ECONOMIC GROWTH AND TRADE OPENNESS: EVIDENCE FROM ZAMBIA

BY

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DECLARATION

I, **Elias Muwau**, declare that this dissertation is my own original work and that it has not been previously presented, and will not be presented to any other University for a similar degree award.

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APPROVAL

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ABSTRACT

There has been controversy amongst economists regarding the nature of the relationship between trade openness and economic growth. The standard neoclassical model of exogenous growth postulates that changes in trade openness can only affect the pattern of product specialization but not the long term rate of economic growth, while the new growth theory postulates that changes in trade openness can influence long term economic growth rate but the nature of the impact of trade openness on long term rate of economic growth when trading partners are structurally different in terms of innovation is ambiguous. Zambia has been relatively open since colonial time. Openness to international trade helps to reduce domestic volatility in GDP. Zambia's openness can act as a channel for the diversification of country specific shocks. However, the question of whether trade openness translates to economic growth is still not clear for the Zambian economy because of its long openness period and fluctuating economic growth performance.

This study sought to investigate the linkage between trade openness and economic growth using time series data of Zambia for the period 1978 to 2016. Two additional variables, Foreign Direct Investment (FDI) and physical capital measured by real gross fixed capital formation using 2010 as the base year, were incorporated to form a multivariate framework. Autoregressive Distributed Lag (ARDL) bound approach was used to determine the presence of the long run relationship among the variables while the Vector Error Correction Model (VECM) was used to determine causality among the variables both in the short run and long run.

The ARDL reviewed a long run relationship among the variables. Trade openness was found to have an insignificant effect on economic growth in the long run. In the short run however, trade openness was found to have a significant positive effect on economic growth. Physical capital and FDI were found to have a significant long run effect on economic growth. Bi-directional granger causality was significant between economic growth and trade openness in the short run. Additionally, the study established a unidirectional short run causality flowing from physical capital to trade openness and from FDI to economic growth. A strong long run causality was found flowing from economic growth, FDI and physical capital to trade openness. Additionally, the study established a weak long run causality flowing from economic growth, trade openness and FDI to physical capital. However, no long run causality was found flowing from trade openness, FDI and physical capital to economic growth. As such, Zambia need growth policies that are directed at opening the economy to international trade. This implies that a substantial portion of the economic expansion of Zambia involves the external sector. Additionally, physical capital and FDI led growth policies are necessary for achieving long run growth.

Keywords: Economic Growth, Trade Openness, Causality

DEDICATION

DEDICATED TO MY MOTHER GIN M. MUWAU AND MY SISTER BEATRICE M. MUWAU

M.T.S.R.I.E.P

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ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey-Fuller
AGOA	African Growth Opportunity Act
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
BoP	Balance of Payment
COMESA	Common Market for Eastern and Southern Africa
EAC	East African Community
EBA	Everything But Arms
ECM	Error Correction Model
E-Views	Econometric Views
FDI	Foreign Direct Investment
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GMM	General Method of Moment
GRZ	Government of the Republic of Zambia
IMF	International Monetary Fund
m.f.n.	Most Favored Nations
OECD	Organizations for Economic Co-operation and Development
p.a.	Per Annum
PP	Phillips-Perron
R&D	Research and Development
SADC	Southern African Development Community
SIC	Schwarz Information Criterion
TFTA	Tripartite Free Trade Area
UBZ	United Bus Company of Zambia
UNCTAD	United Nations Conference on Trade and Development
US	United States
VECM	Vector Error Correction Model
WTO	World Trade Organization
WBG	The World Bank Group
ZDA	Zambia Development Agency
ZPA	Zambia Privatization Agency

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

There has been controversy amongst economists regarding the nature of the relationship between trade openness and economic growth. The standard neoclassical model of exogenous growth postulates that changes in trade openness can only affect the pattern of product specialization but not the long-term rate of economic growth. The new growth theory postulates that changes in trade openness can influence long term economic growth rate, however, the nature of the impact of trade openness on long term rate of economic growth when trading partners are structurally different in terms of innovation is ambiguous (Khobai and Mavikela, 2017). Almost every country trades with at least one other country for different commodities. Trade openness has different effects on the growth of different countries. Openness to trade is mostly related to exports and imports. The most used definition of openness is the ratio of the sum of export and import to gross domestic product (GDP) of a country (Semancikova, 2016).

The Zambian economy has been relatively open since colonial times. At independence in 1964, Zambia was heavily dependent on copper as its major export commodity. In 1970, copper accounted for over 90 percent of Zambia's foreign earnings, 40 percent of her GDP and 50 percent of the government earnings (Bostock and Harvey, 1972). In the 1980's the government adopted new economic policies that were aimed at diversifying the economy into agriculture and industrial development. This was to increase the sources of foreign exchange. Following the new policies, non-traditional exports grew rapidly hitting 17 percent in 1995 from 8 percent recorded in 1990 (WTO, 1996). Zambia experienced a further increase in non-traditional exports beginning 2010. The Sixth National Development Plan indicates that the share of non-traditional exports in total exports reached 22.1 percent in 2011 from the 17.9 percent recorded in 2010. In 2012 non-traditional exports contributed to more than 30 percent of merchandise exports (World Bank, 2014).

Zambia's main trading partners for exports are Switzerland, China, Democratic Republic of Congo, Singapore, South Africa, United Arab Emirates, United Kingdom, India, Hong Kong, Zimbabwe, Malawi, Tanzania, Kenya, Luxembourg, and Rwanda. Zambia's major import partners are South Africa, Congo- Kinshasa and China. The imports consist mainly of machinery, clothing and foodstuff.

Figure 1 below shows the trend in per capita real GDP and trade openness of Zambia for the period under study (1978 to 2016). The trade openness trend line shows that between 1978 and 2016 the highest trade openness ratio was 99.2 percent in 1990 with a record low of 58.6 percent in 2009. In between the two extreme points were fluctuations from year to year. Major fluctuations are noticeable for the period before 1994. The degree of openness was rising reaching 82.25 percent in 1979 and declined to 62 percent in 1982. It started to rise again from 62 percent in 1982 to 87.6 percent in 1986, then a sharp drop was recorded in 1988 before hitting the record high of 99.2 percent in 1990.

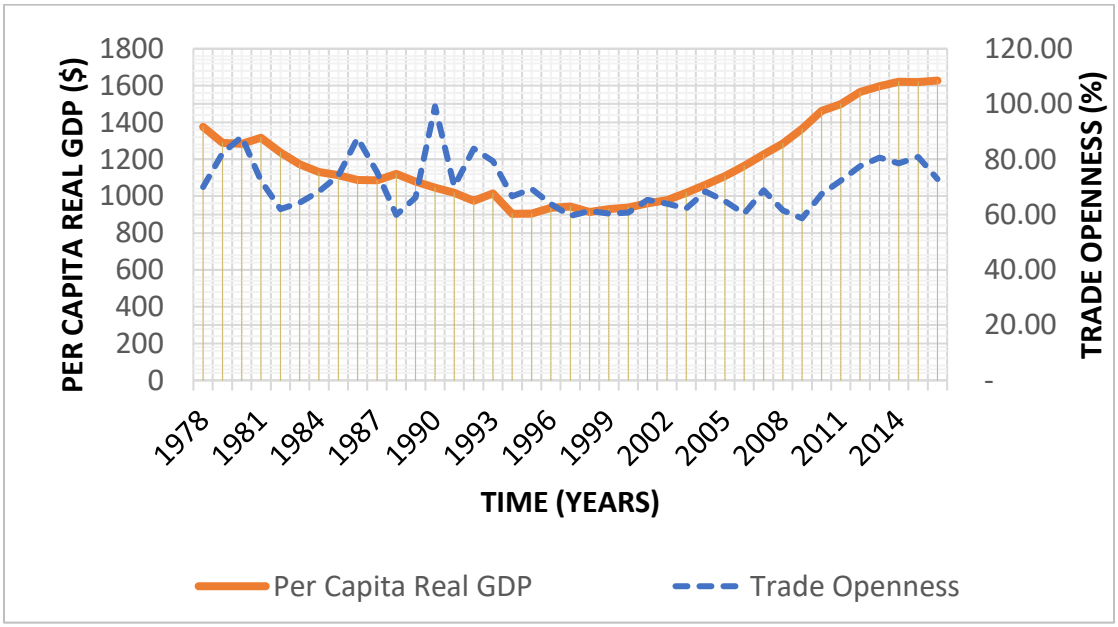

Figure 1: Trends in Per capita Real GDP and Trade Openness
Source: Author's own computation using data based on World development indicators

