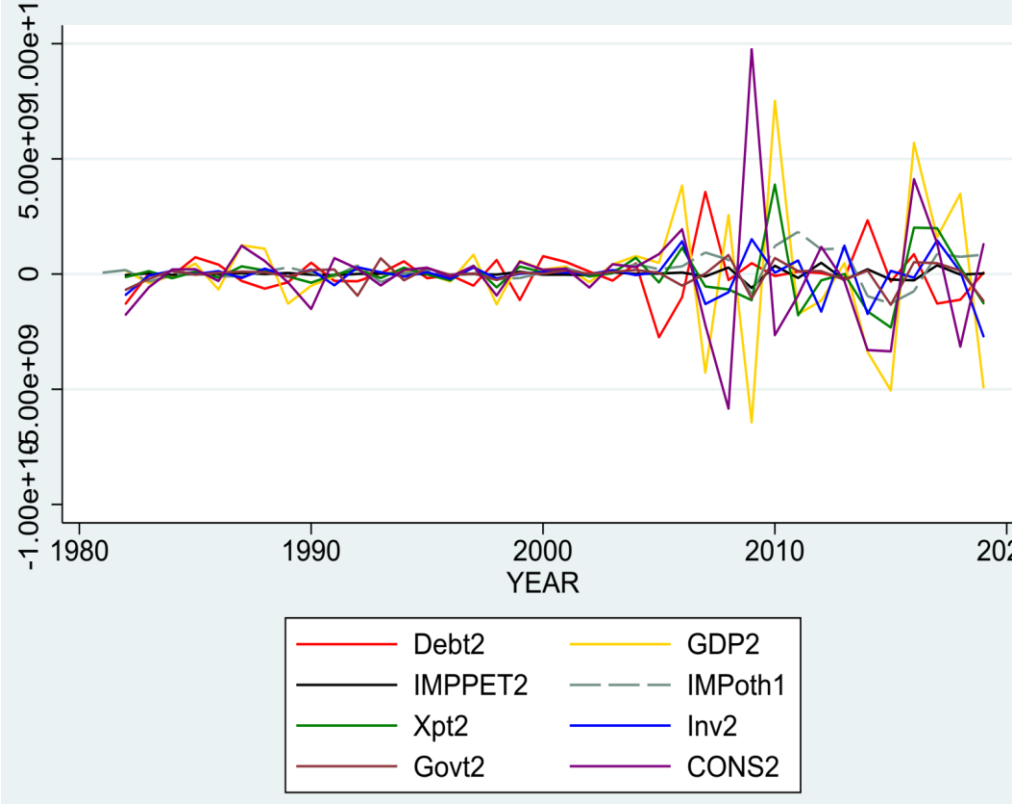

Figure 5.1: Model as 2nd difference mean reverting stationary process

Source: Author using Stata 15

5.2.2 The Markov Switch Auto Regression Model Results.

Table 5.2 reveals the converged Markov Switch Auto Regression model's regressed coefficients from the stationary second differenced variables and the state coefficients including the state probabilities and standard deviation of the estimates. In this regression rerun all coefficients were treated as switching.

The study estimated the following model from the regressed coefficients for the two states with MacKinnon's p-values in brackets:

State 1:

Debt = -8.68e+08***(0.000)*** – 0.7676099GDP***(0.000)*** + 0.3316939IMPoth***(0.080)*** – 2.251837IMPPET***(0.000)*** + 1.599351Xpt***(0.000)*** + 1.198707Govt***(0.000)*** - 0.8515111Inv***(0.000)*** – 0.4526043CONS***(0.000)*** + AR[0.5493032]***(0.000)***

State 2:

Debt = -2.64e+08***(0.000)*** – 0.3309875GDP***(0.000)*** + 0.1032863IMPoth***(0.524)*** – 1.88971IMPPET***(0.000)*** + 0.7879281Xpt***(0.000)*** + 0.07501462Govt***(0.000)*** - 0.1894514Inv ***(0.000)*** – 0.0878015CONS***(0.044)*** - AR[1.122933] ***(0.000)***

The results revealed a significant negative impact of Petroleum imports on national debt for the period under study where on average a 1% change in Petroleum imports significantly reduced national debt by an estimated 2.259% in state 1 and an estimated 1.9% negative impact in state 2.

Table 5.2: Markov Switch Auto Regression Model Results

D2.Debt	Coef.	Std.Error	z	Prob(z)
STATE 1				
D2. GDP	-0.767097	0.0506504	-15.16	0.000
D2. IMPoth	-0.3316939	0.1896253	-1.75	0.800
D2. IMPPET	-2.251835	0.5227109	-4.31	0.000
D2. Xpt	1.599351	0.2267844	7.05	0.000
D2. Govt	1.198707	0.2650045	4.52	0.000
D2. Inv	-0.8515111	0.1163208	-7.28	0.000
D2. CONS	-0.4526043	0.057573	-7.86	0.000
AR LAG1.	1.122933	0.1807615	6.21	0.000
_CONS	-8.68e + 08	9.25e+07	-9.39	0.000
STATE 2				
D2. GDP	-0.3309875	0.0662946	-4.99	0.000
D2. IMPoth	0.1032863	0.162098	0.64	0.524
D2. IMPPET	-1.8897	0.5142301	-3.67	0.000
D2. Xpt.	0.7879281	0.1789507	4.40	0.000
D2. Govt	0.7501462	0.1465783	5.12	0.000
D2. Inv	-0.1894514	0.0373669	-5.07	0.000
D2. CONS	-0.087015	0.0425396	-2.02	0.044
AR LAG1.	-0.5493032	0.1394287	-3.94	0.000
_CONS	2.64e+08	8.81e+07	4.85	0.000
Sigma	2.52e+08	2.20e+07		
P11	0.2136117	0.1097778		
P21	0.7025264	0.1221621		

Source: Author using Stata 15

The autoregressive 1st lag of National debt on itself also significantly positively impacted national debt by 0.55% in state 1 but significantly negatively impacted national debt by 1.12% in state 2

The study revealed a consistent significant negative impact of GDP on national debt in both states with the negative GDP impact being estimated at 0.77 % in state 1 and 0.33% in state 2.

The study additionally revealed an otherwise paradoxical result concerning the Zambian exports whereby the model reveals a significant positive impact of exports on national debt in both states with the estimates being at 1.6% in state 1 and 0.79% in state 2 – a matter of controversy!

Gross Capital Formation was brought out in the study as having had a consistent significant negative impact on national debt with the model estimating a negative impact of 0.85% in state 1 and 0.19% in the 2nd state.

Government expenditures were revealed in the study as having had a significant positive impact on National debt for the period under study with the coefficient estimates being at 1.2% in state 1 and 0.075% in state 2

Aggregate Consumption was brought out in the model as having a consistent negative impact on national debt with the coefficients being estimated at 0.45% in state 1 and 0.09% in state two.

The study revealed other Non- Petroleum Imports as having insignificantly negatively impacted National debt at an estimate of 0.9% in state 1 and insignificantly positively impacted national debt in State 2 at an estimate of 0.1%.

The State1 intercept parameter was significantly negative suggesting a negative (contractionary) impact of unknown state variables holding all the known study variables constant. The State2 intercept parameter was on other hand significantly, positive suggesting an expansionary positive impact on National Debt from unknown state variables in state two.

Sigma is the standard deviation of the dependent variable and it was around US$236 million with a standard error of US$20.7 million.

5.2.3 Markov Switching Auto Regression Model Post –Estimation Tests

For additional construct validation the study also performed some post testing of the model to ascertain validity.

5.2.3.1 Normality of the Residuals

The distribution of the model residuals was tested for normality by plotting the kernel density estimate as shown in Figure 5.1 which revealed a Gaussian kernel type distributed over the whole x-axis producing showing a fairly normally distributed kernel density estimate of the residuals (plot in Blue) when compared or contrasted to the normal density (plot in red).

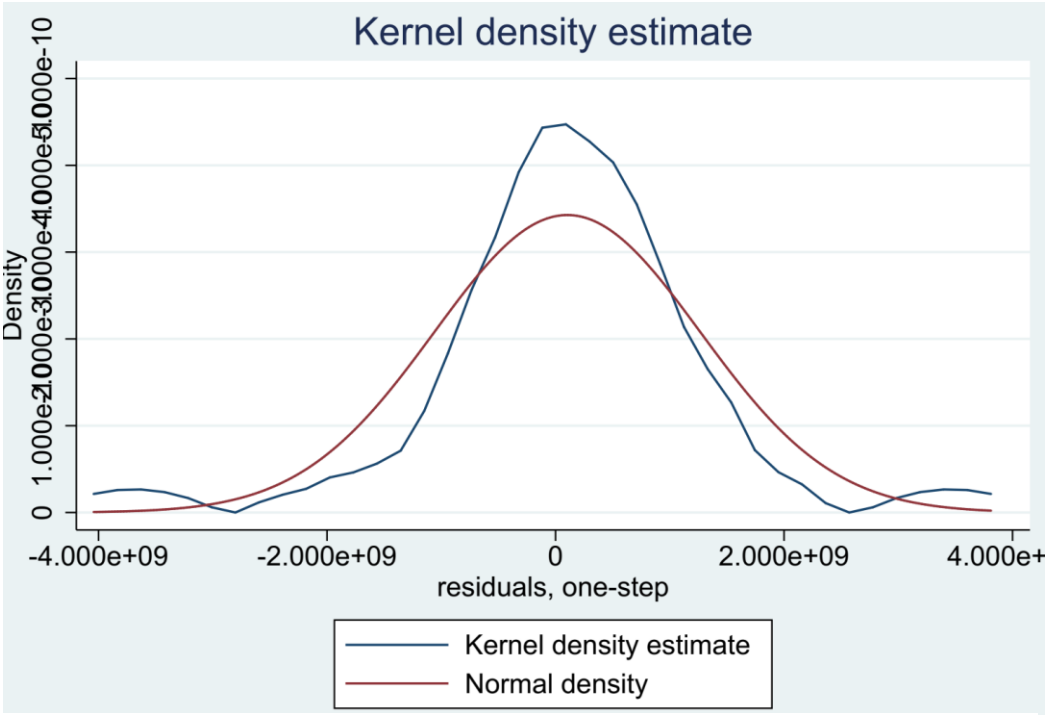

Figure 5.2: Kernel Density Estimate for Normality of the Model Residuals

Source: Author using Stata 15

5.2.3.2 Shapiro-Wilk Test for Normal Data

The normality of the residuals was further tested using the Shapiro - Wilk log normalised test shown in and Table 5.3 with the p-values for the test being larger than 5% resulting in the failure to reject the null that the residues were normally distributed.

Table 5.3: Shapiro-Wilk Test for LogNormal Data

Variable	Obs.	W	**z**	**Prob>z**
r	36	2.679	-1.788	0.96309

Source: Author using Stata 15

5.2.3.4 Long Run Cointegration Relationship of the Model variables.

Before Cointegration for the model variables was done there was Johansen's tests for cointegration for the model variables at second difference, there was need for determining the lag order for the cointegration. This was done using the VAR/VECM lag order selection criteria since the Markov Switching model is a reduced rank model of the underlying VAR/VECM model with regime changes (Jochmann & Koop, 2014) which is valid as long as the variables are integrated of the same order. This was evaluated as shown in Table 5.3 where the lag order was established to be 3.

5.2.3.5 Johansen Long Run Cointegration Relationship of the Model variables.

The Long run cointegration relationship for the model was established by firstly establishing the lag criteria as evidenced in table 5.4 from which was established that the lag length for the cointegration test was 3 as unanimously chosen by the LR, AIC, HQIC and SBIC lag information criteria.

Table 5.4: Lag Order selection for Johansen Test for Cointegration

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-5910.85				2.e+141	348.167	348.29	348.527
1	-5755.26	311.17	64	0.000	1.e+139	342.78	343.882	342.012
2	-5625.41	259.71	64	0.000	5.e+137	338.906	340.989	345.012
3	-5376.79	497.24*	64	0.000	1.e+134	328.046*	331.108*	337.025*
4	.	.	64	.	-7.5e+25*	.		

Source: Author using Stata 15

Long run cointegration relationship of the model variables was evaluated using Johansen's tests for cointegration at second difference as shown in Table 5.5 below. The results revealed the Trace statistic being lower than the 5% critical value at maximum rank of 5 implying that the null hypothesis of five (5) cointegrating equations was accepted. This meant that there was long run relationship among the independent and dependent variables and corresponded to the maximum n -1 regressor/cointegrating equations requirement (With n being the number of regressors). As such the results

from the study portrayed a valid long run revelation of the state of the variables and their cointegrated relationship.

Table 5.5: Johansen Test for Cointegration Results

Maximum Rank	Parms	LL	Eigenvalue	Trace Statistic	5% Critical Value
0	105	-5137.7041		348.5755	124.24
1	118	-5083.925	0.95372	241.0173	94.15
2	129	-5044.1365	0.89706	161.4402	68.52
3	138	-5018.3262	0.77119	109.8197	47.21
4	145	-4993.9851	0.75115	61.1375	29.68
5	150	-4970.8453	0.73347	14.8578*	15.41
6	153	-4965.0035	0.28381	3.1743	3.76
7	154	-4963.4164	0.08670		

Source: Author using Stata 15

5.2.3.6 Markov Switching Model Transition Probabilities

Table 5.6: Markov Switching Model Transition Probabilities

Transition Probabilities	***Estimate***	***Std. Err.***	***[5% Confidence Interval]***	
p11	0.2136117	0.1097778	0.0701657	0.4943917
p12	0.7863883	0.1097778	0.5056083	0.9298343
p21	0.7025284	0.1221621	0.4288992	0.8813292
P22	0.2974716	0.1221621	0.1186708	0.5711008

Source: Author using Stata 15

The transition probabilities in Table 5.6 reveal that the model followed a Markov chain with p1/1, that probability of the national debt being in state 1 in a given year and remaining in that state in the following year, and p1/2, the probability of the national debt being in state 1 in a given year and shifting to state 2 in the following year, summing to unity. Equally p2/1, the probability of the national debt being in state 2 in a given year and shifting to state 1 in the following year and p2/2, the probability of the national debt being in state 2 in a given year and remaining in that state in the following year, equally summing to unity.

5.2.3.7 Markov Switching Model State Duration.

Rather than just knowing the state at which the debt series would be in at a point in time, the study also wished to know the average time the debt series spent in a given state. The computation of the expected duration of the process or the average length of the dormant periods and expansive periods for the Zambian data set is shown in

Table 5.8 where it is approximated that state 1, the dormant state typically persisted for about 1.27 years while state 2, the expansive state, persisted for about 1.4 years.

Table 5.7: Markov Switching Model State Duration

Expected Duration	***Estimate***	***Std. Err.***	***[5% Confidence Interval]***	
State1	1.271636	0.1775172	1.07546	1.977816
State2	1.42343	0.247519	1.13465	2.33155

Source: Author using Stata 15

5.2.3.8 Assessing Model Fit

The study further examined the model fit by comparing the fitted values of differenced Zambian National Debt and the residuals with the actual data. The fitted values were obtained using smoothed probabilities that consider all sample information and these were graphed as exhibited in Figure 5.3 which shows that our study did not have a good fit in state 1 as residuals accounted for much of the variation in the dependent variable. But the model had a good fit in state 2 as the residuals did not account for much of the variations in the dependent variable as shown by the fact that the residuals are lying a relatively far off distance from the predicted values.

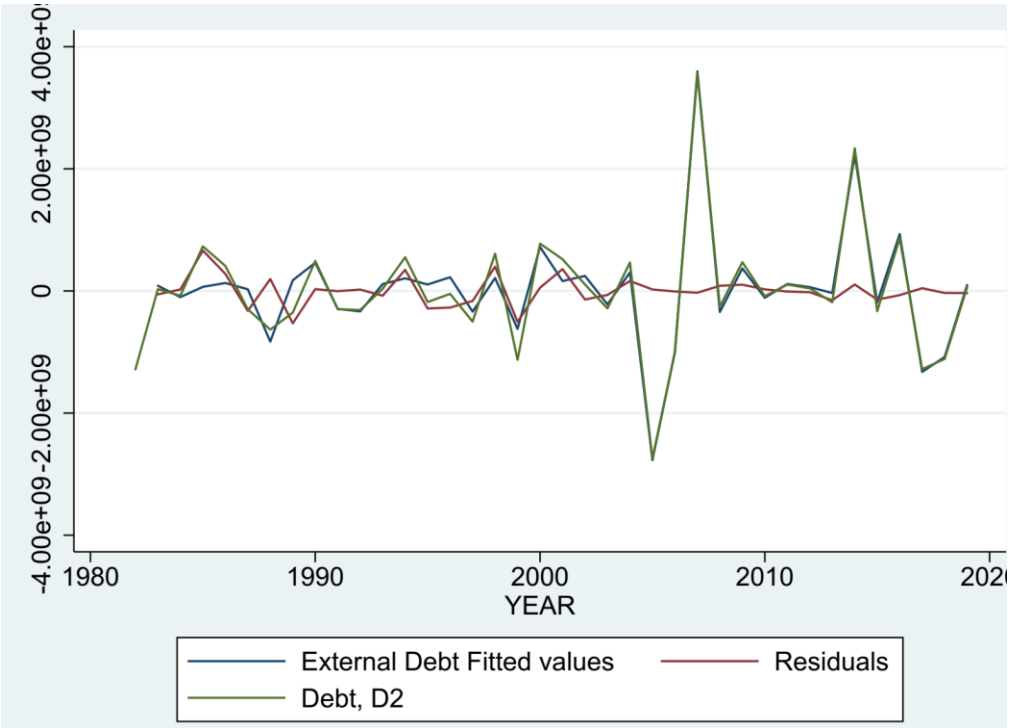

Figure 5.3: Post Estimation Tests – Differenced Model Fit and State Predictions

Source: Author using Stata 15.

As a control the study examined the model fit by comparing the fitted values of non - differenced Zambian National Debt and the residuals with the actual data. The fitted values were obtained using smoothed probabilities that consider all sample information and these were graphed as exhibited in Figure 5.4. The graph exhibited that study had a good fit overall as the residuals did not account for much of the variations in the dependent variable as shown by the fact that the residuals are lying a relatively far off distance from the predicted values.

5.2.3.9 Assessing Model Robustness/Stability

The structural model robustness or stability was assessed by running the simultaneous equation system model stability test command in Stata to assess stability of the model results where the stability condition was that all the eigenvalues had to lie with unit modulus. The results are given in the Table 5.8 where the stability index was less than one implying that all the eigenvalues lay inside the unit circle implying that the simultaneous equation system satisfied the stability condition.

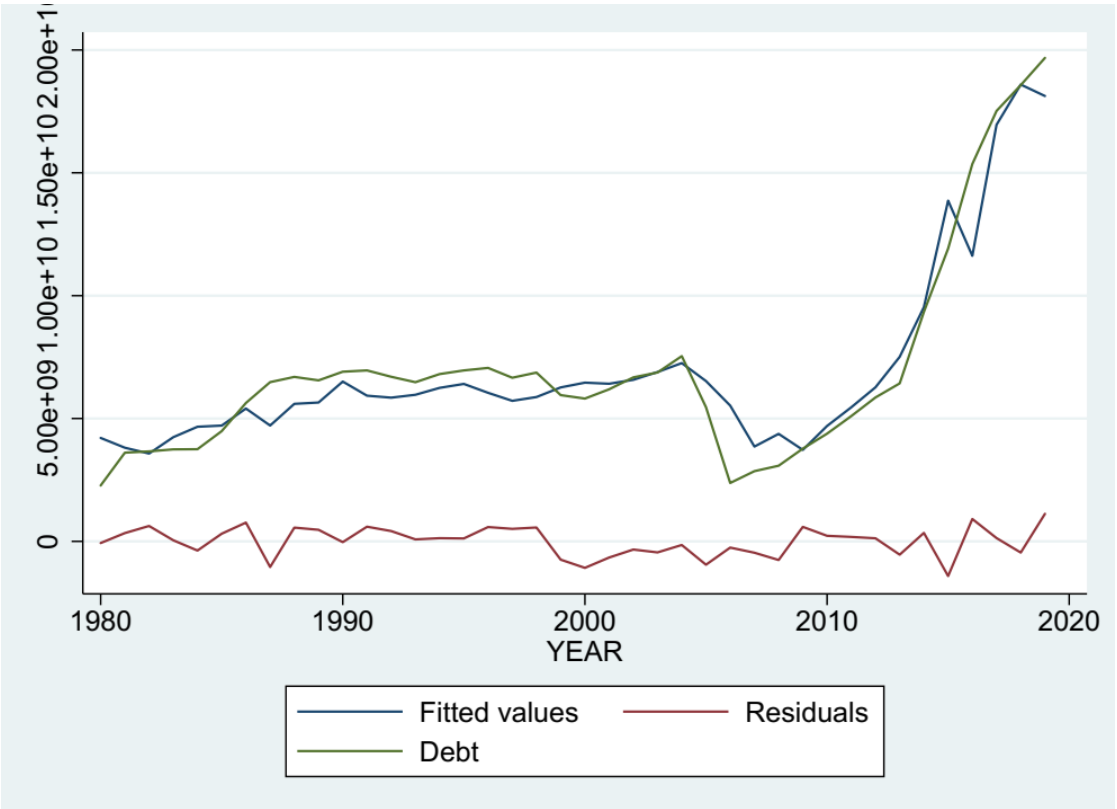

Figure 5.4: Non Differenced Debt, Predicted Debt and Residuals State1 and State2

Source: Author using Stata 15.

Table 5.8: Stability Analysis of Simultaneous Equation Model Stability (Eigen Values Stability Condition)

Eigenvalue	*Modulus*
0	*0*
0	*0*
0	*0*
0	*0*
0	*0*
0	*0*
0	*0*
0	*0.*

Stability Index = 0

All the Eigenvalues lie inside the unit circle. SEM satisfies stability condition

Source: Author Using Stata 15

5.3 Chapter Summary

This chapter brought out the data used in the study for the concerned study period 1980-2019. The data was collected for the variable National Debt as the regressand and GDP, other Non-Petroleum Imports, Petroleum imports, Exports, Gross Capital formation, Government expenditure and Aggregate consumption as the regressor variables. The descriptive statistics were obtained and the study found no restricting findings to prevent the data analysis.

The non-linearity of the variables and the second order of integration warranted the choice of the Markov Switching Regression model as the most adequate to analyse the study variables and the Autoregressive model was adopted rather than the Dynamic one due to the relative low frequency of the data which was yearly.

The results revealed a significant negative impact of Petroleum imports on national debt for the period under study in both state 1 and state 2.

The autoregressive 1st lag of National debt on itself also had a significant negative impact on national debt in state 1.

The study revealed a consistent significant negative impact of GDP on national debt in both states.

The study additionally revealed a significant positive impact of exports on national debt in both states with the estimates.

Gross Capital Formation was brought out in the study as being of a consistently insignificant negative impact on national debt in both states.

Government expenditures were revealed in the study as having had a significant positive impact on national debt in both states.

Aggregate household consumption was brought out in the model as having had a consistent and significant negative impact on national debt in both states.

The study revealed other Non- Petroleum Imports as having insignificantly negatively impacted National debt in state 1 and insignificantly positively impacted national debt in State 2 making their impact totally inconclusive.

The State1 constant parameter was significantly positive suggesting a positive (expansionary) impact of unknown state variables holding all the known study variables constant. The State two constant parameter was significantly negative suggesting a contractionary (negative) impact on National Debt from unknown state variables in state two.

The standard deviation of the National Debt the dependent variable was around US$252 million with a standard error of US$32 million.

Model suitability and stability was established by the following concerned tests. The second order processing was justified by the stationary order of the variables showing the variables with mean 0 and constant variance across the period of study which then justifies the stationarity of the model variables adopted. Additional construct validation of the study was also performed by post testing of the model to ascertain validity. First was normality of the distribution of the model residuals was being tested by plotting the kernel density estimate which approximated the normal density showing that the model residuals were normally distributed. This was further confirmed by the Shapiro-Wilk lognormal testing of the residual distribution where the results failed to reject hypothesis of the normal distribution.

Long run cointegration relationship of the model variables was evaluated using Johansen's tests for cointegration at second difference. The results revealing the Trace

statistic being lower than the 5% critical value at maximum rank of 5 implying the null hypothesis of five (5) cointegrating equations being accepted.

The Markov Model's transition probabilities revealed that the model followed a Markov chain with the probability of the national debt being in state 1 in a given year and remaining in state 1 in the following year and the probability of the national debt being in state 1 in a given year and shifting to state 2 in the following year, summing to unity. Equally the probability of the national debt being in state 2 in a given year and shifting to state 1 in the following year and the probability of the national debt being in state 2 in a given year and remaining in state 2 in the following year, equally summing to unity.

The Markov Model's State Duration or the average time the debt series spent in a given state was approximated that state 1, the dormant state typically persisted for about 1.27 years while state 2, the expansive state, persisted for about 1.4 years.

The Markov Switch structural model robustness or stability was assessed by running the simultaneous equation system model stability test command in Stata to assess stability of the model results where the stability condition was fulfilled in that all the eigenvalues lay with unit modulus.

CHAPTER SIX: DISCUSSION OF RESEARCH RESULTS

6.1 Introduction

This Chapter brings out the objective and subjective discussions of the model results with regard to both economic theory and the empirical or practical model data computation results as compared with or contrasted to other study findings and existing theoretical propositions if any.

6.2 Petroleum Imports Impact on National Debt

The results revealed a significant negative impact of petroleum imports on national debt for the period under study where on average a 1% change in petroleum imports significantly reduced national debt by an estimated 2.25% in state 1 and where on average a 1% change in petroleum imports significantly reduced national debt by an estimated 1.9% negative impact in state 2 in the period under study. This brings out the underlying positive multiplier effects of petroleum in the economy. Being a vital input in all the economic sectors, petroleum enables production to take place and some of the resulting output goes in to trade exports bringing foreign reserves and tax revenues to the government which can equally be used for debt servicing which in the long run results into the overall reduction of national debt.

This is quite paradoxically contrary to most studies on relationships between petroleum imports and national debt for most countries. For instance Hasanli & Ismayilo (2018) concluded that a rise in oil prices resulted in the growth of the world national debt where a 1% growth in oil prices increased the volume of foreign debt to world GDP by 3.17%. These results could be attributed to the fact that the studies like the one by Hasanli & Ismayilo were not country specific one but cross cutting panel data studies that tend to approximate results from data collected at one point in time as compared to this study's approach which was a single country macroeconomic analysis using time series data.

It is also contrary to findings by Nkomo (2006) who concluded that the heavy dependence or reliance on imported oil for SADC countries was meshed with other country specific factors that revealed the impact of the oil shocks and the limited resources for the countries to cope with it which could be why "most of Southern Africa suffered from high external debts". But the studies undertaken by Nkomo, though

bringing out a link between petroleum prices and SADC countries' external debt in general , tended to be more generalized and simulational rather being based on actual country based data.

This result is equally contrary to the findings by Waheed (2020) whose panel data analysis of 12 oil and gas exporting and 12 oil and gas importing countries from 2004 to 2013 showed that the international price of oil played an important role in external debt of oil and gas exporting and importing countries. The coefficient of Petroleum price was negative for oil-gas exporting countries while it was positive for oil-gas importing countries. This showed that an increase in international price of oil was expected to reduce the external debt of oil and gas exporting countries but worsen the debt burden in oil and gas importing countries. This study was a panel data analysis however whose results are not so advisable to generalize from when performing a case study analysis.

Some studies done in fact tend to point to national debt increasing more for some oil exporting countries. Kretzmann & Nooruddin's (2009) findings were that increasing oil production led to increasing debt because there existed a strong and positive relationship between oil production and debt burdens exhibiting that the more oil a nation produces, the more debt it tends to generate. This was the case for Nigeria, in their study, where the petroleum revenue windfall of the 1970's left the country was severely over- indebted in the 1980s and 1990's. This left the government incapacitated from handling the debt crisis as a result of the external constraints brought by the structural adjustment, political realities and the internally socially entrenched corruption which made all the required adjustments for debt handling to be continuously postponed making the country credit worthiness to fall.

But the findings from our study can be justified when one looks at the role of petroleum as an energy product whose usage is cardinal in the running of any economy. The Zambian Energy Regulation Board (ERB, 2018) report cited petroleum as providing a vital upstream, midstream and downstream sector value chain involving exploration and production, infrastructure such as transport, storage facilities and then refining and marketing. The petroleum industry in the country is of a vital nature encompassing a range of different activities and processes which jointly contribute to the transformation of underlying petroleum resources into end products to be used as inputs by industrial and private customers. Hence the economic multiplier effects for petroleum are of vast

magnitudes seeing its vast usage in energy production and transportation which could just explain the negative impact of petroleum imports on national debt as it enables the nation's productive capacities to bring about positive national returns sufficient enough to reduce the growth of national debt through the national production channel.

Additionally none of the studies linking petroleum prices to national debt have approached the petroleum/debt relationship from the decomposed general macroeconomic theory approach which this study undertook where petroleum imports were separated from the non- petroleum imports and then the petroleum imports' impact on debt were simultaneously compared or contrasted to the impact of the other general macroeconomic variables used in this study namely GDP, Non-Petroleum imports, National exports, Gross Capital Formation, Government spending and Private Final Consumption.

6.3 GDP Impact on National Debt

The study revealed a consistent significant negative impact of GDP on national debt in both states where a 1% change in GDP resulted in an approximate 0.8% reduction in national debt in state 1 and 0.33 % reduction in national debt in state 2. This result cannot be then surprising when you cross compare the impact of petroleum productive effects on debt in the Zambian case. Though not the actual objective of this study it would not be that far from the possible fact that petroleum induced economic production should have a positive impact on economic growth.

This result is similar to that for Bittencourt (2013) who investigated the determinants of external debt in South America and whose estimation results from the principal component and dynamic panel data analysis confirmed that economic growth had the ability to significantly reduce the debt in the region, although these results could not be generalized.

It is also similar to that for Waheed (2017) whose panel data estimation results for petroleum exporting countries showed that increased economic growth was one of the important factors in reducing external debt.

The results are equally similar to those found by Tiruneh (2004) whose cross-section pooled time-series analysis for heavily indebted poor countries indicated that sluggish economic growth was one of the main reasons for external borrowing.

The results are equally similar to those found by Beyene & Kotosz (2020) who showed that for Ethiopia what significantly increased the external debt was the savings-investment gap, trade deficit, fiscal deficit, and debt service. However among the factors that significantly negatively affected the external debt of the country was the GDP growth rate.

These results are supported by Appiah-Kubi, et al (2022) who found that gross domestic product had a negative and significant relationship with public debt signifying that as a country improves on its domestic production of goods and services, it can generate more revenue, leading to less borrowing.

These results differ from those found by Forslund et al. (2011) whose study using data from an unbalanced panel of 1558 observations covering 104 countries for the 1990-2007 period found that GDP had significant positive effect on public debt, while past debt and real exchange rate depreciation had a significant negative effect on public debt. However this was due to the nature of the panel data studies whose results are not so good to generalise from when trying to analyse a case study scenario the way this study did in the Zambian case.

Most studies executed on the GDP national debt nexus put GDP as the regressand and debt as the regressor whereby most studies have found national debt impacting GDP negatively. This study looked at the reverse side of the nexus and found GDP equally impacting national debt negatively.

6.4 Exports' Impact on National Debt

The study additionally revealed an otherwise controversial result concerning the Zambian exports whereby the model reveals a significant positive impact of exports on national debt in both states with the estimates being at 3.17% in state 1 and 0.53% in state 2 – a matter of great controversy because theoretically exports are supposed to be having a positive impact on GDP and GDP has been shown to be having a negative impact on debt. One would then expect exports to be having negative impact on debt.

But this is not new or particularly happening in the Zambian case alone where copper price rises bring about booms that are seconded with price falls which make the repayment of previous debts difficult. There may be further effects of copper price rises bringing about the uncompetitive appreciation of the local currency which may make exports uncompetitive hence making low revenue resulting in less debt service for the country.

The worldwide known issue of "Resource Curse" or "Dutch Disease" among the primary commodity exporting nations has seen this reality of exports being responsible for this apparent theoretical contradiction. This phenomenon arises from the primary commodity exporting countries' export diversification inability which makes their terms of trade to be a shadow of the export commodity's world market price such that that given high export prices, the high revenues tend to disguise the underlying structural problems with the primary commodity exporting nations' economies, such that when the export commodity's prices fall, there is inability for affected nations to effectively deal with the debt problems which arise thereafter. The resultant is a positive relationship between debt and the exports arising from this economic dependence on non-diversified export trade. For instance according to Kretzmann and Nooruddin (2009) comparing Nigeria's high levels of debt to its vast petroleum and natural gas reserves is a typical "Resource Curse" or "Dutch Disease" reality.