After the implementation of the trade liberalization policies, the degree of trade openness began to decline from 1992 all the way to 1997 from 83.8 percent to 59.49 percent, respectively. The government privatized most of the state-owned entities, decontrolled prices, and lifted exchange controls. This period also saw a decline in the inflation rate from over 100 percent in 1992 to about 35 percent in 1995.

Openness to trade is also affected by the intensity of trade restrictions imposed by the trading country. Zambia was a member of General Agreement on Tariffs and Trade (GATT) and the founding member of World Trade Organization (WTO). The country has applied the principle of the WTO agreement in the trade policy. This helped to widen Zambia's openness degree. (WTO, 1996).

The growth of the nation is very important for the improved and stable standard of living for the residents of any country. Whereas trade openness was highly fluctuating between 1978 and 1994, per capita real GDP was declining. Per capital real GDP started to rise beginning 1995 all the way to 2016 hitting a record high of US$1,627 in 2016 and a record low of US$904 in 1994. The positive trend period can be associated with the implementation of the new trade policies. Figure 2 below shows the trend in the GDP growth of Zambia for the period under study. The trend line shows that between 1978 and 2016, the highest growth in GDP was 10.2 percent in 2010 and a low of -8.63 percent in 1994. After 1994, GDP growth increased again, reaching 6.2 percent in 1996, and fell to -0.4 percent in 1998. From 1998, the growth in GDP rose, all the way to around 2010, and then declined to 3.6 percent in 2016.

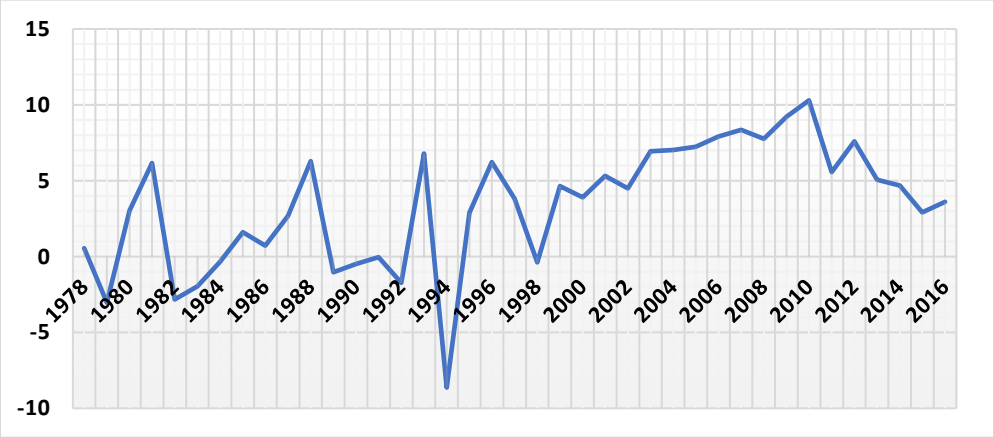

Figure 2: GDP growth rate over time
(*Source: Author's own computation based on World Development Indicators)*

1.2. Macroeconomic Background

After attaining her independence, Zambia underwent two major institutional and economic reforms: a command economy which was characterized by administrative and economic controls; and a market economy in which the economy was liberalized to remove any controls on economic performance.

In 1960, Zambia's per capita income was higher than that of South Korea (McPherson, 1995), and from the end of World War II to 1974, savings and investments were more than 30 percent of Zambia's GDP. This was a period for further economic growth for Zambia. Copper was enjoying a high price on the market and the then government was reluctant to promote economic reforms. Zambia began the formal planning after independence with the First National Development Plan (1966-1970) coming to effect and was based on the "Seers Mission Report" which had proposed

an increased government involvement in the economy to help expand infrastructure, promote agriculture, and to direct more resources to regional development. These reforms transferred control of economic activities to the state. The government nationalized most privately-owned entities. The period 1964-1974 saw an average copper price of US$5,653 per metric ton per annum growing at an average rate of 7.65 percent, with low prices of crude oil averaging US$6.71 per annum. (Chirwa and Odhiambo, 2016). The economy also experienced economic growth rate averaging 4.7 percent per annum, a real GDP per capita which averaged US$989, inflation rate averaging 8.4 percent and an investment share level that averaged 29.3 percent of real GDP.

After 1974, Zambia suffered a major external shock in the form of a drastic 40% fall in copper prices (Ndulo and Mudenda, 2010), and 221 percent rise in crude oil price per barrel in 1973. This shock was transmitted to all sectors of the economy and this saw the collapsing of real GDP per capita, Fuel prices skyrocketed, inflation rate increased, and investment reduced. These drastic changes followed from the institution of the Mulungushi Reforms of 1968 (Chirwa and Odhiambo, 2016).

The period 1974-1991 was the period of down turn for Zambia. This was the period when the copper and crude oil price shocks hit the Zambian economy severely such that the economy grew at an average of 1 percent growth per annum and per capita real GDP dropped from US$1,070 recorded in 1965 to US$651 in 1991. Gross domestic investment also reduced from 50.9 percent of real GDP recorded in 1969 to 0.3 percent of real GDP in 1992. The 1970s hardships which Zambia went through forced the government to seek financial assistance from the international Monetary Fund in 1978 to control inflation which resulted from the continued balance of payment deficit (Chirwa and Odhiambo, 2016). However, in the 80s this inflation rate went up to hit a triple digit figure in 1989 (128.7% per annum) and the annual average inflation rate between 1980 and 1991 was 50.22 percent per annum (Mcpherson, 1995).

The economy underwent massive economic reforms after 1991 where most of the state-owned entities were privatized. The privatization programme was formally launched with the enactment of the Privatization Act of 1992 which provided the Zambia Privatization Agency (ZPA) the responsibility of planning, implementing and controlling the privatization of the state-owned enterprises in Zambia (UNCTAD, 2011). The result of the privatization process was an increase in investment in the country. Some companies such as the Zambian Airways and United Bus Company of Zambia (UBZ) were liquidated and many people went unemployed for some time.