The Jubilee Debt Campaign study and report (2016) equally brought out the exports-debt positive relationship as being the result of the incipient increase in lending and borrowing transactions resulting from the discovery of petroleum oil in Ghana in 2011 and the fall in commodity prices where more money was borrowed after the fall in the price of oil and other commodities since 2013. The study further underscored the Ghanaian return to a debt crisis as being underlain by continued dependence on commodity exports, as well as irresponsible borrowing and lending where new debts do not generate sufficient revenues to enable them make sufficient repayment of the debts and hence this positive relationship between exports and external debt.

Another reason why the exports volume seem to impact national debt positively is that there are a high volumes of exports which though recorded in the developing nations' balance of payments have no corresponding foreign exchange inflow records in form of the receipts from this trade because the proceeds do not end up in the local banks, be they commercial or central banks. In addition even though these trade may be recorded

they are either under invoiced or under declared or simply not declared at all. The Centre for Trade Policy and Development (CTPD, 2021) brings out this factor as the Illicit Financial Flows (IFF's) which they claim to be as high as 10% of the entire Africa's GDP.

Zambia's main export commodity being copper and on a smaller scale Gold, cobalt and a number of precious stones which is mainly from the extractive industry. The Zambia Extractive Industries Transparency Initiative (EITI, 2019) reported the extractive industries contribution to the economy as being 70% to exports, 10% to GDP, 26% to Government revenue and 2% to employment. However even from such authorities one cannot get conclusive data of the breakdown of these exports by revenues, or the ownership and domicile of these export revenues in as far as financial institutions are concerned. The ownership of the extractive industry being mostly foreign and the failure of initiatives such as the Statutory instrument 55 which required export trade records to be declared with the Zambian Central bank can account for the failure of these exports to make a significant negative impact on foreign debt.

Several other non-copper mineral exports of the precious stone category, were quoted by the 7th National Development Plan Mid Term Review (2017-2021) as having declined in figures due to low compliance in the submission of mineral returns and inadequate capitalization in the sector. It is hoped that the policies to lead to the capitalization of this sector will not come at a cost of increased debt the way copper exports have tended to be.

These results differ from those found by Eichengreen and Portes (1986) using the data for 23 countries performed both cross-section and panel data analysis. This study indicated that there was an insignificant effect of export instability and degree of openness on external debt. Only the log of gross domestic product (GDP) per capita was found to have significant effect on external debt. On panel data regression, all variables *except export variability* turned out to be statistically significant.

The total lack of significant contribution to Zambian national debt decrease from the export sector can also lie in the deteriorating terms of trade from the commodity exports (notably minerals) due to the undiversified nature of the country's exports. Though a bit on the old side Brock (1984) had taken note that countrues with a much diversified exports base like Korea, for example, which despite being among the five highest

debtor nations among developing countries had emerged from the international debt crisis in reasonably good shape. This was attributable to its success in building a diversified, competitive export sector that had enabled the country to service debt burdens.

6.5 Gross Capital Formation's Impact on National Debt

Gross Capital Formation is brought out in the study as having had a consistent significant negative impact on national debt with the model estimating a negative impact of 0.85% in state 1 and 0.19 % in the 2nd state showing the significant effect of this variable in reducing Zambia's national debt.

These results are similar to the ones found by Belguith (2017) in his study using Vector Error Correction model for the period 1986-2015 on Tunisia where the results of the full sample analysis revealed that investment reduced the value of Tunisian public debt.

The results differ from those of Swamy (2015) who used a dataset comprising annual macroeconomic data for the World Development Indicators (WDI) database 2014 of World Bank on 252 countries, over the period 1980-2009. Using Panel Granger causality testing he established causality running from his study's determinants of debt where the results revealed that Gross fixed capital formation, had a positive effect on debt.

Hence in our study we see that overall gross capital formation has significantly reduced Zambia's long run national debt. The difference from Swamy's (2015) findings should be through the technical complications of panel causality tests particularly for wide base data sets like the ones applied in his study.

6.6 Government Expenditures' Impact on National Debt

Government expenditures are revealed in the study as having had a significant positive impact on National debt for the period under study with the coefficient estimates being at 0.54% in state 1 and 0.40% in state 2. This is quite an expected outcome as can be supported by several studies and reports.

This result is similar to the findings by Waheed (2017) who investigated the macroeconomic determinants of external debt in petroleum exporting and importing

countries using panel data of 12 oil and gas exporting and 12 petroleum importing countries covering the period 2004-2013. The study identified that general government expenditures, like the current account deficit and inflation, were the main factors responsible for the accumulation external debt of these countries.

These results differ from those obtained by Swamy (2015) whose Panel Granger causality testing results from a full sample of 252 countries, over the period 1980-2009, revealed that government expenditure was one of the variables like inflation and population growth that had a negative effect on national debt.

Fitch Ratings (2020) reported an outstanding overshoot of the Zambian fiscal deficit in 2019 bringing out the Zambian government's challenges in containing debt accumulation with the country recording a preliminary fiscal deficit of 8.2% of GDP in 2019 which was well above the budget objective mark of 6.5%. Though government revenues were higher than targeted, expenditures exceeded the 2019 budget estimates by about 9%, which reflected higher interest payments, which were 1% of GDP above target caused by domestic currency's depreciation, capital expenditures and subsidies.

Fitch Ratings further observed that the continuous fiscal deficits increased general government debt to 88% of GDP in 2019, from 32% in 2014. External public debt was US11.1 billion (54% of GDP) while the country faced approximately USD1.5 billion in national debt servicing (105% of current international reserves) in 2020. With the failure of managing the 2020 debt servicing requirements, the subsequent Eurobond repayments of USD750 million in September 2022 and USD1 billion in April 2024 will most likely lead to a surge in national debt servicing in those years. The country's 2020 Budget, approved in September 2019, called for narrowing the fiscal deficit to 5.5% of GDP but the government's failure to meet spending objectives in 2019 highlighted how difficult it was to achieve any substantial narrowing of the deficit in 2020 or the years beyond. As such the study's finding of the positive impact of government expenditure on national debt is quite a valid one.

6.7 Aggregate Consumption's Impact on National Debt

Aggregate Consumption was brought out in the model as having a consistent and significant negative impact on national debt with the coefficients being estimated at 0.4% in state one and 0.19% in state two. This theoretically and empirically binding

Keynesian macroeconomic point is as valid now as it were then in the aftermath of the great depression. A country's economic agents need to spend for multiplier effects to take place and add to a nation's national income (Mankiw, 1992). It is not only supply side economics as determined by the production and export functions that can give a nation that ability to generate resources to pull an economy to a relatively healthy and prosperous macroeconomic equilibria and be able to reduce foreign debt but equally its internal marginal propensity to consume as shown by the study's findings. The negative impact of aggregate consumption on national debt show the results of improved aggregate incomes to households and should make the national economic policies to be incomes oriented and this can partially be promoted in facilitating more formal sector employment by enabling start up corporate ventures by possibly enforcing good tax incentives.

These results are supported by those found from the study by Appiah-Kubi, et al (2022) whose results revealed that aggregate (government) consumption had a significant negative relationship with the levels of public debt in Africa because as governments ensure good conditions of service to public officials by paying wages and salaries regularly and equipping public workers with the necessary resource that facilitate work, the overall productivity of the public sector improves, which reflects on the revenue generation of the government.

The results on final consumption are different from those obtained by Swamy (2015) whose Panel Granger causality testing results from a full sample of 252 countries, over the period 1980-2009 revealed that final consumption expenditure was one of the factors, like trade openness, that had a positive effect on national debt.

The differences between the case study results and those from panel data analysis need a deep understanding in that the methods of analysis differ quite a lot just as the sampled data including the period of study. But case study results are more dependent because there is no diversity in the data.

6.8 Non- Petroleum Imports' Impact on National Debt

The study revealed non- petroleum imports as having insignificantly negatively impacted national debt at an estimate of 0.9% in state 1 but equally insignificantly positively impacted national debt in State 2 at an estimate of 0.44%. This has somewhat

similar consequences as was seen for petroleum imports with the difference being that the other imports are for multiple sectors. Zambia is basically an import oriented country with many major inputs to industry being imported not just as inputs but as finished products for the commercial sectors as well. State 1 in the model where the Non- Petroleum Imports impacted debt negatively could be that period where imports were had not gone down to the post 2018 period due to favourable world trade conditions.

The Bank of Zambia "Direction Of Trade Report (2019)" cites declining trade for both exports and imports in the post 2018 period by as much as 19.3%, with some reasons for imports being on account a decrease in imports of copper ore. The positive contribution of imports to national debt can also be explained if some contents of the imports are analysed in detail. For instance the Bank of Zambia report, imports from India increased by 21.7% to US$130.12 million in quarter 1 (Q1) 2019 from US $106.94 million in Q1 2018 on account of a rise in imports in nuclear reactors and boilers. It is a major question mark as to how these technologies will contribute that positively to our technologically challenged environment operational wise seeing that these technologies have had catastrophic consequences in operational accidents with very high environment damages in countries like Russia and Japan which are highly technologically advanced. Imports on such technologies certainly could have contributed to the positive impact of imports on national debt in state 2 of the study's model.

6.9 Chapter Summary

In this chapter the impact of Petroleum imports on national debt was revealed to have been insignificantly negative for the period under study with a 1.26% negative impact in state 1 and significant 2.88% negative impact in state 2. The study revealed a consistent significant negative impact of GDP on national debt in both states with the negative GDP impact being estimated at 1.09% in state 1 and 0.29% in state 2. The study additionally brought out an otherwise controversial result for the Zambian exports whereby the model revealed a significant positive impact of exports on national debt in both states with the estimates being at 3.17% in state 1 and 0.53% in state 2.

Gross Capital Formation was brought out in the study as having a consistent significantly negative impact on national debt with the model estimating a negative

impact of 0.34% in state 1 and 0.19% in the 2nd state showing the significant effect of this variable in reducing Zambia's national debt. Government expenditures were revealed in the study as having had a significant positive impact on National debt for the period under study with the coefficient estimates being at 0.54% in state 1 and 0.40% in state 2.

Aggregate Consumption was brought out in the model as having a consistent and significant negative impact on national debt with the coefficients being estimated at 0.4% in state one and 0.19% in state two. The study revealed other Non- Petroleum Imports as having insignificantly negatively impacted National debt at an estimate of 0.9% in state 1 but equally insignificantly positively impacted national debt in State 2 at an estimate of 0.44%.

CHAPTER SEVEN: RESEARCH FINDINGS

7.1 Introduction

This chapter brought out the research findings in view of the study's general and specific objectives and the concerned hypotheses. It is of a positive interpretation of the findings by the results from the data in the model and does not carry any subjective connotations or mitigations as could have been the case for the previous chapter where there was recourse to subjective and objective sides of the findings. The chapter recaps on the objectives and hypotheses and gives reasons for accepting or failing to accept the hypothetical connotations on the findings.

The study's main objective was the determination of the relative impact of the petroleum imports on the Zambian national debt burden so as to assess the viability of the mitigation the debt contributions arising from this commodity if any in order to reduce the debt and assist in the removal of political, financial, and practical impediments to the development of alternative national energy resources to petroleum by the private sector. Generally it is the aim of this research to encourage developing countries like Zambia to adopt appropriate policies in establishing the necessary climate and infrastructure to foster private sector investment in alternative energy in the energy sector to complement, supplement or totally replace petroleum energy in the long run.

Specifically the study sought to establish to what extent the petroleum import expenditures have impacted the Zambian national debt and equally to evaluate to what extent expenditures on the imports of other goods and services have impacted the Zambian external debt. Additionally the study specifically ought to evaluate to what extent other General Macroeconomic Variables had impacted the Zambian external debt. (These were Exports of Other Goods and Services, Gross Fixed Capital Formation, National Income [GDP], Private Domestic final Consumption, and Government Consumption).

7.1.1 Petroleum Imports Impact on National Debt

The study established that petroleum imports had had a significant negative impact generally on national debt for the period the study was undertaken though the exact channels were not the aim of the study. But the nature of the commodity as an energy

commodity cannot rule out the massive role it plays in the nation's productive capacity in many sectors of the economy channels. Hence the negative impact on national debt should be through the dynamic multiplier effects the product has in its many usages in the economy.

Hence the study accepted the alternative hypothesis that petroleum imports had an impact on national debt in the period under study and this impact was a debt reducing impact.

7.1.2 Other Non- Petroleum Imports' Impact on National Debt

Other Non- Petroleum Imports were discovered as having mixed non-significant negatively and positively impacts with both being depending on whether they were productive inputs or mere consumption imports. This could be because of Zambia being a liberalised economy and a signatory to the World Trade Organisation (WTO), SADC and COMESA protocols, has no import restrictions and economic agents are free to participate in international trade to buy goods in whatever form, quantity and nature of application whether economic or not as long they within the trade laws.

The study, as such, failed to reject the null hypothesis that non-petroleum imports had no impact on national debt in the period under study and rejected the alternative that they had impacted external debt.

7.1.3 Zambia's Gross Domestic Product's Impact on National Debt.

Zambia's Gross Domestic Product as a stock not as a flow consistently and significantly impacted national debt negatively showing the advantage of having a growing economy as far as debt is concerned. The growing stocks of GDP over the period covered by the study did have mitigatory negative impacts on external debt.

In this regard the null hypothesis that national Gross Domestic Product had no impact on national debt was rejected by the study and as such failed to reject the alternative that GDP had had an impact on national debt in the period under study and this impact had been debt reducing.

7.1.4 Exports' Impact on National Debt

As discussed in the previous chapter the model data revealed a not so theoretically compliant result concerning the Zambian exports whereby the model found a significant positive impact of exports on national debt in both states in the period under study.

Hence the model failed to accept the null hypothesis that national exports had no impact on national debt and consequently, then, failed to reject the alternative that exports had a significant impact on external debt and this impact had been debt increasing. The channels through which this occurred are many and the study does not have offer much on this and would recommend further studies on this revelation.

7.1.5 Gross Capital Formation's Impact on National Debt

The study found Gross Capital Formation as being of a consistent significant impact on national debt for the period under the study which was interpreted from the main capital formation proxy, foreign direct investment, having had sustainable impact on economic growth.

Hence the study rejected the null hypothesis that Gross Capital Formation had had no impact on national debt and, as such, failed to reject the alternative that it had an impact on national debt for the period under study because the Gross Capital Formation impact on national debt had been debt reducing.

7.1.6 Government expenditures' Impact on National Debt

Government expenditures were revealed in the study as having had a significant positive impact on National debt for the period under study possibly due to the continuous fiscal deficits bringing the need for foreign financing and failure to service certain critical debts like the Euro Bonds which set a precedent for future debt increases.

Consequently the study failed to accept the null hypothesis that Government expenditures had had no impact on national debt and accepted the alternative that it had an impact on national debt for the period under study and this impact had been debt increasing.

7.1.7 Aggregate Consumption's Impact on National Debt

Aggregate Consumption posed its significant negative impact on national debt in both states of the model. Hence the study rejected the null hypothesis that Aggregate Consumption had no impact on national debt and instead failed to reject the alternate that it had in both states and this impact had been debt reducing. This, as has been mentioned, could be a reconfirmation of the Keynesian stance that it is not only the supply side which matters in economic development but the demand side as well. It further confirms indications by the International Monetary Fund that the country is indeed an Upper Mid Income country as is confirmed by the impact of its Aggregate Consumption's ability to generate enough multiplier effects sufficient enough to negatively impact external debt.

7.2 Chapter Summary

The study established that petroleum imports had a statistically significant debt reducing impact on national debt for the period the study was undertaken making the study accept the alternative hypothesis that petroleum imports had an impact on national debt in the period under study and this impact was a national debt reducing impact.

Other Non- Petroleum Imports were found to have had a mixed non-statistically significant impact on national debt making the study accept the null hypothesis that non-petroleum imports had no impact on national debt in the period under study.

Zambia's Gross Domestic Product significantly (statistically) impacted national debt negatively with consistent debt reducing impacts in both states of the model. This made the study to reject the null hypothesis that national GDP had no impact on national debt because impact on national debt in the period under study had been debt reducing.