Some people who were discouraged from the process did not even bother to search for new employment but instead went out of the labour force. The new government reduced its expenditure considerably during the period 1991-2000. In 1993 the government eliminated all government subsidies from the budget coupled with the reduction of the civil servants' wages (Chirwa and Odhiambo, 2016). The government introduced a freely floating exchange rate regime. This was supported by a further establishment of the foreign exchange bureaus and the elimination of all exchange rate controls on both capital and current accounts by 1994 (Mungule 2004). Interest rates also became more market determined. Other reforms include the removal of the quantitative restrictions on imports and exports, as well as the reduction of the level and dispersion of customs tariffs (GRZ, IMF, and World Bank, 1999)

Most of the reforms initiated since 1991 started to produce results in the period 2001-2013. The copper prices increased significantly by 162 percent from the year 2003 to 2006. Copper production recovered sharply from 200,000 tons per annum in the late 1990s to over 800,000 tons per annum in 2012 (Chirwa and Odhiambo, 2016). FDI and gross domestic investment also increased, averaging 7 percent of real GDP and 22.4 percent of real GDP respectively. The current account deficit also declined from -19.1 percent of GDP in 2001 to -3.7 percent of GDP in 2013 because of the liberalization of the market (Chirwa and Odhiambo, 2016). There was significant inflation rate and exchange rate stabilization in the 1991-2012 period. The economy grew at an average rate of 5.9 percent per annum. The inflation rate resumed its upward trend in 2012. It increased from 6.6 percent to 10.1 percent in 2015.The main contributor was the increase in prices of non-food products mainly imported products because of the Kwacha depreciation.

1.3. Trade Overview

The reforms which were put in place between 1964 and 1974 affected the Zambian trade balance. The economy recorded an average trade deficit of -8.5 percent of real GDP per annum. This led the government to introduce a system of import licensing and foreign exchange allocation in 1975 (Chirwa and Odhiambo, 2016). The purpose was to reduce the trade deficit. This trade policy reduced the trade deficit from -6 percent recorded in 1975 to a trade surplus averaging 4.2 percent per annum between 1976 to 1991. The exchange controls led to the creation of parallel markets for foreign exchange due to arbitrage. In 1964 when Zambia gained independence, the nation was heavily dependent on copper as its major export commodity with a few agricultural products such as tobacco, maize and timber (UNCTAD, 2016). Copper accounted for over 90 percent of

Zambia's foreign earnings (Bostock and Harvey, 1972) and about 94 percent of total exports (UNCTAD, 2016). Over time there has been a shift from copper dependency into Non-traditional exports. Today Zambia exports several products into the Common Market for Eastern and Southern Africa (COMESA) and Southern African Development Community (SADC) markets. These include tobacco, unstrapped, raw cane sugar, Portland cement, plates, sheets and strip of refined copper, wheat or muslin flour, sulphuric acid, wire of refined copper, maize seed and non-seed maize (ZDA, 2017). Zambia, being a member of some regional trading groups, has benefited from some duty-free market access. Zambia also has market access to the US market through the African Growth Opportunity Act (AGOA) and market access to the European Union through the Everything But Arms (EBA) initiative.

Between 2003 and 2008 exports accounted for between 25 percent and 40 percent of GDP and imports accounted for between 25 percent and 30 percent of GDP. Trade policies have been pursued to deviate from copper dependency as a major export commodity to more non-traditional exports (WTO, 2009). Agriculture remains an important sector and provides livelihood for over 70 percent of the population. It contributes 10 percent to GDP and to total export earnings (WTO, 2016). Trade in goods and services grew steadily from US$8 billion in 2009 to US$21 billion in 2014. In 2015 Zambia exported mainly traditional copper, agri-food products, chemicals and certain semi-manufactured products. The fall in copper prices in 2015 and the electricity load shedding affected the economy adversely. The economic sectors slowed down in production (Gondwe and Gajarsa, 2017). As part of the strategies to expand export volumes, Zambia joined the tripartite free trade area (TFTA) in June 2016. The TFTA is an African agreement between COMESA, SADC and East African Community (EAC).

1.4. Problem Statement

Zambia has been relatively open since colonial times and the growth of the nation has been fluctuating over time. Considering the past three decades, the growth performance of the Zambian economy was less satisfactory for the first of the three decades. The last two decades have seen an improvement in economic growth rate of the nation. Zambia has been trading within and outside some regional trading groups such as SADC and COMESA. Such openness has been good for the reduction of domestic GDP volatility (World Bank, 2014). With the increase in the volume of trade in non-traditional exports, Zambia's openness can act as a channel for the diversification of the country. However, the question of whether trade openness translates to economic growth is still

not clear for the Zambian economy because of its long openness period and fluctuating economic growth performance. The main purpose of this study is to investigate the relationship between trade openness and economic growth.

1.5. Objectives

1.5.1. General objective

To investigate the linkage between trade openness and economic growth.

1.5.2. Specific objective

1. To determine whether trade openness has a causal effect on economic growth in Zambia
2. To determine whether economic growth has a causal effect on Trade openness in Zambia.
3. To determine whether the individual short run effect of trade openness, FDI and physical capital on economic growth differs from the individual long run effect of the same variables on economic growth.

1.6. Hypothesis

1. Trade openness has a causal effect on economic growth.
2. Economic growth has a causal effect on trade openness.
3. Individual Short run effect of trade openness, FDI, and physical capital on economic growth is different from the individual long run effect of the same variables on economic growth.

1.7. Significance of the Study

Openness to international trade has gained attention of world economies. No country produces all that its citizens want, both in existence, quality, and quantity. Nations get what they lack from other countries to improve the standard of living of the people within any given country. Hence, a study like this one is important to policy makers in that it can help devise the direction of policies that need to be taken or advocated for; whether to increase/reduce trade openness or to pursue other policies that can lead to sustainable economic growth. Further, this study may be one of a few studies linking trade openness and economic growth of the Zambian economy that takes interest in establishing causality between economic growth and trade openness.

1.8. Scope of the Study and Study Limitation

The study covered the period 1978 to 2016. The difficulties in extracting the data on GDP for the Zambian economy from the local sources, for the period dating back before 1990, may potentially undermine the robustness of the findings. As such we used data from the world development indicators. This source was chosen because other researchers such as Banda (2011) and Zombe (2014) in Zambia, and Awojobi and Katircioglu (2011) in Nigeria, used the same source to conduct their studies. The second limitation was on the measure of the openness index. The author was aware of the limitations that come with measuring trade openness as a ratio of total trade to GDP, as indicated by Lloyd and Maclaren (2000). However, data limitations indicated above posed a challenged in using a more robust measure of trade openness. As such, we used the ratio of total trade to GDP as a measure of trade openness due to data availability and its extensive use by other researchers in literature. Lastly, the author was fully aware of the contributions which human capital makes to economic growth according to literature such as the Solow model, however, there was incomplete data for human capital to cover the study period. The author used physical capital as used in most studies studying economic growth and its determinants.

1.9. Organization of the Dissertation

The study is organized as follows: Chapter One covers the introduction to the study, objectives, hypotheses, significance of the study, scope and data limitation of the study. Chapter Two provides a review of the theory and empirical literature while Chapter Three presents the methodology that was used in this study. The analysis of the results of the study are presented in Chapter Four. Finally, conclusion and policy recommendations of the findings are presented in Chapter Five.

CHAPTER TWO

LITERATURE REVIEW

2.1. Theoretical Review

This chapter presents different theories linking trade and economic growth. There have been different views as to whether openness to international trade affects economic growth or not. There exist a number of theories on international trade openness and economic growth which started as far back as the sixteenth century. This study exposes six theories, namely, the mercantilist theory, the theory of absolute advantage, the theory of comparative advantage, the Heckscher-Ohlin theory, Solow growth model, and the new growth theory.