The study revealed national exports as having had a statistically significant positive impact on national debt in both states in the period under study resulting in the study rejecting the null hypothesis that national exports had no impact on national debt because the study result showed a national debt increasing impact from exports in the long run.

Gross Capital Formation was found to have had a consistent and statistically significant impact on national debt for the period under the study making the study to reject the null hypothesis that Gross Capital Formation had had no impact on national debt because Gross Capital Formation had a debt reducing impact on national debt for the period under study.

The study revealed Government expenditures as having had a significant positive impact on National debt for the period under study resulting in the rejection of the null hypothesis that Government expenditures had had no impact on national debt because Government expenditures were found to have had a national debt increasing impact.

Aggregate Consumption was found to have had a significant negative impact on national debt in both states of the model making the study to reject the null hypothesis that Aggregate Consumption had no impact on national debt because it was revealed in the study that Aggregate Consumption's impact, in both states, had been debt reducing.

CHAPTER EIGHT: CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

This Chapter brought out the study's final stance on the findings and the subsequent policy recommendations that could be put forward in regard to what the data in the model brought out.

8.2 Conclusion

The following then encapsulate the study's final conclusion comparative relationship between Zambia's national debt and petroleum imports.

8.2.1 Petroleum Imports Impact on National Debt

In final analysis, the study reveals that petroleum imports had not contributed to the nation's long run increase in national debt and had in fact contributed to the long run reduction in national debt. This could be due to the reason that petroleum products are a vital industrial input and as such generate vital macroeconomic multiplier effects in the economy.

8.2.2 Other Non- Petroleum Imports Impact on National Debt

The study established that though the Other Non- Petroleum Imports had a mixed insignificant impact on national debt in the two states, the negative impact on debt, however had a magnitude that was relatively higher than the positive one hence bringing about the logical conclusion that imports may have not necessarily contributed to the nation's long term external debt. This is because when one looks at the different comparative advantages nations have in the production processes from different sectors one realises the necessity of imports of foreign goods and services from countries having comparative advantages in such. Trying to forge into making everything as the import substitution efforts tried to do, leads to sub optimal national production and can equally lead into more debt as the nation's productive capacity tends to be highly distorted.

Hence importing as an economic option can make a nation cut on production costs by buying those products from the rest of the world which is a much cheaper production

place than the domestic production place with huge opportunity costs. If a bigger proportion of imports can be on productive than just consumption products we should expect imports to have a much bigger negative impact on national debt through internal productive multiplier effects. The fact that all nations import goods of their comparative disadvantages can interpret the reducing impact the imports have had on the nation's debt in the long run.

8.2.3 Zambia's Gross Domestic Product (GDP) Impact on National Debt

The study's stance on the effect of GDP on national debt is that the nation's increasing GDP had not contributed to its national debt in the long run and, if anything, the nation's increasing GDP had contributed to the reduction of national debt over the long run. The many theories and studies on the external debt/GDP relationships have long brought out the negative and positive relationships between these two variables with causality tending to be running from debt to GDP. In contribution this study has established the negative impact of GDP on national debt in all the two state configurations of the model. This finding is significant because it brings out one salient importance of GDP growth in economies. As long as a nation can keep its GDP levels above its national debt, it has the capacity of reducing the debt levels in the long run from what the data had shown thus far for the Zambian case.

8.2.4 Exports' Impact on National Debt

The study's revelation from the model's data analysis that exports or a component of the nation's exports had been contributing to the nation's national debt over time. The exact components of these exports are not that clearly known and were not the objective of this study. But the country's main export commodity being copper whose ownership has been of a foreign and controversial nature and the not so clear operations of the mining industry after the privatization of the mines does raise an educated guess that the components of the national exports that have been debt increasing could be from this source.

Hence the study's conclusion is that despite the controversial nature of the finding, there has been a component of the nation's exports that have been debt promoting over the period of study which can either be from the controversial nature of the ownership

of the mineral export resources (the major export commodity) or for the deteriorating or poor terms of trade at which this export trade is done.

8.2.5 Gross Capital Formation's Impact on National Debt

Gross capital formation in the study was found to have significantly negatively impacted the national debt levels in the Zambian case. This does answer our question in relation to Rainer (1984|) in his study on the verification of the Debt Distribution Theory's approach where, concerning this study, it was of interest to see what kind of relationship existed between debt and capital formation in the Zambian case due to the Debt Distribution Theory's assumption that we would not expect to see much of an impact between debt and gross capital formation because much of the gross capital formation would, temporal wise, be independent of the debt levels because of the inter temporal consumption preference, except maybe, in very complicated time lag relationships or analyses. Thus the question of what could have been the other factors that could have contributed towards the current debt crisis if the two questions posed by Rainer were not answered cannot be, as this study hypothesised, that mounting expenditures on the oil imports just could be the missing link in the this debt build up puzzle because the study has found oil imports to have negatively impacted debt.

Gross capital formation was hence concluded to have significantly impacted the nation's long term external debt.

8.2.6 Government expenditures' Impact on National Debt

Government expenditures' significant positive impact on national debt for the period under study further reinforced Rainer's Debt Distribution Theory's approach regression analyses which revealed significant negative correlation between capital imports and national savings for the countries he had analysed of which Zambia was part. Though not affirming causality or direction of causality, the negative correlation, he claimed, was mainly as a result of the fiscal policy in terms of government budgets where public finances for these countries were extremely mining industry profitability dependent such that prosperity period in the raw materials markets went in tandem with notable additions in public revenue leading to increases in government consumption levels. This, he claimed, resulted into expectations which could only be reduced at the expense

of big political unpopularity when and if when export commodity prices fell. As such the reason why many governments looked to national debt was to finance the irreversible current expenditures leading to reductions in government saving. The loans, as he further claimed, did not serve so much as to build up investments but rather to compensate for the fall in real incomes as a result of the deteriorated terms of trade so as to stabilise consumption levels or to finance growing government deficits (Rainer, 1984).

Hence the study concluded form the data analysis in the model that Government expenditures had an outstanding significant debt increasing impact on the nation's debt in the period under study

8.2.7 Aggregate Consumption's Impact on National Debt

Aggregate Consumption (Demand) posed its significant negative impact on national debt in both states of the model. This should not be very surprising. Though not exactly mapping out the relationship between aggregate demand and external debt, John Maynard Keynes had proposed that low aggregate demand was responsible for high unemployment that characterises economic downturns meaning that increasing aggregate demand tended to lower unemployment of factors which tends to have a positive impact on national income as the IS-LM models bring out (Mankiw, 1992). The exact channels by which Aggregate Consumption has had a negative impact on national debt is unknown in this study and tends to be one issue for further studies recommendations.

As a conclusion the study established that aggregate consumption had a very significant debt reducing impact on national debt in the period under study suggesting that the marginal propensity to consume (MPS) multiplier effects tended to have quite dynamic national debt reducing effects through channels which as the above paragraph suggests are not the objectives of this study.

8.3 Recommendations

After having found the problem of determining the impact of petroleum imports on Zambia's national debt and having consulted worldwide, regional wide and national

wide literature and empirical analysis, having conceptualized, proposed and executed the methodology of analysing the data collected and seeing the results, the study was in a position to propose the following recommendations.

8.3.1 Petroleum Imports

Petroleum imports for the current period remain a vital source of energy both for running industries and for vital transportation. The Zambian economy being a developing economy needs this vital source of fossil power for production and as such should source for the cheaper sources of this commodity national wide, regional wide, continent wide and world-wide. This is because of the dynamic multiplier effects this commodity has on the economy as evidenced by the model results that imports of this commodity have been national debt reducing .

However, as noted in the conclusions, this does not imply that the country should not be looking out to advance towards using renewable sources of energy for production industries and transportation. The advanced economies have realised the benefits of moving away from fossil fuels in the interest of not just the economic rewards but in the interest of the environment as well. Renewable energy has the capacity of reducing the diminishing returns nature of fossil fuels due to the high variable costs involved in their production processes and that includes transportation costs.

It should be in the government's interest to promote business start-ups in renewable energy ventures and technologies, by relaxing laws on taxation in these fields in the case of easing the cost of doing business and waiving import taxes on material inputs in these types of investments. Tax credits and subsidies for renewable technologies should be further looked into as a way of promoting investment and consumption of this type of energy. It should further be in the government's interest to realign the schools curricula at tertiary and higher education to factor in the gradual moving of the economy to these technologies so as to create a viable human knowledge base to ensure the success of a gradual transformation of industry from fossil fuels to renewable energy.

Notwithstanding the influence of the petroleum imports, the government should promote the investment of petroleum business into local ownership to support the gradual investment by these locals in renewable energy as a backup to renewable energy

not falling into an import product the way petroleum is currently so as to safe guard against the foreign exchange volatility due to dependence on imported energy.

This would help assist the implementation of Pillar one of the national budget which emphasised economic diversification and job creation in which industrialisation is expected to drive growth with energy and infrastructure development being key enablers (Ministry of Finance and National Planning, 2020). In would further go a long way into rural electrification.

The proposed lowering of import duty to 15 percent from 30 percent on electric motor vehicles to reduce the use of fossil fuel in the 2021 national budget (Ibid) was a move in the correct direction but could further be made better by lowering duty even more or even waiving it particularly for inputs in investments on renewable energy.

8.3.2 Other Non- Petroleum Imports

These imports remain vital in the economic performance of the nation (and any nation for that matter) as they bring in goods and services of a nation's comparative disadvantage that contribute to the nation's real GDP. A nation cannot produce all it needs in its economic lifeline. So it is not a contradiction to any economic theory or empirical evidence that these imports have had a negative contribution (though statistically insignificant) to the nation's external debt. Hence the due recommendations here are that the nation should strive to have relatively lower values of import duties for goods of an input nature to the nation's productive sectors so as to offer a favourable effective rate of protection to domestic producers of local products and services which offer valuable employment and value added to the nation's GDP.

8.3.3 Gross Domestic Product (GDP)

The nation's GDP has been brought in the model as having consistently contributed to the reduction of national debt in both states of the model. As such it is of due recommendation that all micro and macro-economic aspects of the economy that contribute to the expansion or growth of a nation's GDP be supported in the nation's economic plans and all those that can be identified as contributing to a nation's reduction of GDP growth to be checked. The due task of identifying such, however, is

not the objective of this study and would be of due interest to recommend to other scholars to evaluate such macro variables and processes.

The achieving of a real GDP growth rate of at least 1.8 percent as stated in the macroeconomic objectives, policies and strategies for 2021 national budget could subsequently be further boosted in coming years if the nation moves on with the diversification efforts with renewable energy being one of the key drivers for industrialization.

8.3.4 Gross Capital Formation

Gross Capital Formation's consistent and significant, negative impact on national debt could be a result of an effective foreign direct investment policy and equally and encouraging effective domestic investment promotion policy programme. In regard to this study, then, it would be of recommendation that the government makes a stance in supporting gross fixed capital formation in both the petroleum and the renewable energy sectors. This is because these are the chosen drivers for the industrialization drive in the nation as noted in pillar one of the 2021 national budget. (Ibid). The multiplier effects from the energy industry are dynamic and well documented on a world wide scale as is shown by the high trade volumes in energy**.**

8.3.5 The National Exports

Though the model data revealed a not so theoretically compliant result concerning the Zambian exports where it was revealed that exports had a significant debt increasing impact on national debt for the period under study should be an exception rather than the rule. It is important to understand that the study related exports to national debt and not relating exports to GDP. What study brought out was a reality that Zambia's exports or some portions of the export trade had been debt increasing over the period of the study. This could be because of the export trade being dominated by copper earnings which somehow tended to get the country more indebted although the reasons not being very clear at this stage of the study but ownership factors may not be ruled out with the government admitting to actively working towards finding strategic investors to improve operations and production of the various copper mines. What the 2021 national

budget brought out was that despite copper production volumes increasing the copper export earnings had been falling (Ibid).

The study recommends that the nation in its efforts to diversify exports should also look at improving or reducing on energy costs so that the exporting entities can produce competitive output for the export markets. It is the study's conviction that low cost petroleum and renewable energy can go a long way into reducing production costs for domestic export oriented industries which can go a long way towards eliminating this positive contribution of exports to external debt.

8.3.6 Government Expenditure

All governments have some debt as it is almost a law that when a government spends more than it collects in taxes it borrows from both the internal and external sources to finance the budget deficit. In this study the government expenditures' significant positive impact on national debt cannot be underemphasized. This is because government expenditures are cardinal to the operations of any economy with the government spending multiplier being the most dynamic of all macroeconomic variables. The reasons why government expenditures can contribute to national debt are many and are quite varied in form and process and it is by far not in the realm of this study to try to explain any one of them. However borrowing from Rainer (1984) Debt Distribution Theory government's national debt particularly for developing countries have to do most with many governments looking to national debt so as to finance the irreversible current expenditures leading to reductions in government saving. These loans, do not serve so much as to build up investments but rather to compensate for the fall in real incomes as a result of the deteriorated terms of trade so as to stabilise consumption levels or to finance growing government deficits.

It is the recommendation of this study that the government looks up to fiscal discipline in order to maintain government expenditure within the budget estimates. Fiscal discipline is not meant to ignore contingencies but rather to maintain government expenditures in economically achievable dimensions and avoiding overshoots which have measures extending to foreign exchange spending or borrowing and subsequently leading to increasing external debt.

8.3.7 Aggregate Consumption

As noted in the previous chapter, aggregate consumption (Demand) posed its significant debt reducing impact on national debt in both states of the model suggesting that increasing consumption demand levels had the resultant impact of reducing external debt. From the Keynesian economics arising from the great depression this should not be a surprise find though the study was regressing aggregate consumption to national debt and not to economic growth or economic recovery as the tradition normally is in economic analysis.

Aggregate consumption demand is normally positively related to the economic agents' disposable income suggesting that lower tax rates or production subsidies in certain key sectors would be the recommendations that the study would suggest to be the operational mode of economic policy in this regard. In addition would be reduced interest rates as suggested in the 2021 budget plan by the reduction in the Monetary Policy Rate to 8.0 percent from 11.5 percent so as to improve liquidity levels in the market. The enhancement of the Social Protection Programmes involving cash transfers across the country would further be recommended to increase the aggregate demand in the economy as suggested in pillar II of the poverty and vulnerability reduction in the 2021 national budget (Ibid).

8.4 Research Delimitations and Limitations

The study had constraints in the collection of data on taxation revenues for Zambia which proved a real challenge from almost all data archives. To get around this the theoretical model had to be adjusted to regard disposable consumption as autonomous and not defined by the product of the propensity to consume and the net of income less taxation. In addition data availability, especially in the pre multiparty era proved a challenge due to the non- openness of the then existing democracy in availing such data. Most data is only available in major sources such as the World Bank and IMF databank but not on local data sources. The research was therefore forced to depend on data from the COMSTAT database because even though these are relatively new, their data cover a multiplicity of variables for wide expanse of years and for many countries. This equally necessitated the dropping of the tax revenue variable. It equally necessitated the dropping of data for the intervening variables (real exchange rates and real interest rates) not just from the unavailability of data for several years but equally

due to their misleading scale effect which could not be eliminated even when the data was logged.

In addition the study had limitations in the evaluation of external reliability (convergent and divergent) and external validity test statistics due to the rigorous assumptions on the data types, data levels, and the underlying theoretical framework limitations implied in the Structural Equations Modelling (SEM) and Generalised Structural Equations Modelling GSEM models in the evaluation of latent variables on which to conduct and evaluate these test statistics as far as time series data for the Markov Switch Auto regression model was concerned in view of data convergences. The software at hand Stata 15 could not offer satisfactory procedural modules for evaluating these statistics and thus the study recommends scholars with advanced knowledge in the above econometric procedures to undertake the development of validation models for Markov Switch time series data or factor variables.

Graphical Markov Models as an alternative to SEM and GSEM are proposed by Kathrin Gruber, Thomas Reuttere and Radoslaw Karpienk (2013) through the acyclic graphs (a subclass of graphical Markov Models) as an alternative to structural equation models where the relationships between the latent and structural variables can be incorporated in a multivariate model, by specifying only an initial ordering and thus appear to be particularly suitable for situations, when the theoretical foundations are weak or ambiguous (Gruber, et al., 2013).

8.5 Areas for Further Studies

This study's philosophical orientation was Post Positivistic whose philosophical view is that reality can only be known in approximate but not in absolute terms because there is always a temporal (time) aspect to any level of known human knowledge implying that there always is a margin of error or inability thus making it rather unrealistic to conduct strictly objective and value-free inquiry into the social aspects of many studies**.** In view of this the study leaves room for constructive criticism and additional knowledge contribution to these findings so as bring about valuable and wealth creating findings to assist in national development. The study hence recommended the following problems to be considered in additional or further studies.

8.5.1 Petroleum Imports

Petroleum imports in most literature on have been found to have had a reducing impact on the GDPs of developing nations, through the crude oil price rises. But petroleum imports were found out in this study to have had an equally long run reducing impact on national debt in the Zambian case. The channels are generally through the productive mechanisms with petroleum being an industrial input. But it would be of interest to find out the exact productive transmission channels by which petroleum imports turn out to be debt reducing in the long run for developing nations like Zambia.

8.5.2 Other Non- Petroleum Imports

The study established that Other Non-Petroleum Imports had not necessarily contributed to the nation's long term external debt. The nation is basically an import based one with comparative advantages lying in raw mineral exports and other raw material products. But how exactly this comparative disadvantage in so many other products which are imported has tended to impact national debt negatively is still no so much revealed in this study. It would be of major interest, research wise, to understand how exactly these trade in imported foreign goods exactly transmits into the lowering of external debt.

8.5.3 Zambia's Gross Domestic Product (GDP)

The negative impact of Zambia's GDP, as a stock variable, on national debt would be of economic knowledge's advantage in the causal relationship context. Many studies have brought out the negative and positive relationship that national debt may have on GDP. But the GDP's impact on national debt is somehow a novel challenge which would deserve some research efforts particularly in the Zambian context. It would be of interest to analyse what GDP thresholds are required to hold down or reduce eternal debt or what national debt percentages of GDP are required to keep national debt on a reducing scale if at all this can be managed by the borrowing nation.

8.5.4 Gross Capital Formation

Gross fixed capital formation takes form of three economically documented forms: business fixed capital formation, residential capital formation and inventory capital formation (Mankiw, 1992). The last two are not really not to be expected to be that much attached to national debt because they are more or less domesticated variables unless they involve borrowed foreign finances. Where business fixed capital formation comes in as an attachment to national debt would be in the form of foreign direct investment. Gross Capital Formation's consistent and significant, debt reducing impact has a bearing which needs to be built on through the promotion of enterprise.

8.5.5 The National Exports

From the Balance of Payments Theory (Carbaugh, 2009), exports are supposed to be contributing to a current account surplus, or at least mitigating a deficit, for any nation so as to lead into increases in external assets or to the reduction in external liabilities in the capital and financial account. The fact that the study found a positive contribution of certain components of exports to national debt suggests a necessity of further study to ascertain just why this reality could have been like that in the period under study. There is a necessity to break down the nation' exports into component parts, whether by sector or by industry, and ascertain which of these export components are because if not isolated they would further lead to national debt increasing in the Zambian case This would help in putting in place measures to rectify this otherwise theoretically controversial reality.

8.5.6 Government Expenditure

Government expenditure is a contentious issue because you cannot separate the fiscal and monetary policies that are put in place by respective governments from their political agenda and the consequent political economy of the day. For this reason, further studies in the relationship between government expenditure and national debt would be better left to the political economists who would have a better philosophical understanding of the socio-political and socio-economic orientation of the government of the day or the governments that have been in office for the period covered by the study.

It would be of interest to try to verify, by further research, if Rainer's (1984) claim that the negative correlation between capital imports and national savings resulted into expectations which could only be reduced at the expense of big political unpopularity when and if when export commodity prices fell could be valid in the Zambian case. This is because this is what Rainer claimed to be the reason for many governments looking to national debt to finance the irreversible current expenditures which lead to the reductions in government saving resulting into loans which did not serve in building up investments but rather just went into compensating for the fall in real incomes as a result of the deteriorated terms of trade so as to stabilise consumption levels or to finance growing government deficits. It would be of interest to see if this can account or could have accounted for the positive contribution of government expenditure to national debt in this study.

8.5.7 Aggregate Consumption

Aggregate consumption has been heralded from the Keynesian times as a vital component for upswings in economic employment of factors. The study brought out the negative impact of aggregate consumption on national debt which is a novel finding in the case of a developing country. From a further study perspective there would be a necessity to break down the nation's aggregate consumption into the respective sub components and get an analytical understanding on which of these components were and would further lead to the reduction of the Zambian external debt.

Additionally further studies should take into account the intervening variables, exchange rates and interests rates, because these financial variables do have quite a profound influence in international trade and debt and will shade more light on the exact impact on or relationships of these macroeconomic variables with international debt for the Zambian case.

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APPENDIX I

Table 8.1: Percentage Change in GDP required by a US$10 a barrel rise *in*

Per Capita Income (1999 to 2001 US$)	% Change in GDP
Net Oil Importing Countries	
< 300 (18 Countries)	-1.47
> 300 but < 900 (22 Countries)	-0.76
> 900 but < 9000 (36 Countries)	-0.56
> 9000 (21 Countries)	-0.44
Net Oil Exporting Countries	
> 900 (10 Countries)	+5.21
> 900 but < 9000 (27 Countries)	+4.16

Source: (Bacon, 2005)

Table 8. 2: Effects of a 100% Increase in the Price of Oil (Net Oil-Importing Country, Managed Floating)

	Impact effect (1 year) %	Cumulative effect (5 years) %
Output		
Complete pass-through	−6	−23
Zero pass-through	2	−1
Consumption		
Complete pass-through	−4	−18
Zero pass-through	−5	−25
Investment		
Complete pass-through	−10	−38
Zero pass-through	−1	−21
Inflation		
Complete pass-through	5	4
Zero pass-through	4	5
Real exchange rate		
Complete pass-through	−1	−5
Zero pass-through	9	30
Budget deficit		
Complete pass-through	0	−1
Zero pass-through	6	20
Foreign debt		
Complete pass-through	1	2
Zero pass-through	16	12

Note: Budget deficit in percentage of steady-state output.

Source: African Development Bank & ESMAP, 2009

Table 8.3: Effects of a 100% Increase in the Price of Oil (Net Oil-Importing Country, Fixed Exchange Rate Regime)

	Impact effect (1 year) %	Cumulative effect (5 years) %
Output		
Complete pass-through	−6	−24
Zero pass-through	−1	−5
Consumption		
Complete pass-through	−5	−19
Zero pass-through	−6	−25
Investment		
Complete pass-through	−11	−39
Zero pass-through	−7	−25
Inflation		
Complete pass-through	2	1
Zero pass-through	−4	−4
Real exchange rate		
Complete pass-through	−2	−7
Zero pass-through	4	22
Budget deficit		
Complete pass-through	4	7
Zero pass-through	31	45
Foreign debt		
Complete pass-through	−1	2
Zero pass-through	9	11

Note: Budget deficit in percentage of steady-state output.

Source: African Development Bank & ESMAP, 2009

Figure 8.4: Zambia's Foreign Reserves 2016 – 2020

Table 8.4: World Crude Oil Imports 2019

	IMPORTER	CRUDE OIL IMPORTS (US$)	%WORLD TOTAL		IMPORTER	CRUDE OIL IMPORTS (US$)	%WORLD TOTAL
1.	China	$238,707,061,000	22.6%	60.	Nicaragua	$229,032,000	0.02%
2.	United States	$132,370,663,000	12.5%	61.	Azerbaijan	$191,347,000	0.02%
3.	India	$102,306,491,000	9.7%	62.	Jamaica	$161,225,000	0.02%
4.	Japan	$73,085,389,000	6.9%	63.	Papua New Guinea	$125,638,000	0.01%
5.	South Korea	$70,193,489,000	6.6%	64.	Brunei Darussalam	$117,009,000	0.01%
6.	Netherlands	$46,414,486,000	4.4%	65.	Myanmar	$114,472,000	0.01%
7.	Germany	$40,737,628,000	3.9%	66.	Dominica	$62,547,000	0.01%
8.	Spain	$30,499,660,000	2.9%	67.	Uzbekistan	$61,394,000	0.01%
9.	Italy	$29,615,998,000	2.8%	68.	Saint Lucia	$53,592,000	0.01%
10.	United Kingdom	$24,542,383,000	2.3%	69.	Slovenia	$44,105,000	0.004%
11.	France	$24,446,306,000	2.3%	70.	Curaçao	$38,505,000	0.004%
12.	Singapore	$24,224,539,000	2.3%	71.	Jordan	$37,293,000	0.004%
13.	Thailand	$22,284,239,000	2.1%	72.	Bahamas	$32,876,000	0.003%
14.	Taiwan	$21,326,199,000	2%	73.	Iran	$28,800,000	0.003%
15.	Belgium	$18,784,563,000	1.8%	74.	Mexico	$20,592,000	0.002%
16.	Canada	$14,275,027,000	1.4%	75.	Kazakhstan	$11,138,000	0.001%
17.	Poland	$11,966,872,000	1.1%	76.	Tajikistan	$7,012,000	0.001%
18.	Greece	$10,479,290,000	1%	77.	Georgia	$5,663,000	0.001%
19.	South Africa	$8,840,167,000	0.8%	78.	Trinidad/Tobago	$5,431,000	0.001%
20.	Australia	$8,615,668,000	0.8%	79.	Pitcairn	$2,254,000	0.0002%
21.	Sweden	$8,006,171,000	0.8%	80.	Latvia	$1,554,000	0.0001%
22.	Belarus	$6,551,114,000	0.6%	81.	Ecuador	$1,018,000	0.0001%
23.	Malaysia	$6,461,097,000	0.6%	82.	Luxembourg	$693,000	0.0001%
24.	Israel	$5,978,970,000	0.6%	83.	Namibia	$616,000	0.0001%
25.	Finland	$5,805,775,000	0.5%	84.	Kyrgyzstan	$502,000	0.00005%
26.	Portugal	$5,437,064,000	0.5%	85.	Bosnia/Herzegovina	$342,000	0.00003%
27.	Brazil	$4,651,642,000	0.4%	86.	Kenya	$288,000	0.00003%
28.	Lithuania	$4,469,287,000	0.4%	87.	Guatemala	$236,000	0.00002%
29.	Austria	$4,299,658,000	0.4%	88.	Estonia	$229,000	0.00002%
30.	Romania	$4,161,599,000	0.4%	89.	Mozambique	$213,000	0.00002%
31.	Chile	$4,096,985,000	0.4%	90.	Mali	$149,000	0.00001%
32.	Czech Republic	$3,740,778,000	0.4%	91.	New Caledonia	$120,000	0.00001%
33.	Philippines	$3,468,523,000	0.3%	92.	Lesotho	$111,000	0.00001%
34.	Bulgaria	$3,164,676,000	0.3%	93.	Russia	$81,000	0.00001%
35.	Hungary	$2,912,083,000	0.3%	94.	Fiji	$67,000	0.00001%
36.	New Zealand	$2,807,741,000	0.3%	95.	Cuba	$54,000	0.00001%
37.	Peru	$2,476,082,000	0.2%	96.	Paraguay	$37,000	0.000004%
38.	Denmark	$2,392,267,000	0.2%	97.	Eswatini	$34,000	0.000003%
39.	Slovakia	$2,350,213,000	0.2%	98.	Libya	$24,000	0.000002%
40.	Panama	$2,313,060,000	0.2%	99.	Zimbabwe	$12,000	0.000001%
41.	Indonesia	$2,172,831,000	0.2%	100.	El Salvador	$12,000	0.000001%
42.	Norway	$1,545,006,000	0.1%	101.	Costa Rica	$12,000	0.000001%
43.	Switzerland	$1,308,835,000	0.1%	102.	Andorra	$11,000	0.000001%
44.	UAR	$1,271,626,000	0.1%	103.	Benin	$11,000	0.000001%
45.	Ireland	$1,263,123,000	0.1%	104.	Angola	$8,000	0.000001%
46.	Ivory Coast	$1,132,098,000	0.1%	105.	Iceland	$6,000	0.000001%
47.	Serbia	$1,012,865,000	0.1%	106.	Botswana	$4,000	0.0000004%
48.	Croatia	$1,011,490,000	0.1%	107.	Marshall Islands	$3,000	0.0000003%
49.	Uruguay	$990,612,000	0.1%	108.	Gabon	$3,000	0.0000003%
50.	Zambia	$504,747,000	0.05%	109.	Malawi	$2,000	0.0000002%
51.	Togo	$456,399,000	0.04%	110.	Cook Islands	$2,000	0.0000002%
52.	Vietnam	$452,722,000	0.04%	111.	Suriname	$2,000	0.0000002%
53.	Colombia	$440,624,000	0.04%	112.	Tanzania	$1,000	0.0000001%
54.	Senegal	$403,291,000	0.04%	113.	Congo DRC.	$1,000	0.0000001%
55.	Dominican Republic	$388,867,000	0.04%	114.	Antigua/Barbuda	$1,000	0.0000001%
56.	Cameroon	$347,344,000	0.03%	115.	Madagascar	$1,000	0.0000001%
57.	Ukraine	$280,125,000	0.03%	116.	Morocco	$1,000	0.0000001%
58.	Gibraltar	$231,704,000	0.02%	117.	Qatar	$1,000	0.0000001%
59.	Ghana	$230,952,000	0.02%				

Source: World Top Exports (By *Daniel -Workman),* **April 2020** ***http://www.worldstopexports.com/crude-oil-imports-by-country***

Table 8.5: Balance of Payments– Zambia (US$ Million) [2010-2012]

	2010	2011	2012
Current Account	**1205.5**	**704.7**	**-53.1**
Balance on goods	2703.7	2205.6	1452.7
Exports, f.o.b	7261.7	8512.3	9242
Metal sector	6071.7	6915.7	6529.8
Copper	5767.9	6659.7	6294.5
Cobalt	303.8	256	235.3
Non-traditional	1190	1596.6	2712.2
Imports, f.o.b	-4709.9	-6454.2	-7960.8
Metal sector	-1029.3	-1567.3	-2083.7
Non-metal sector	-3680.6	-4887	-5877.1
Fertilizer	-215.3	-330	-304.3
Petroleum	-618.1	-530.5	-930.6
Others	-2847.2	-4026.5	-4642.2
Goods Procured in ports by carriers(Bunker Oil)	42	44.5	47.2
Nonmonetary Gold	109.9	103	124.3
Services (Net)	-567	-723.6	-770.1
Services Receipts	310.9	374.5	468
Services Payments	-877.9	-1098.1	-1238.1
Balance on goods and services	2136.7	1482	682.6
Income (Net)	-1363	-1155.3	-1126.8
Income Receipts	8.4	11.1	10.1
Income Payments	-1371.4	-1166.4	-1136.9
Of which: Income on Equity Payments	-1302.7	-1092.5	-1032.6
Interest payments	-39.8	-44.8	-74.1
General government	-9.3	-13.9	-43.6
Private sector	-30.5	-30.9	-30.5
Current Transfers (Net)	431.8	378	391.1
Private	194.4	231.8	244.9
Official	237.4	146.2	146.3
Commodity, SWAP & Global Fund	89.1	11.9	22.4
Budget Grants	148.3	134.3	123.9
Capital and Financial Account	-1075.8	-400.5	789.5
Capital Account	149.7	119	280.5
Capital Transfers	149.7	119	280.5
General Government	149.7	119	280.5
Project Assistance grants	149.7	119	280.5
Financial Account	-1225.5	-519.5	509
Direct Investment	633.9	1109.9	1066.8
Portfolio Investment	73.6	70.7	813
Liabilities	73.6	70.7	813
Financial Derivatives	225.7	-154.3	-44.4
Other Investment	-2158.7	-1545.8	-1326.4
Assets	-2085.5	-2183.9	-1491.3
Increase in NFA - banks(-)	-172.9	0	490.4
Other Assets	-1912.6	-2183.9	-1981.7
Liabilities	-73.2	638.1	164.9
Government	121.9	371.1	185
Disbursement of Loans	161	397.3	420.5
Project	91.8	367.3	355
Budget	69.2	30	65.5
Amortization of loans (-)	-39.1	-26.2	-235.5
Private Foreign Borrowing(net)	-195.1	267	-20.1
Errors and Omissions	-46.4	-60.4	-41.4
Overall balance	83.3	243.8	694.9
Financing	-83.3	-243.8	-694.9