2.1.1. Mercantilist Trade Theory

The merchants, bankers, government officials and philosophers, wrote essays on international trade during the seventeenth and eighteenth centuries. They advocated an economic philosophy known as mercantilism. In these essays, they demonstrated and maintained their view of trade, that for a nation to become rich and powerful, it needed to export more than it imported. In other words, the mercantilists maintained that a nation needed to maintain a positive trade balance for it to become rich and powerful. In their view, the economy would grow by restricting imports and encouraging exports. By so doing, government would stimulate national output and employment. Some of the propagandist of this theory are Thomas Munn (1571 - 1641) Jean Baptiste Colbert and Thomas Hobbes. In the times that the theory was established, the most important way in which a country could be rich was by acquiring precious metals such as gold. The more gold a nation acquired, the more money it had in circulation and the greater business activities to allow for the continued growth of the nation.

2.1.2. Absolute Advantage Trade Theory

This theory was established by Adam Smith (1776). It was presented in his book on the "wealth of the nation." He criticized the view that the mercantilist had on trade and argued that nations can only engage in trade if they all gain. Smith argued that if one nation gains, while the other doesn't (as implied in the mercantilist view) then the nation that does not benefit from trade will simply refuse to trade. In his view of trade, he argued that nations can trade based on absolute advantage. That is, when one nation is more efficient than (or has an absolute advantage over) another nation in the production of one commodity but is less efficient than (or has an absolute disadvantage with

respect to) the other nation in producing a second commodity, then both nations can gain by each specializing in the production of the commodity of its absolute advantage and exchange part of its output with the other nation for the commodity of its absolute disadvantage (Salvatore, 2013). The results from such trading was expected to lead to a utilization of resources in the most efficient way and a rise in the output of both commodities. Resources would be utilized in the most efficient way and world welfare would be maximized if there was free trade. Hence, he advocated for the policy of free trade and Laissez-faire. He maintained that national economies would grow if the government has less interference with the movement of commodities between countries.

2.1.3. Comparative Advantage Theory

This theory is an extension of the law of absolute advantage and it was advocated by Ricardo (1818). It postulates that even if one nation is less efficient than (has an absolute disadvantage with respect to) the other nation in the production of both commodities, there is still a basis for mutually beneficial trade to occur if the first nation specializes in the production and exportation of the commodity of comparative advantage (i.e. the commodity in which its absolute disadvantage is less) and import the commodity in which its absolute disadvantage is greater (i.e. the commodity of its comparative advantage).

However, the assumption of the labor theory of value presented problems for the theory (Salvatore, 2013). In 1936, Haberler explained the law of comparative advantage using the opportunity cost theory which says that the cost of a commodity is the amount of a second commodity that must be given up to release just enough resources to produce one additional unit of the first commodity. The opportunity cost theory stresses that a nation will specialize in the production of a commodity with a lower opportunity cost and export part of the output and import the other commodity that has a higher opportunity cost of production. As nations trade freely, their economies grow since both nations gain from trade. Just like the law of absolute advantage, this theory also provides a basis for the link between trade and economic growth.

2.1.4. Heckscher – Ohlin Trade Theory

This theory was established by two Swedish economists, Eli Heckscher and Bertil Ohlin. The theory tries to highlight two things in the theory of comparative advantage. First, it highlights on what factors determine comparative advantage of countries and second, it also highlights on the

effects of trade on factor income in the trading countries? The theory rests on a number of simplifying assumptions and Salvatore (2013) listed these assumptions.

The Heckscher-Ohlin theory built an explanation on the above two issues captured from the theory of comparative advantage. It concludes that trade increases total world output, and that all countries gain from trade. The theory also helps to explain how trade enables countries to secure capital and consumption of goods from other parts of the world. With all this, it is clear from the theory that, trade stimulates economic growth. "Economic growth means the steady process by which the productive capacity of the economy is increased over time to bring about rising levels of national output and income" (Ibraheem et al, 2013). In the 1970s, economists looked at growth theories in the perspective of the Ricardian-Heckscher-Ohlin trade model drawn from Solow (1957) Model. The model postulated that the country allocates its resources more efficiently after opening up to trade based on its comparative advantage. That trade openness will bring out only a one time increase in output (Khobai and Mavikela, 2017). This one-off increase was observed to have no impact on the long run growth. Hence long run output growth is exogenous in this model.

2.1.5. Solow Growth Model

The Solow model focuses on four things. These are output, capital (through savings and investment), labour (through population growth and education) and knowledge (through technological progress). Solow (1956) replaced the existing production function with the neoclassical production function. To understand the growth process, Solow assumed diminishing returns to capital and constant returns to scale in the production process. Solow's model included a 'sources of growth analysis' procedure which was intended to determine the magnitude of the effect each of the inputs had on the growth of the economy (Waithaka, 2012). The Solow model predicts that countries with high investment rates, low population growth rates and low rates of depreciation are likely to have more output per worker; and that countries with a larger population are likely to have larger economies ceteris paribus.

This model postulates that output growth occurs because of increases in either labour quantity and quality, increases in capital, or improvements in technology or a combination of two or all of these factors. Solow's theory also highlights on the effect of the change in savings on income growth. The theory postulates that permanent increases in saving rates have no permanent effect on the rates of income growth. However, an increase in the savings rate raises capital stock to levels that

are more than what is needed to equip new workers with the same amount of capital as existing workers have. Hence such a rise in savings rate only leads to capital accumulation (Zombe, 2014). The increased capital per worker also temporarily increases output per worker.

This theory, however, is not sufficient in providing an explanation for the relationship between trade openness and economic growth in that it does not sufficiently explain the determinants of the change in technology. Therefore, the next section covers the new growth theory which seeks to explain the linkage between trade openness and economic growth and explain what determines the changes in technology.

2.1.6. The New Growth Theory

This theory stands on the ground that investments and technology are the two linkages between trade openness and economic growth. In terms of investment, it is postulated that since the traded sector is more capital intensive than the non-traded sector and there is a low price of capital due to competition in the international market of machinery and capital equipment, trade openness tends to promote economic growth (Khobai and Mavikela, 2017). In the technology link, trade openness is argued to possibly increase technology due to technology spill-over, economies of scale in research and development and high profits to innovators. This is provided by a large international market (Grossman and Helpman (1990); Romer (1990); Rivera-Batiz and Romer (1991); Coe and Helpman (1995)) cited by Khobai and Mavikela (2017).

Rivera-Batiz and Romer (1991), and Grossman and Helpman (1990) points out four distinct opportunities through which trade openness may lead to long run economic growth:

1. Communication effect: A nation that opens up to international trade tends to have an opportunity to communicate with foreign counterparts. The communication then facilitates the transmission of technology. When residents of a small country interact with agents in the outside world, they gain access to a body of accumulated wisdom there, as well as to some of the new discoveries that are being made on the on-going basis (Grossman and Helpman, 1990).
2. Duplication effect: Some new ideas and technology get to be invented due to trade openness. This prevents the duplication of research and development efforts. Greater flow of ideas can permanently increase the rate of growth (Rivera and Romer, 1990)
3. Integration effect: It is argued that openness to international trade increases the size of the market that firms can access. With an assumption that intermediate and final goods are traded

across countries. A large market size of the research and development sector increases R&D activities. This results in the economic growth in the sector because of the presence of increasing returns to scale. Following from proposition three of Grossman and Helpman, (1989), the long run growth is higher the larger is the effective labour force of the country with comparative advantage in R&D. This comparative advantage may be associated with faster or slower growth, depending upon the extent of productivity differences.