Source: Bank of Zambia Annual Report 2012

Table 8.5: Balance of Payments– Zambia (US$ Million) [2011-2013]

	2011	2012	2013
Current Account	**704.7**	**774.1**	**197.6**
Balance on goods	2,205.60	1,437.10	1,450.70
Exports, f.o.b	8,512.30	9,191.10	10,410.40
Metal sector	6,915.70	6,497.60	7,049.30
Copper	6,659.70	6,294.50	6,911.40
Cobalt	256	203.1	137.9
Non-traditional	1,596.60	2,693.50	3,361.00
Imports, f.o.b	-6,454.20	-7,925.50	-9,195.40
Metal sector	-1,567.30	-2,083.70	-2,560.10
Non-metal sector	-4,887.00	-5,841.90	-6,635.20
Fertilizer	-330	-304.3	-382.9
Petroleum	-530.5	-930.6	-1,082.60
Others	-4,026.50	-4,606.90	-5,169.70
Goods Procured in ports by carriers(Bunker Oil)	44.5	47.2	50
Nonmonetary Gold	103	124.3	185.6
Services (Net)	-723.6	-783.4	-874.3
Services Receipts	374.5	466.3	585.4
Services Payments	-1,098.10	-1,249.70	-1,459.70
Income (Net)	-1,155.30	-333.5	-767.6
Income Receipts	11.1	10.1	5.3
Income Payments	-1,166.40	-343.6	-772.9
Of which: Income on Equity Payments	-1,092.50	-239.2	-652.8
Interest payments	-44.8	-74.1	-91.3
Current Transfers (Net)	378	453.9	388.9
Private	231.8	265	279
Official	146.2	188.9	109.9
Capital and Financial Account	-368.5	-32.6	-514
Capital Account	151	223	225
Capital Transfers	151	223	225
General Government	151	223	225
Project Assistance grants	151	223	225
Financial Account	-519.5	-255.6	-739
Direct Investment	1,109.90	2,433.40	1,630.40
Assets	1.4	701.9	-180.5
Liabilities	1,108.50	1,731.50	1,810.90
Portfolio Investment	70.7	899.3	89.9
Assets	0	104.7	0
Liabilities	70.7	794.6	89.9
Financial Derivatives	-154.3	-10.8	11.9
Other Investment	-1,545.80	-3,577.50	-2,471.10
Assets	-2,183.90	-3,929.40	-2,657.90
Liabilities	638.1	351.9	186.8
Government	371.1	171.9	104.6
Disbursement of Loans	397.3	407.4	223.5
Amortization of loans (-)	-26.2	-235.5	-118.9
Private Foreign Borrowing (Net)	267	180	82.2
Errors and Omissions	-92.4	-14.7	-28.5
Overall balance	243.8	726.7	-344.9
Financing of Overall balance	-243.8	-726.7	344.9
Change: NIR of Bank of Zambia	-243.8	-726.7	344.9
Reserve Assets	-270.4	-721.9	360.2
Of which: Gross Official Reserves[incr (-)] 1/	-270.4	-289.8	205.5
Encumbered Reserves	0	-432.2	154.7
Use of Fund Credit and Loans (Net)	26.6	-4.8	-15.3
Financing gap	0	0	0

Source: Bank of Zambia Annual Report 2013

Table 8.6: Balance of Payments– Zambia (US$ Million) [2014-2016]

	2014	2015	2016
A. Current Account, n.i.e	**581.2**	**-767.7**	**-819.6**
Balance on goods	1,625.40	-74.3	-33.9
Goods: exports (f.o.b)	10,220.20	7,362.00	6,504.70
of Which Copper	7,618.50	5,233.60	4,399.10
Cobalt	123.9	70.7	112.9
NTEs	2,272.00	1,848.60	1,740.10
Gold	152.2	151.8	191.2
Goods: imports (f.o.b)	8,594.80	7,436.20	6,538.50
Balance on Services	-793.5	-570.9	-508.2
Services: credit	850.9	861.5	885
of Which Transportation	61.1	43.7	38.2
Travel	641.5	660.1	682.6
Services: debit	1,644.40	1,432.40	1,393.30
of Which Transportation	902.8	825.3	769.1
Travel	222.2	234.5	247.4
Insurance & Pension Services	116.3	113.7	112.8
Balance on Primary Income	-552	-349.1	-489.5
Primary income: credit	5.9	8.3	8.8
Primary income: debit	557.9	357.3	498.2
Balance on Secondary Income	301.4	226.6	211.9
Secondary income, n.i.e.: credit	353.7	268.8	246.4
Secondary income: debit	52.3	42.2	34.5
B. Capital \Account, n.i.e.	**202**	**81**	**55**
Capital account, n.i.e.: credit	202	81	55
C. Financial Account, n.i.e.	**462.6**	**-279.9**	**-564.1**
Direct investment: assets	-1,706.10	127.4	36.9
Direct investment: liabilities, n.i.e.	1,488.80	1,582.70	1,658.00
Portfolio investment: assets	-11.7	-14.9	-27
Equity and investment fund shares	1,184.80	1,207.00	386.7
Debt securities	6.1	0.2	0
Portfolio investment: liabilities, n.i.e.	1,178.70	1,206.80	386.7
Equity and investment fund shares	-25.4	18.1	-15.3
Debt securities	1.4	4.4	-8.8
Financial derivatives: net	26.8	-13.7	6.5
Financial derivatives: assets	5,301.20	3,328.20	1,744.40
Financial derivatives: liabilities	5,301.20	3,328.20	1,744.40
Other investment: assets	125.7	223.2	-284.9
Other debt instruments	0	230	235.6
Central bank	5,175.50	2,875.00	1,793.70
Deposit-taking corporations, except the central bank	5,175.50	2,875.00	1,793.70
Other sectors	421.8	948.9	258.3
Non-financial corporations, households, and NPISHs	421.8	948.9	258.3
Other investment: liabilities, n.i.e.	-148.9	1.9	51.5
Other debt instruments	120.2	823	100.8
Deposit-taking corporations, except the central bank	450.4	123.9	106
General government	450.4	123.9	106
Other sectors	**0.9**	**13.5**	**13**
Non-financial corporations, households, and NPISHs	-321.6	**393.3**	**187.6**
D. Net Errors and Omissions	**321.6**	**-393.3**	**-187.6**
E. Overall Balance	315.1	-446.1	-249.7
F. Reserves and Related Items	-29.5	-52.8	-62.1
Reserve assets	23	0	0
Credit and loans from the IMF	**581.2**	**-767.7**	**-819.6**
Exceptional financing	1,625.40	-74.3	-33.9

Source: Bank of Zambia Annual Report 2016

Table 8.7: Balance Of Payments– Zambia (US$ Million) [2016-2018]

	2016	2017r	2018**
Balance on goods	-684.4	-435.0	-341.4
Goods: exports (f.o.b)	238.4	960.2	513.9
of Which Copper	6,534.8	8,215.5	9,029.4
Cobalt	4,399.1	6,118.6	6,658.4
NTEs	112.9	124.8	116.7
Gold	1,770.2	1,752.8	2,036.1
Goods: imports (f.o.b)	191.2	156.1	148.0
Balance on Services	6,296.4	7,255.4	8,515.5
Services: credit	-487.5	-609.3	-724.3
of Which Transportation	885.2	864.9	953.3
Travel	38.3	48.8	53.8
Services: debit	682.6	652.6	742.2
of Which Transportation	1,372.8	1,474.3	1,677.5
Travel	750.0	841.3	957.4
Insurance & Pension Services	247.4	223.3	279.3
Balance on Primary Income	111.4	121.5	117.4
Primary income: credit	-647.1	-1,144.7	-407.0
Primary income: debit	77.0	73.1	28.4
Balance on Secondary Income	724.1	1,217.9	435.4
Secondary income, n.i.e.: credit	211.9	358.8	275.9
Secondary income: debit	246.4	448.5	373.96
B. Capital Account, n.i.e.	34.5	89.7	98.0
Capital account, n.i.e.: credit	**55.0**	**58.4**	**66.18**
C. Financial Account, n.i.e.	55.0	58.4	66.2
Direct investment: assets	**-347.8**	**-364.2**	**99.9**
Direct investment: liabilities, n.i.e.	176.7	-72.0	45.3
Portfolio investment: assets	662.9	1,107.5	408.4
Equity and investment fund shares	-27.0	43.9	5.4
Debt securities	-27.0	0.0	0.0
Portfolio investment: liabilities, n.i.e.	0.0	43.9	5.4
Equity and investment fund shares	389.7	278.6	-232.7
Debt securities	3.0	-2.5	-5.4
Financial derivatives: net	386.7	281.2	-227.4
Financial derivatives: assets	-15.3	-68.2	-32.0
Financial derivatives: liabilities	-8.8	79.1	-1.5
Other investment: assets	6.5	147.3	30.5
Other debt instruments	1,294.3	1,763.7	1,591.4
Central bank	1,294.3	1,763.7	1,591.4
Deposit-taking corporations, except the central bank	-284.9	-235.0	-56.5
Other sectors	235.8	150.0	236.3
Non-financial corporations, households, and NPISHs	1,343.4	1,848.7	1,411.6
Other investment: liabilities, n.i.e.	1,343.4	1,848.7	1,411.6
Other debt instruments	723.9	645.3	1,334.5
Deposit-taking corporations, except the central bank	723.9	645.3	1,334.5
General government	171.5	-3.7	105.9
Other sectors	161.1	745.7	1,526.2
Non-financial corporations, households, and NPISHs	391.2	-96.7	-297.5
D. Net Errors and Omissions	**391.2**	**-96.7**	**-297.5**
E. Overall Balance	**24.7**	**30.7**	**-12.6**
F. Reserves and Related Items	**256.8**	**-18.3**	**387.8**
Reserve assets	-256.8	18.3	-387.8
Credit and loans from the IMF	-325.6	-55.3	-449.2
Exceptional financing	-68.8	-73.6	-61.4

Source: Bank of Zambia Annual Report 2018

Table 8.8: Balance Of Payments– Zambia (US$ Million) [2017-2019]

	2017	2018	2019
A. Current Account, n.i.e.	**-435**	**-341.5**	**241.6**
Balance on goods	960.2	513.9	728.8
Goods: exports	8215.5	9029.4	7228.1
of Which Copper	6118.6	6658.4	4994.5
Cobalt	124.8	116.7	42.7
NTEs	1752.8	2036.1	1919.4
Gold	156.1	148	196.4
Goods: imports	7255.4	8515.5	6499.2
Balance on Services	-609.3	-724.3	-520.1
Services: credit	864.9	953.2	1013.7
of Which Transportation	48.8	53.8	44.5
Travel	652.6	742.2	819.2
Services: debit	1474.3	1677.5	1533.8
of Which Transportation	841.3	957.4	817.2
Travel	223.3	279.3	298.4
Insurance & Pension Services	121.5	117.4	109
Balance on Primary Income	-1144.7	-407	-298
Primary income: credit	73.1	28.4	41.8
Primary income: debit	1217.9	435.4	339.8
Balance on Secondary Income	358.8	275.92	330.9
Secondary income, n.i.e.: credit	448.5	373.96	417.83
Secondary income: debit	89.7	98	86.9
B. Capital Account, n.i.e.	58.4	66.18	96.57
Capital account, n.i.e.: credit	58.4	66.2	96.6
C. Financial Account, n.i.e.	-364.2	99.9	463.8
Direct investment: assets	-72	45.3	706
Direct investment: liabilities, n.i.e.	1107.5	408.44	481.4
Portfolio investment: assets	43.9	5.4	0
Equity and investment fund shares	0	0	0
Debt securities	43.9	5.4	0
Portfolio investment: liabilities, n.i.e.	278.6	-232.7	-159
Equity and investment fund shares	-2.5	-5.4	1.2
Debt securities	281.2	-227.4	-160.2
Financial derivatives: net	-68.2	-32	-85.5
Financial derivatives: assets	79.1	-1.5	-41.6
Financial derivatives: liabilities	147.3	30.5	43.9
Other investment: assets	1763.7	1591.4	667.9
Other debt instruments	1763.7	1591.4	667.9
Central bank	-235	-56.5	0
Deposit-taking corporations, except C/bank	150	236.3	-314.9
Other sectors	1848.7	1411.6	982.8
Non-Financial corps, h/holds & NPISHs	1848.7	1411.6	982.8
Other investment: liabilities, n.i.e.	645.3	1334.5	512.3
Other debt instruments	645.3	1334.5	512.3
Deposit-taking corporations, except c/bank	-3.7	105.9	-19.5
General government	745.7	1526.2	1127.3
Other sectors	-96.7	-297.5	-595.5
Non-Financial corps, h/holds & NPISHs	-96.7	-297.5	-595.5
D. Net Errors and Omissions	30.7	-12.6	13.1
E. Overall Balance	-18.3	387.8	102.5
F. Reserves and Related Items	18.3	-387.8	-102.5
Reserve assets	-55.3	-449.2	-146.7
Credit and loans from the IMF	-73.6	-61.4	-44.2
Exceptional Financing	0	0	0

Source: Bank of Zambia Annual Report 2019

APPENDIX II

Table 9.1: Study Data Statistics

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Estimation sample mswitch Number of obs = 40

Variable	Mean	Std. Dev.	Min	Max
Debt	6.98e+09	4.12e+09	2.27e+09	1.97e+10
GDP LD.	9.95e+09	9.25e+09	1.80e+09	2.80e+10
IMPPET	4.68e+08	5.71e+08	4.19e+07	2.07e+09
IMPoth	2.51e+09	2.43e+09	5.18e+08	8.11e+09
Inv	3.02e+09	3.69e+09	8.443264	1.12e+10
Xpt	3.64e+09	3.69e+09	7.67e+08	1.16e+10
Govt	1.30e+09	1.06e+09	3.09e+08	3.95e+09
CONS	6.71e+09	5.46e+09	1.30e+09	1.95e+10

Source: Author (2022) Using Stata 15

Table 9.2: ADF test for Unit root For National Debt at level

Augmented Dickey-Fuller test for unit root Number of obs = 36

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-0.658	-3.675	-2.969	-2.617
MacKinnon approximate p-value for Z(t) = 0.8574				

D.Debt	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Debt						
L1.	-.0565221	.0859627	-0.66	0.516	-.2318441	.1188
LD.	.6902353	.1888812	3.65	0.001	.3050095	1.075461
L2D.	.0103997	.2321024	0.04	0.965	-.4629764	.4837757
L3D.	.1091655	.2154127	0.51	0.616	-.3301715	.5485025
_cons	5.05e+08	5.22e+08	0.97	0.340	-5.59e+08	1.57e+09

Source: Author (2022) Using Stata 15

Table 9.3: ADF test for Unit root For External Debt at 1st Difference

Augmented Dickey-Fuller test for unit root Number of obs = 35

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.797	-3.682	-2.972	-2.618
MacKinnon approximate p-value for Z(t) = 0.3820				

D.Debt1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Debt1						
L1.	-.3644444	.2028106	-1.80	0.082	-.778639	.0497501
LD.	.0135878	.2201244	0.06	0.951	-.4359661	.4631417
L2D.	-.0472632	.2128502	-0.22	0.826	-.4819613	.3874349
L3D.	-.006196	.2013524	-0.03	0.976	-.4174125	.4050205
_cons	1.89e+08	1.81e+08	1.04	0.306	-1.82e+08	5.59e+08

Source: Author (2022) Using Stata 15

Table 9.4: ADF Test for Unit Root for External Debt at 2nd Difference.

Augmented Dickey-Fuller test for unit root Number of obs = 34

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.284	-3.689	-2.975	-2.619
MacKinnon approximate p-value for Z(t) = 0.0005				

D.Debt2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Debt2						
L1.	-2.105001	.4913154	-4.28	0.000	-3.109854	-1.100148
LD.	.8293867	.4036815	2.05	0.049 .	0037654	1.655008
L2D.	.5062901	.300128	1.69	0.102	-.1075406	1.120121
L3D.	.2694583	.1840359	1.46	0.154	-.1069375	.645854
_cons	7.27e+07	1.77e+08	0.41	0.684	-2.89e+08	4.34e+08

Source: Author (2022) Using Stata 15

Table 9.5: ADF Test for Unit Root for GDP at Levels.