4. Allocation effect: Openness to international trade allows countries to specialize in the production of the commodities of their comparative advantages that are determined by factor endowment. Upon opening to international trade, relative factor prices are subject to change.

In conclusion, this study has reviewed six theories, the mercantilist theory, the theory of absolute advantage, the theory of comparative advantage, the Heckscher-Ohlin theory, the Solow growth model, and the new growth theory. The study relied much on the Heckscher-Ohlin theory and the new growth theory.

2.2. Empirical Review

There are many studies that have been conducted on the growth effect of trade openness within the African region and the world at large. Many studies demonstrate the different effects of openness to international trade on economic growth. Some studies demonstrate a positive, others negative, while still others demonstrate an ambiguous effect.

Zombe (2014) conducted a study which aimed at investigating the causal relationship among financial development, trade openness, and economic growth in Zambia from 1965 to 2011. He used the Johansen co-integration test to establish the long run relationship among the variables and the VECM for the granger causality test. The Johansen co-integration tests validated the existence of a long run relationship among the variables. Trade openness was found to significantly cause economic growth when broad money was used as a measure of financial development. However, trade openness and economic growth caused financial development when domestic credit to private sector was used to measure financial development. The author highlighted the importance for policy makers in Zambia to pursue policies that further open up the economy to international trade with caution because trade openness was found to hinder the growth of domestic credit to the private sector in the short run.

Malefane and Odhiambo (2018) examined the impact of trade openness on economic growth in South Africa using annual time series data over the period 1975 to 2014. The authors used the autoregressive distributed lag (ARDL) bounds testing approach to investigate the dynamic impact of trade openness on economic growth. Four trade openness proxies were used to arrive at robust results. The first proxy was the ratio of total trade to GDP. The second proxy was the ratio of exports to GDP. The third proxy was the ratio of imports to GDP, and the last proxy is an index of trade openness, which captures the effects of residual openness, resulting from taking the country's size and geography into account. The results of their study indicated a positive and significant long run impact of trade openness on economic growth when the ratio of total trade to GDP is used as a proxy, but not when the three other proxies were employed. The short run results, however, indicates significant positive impact of trade openness on economic growth when the first three trade openness proxies are employed, but not so when the trade openness index is employed. The authors, therefore, suggested that the promotion of policies that support international trade were relevant for the South African economy.

Keho (2015) conducted a study which analysed the relationship among FDI, exports, and economic growth in 12 selected Sub-Saharan African countries over the period 1970 to 2013. The study employed the multivariate co-integration approach of Johansen. The results showed that the three variables were co-integrated in ten countries. Economic growth was found to have a long run effect on FDI in five countries. The results also reviewed a short run bi-directional causality between FDI and GDP.

Zahonongo (2017) conducted a study on trade openness and economic growth in developing countries. The main objective of the study was to investigate how trade openness affects economic growth in developing countries, with a focus on the Sub-Saharan Africa. The study used data from 42 Sub-Saharan African countries, covering a period 1980 to 2012, and employed the pooled mean group estimation techniques. The results showed that trade openness has a positive and significant effect on economic growth.

Olufemi (2004) conducted a study on trade openness and economic growth in Nigeria. The main aim of the study was to investigate the causality between trade openness and economic growth using data from the Nigerian economy. The study used the Johansen co-integration technique and the VECM to arrive at its findings. The author found that there was a long run relationship between

economic growth and trade openness in Nigeria and that economic growth causes trade openness. This observation showed a unidirectional causality.

Moyo et al (2018) conducted a study on the relationship between trade openness and economic growth in Ghana and Nigeria for the period 1980 to 2016. The study employed the ARDL approach to examine the long run relationship between variables. The study found the existence of a long run relationship among variables for both countries. In addition, the results showed that while trade openness had a positive impact on economic growth of Ghana at the 1 percent level of significance, it had a negative and insignificant effect on the economic growth of Nigeria.

Belloumi (2014) conducted a study which sought to examine the relationship between FDI, trade openness and economic growth in Tunisia using the Autoregressive Distributed Lag Bounds approach to co-integration for the period 1970 to 2008. The results showed that the variables in the model were co-integrated when FDI is the dependent variable. The results also indicated that there was no significant short run Granger causality from FDI to economic growth, from economic growth to FDI, from trade openness to economic growth, and from economic growth to trade openness.

A study was conducted on Cote d'Ivoire by Keho (2017). The main aim of the study was to examine the impact of trade openness on economic growth for Cote d'Ivoire over the period 1965 to 2014 in a multivariate framework including capital stock, labour and trade openness as regressors. The study used two techniques of the Autoregressive Distributed Lag bounds test and the Toda and Yamamoto Granger causality test to arrive at the results. In this study, trade openness was found to have a positive effect on economic growth both in the short run and long run. The study also identified a strong complementary relationship between trade openness and capital in promoting economic growth.

Khobai and Mavikela (2017) conducted a study in Argentina which aimed at investigating the causal relationship between economic growth and trade openness using data covering the period 1970 to 2016. They used the Autoregressive distributed lag (ARDL) model and the vector error correction model (VECM) to investigate the relationship. In addition to economic growth and trade openness, the authors used FDI and physical capital as additional variables to form a multivariate framework. The ARDL results validated the existence of a long run relationship between economic

growth, trade openness, FDI and capital. They further observed a long run causality flowing from trade openness, foreign direct investment and capital to economic growth.

Muhammad et al (2012) conducted a study on the causal relationship between trade openness and economic growth for Pakistan. The authors employed the Johansen co-integration test and the error correction model to examine the long run relationship. They used annual data from 1970 to 2012. The results indicated that a significant relationship between openness and economic growth existed.

Dutta et al (2017) investigated the causal relationship among economic growth, domestic investment, FDI and trade openness over the period 1976-2014 for Bangladesh. The authors employed the Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) tests of unit root to test for the stationarity of the variables employed in the study. The Johansen co-integration test was employed to test for the long run relationship among the variables. The Granger Causality test based on the vector error correction model (VECM) was used to test for any existence of the causal relationship among the variables. The findings of the study reviewed that all variables were non-stationary in their level form but became stationary after taking the first difference of each variable. The Johansen co-integration test validated the existence of a long run relationship among the variables and the VECM established some causal relationships. A unidirectional causality was found flowing from: FDI to economic growth, domestic investment to trade openness, and economic growth to trade openness. Further, the authors found a bi-directional causality between domestic investment and economic growth, and between domestic investment and FDI.

Adhikary (2011) conducted a linkage analysis on FDI, trade openness, capital formation, and economic growth in Bangladesh using time series data for the period 1986 - 2008. The author employed the VECM to determine the causal linkage among the variables. A unidirectional causal flow was observed from trade openness, FDI and capital to economic growth. Following the results from the short run model, trade openness was found to have a significant negative but diminishing effect on economic growth while FDI and capital had a significant positive effect on economic growth.

Idris et al (2016) conducted a study which aimed at investigating the relationship between trade openness and economic growth in 87 selected countries. These included Organizations for Economic Co-operation and Development (OECD) and developing countries for the period 1977

– 2011. The authors adopted two measures of trade openness. The first measure considered the ratio of the sum of export and import in their nominal values to nominal GDP. The second measure considered trade openness in real values and this method takes the ratio of export and import in US$ to real GDP. The authors adopted the General Method of Moment (GMM) technique. They observed a significant bidirectional causal relationship for both developing countries and OECD countries. That is, trade openness was found to cause economic growth and then economic growth further caused trade openness.