Augmented Dickey-Fuller test for unit root Number of obs = 36

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	0.326	-3.675	-2.969	-2.617
MacKinnon approximate p-value for Z(t) = 0.9785				

D.GDP	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
GDP						
L1.	0140948	.0431936	0.33	0.746	-.0739992	.1021888
LD.	.1564841	.1791459	0.87	0.389	-.2088865	.5218547
L2D.	.1423516	.1886219	0.75	0.456	-.2423453	.5270485
L3D.	-.3174094	.1883797	-1.68	0.102	-.7016123	.0667934
_cons	4.96e+08	5.22e+08	0.95	0.350	-5.69e+08	1.56e+09

Source: Author (2022) Using Stata 15

Table 9.6: ADF test for Unit root For GDP at 1st Difference

Augmented Dickey-Fuller test for unit root Number of obs = 35

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.909	-3.682	-2.972	-2.618
MacKinnon approximate p-value for Z(t) = 0.0443				

D.GDP1	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
GDP1						
L1.	-.9274637	.318844	-2.91	0.007	-1.57863	-.2762973
LD.	.1122066	.2690984	0.42	0.680	-.4373656	.6617789
L2D.	.249425	.2429139	1.03	0.313	-.2466714	7455214
L3D.	-.0730499	.1956449	-0.37	0.711	-.47261	.3265102
_cons	6.22e+08	4.01e+08	1.55	0.131	-1.97e+08	1.44e+09

Source: Author (2022) Using Stata 15

Table 9.7: ADF test for Unit root For GDP at 2nd Difference

Augmented Dickey-Fuller test for unit root Number of obs = 34

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.289	-3.689	-2.975	-2.619
MacKinnon approximate p-value for Z(t) =	0.0000			

D.GDP2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDP2						
L1.	-3.109644	.5879676	-5.29	0.000	-4.312173	-1.907116
LD.	1.477176	.5028514	2.94	0.006	.4487292	2.505623
L2D.	1.126746	.3845775	2.93	0.007	.3401963	1.913295
L3D.	.4624307	.2140921	2.16	0.039	.0245632	.9002983
_cons	4.61e+07	3.91e+08	0.12	0.907	-7.54e+08	8.46e+08

Source: Author (2022) Using Stata 15

Table 9.8: ADF Test for Unit Root for Other Imports at level

Augmented Dickey-Fuller test for unit root Number of obs = 36

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	0.368	-3.675	-2.969	-2.617
MacKinnon approximate p-value for Z(t) =	0.9803			

D.IMPoth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
IMPoth						
L1.	.0171855	.0466765	0.37	0.715	-.0780118	.1123828
LD.	.427792	.1837413	2.33	0.027	.0530491	.8025349
L2D.	-.2323293	.1918265	-1.21	0.235	-.623562	.1589034
L3D.	-.1754542	.1869791	-0.94	0.355	-.5568005	.2058921
_cons	1.36e+08	1.44e+08	0.94	0.352	-1.58e+08	4.30e+08

Source: Author (2022) Using Stata 15

Table 9.9: ADF Test for Unit Root for Other Imports at 1st Difference

Augmented Dickey-Fuller test for unit root Number of obs = 35

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.845	-3.682	-2.972	-2.618
MacKinnon approximate p-value for Z(t) = 0.0025				

D.IMPoth1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
IMPoth1						
L1.	-1.142919	.2972595	-3.84	0.001	-1.750004	-.5358342
LD.	.5629283	.2461127	2.29	0.029	.060299	1.065558
L2D.	.2886831	.2088252	1.38	0.177	-.1377948	.715161
L3D.	.2385312	.1927587	1.24	0.226	-.1551346	.632197
_cons	2.07e+08	1.08e+08	1.91	0.065	-1.41e+07	4.29e+08

Source: Author (2022) Using Stata 15

Table 9.10: ADF Test for Unit Root for Petroleum Imports at Level

Augmented Dickey-Fuller test for unit root Number of obs = 36

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	2.976	-3.675	-2.969	-2.617
MacKinnon approximate p-value for Z(t) = 1.0000				

D.IMPPET	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
IMPPET						
L1.	.1701018	.0571533	2.98	0.006	.0535368	.2866668
LD.	-.2408268	.1878001	-1.28	0.209	-.6238477	.1421941
L2D.	-.0267814	.1907536	-0.14	0.889	-.4158259	.3622631
L3D.	-.4680879	.1820596	-2.57	0.015	-.839401	-.0967749
_cons	4468201	2.60e+07	0.17	0.865	-4.85e+07	5.74e+07

Source: Author (2022) Using Stata 15

Table 9.11: ADF Test for Unit Root for Petroleum Imports at 1st Difference

Augmented Dickey-Fuller test for unit root Number of obs = 35

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.285	-3.682	-2.972	-2.618
MacKinnon approximate p-value for Z(t) = 0.1769				

D.IMPPET1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
IMPPET1						
L1.	-.7709539	.3374206	-2.28	0.030	-1.460059	-.0818491
LD.	-.1434948	.2982375	-0.48	0.634	-.752577	.4655873
L2D.	.1180418	.2694593	0.44	0.664	-.4322676	.6683512
L3D.	-.1257254	.2014084	-0.62	0.537	-.5370562	.2856054
_cons	4.34e+07	2.65e+07	1.63	0.113	-1.08e+07	9.76e+07

Source: Author (2022) Using Stata 15

Table 9.12: ADF test for Unit root For Petroleum Imports at 2nd Difference

Augmented Dickey-Fuller test for unit root Number of obs = 34

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-6.309	-3.689	-2.975	-2.619
MacKinnon approximate p-value for Z(t) = 0.0000				

D.IMPPET2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
IMPPET2						
L1.	-3.583191	.5679053	-6.31	0.000	-4.744688	-2.421694
LD.	1.708355	.4750107	3.60	0.001	.7368488	2.679861
L2D.	1.281184	.347172	3.69	0.001	.5711376	1.99123
L3D.	.5481616	.1779713	3.08	0.004	.1841695	.9121537
_cons	1.55e+07	2.21e+07	0.70	0.487	-2.96e+07	6.07e+07

Source: Author (2022) Using Stata 15

Table 9.13: ADF test for Unit root For Exports at level

Augmented Dickey-Fuller test for unit root Number of obs = 36

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-0.131	-3.675	-2.969	-2.617
MacKinnon approximate p-value for Z(t) = 0.9463				

D.Expt	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Expt						
L1.	-.0060331	.0462275	-0.13	0.897	-.1003146	.0882485
LD.	.382666	.1845257	2.07	0.046	.0063233	.7590086
L2D.	-.1862144	.1948245	-0.96	0.347	-.5835617	.2111328
L3D.	-.0682834	.1890227	-0.36	0.720	-.4537976	.3172309
_cons	2.31e+08	2.18e+08	1.06	0.298	-2.14e+08	6.76e+08

Source: Author (2022) Using Stata 15

Table 9.14: ADF test for Unit root For Exports at 1st Difference.

Augmented Dickey-Fuller test for unit root Number of obs = 35

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.885	-3.682	-2.972	-2.618
MacKinnon approximate p-value for Z(t) = 0.0472				

D.Expt1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Expt1						
L1.	-.8824282	.3059092	-2.88	0.007	-1.507178	-.2576782
LD.	.2591153	.2612524	0.99	0.329	-.2744334	.792664
L2D.	.0675799	.2230761	0.30	0.764	-.3880023	.5231621
L3D.	-.010185	.1940223	-0.05	0.958	-.4064314	.3860614
_cons	2.21e+08	1.71e+08	1.29	0.206	-1.28e+08	5.69e+08

Source: Author (2022) Using Stata 15

Table 9.15: ADF Test for Unit Root for Exports at 2nd Difference

Augmented Dickey-Fuller test for unit root Number of obs = 34

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.782	-3.689	-2.975	-2.619
MacKinnon approximate p-value for Z(t) = 0.0031				

D.Expt2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Expt2						
L1.	-2.296487	.6071462	-3.78	0.001	-3.538241	-1.054734
LD.	.9230657	.5091583	1.81	0.080	-.1182801	1.964411
L2D.	.4890001	.3854651	1.27	0.215	-.2993646	1.277365
L3D.	.1241555	.2264123	0.55	0.588	-.3389097	.5872206
_cons	1.71e+07	1.83e+08	0.09	0.926	-3.57e+08	3.91e+08

Source: Author (2022) Using Stata 15

Table 9.16: ADF test for Unit root For Gross Capital Formation at level

Augmented Dickey-Fuller test for unit root Number of obs = 36

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	0.246	-3.675	-2.969	-2.617
MacKinnon approximate p-value for Z(t) = 0.9748				

D.INV	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
INV						
L1.	.0104148	.042252	0.25	0.807	-.0757588	.0965884
LD.	.0956828	.2271438	0.42	0.676	-.3675799	.5589456
L2D.	-.0146404	.2301748	-0.06	0.950	-.4840849	.4548042
L3D.	.0777664	.2252203	0.35	0.732	-.3815735	.5371063
_cons	1.82e+08	1.52e+08	1.20	0.240	-1.28e+08	4.93e+08

Source: Author (2022) Using Stata 15

Table 9.17: ADF test for Unit root For Gross Capital Formation at 1st Difference.

Augmented Dickey-Fuller test for unit root Number of obs = 35

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.766	-3.682	-2.972	-2.618
MacKinnon approximate p-value for Z(t) = 0.3976				

D.INV1	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
INV1						
L1.	-.5551818	.3144201	-1.77	0.088	-1.197313	.0869497
LD.	-.3140164	.2951969	-1.06	0.296	-.916889	.2888561
L2D.	-.3872285	.2681083	-1.44	0.159	-.9347787	.1603217
L3D.	-.3588222	.2165832	-1.66	0.108	-.8011441	.0834997
_cons	1.46e+08	1.42e+08	1.03	0.311	-1.43e+08	4.35e+08

Source: Author (2022) Using Stata 15

Table 9.18: ADF test for Unit root For Gross Capital Formation at 2nd Difference.

Augmented Dickey-Fuller test for unit root Number of obs = 34

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.037	-3.689	-2.975	-2.619
MacKinnon approximate p-value for Z(t) = 0.0000				

D.GOVT	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
GOVT						
L1.	-3.572742	.709324	-5.04	0.000	-5.023472	-2.122011
LD.	1.760504	.5812512	3.03	0.005	.5717118	2.949296
L2D.	.9681511	.4238585	2.28	0.030	.1012632	1.835039
L3D.	.2459855	.2237079	1.10	0.281	-.2115486	.7035195
_cons	1.08e+07	1.21e+08	0.09	0.929	-2.36e+08	2.58e+08

Source: Author (2022) Using Stata 15

Table 9.19: ADF test for Unit root For Govt. Expenditure at Level

Augmented Dickey-Fuller test for unit root Number of obs = 36

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-0.731	-3.675	-2.969	-2.617
MacKinnon approximate p-value for Z(t) = 0.8386				

D.GOVT	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GOVT						
L1.	-.0482974	.0660752	-0.73	0.470	-.1830587	.0864639
LD.	.0366478	.2067317	0.18	0.860	-.3849843	.4582798
L2D.	.0417084	.2055974	0.20	0.841	-.3776103	.4610271
L3D.	.0437443	.1958593	0.22	0.825	-.3557134	.4432019
_cons	1.04e+08	9.90e+07	1.05	0.303	-9.83e+07	3.05e+08

Source: Author (2022) Using Stata 15

Table 9.20: ADF test for Unit root For Govt. Expenditure at 1st Difference

Augmented Dickey-Fuller test for unit root Number of obs = 35

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.238	-3.682	-2.972	-2.618
MacKinnon approximate p-value for Z(t) = 0.1926				

D.GOVT	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GOVT1						
L1.	-.8647227	.3863169	-2.24	0.033	-1.653687	-.0757582
LD.	-.1548792	.3298782	-0.47	0.642	-.8285804	.518822
L2D.	-.1650665	.2713955	-0.61	0.548	-.7193301	.3891971
L3D.	-.1396716	.1944965	-0.72	0.478	-.5368863	.2575432
_cons	4.30e+07	6.81e+07	0.63	0.532	-9.61e+07	1.82e+08

Source: Author (2022) Using Stata 15

Table 9.21: ADF test for Unit root For Govt. Expenditure at 2nd Difference

Augmented Dickey-Fuller test for unit root Number of obs = 34

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.082	-3.689	-2.975	-2.619
MacKinnon approximate p-value for Z(t) = 0.0010				

D.Govt1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Govt2						
L1.	-2.806047	.6874251	-4.08	0.000	-4.21199	-1.400105
LD.	1.012823	.5770356	1.76	0.090	-.1673469	2.192994
L2D.	.3902566	.4048428	0.96	0.343	-.4377399	1.218253
L3D.	-.0126681	.2025564	-0.06	0.951	-.4269424	.4016063
_cons	-3621959	7.05e+07	-0.05	0.959	-1.48e+08	1.41e+08

Source: Author (2022) Using Stata 15

Table 9.22: ADF test for Unit root For Aggregate Consumption at Level.

Augmented Dickey-Fuller test for unit root Number of obs = 36

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-0.861	-3.675	-2.969	-2.617
MacKinnon approximate p-value for Z(t) = 0.1055				

CONS	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CONS						
L1.	-.0509886	.0592505	-0.86	0.396	-.1718309	.0698536
LD.	.1457742	.1800154	0.81	0.424	-.2213697	.51291
L2D.	-.1808691	.1814101	-1.00	0.326	-.5508574	.1891193
L3D.	.2228764	.1824563	1.22	0.231	-.1492457	.5949985
_cons	5.65e+08	4.81e+08	1.18	0.249	-4.15e+08	1.55e+09

Source: Author (2022) Using Stata 15

Table 9.23: ADF test for Unit root For Aggregate Consumption at 1st Difference.

Augmented Dickey-Fuller test for unit root Number of obs = 35

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.542	-3.682	-2.972	-2.618
MacKinnon approximate p-value for Z(t) = 0.1055				

D.CONS	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CONS1						
L1.	-.9279853	.364991	-2.54	0.016	-1.673396	-.18257421
LD.	.0276138	.3228978	0.09	0.932	-.6318314	.687059
L2D.	-.1999636	.2461961	-0.81	0.423	-.7027632	.302836
L3D.	-.0004782	.1858477	-0.00	0.998	-.3800297	.3790734
_cons	2.82e+08	3.31e+08	0.85	0.401	-3.94e+08	9.59e+08

Source: Author (2022) Using Stata 15

Table 9.24: ADF test for Unit root For Aggregate Consumption at 2nd Difference.

Augmented Dickey-Fuller test for unit root Number of obs = 34

	Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.185	-3.689	-2.975	-2.619
MacKinnon approximate p-value for Z(t) = 0.0007				

D.CONS1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CONS2						
L1.	-2.806418	.6706107	-4.18	0.000	-4.177971	-1.434865
LD.	1.098546	.5506238	2.00	0.056	-.0276057	2.224699
L2D.	.3787962	.375982	1.01	0.322	-.3901734	1.147766
L3D.	.0859938	.1965373	0.44	0.665	-.3159701	.4879577
_cons	-1.48e+07	3.52e+08	-0.04	0.967	-7.35e+08	7.06e+08

Source: Author (2022) Using Stata 15

Table 9.25: Cronbach's Alpha for the non-differenced variables

. alpha Debt2 GDP2 IMPoth01 IMPPET2 Xpt2 Inv2 Govt2 CONS2, std

Test scale = mean(standardized items)

Average interitem correlation:	0.8201
Number of items in the scale:	8
Scale reliability coefficient:	0.9733

Table 9.26: Cronbach's Alpha for differenced variables

.alpha Debt2 GDP2 IMPoth01 IMPPET2 Xpt2 Inv2 Govt2 CONS2, std

Test scale = mean(standardized items)

Reversed items: Debt2 Inv2 CONS2

Average interitem correlation:	0.2296
Number of items in the scale:	8
Scale reliability coefficient:	0.7045

Source: Author (2022) Using Stata 15

Table 9.27: Eigenvalue Model Stability

. estat stable

Stability analysis of simultaneous equation systems

Eigenvalue stability condition

Eigenvalue	Modulus
0	0
0	0
0	0
0	0
0	0
0	0
0	0

Stability index = 0

All the eigenvalues lie inside the unit circle.

SEM satisfies stability condition.