In conclusion, it has been observed in this review that the findings of Zahonongo (2017), Keho (2017), Malefane and Odhiambo (2018), and Moyo et al (2018) observed a positive effect of trade openness on economic growth. Adhikary (2011) on the other hand found a significant but diminishing effect of trade openness on economic growth for Bangladesh. This means that different economies may observe different effects of trade openness on their economic growth and vice versa. This is mainly linked to the nature of trade policies adopted in any given country as well as the share of total trade between exports and imports. If exports outweigh imports, ceteris paribus, then one would expect the increase in GDP and thus the growth in the economy. Zombe (2014) observed that trade openness causes economic growth in Zambia when broad money is used as a measure of financial development. Dutta et al (2017) found a unidirectional causality flowing from economic growth to trade openness.

Further, Khobai and Mavikela (2017) observed a long run causality flowing from trade openness, FDI, and capital to economic growth. A bidirectional causal relationship from trade openness to economic growth and from economic growth to trade openness, was observed in the study conducted by Idris et al (2016). On the other hand, Belloumi (2014) did not find a significant short run causality from trade openness to economic growth, from economic growth to trade openness, from economic growth to FDI, and from FDI to economic growth.

This study contributes to the existing literature in that it is one of a few studies on the Zambian economy that investigates the linkage between trade openness and economic growth using the ARDL bound test and VECM.

CHAPTER THREE

METHODOLOGY

This chapter presents the methods and techniques that the study used. It begins with the presentation of the model specification for both general model and econometric model in section 3.1. Section 3.2 presents the data sources. A description of the estimation technique is presented in section 3.3.

3.1. Model Specification

The model which was used in this study states that real GDP per capita is a function of trade openness, foreign direct investment and physical capital. FDI and physical capital are control variables. The model used in this study is similar to the one used by Khobai and Mavikela (2017). The choice of the independent variables follows from the objectives, and from the empirical literature (Khobai and Mavikela (2017); and Adhikary (2011)). The author was fully aware of the contributions which human capital makes to economic growth according to literature such as the Solow model, however, there was incomplete data for human capital to cover the study period. The author used physical capital as used in most studies such as Adhikary (2011), and Khobai and Mavikela (2017). The model of this study took the following general form;

$$GDP_t = f(OPEN_t, FDI_t, K_t)$$

Where,

GDP_t = Real Gross Domestic Product per capita over time

$OPEN_t$ = Trade openness over time

FDI_t = Foreign direct investment over time

K_t = Physical capital over time

Specifically, the econometric model that was used in this study is in logarithmic form.

$$LGDP_t = \beta_0 + \beta_1 LOPEN_t + \beta_2 LFDI_t + \beta_3 LK_t + \epsilon_t$$

Where,

$LGDP_t$ is the natural log of per capita real GDP using 2010 as base year (proxy for economic growth)

$LOPEN_t$ is the natural log of trade openness,

$LFDI_t$ is the natural log of foreign direct investment, and

LK_t is the natural log of gross fixed capital formation (proxy for physical capital)

ϵ_t = error term

The a priori expected signs for the parameters of the model are β_1>0, β_2>0 and β_3>0.

3.2. Data Sources

This study used annual time series data of Zambia for the period 1978 to 2016. Due to some discontinuities in the data available from local sources, the study made use of the data from the World development indicators. In this study, GDP per capita using 2010 constant prices was used to indicate economic growth. Using per capital real GDP to measure economic growth was used by several researchers in their studies such as Khobai and Mavikela (2017), and Malefane and Odhiambo (2018). The study used net inflows (BoP, current US$) to measure foreign direct investment. The author was aware that FDI is a smaller component of total BoP current inflows, however, the problem of data availability for the study period led the author to use net inflows (BoP, current US$) to measure FDI. Physical capital was measured using gross fixed capital formation using 2010 as the base year. The use of gross fixed capital formation is evident from other studies such as Hye and Lau (2015). The ratio of exports plus imports to GDP was used to measure trade openness.

It was noted in this study that measuring trade openness as the ratio of exports plus imports to GDP has many weaknesses such as those spotted by Lloyd and Maclaren (2000). The two authors identified two limitations of this measure. The first limitation they stated was that figures in the numerator and denominator are in current prices and these prices may change over time for internationally traded goods and services. For domestic goods and services, these prices may diverge due to changes in exchange rate or other relative price movements. The second limitation is that the measure depends on two quit distinct sets of factors; (i) resource endowments, country size, tastes, technology and other determinants of comparative advantage. (ii) level of trade restrictions.

There are however, some other measures which are used in the literature to measure trade openness. These include; the ratio of exports to GDP, the ratio of imports to GDP, and the index

of openness which captures the effects of residual openness resulting from taking the country's size and geography into account.

However, due to data limitations on the third measure of trade openness, this study used the total trade to GDP ratio as a measure of trade openness. This has been extensively used in literature. This measure has been used by researchers such as Zombe (2014) and Daniels and Vanhoose (2009).

3.3. Estimation Techniques

The software used to analyze the data was E-views 10 lite student version. This study used the autoregressive distributed lag (ARDL) model to depict the long run and short run relationship between trade openness, foreign direct investment, physical capital and economic growth. This approach is similar to the one used by Khobai and Mavikela (2017), and Malefane and Odhiambo (2018) who conducted similar studies.

The dataset was logged. The unit root test was conducted to test the stationarity of the data before analysis. To conduct the unit root test, the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) unit root test were used. Upon obtaining the order of integration of the series, ARDL bound test to co-integration was used to check for the existence of any long-run or equilibrium relationship between economic growth, trade openness, FDI, and physical capital. Further, the Granger causality tests was conducted based on the VECM to determine the direction of causality relationships among the variables of the model.

3.3.1. Optimal Lag Length

Before running the actual ARDL model, the author obtained the optimal lag length. The criterion of selection was to choose the lag length that is chosen by most criteria. Interest was mainly put on the Akaike Information Criteria (AIC) and the Schwarz Information Criteria (SIC). If both approaches had equal number of selections in terms of being chosen by different criteria, then the smaller value of the AIC or SIC becomes the better result. This approach of selecting between AIC or SIC is adopted from the study by Khobai and Mavikela (2017).

3.3.2. Co-integration test

To determine the long run relationship among economic growth, trade openness, FDI and physical capital, we employed the ARDL bound approach. This model was developed by Pesaran et al (2001). The choice of the ARDL approach was made because; (i) it does not need all variables under study to be integrated of the same order and it can be applied when the underlying variables are integrated of order one, order zero, or fractionally integrated; (ii) the ARDL test is relatively more efficient in the case of small and finite sample data size; and (iii) by applying the ARDL technique we obtain unbiased estimates of the long run model (Harris and Sollis, 2003). However, it is important to also note one of the limitations of the ARDL technique that it cannot be applied if we have variables stationary at second difference. This test involves estimating the following conditional error correction models:

$$\Delta LGDP_t = \alpha_1 + \alpha_T T + \alpha_{GDP} LGDP_{t-1} + \alpha_{OPEN} LOPEN_{t-1} + \alpha_{FDI} LFDI_{t-1} + \alpha_K K_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta LGDP_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta LOPEN_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta LFDI_{t-k} + \sum_{m=0}^{t} \alpha_m \Delta LK_{t-m} + \varepsilon_{1t}$$

$$\Delta LOPEN_t = \alpha_2 + \alpha_T T + \alpha_{GDP} LGDP_{t-1} + \alpha_{OPEN} LOPEN_{t-1} + \alpha_{FDI} LFDI_{t-1} + \alpha_K K_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta LGDP_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta LOPEN_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta LFDI_{t-k} + \sum_{m=0}^{t} \alpha_m \Delta LK_{t-m} + \varepsilon_{2t}$$

$$\Delta LFDI_t = \alpha_3 + \alpha_T T + \alpha_{GDP} LGDP_{t-1} + \alpha_{OPEN} LOPEN_{t-1} + \alpha_{FDI} LFDI_{t-1} + \alpha_K K_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta LGDP_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta LOPEN_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta LFDI_{t-k} + \sum_{m=0}^{t} \alpha_m \Delta LK_{t-m} + \varepsilon_{3t}$$

$$\Delta LK_t = \alpha_4 + \alpha_T T + \alpha_{GDP} LGDP_{t-1} + \alpha_{OPEN} LOPEN_{t-1} + \alpha_{FDI} LFDI_{t-1} + \alpha_K K_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta LGDP_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta LOPEN_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta LFDI_{t-k} + \sum_{m=0}^{t} \alpha_m \Delta LK_{t-m} + \varepsilon_{4t}$$

Where:

$LGDP_t$ is the natural log of real GDP per capita using 2010 as the base year

$LOPEN_t$ is the natural log of Trade openness

$LFDI_t$ is the natural log of foreign direct investment

LK_t is the natural log of real gross fixed capital formation

T is the time period under consideration

Δ is the first difference operator

ε_{it} , i = 1, 2, 3, 4 are the residuals and ε_{it} are normally distributed

This test is based on the F-test. The hypothesis here is that;

$H_0: \alpha_{GDP} = \alpha_{OPEN} = \alpha_{FDI} = \alpha_K = 0$

$H_1: \alpha_{GDP} \neq \alpha_{OPEN} \neq \alpha_{FDI} \neq \alpha_K \neq 0$

The null hypothesis is formulated to indicate no co-integration while the alternative hypothesis is formulated to indicate the presence of co-integration. This implies that the rejection of the null hypothesis will indicate the presence of co-integration at a given level of significance under consideration. This will occur if the calculated F-statistic exceeds the upper critical bound value. If the F-statistic falls below the lower critical bound value, the null hypothesis will not be rejected, and this will indicate nonexistence of co-integration. Inconclusive results about co-integration will be arrived at if the F-statistic fall between the two critical bound values.

CHAPTER FOUR

ANALYSIS OF THE RESULTS

This chapter presents the findings of the study. We begin by presenting the descriptive statistics of the variables used in the study in section 4.1. Unit root test is presented in section 4.2. The diagnostic tests then follow in section 4.3. After determining the appropriate lag length for the model in section 4.4, the co-integration test based on the ARDL bound approach then follows in section 4.5. The long run results are presented in sections 4.6. The Granger causality test based on the VECM is presented in section 4.7. The discussion of the findings concludes the chapter in section 4.8.

4.1. Descriptive Statistics of the Variables of the Model

Before the estimation of the model, we conducted an analysis of the time series characteristics of the data to ascertain the normality of the variables. The results in Table 4.1 below show the descriptive statistics of the variables employed in this study.

Table 4.1: Descriptive statistics

	LGDP	LOPEN	LFDI	LK
Mean	7.051762	4.245865	19.087	21.53385
Median	7.013012	4.224001	19.00866	21.56765
Maximum	7.394493	4.596667	21.46511	23.0275
Minimum	6.806829	4.071093	16.66042	20.24635
Std. Dev.	0.186868	0.13025	1.415	0.804887
Skewness	0.512197	0.708739	0.128339	0.087133
Kurtosis	2.071851	2.76823	1.828105	1.906955
Jarque-Bera	3.025499	3.266358	2.278769	1.939768
Probability	0.220303	0.195308	0.320016	0.379127
Observations	38	38	38	38

Notes: LGDP = Logarithm of Real GDP per capita, LFDI= Logarithm of FDI, LOPEN = Logarithm of Trade Openness, LK = Logarithm of Physical capital
Source: Author's own computation using data from the World Development Indicators

The results in Table 4.1 above show that the variables of the model are all normally distributed. This follows from the Jarque-Bera probability values which are all greater than the 5 percent level of significance.

4.2. Unit Root Tests

Unit root test is basically required to determine whether the time series have a stationary trend or non-stationary. In the case of the later, the unit root test is required to also ascertain the number of times the variables have to be differenced to arrive at stationarity. This study employed the Augmented Dickey Fuller unit root tests as well as the Phillips-Perron unit root tests for the four variables of the model at lag 1.

Table 4.2: Results for Unit Root Tests for Variables at levels

Variable	ADF Statistics	ADF Order of Integration	PP Statistics	PP Order of Integration
LGDP	-1.151922	I(1)	-1.153557	I(1)
LOPEN	-3.651494**	I(0)	-3.634513**	I(0)
LFDI	-4.551797*	I(0)	-4.537896*	I(0)
LK	-1.799083	I(1)	-1.758875	I(1)

*Notes: (i) McKinnon critical values are used for rejection of hypothesis of a unit root. (ii) Critical values for ADF and PP statistics are -4.219126, -3.533083 and -3.198312 at 1 percent, 5 percent and 10 percent Significance level respectively. (Where *** mean significant at 10 percent, ** significant at 5 percent and * significant at 1 percent).*

Source: Author's own computation using data from the World Development Indicators

Table 4.2 shows that there is a unit root in two variables at their levels namely, LGDP and LK. These variables became stationary after taking their first difference. They are hence I(1). However, LOPEN and LFDI are stationary in levels at respectively 5 percent and 1 percent levels of significance and are as such I(0). The ADF test results were validated by the PP test results and both produced similar results. The first differences of LGDP and LK were taken and tested for unit root. Table 4.3 below shows the result

Table 4.3: Results for Unit Root Tests for Variables at first difference

Variable	ADF Statistics	ADF Order of Integration	PP Statistics	PP Order of Integration
D(LGDP)	-5.603709*	I(0)	-5.625411*	I(0)
D(LK)	-5.063395*	I(0)	-5.299926*	I(0)

*Notes: (i) McKinnon critical values are used for rejection of hypothesis of a unit root. (ii) Critical values for ADF and PP statistics are -4.226815, -3.536601 and -3.200320 at 1 percent, 5 percent and 10 percent Significance level respectively. (Where *** mean significant at 10 percent, ** significant at 5 percent and * significant at 1 percent).*

Source: Author's own computation using data from the World Development Indicators

At first difference, LGDP and LK become stationary at 1 percent level of significance and are hence integrated of order zero I(0) in their differenced mode.

4.3. Diagnostic Test

4.3.1. Normality Test

Normality test is needed to ascertain if the residuals of the model are normally distributed. We used the histogram test of normality with a focus on the Jarque-Bera statistic and its associated probability value.