Source: Author (2022) Using Stata 15

Table 9.28: The Markov Switch Auto Regression Model

Markov-switching autoregression

Sample: 1983 - 2019 No. of obs = 37

Number of states = 2 AIC = 42.6397

Unconditional probabilities: transition HQIC = 42.6704

SBIC = 42.7268

Log likelihood = -786.83396

	D2.Debt	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
State 1	GDP D2.	-.7676097	.0506504	-15.16	0.000	-.8668828	-.6683367
	IMPoth D2.	-.3316939	.1896253	-1.75	0.080	-.7033527	.0399649
	IMPPET D2.	-2.251837	.5227109	-4.31	0.000	-3.276332	-1.227343
	Xpt D2.	1.599351	.2267844	7.05	0.000	1.154862	2.043841
	GOVT D2.	1.198707	.2650045	4.52	0.000	.6793077	1.718106
	Inv D2.	-.8515111	.1169208	-7.28	0.000	-1.080672	-.6223504
	CONS D2.	-.4526043	.057573 -	7.86	0.000	-.5654453	-.3397634
	ar.L1	1.122933	.1807615	6.21	0.000	.7686471	1.477219
	_cons	-8.68e+08	9.25e+07	-9.39	0.000	-1.05e+09	-6.87e+08
State 2	GDP D2.	-.3309875	.0662946	-4.99	0.000	-.4609225	-.2010524
	IMPoth D2.	.1032863	.162098	0.64	0.524	-.2144198	.4209925
	IMPPET D2.	-1.8897	.5142301	-3.67	0.000	-2.897573	-.8818279
	Xpt D2.	.7879281	.1789507	4.40	0.000	.4371911	1.138665
	GOVT D2.	.7501462	.1465783	5.12	0.000	.4628581	1.037434
	Inv D2.	-.1894514	.0373669	-5.07	0.000	-.2626893	-.1162136
	CONS D2.	-.0878015	.0435396	-2.02	0.044	-.1731375	-.0024655
	ar.L1	-.5493032	.1394287	-3.94	0.000	-.8225784	-.276028
	_cons	2.64e+08	5.81e+07	4.55	0.000	1.50e+08	3.78e+08
Sigma	2.52e+08	3.20e+07				1.97e+08	3.23e+08
p11	.2136117	.1097778				.0701657	.4943917
p21	.7025284	.1221621				.4288992	.8813292

Source: Author (2022) Using Stata 15

Table 9.29: Lag Order selection for Johansen Cointegration

varsoc D2.Debt D2.GDP D2.IMPoth D2.IMPPET D2.Xpt D2.Govt D2.Inv D2.CONS

Selection-order criteria

Sample: 1986 - 2019 Number of obs = 34

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-5910.85				2.e+141	348.167	348.29	348.527
1	-5755.26	311.17	64	0.000	1.e+139	342.78	343.882	346.012
2	-5625.41	259.71	64	0.000	5.e+137	338.906	340.989	345.012
3	-5376.79	497.24*	64	0.000	1.e+134	328.046*	331.108*	337.025*
4	.	.	64	-	7.5e+25*	.	. .	. .

Source: Author (2022) Using Stata 15

Table 9.30: Johansen tests for Cointegration Results

vecrank D2.GDP D2.IMPoth D2.IMPPET D2.Xpt D2.Govt D2.Inv D2.CONS, trend(constant)

lags(>3)

Johansen tests for cointegration

Trend: constant Number of obs = 35

Sample: 1985 - 2019 Lags = 3

Maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	105	-5137.7041	-	348.5755	124.24
1	118	-5083.925	0.95372	241.0173	94.15
2	129	-5044.1365	0.89706	161.4402	68.52
3	138	-5018.3262	0.77119	109.8197	47.21
4	145	-4993.9851	0.75115	61.1375	29.68
5	150	-4970.8453	0.73347	14.8578*	15.41
6	153	-4965.0035	0.28381	3.1743	3.76
7	154	-4963.4164	0.08670		

Source: Author (2022) Using Stata 15

Table 9.31: Shapiro Wilk Test for LogNormal Data

. swilk r, lnnormal

Shapiro-Wilk W test for 3-parameter lognormal data

Variable	Obs	W	V	z	Prob>z
r,	36	0.92653	2.679	-1.788	0.96309

Source: Author (2022) Using Stata 15

Table 9.32: Markov Switching Model Transition Probabilities.

estat transition

Number of obs = 37

Transition Probabilities	Estimate	Std Err.	[95% Conf. Interval]
p11	.2136117	.1097778	.0701657 .4943917
p12	.7863883	.1097778	.5056083 .9298343
p21	.7025284	.1221621	.4288992 .8813292
P22	.2974716	.1221621	.1186708 .5711008

Source: Author (2022) Using Stata 15

Table 9.33: Markov Switching Model State Duration

. estat duration

Number of obs = 37

Expected Duration	Estimate	Std. Err.	[95% Conf. Interval]	
State1	1.271636	.1775172	1.07546	1.977816
State2	1.42343	.247519	1.13465	2.33155

Source: Author (2022) Using Stata 15

APPENDIX III

Table 10.0: DATASET

YEAR	Debt	GDP	IMPoth	IMP_{PET}	Xpt	Govt	Inv	CONS
1980	2,272,135,864	4,314,873,626	746,350,224	197,001,820	942,037,653	514,837,676	443,263,549	2,145,265,568
1981	3,609,973,000	4,033,004,281	805,255,057	210,001,770	1,021,576,375	1,133,876,812	774,279,129	3,735,353,686
1982	3,662,594,000	3,891,883,207	981,104,666	177,001,770	969,271,323	1,072,301,515	649,152,052	3,562,638,092
1983	3,745,388,000	3,359,519,741	659,266,379	179,901,764	1,043,379,142	801,270,850	456,711,676	2,817,076,918
1984	3,751,428,000	2,761,520,617	601,280,692	148,001,770	937,842,464	683,932,720	399,296,268	2,270,197,705
1985	4,487,172,000	2,618,809,988	711,513,220	121,801,773	929,162,850	537,227,208	335,388,771	1,934,202,678
1986	5,633,318,000	1,804,246,982	609,676,604	71,601,768	766,523,033	446,969,568	396,304,776	1,296,535,205
1987	6,480,343,000	2,235,934,821	517,798,224	67,201,767	938,829,605	462,105,565	287,999,227	1,891,376,369
1988	6,694,152,000	3,766,454,502	625,398,222	61,601,768	1,268,417,359	554,365,946	412,919,382	3,049,738,584
1989	6,553,433,000	4,014,222,516	916,998,221	103,001,770	1,493,191,316	548,317,986	431,723,595	3,843,358,428
1990	6,904,814,000	3,756,617,531	964,998,221	119,001,770	1,342,441,715	711,992,094	646,542,858	3,121,797,156
1991	6,958,489,000	3,393,367,318	868,998,221	83,001,770	1,169,784,906	1,074,478,935	372,003,596	3,093,903,595
1992	6,700,066,000	3,323,790,396	1,248,998,221	53,001,770	1,193,992,871	496,457,919	393,295,559	3,296,699,305
1993	6,477,915,000	3,264,340,919	902,998,221	47,001,770	1,046,344,290	603,288,927	492,418,552	3,004,673,862
1994	6,808,521,000	3,363,387,562	928,398,221	74,101,770	1,173,656,179	438,626,219	482,009,908	2,892,039,669
1995	6,957,809,000	3,487,392,087	1,103,598,221	90,301,770	1,281,321,605	537,019,745	553,375,859	3,054,601,584
1996	7,060,057,000	3,287,487,922	977,098,221	78,401,770	1,113,766,474	597,391,865	420,099,670	3,097,103,551
1997	6,659,849,000	3,929,620,600	1,145,983,722	72,001,770	1,305,374,519	683,120,824	569,815,650	3,492,465,793
1998	6,870,434,000	3,253,574,154	928,798,221	41,901,770	918,648,274	510,989,870	530,655,093	2,954,712,770
1999	5,953,050,000	3,147,254,293	755,764,386	114,676,770	858,981,204	404,331,748	507,204,774	2,954,116,435
2000	5,811,480,000	3,237,679,972	820,000,000	158,000,000	872,249,776	308,712,724	564,722,478	3,138,765,957
2001	6,189,776,000	3,653,817,652	1,079,000,000	174,000,000	1,055,086,648	369,586,312	691,097,671	3,554,320,254
2002	6,674,675,000	3,711,288,305	1,062,554,919	141,000,000	1,137,945,879	440,096,488	813,823,878	3,385,476,066
2003	6,874,311,000	4,185,434,906	1,210,000,000	182,500,000	1,258,994,450	600,430,569	1,106,675,350	3,644,308,900
2004	7,540,237,000	5,439,171,232	1,636,314,000	235,586,000	2,086,559,100	935,996,293	1,354,807,661	4,204,177,723
2005	5,460,805,000	7,178,554,194	1,848,473,000	312,127,000	2,550,442,910	1,326,604,030	1,699,355,413	5,629,297,538
2006	2,375,623,000	12,756,957,873	2,181,843,300	453,956,700	4,157,870,000	1,214,446,716	3,465,950,753	8,997,518,231
2007	2,857,155,000	14,056,878,386	3,117,574,393	492,969,107	5,227,100,000	1,121,089,162	3,931,616,216	10,151,788,023
2008	3,079,660,000	17,911,046,612	3,738,685,761	815,567,000	5,631,600,000	1,855,838,710	3,610,545,163	5,466,383,873
2009	3,774,353,000	15,328,314,225	2,877,635,100	535,767,000	4,900,400,000	1,530,163,424	4,805,344,057	10,540,960,488
2010	4,384,213,000	20,265,400,495	4,091,827,631	618,062,954	8,054,400,000	1,900,821,310	6,054,799,093	12,964,087,042
2011	5,099,156,000	23,460,264,700	5,923,787,439	530,453,000	9,419,004,831	2,403,621,464	7,892,869,762	14,458,287,561
2012	5,857,017,000	25,503,609,117	6,994,885,937	930,648,096	10,510,884,937	3,034,240,014	8,098,553,289	17,133,415,773
2013	6,429,610,000	28,024,166,667	8,112,741,079	1,082,622,643	11,601,397,974	3,414,574,074	9,539,037,037	19,502,851,852
2014	9,338,721,000	27,163,006,504	7,153,215,060	1,441,594,721	11,071,102,875	3,945,138,211	9,247,073,171	18,572,925,203
2015	11,916,830,000	21,249,258,401	5,875,497,858	1,560,702,142	8,223,453,250	3,140,764,774	9,092,873,696	14,288,991,889
2016	15,359,000,000	21,030,678,317	5,130,236,480	1,408,293,341	7,389,720,979	2,851,979,036	8,779,080,350	14,126,583,135
2017	17,520,330,000	22,414,327,324	6,006,614,234	1,636,764,071	8,544,173,080	3,034,425,579	9,926,941,261	15,288,773,044
2018	18,568,616,897	27,282,854,512	6,754,565,647	1,840,576,061	9,987,336,928	3,363,817,133	11,176,364,126	13,301,500,758
2019	19,679,625,524	27,234,009,075	7,595,652,942	2,069,766,985	10,160,598,541	2,530,805,369	9,722,272,652	12,610,077,830

Source: COMESA/AFDB (COMSTAT) 2020

Table 10.1: *Central Government's Global Debt (% of GDP)*

Country	Govt Debt % Of GDP 2019	Country	Govt Debt % Of GDP 2019	Country	Govt Debt % Of GDP 2019	Country	Govt Debt % Of GDP 2019
Afghanistan	6.13	Czech Republic	28.52	Trinidad and Tobago	45.01	Mauritius	77.7
Armenia	49.95	Denmark	26.45	**South American Average**	**48.03**	Namibia	104.38
Azerbaijan	17.7	Estonia	9.62	Algeria	40.28	Mozambique	54.29
Bhutan	104.4	Finland	49.13	Egypt	83.80	Seychelles	55.26
Brunei Darussalam	2.58	France	81.49	Mauritania	58.12	South Africa	62.15
Cambodia	28.61	Germany	37.69	Morocco	65.75	Tanzania	38.22
China	56.56	Greece	189.92	Tunisia	72.73	Zambia	91.9
Georgia	41.34	Hungary	66.21	**North African Average**	**53.45**	Zimbabwe	50.1
India	46.16	Iceland	42.57			**SADC Average**	**51.80**
Indonesia	30.18	Ireland	64.04	Benin	41.23		
Japan	201.39	Italy	130.59	Burkina Faso	42.67	Antigua and Barbuda	84.47
Kazakhstan	18.48	Kosovo	17.53	Cabo (Cape) Verde	124.98	Barbados	118.83
Kyrgyzstan	54.14	Latvia	35.47	Cameroon	36.83	Dominica	82.64
Malaysia	32.49	Latvia	35.46	Chad	44.29	Dominican Republic	39.58
Maldives	77.99	Lithuania	35.26	Cote d'Ivoire	37.89	Grenada	59.08
Mongolia	59.97	Luxembourg	16.72	Egypt	83.8	Haiti	47.69
Myanmar	38.84	Malta	39.79	Equatorial Guinea	41.06	Jamaica	94.28
Nepal	30.07	Moldova	24.99	Ghana	62.76	Kiribati	18.34
P.D.R.Lao	62.64	Montenegro	63.73	Guinea	34.8	Saint Kitts and Nevis	56.22
Pakistan	85.56	Netherlands	48.38	Guinea Bissau	67.62	Saint Lucia	61.32
Philippines	36.97	North Macedonia	40.17	Liberia	53.27	Saint Vincent and the Grenadines	67.65
Republic of Korea	36.42	Norway	14.39	Mali	40.46	The Bahamas	58.04
Russian Federation	13.11	Poland	42.81	Niger	41.73	**Caribbean Average**	**65.68**
Singapore	129.29	Portugal	120.68	Nigeria	26.46		
Sri Lanka	86.78	Romania	35.9	Senegal	40.46	Bahrain	103.36
Taiwan	28.21	San Marino	85.71	Sierra Leone	70.05	Iran	44.74
Tajikistan	43.09	Serbia	52.04	The Gambia	80.01	Iraq	46.19
Thailand	34.02	Slovak Republic	52.53	Togo	70.85	Iraq	46.9
Thailand	34.02	Slovenia	59.49	**West African Average**	**54.80**	Israel	58.49
Turkmenistan	32.78	Spain	88.22			Jordan	78.02
Ukraine	50.28	Sweden	36.1	Central African Republic	47.18	Kuwait	11.77
Uzbekistan	29.32	Switzerland	42.14	Chad	44.29	Lebanon	174.48
Vietnam	44.25	Turkey	30.76	Congo Republic	83.67	Oman	63.06
Asian Average	**49.81**	UK	84.39	Ethiopia	57.60	Saudi Arabia	22.79
		European Average	**54.35**	Gabon	62.40	UAE	27.27
Australia	34.82	Canada	36.82	Gabon	62.4	West Bank and Gaza	34.64
Fed. States of Micronesia	17	USA	92.57	South Sudan	65.43	Yemen	76.35
Fiji	49.00	**North American Average**	**64.70**	Sudan	200.37	**The Mid East Average**	**60.62**
Marshall Islands	22.63			**Central African Average**	**77.92**		
Nauru	61.99	Argentina	90.38				
New Zealand	31.54	Belize	105.08	Burundi	57.37		
Papua New Guinea	40.06	Bolivia	42.39	Djibouti	38.47		
Samoa	47.53	Chile	27.91	Eritrea	189.3		
Solomon Islands	8.91	Colombia	42.04	Kenya	62.1		
Timor-Leste	11.93	Costa Rica	58.46	Rwanda	51.36		
Tonga	41.28	El Salvador	48.24	São Tomé and Príncipe	73.07		
Tuvalu	19.52	Equador	50.15	Uganda	38.23		
Vanuatu	45.34	Guatemala	26.65	**East African Average**	**72.84**		
Oceania Average	**33.20**	Guyana	39.79	Angola	109.21		
Albania	66.25	Honduras	42.14	Botswana	14.74		
Belarus	38.40	Mexico	36.44	Comoros	25.24		
Belgium	83.82	Nicaragua	42.14	DRC Congo	14.75		
Bosnia Herzegovina	32.8	Panama	41.04	Eswatini	38.2		
Bulgaria	25.55	Paraguay	21.1	Lesotho	46.46		
Croatia	71.64	Peru	23.2	Madagascar	38.42		
Cyprus	135.34	Suriname	82.30	Malawi	59.54		

Source: Global Debt Monitor - International Monetary Fund (2022)

Computation of Average values by Author (2022)