H_0: The residules are normally distributed

H_0: The residules are not normally distributed

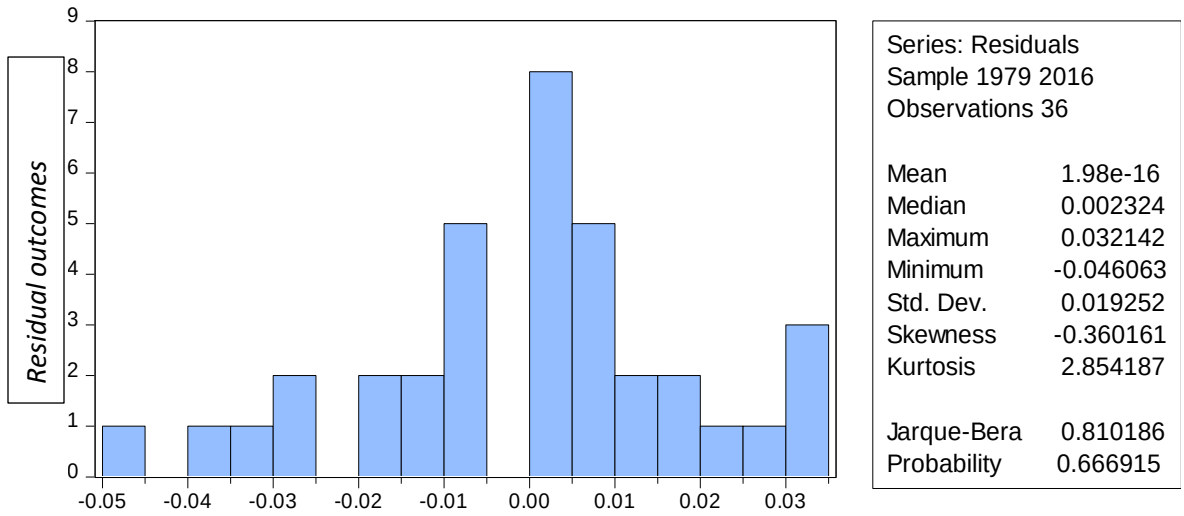

Figure 3: Normality Test results

Source: *Source: Author's own computation using data from the World Development Indicators*

The results in Figure 3 above show the Jarque-Bera statistic of 0.810186 with an associated P-value of 0.666915. As such, the null hypothesis of normality was statistically returned at all conversional levels of significance (i.e. at 1 percent, 5 percent and 10 percent). The residuals are statistically normally distributed.

4.3.2. Hetroscedasticity test

This study used the Breusch-Pagan-Godfrey test of heteroscedasticity to test if the residuals of the model are equally spread. To arrive at the conclusion of this test, the study tested the following Hypotheses.

H_0: There is homoscedasticity

H_0: There is heteroscedasticity

This study used the Breusch-Pagan-Godfrey test of Heteroscedasticity.

Table 4.4: Breusch-Pagan-Godfrey Test of Heteroscedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.139339	Prob. F(7,28)	0.3677
Obs*R-squared	7.980831	Prob. Chi-Square(7)	0.3343
Scaled explained SS	4.475925	Prob. Chi-Square(7)	0.7236

Source: Author's own computation using data from the World Development Indicators

Following the chi-square value of 7.980831 with an associated p-value of 0.3343, the residuals were statistically homoscedastic at all conversional levels of significance (at 1 percent, 5 percent, and 10 percent).

4.3.3. Serial Correlations

The Breusch-Godfrey serial correlation test in Table 4.5 below shows a chi square value of 0.741512 with an associated p-value of 0.3892.

Table 4.5: Breusch-Godfrey Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.567830	Prob. F(1,27)	0.4576
Obs*R-squared	0.741512	Prob. Chi-Square(1)	0.3892

Source: Author's own computation using data from the World Development Indicators

This implies that there is no serial correlation in the model at 1 percent, 5 percent and 10 percent levels of significance so the null hypothesis of no autocorrelation was statistically returned.

4.3.4. Stability Test

This study employed the CUSUM test and the CUSUMSQ test of stability. The results in figure 4 below shows that the null hypothesis of stability in the model could not be rejected at 5 percent level of significance since the curve lies within the two 5 percent level of significance boundaries in both the CUSUM and the CUSUMSQ. Hence the model is statistically stable.

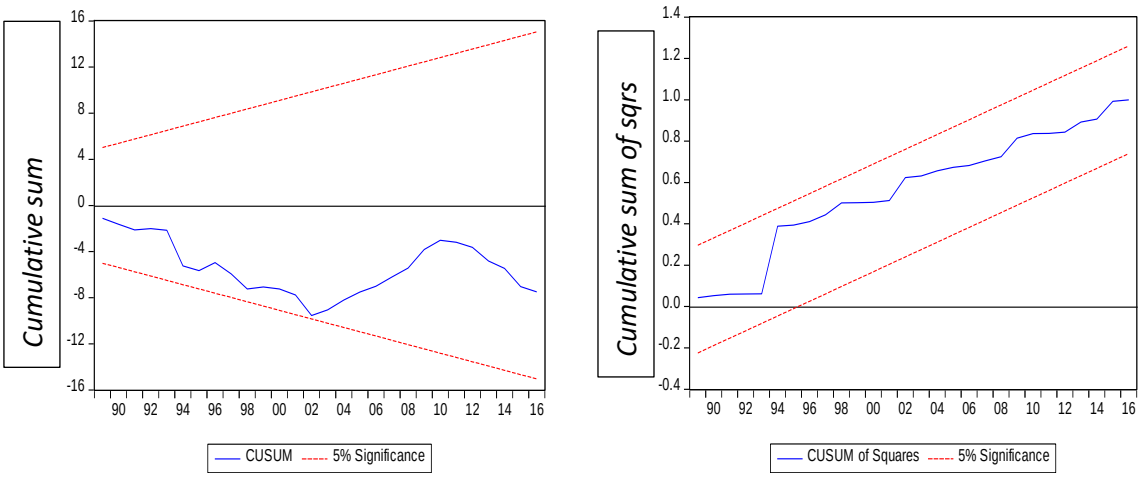

Figure 4: CUSUM and CUSUMSQ Stability Test
Source: Author's own computation using data from the World Development Indicators

4.4. Model Lag Selection Criteria

Table 4.6 below presents the results of the optimal selected lag length. As observed from the lag length criteria results, all the criteria chose the lag length of one. Going by the described mode of choosing the optimal lag, the study used the lag chosen by the AIC since it is the smaller of the two criterions.

Table 4.6: VAR Lag Order Selection Criteria

Endogenous variables: LGDP LOPEN LFDI LK
Exogenous Variables: C
Sample: 1978 - 2016
Included observations: 34

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	-26.73623	NA	0.0000717	1.808014	1.987585	1.869253
1	111.7149	236.1813*	0.0000000538*	-5.394994*	-4.497135*	-5.088798*
2	124.2803	18.47854	0.0000000687	-5.192959	-3.576818	-4.641807

Note:
** Indicates lag order selected by criterion, LR = Sequential modified LR test statistic (each test at 5 percent level), LPE = Final prediction criterion, AIC = Akaike information criterion, SIC = Schwarz information criterion, and HQ = Hannan-Quinn information criterion*
Source: Author's own computation using data from the World Development Indicators

4.5. Co-Integration Test Using the ARDL Approach

The ARDL bound test to cointegration was used to test for the long run equilibrium relationship among economic growth, trade openness, FDI, and physical capital. The observed F-statistic was compared with the critical values at the upper and lower bound values. The F-statistics obtained

in Table 4.7 below indicate that the variables are all co-integrated. This is because all the respective observed F-statistics are greater than the upper critical value bound at all conversional levels of significance.

Table 4.7: ARDL Co-integration Test

Critical Value bound of the F-statistic								
	10 percent level		5 percent level		2.5 percent level		1 percent level	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
K = 3	2.72	3.77	3.23	4.35	3.69	4.89	4.29	5.61

Dependent Variable	F-Statistic	Co-integration
$\boldsymbol{LGDP_t}$	$F_{LGDP} = 13.97537$	Yes
$\boldsymbol{LOPEN_t}$	$F_{LOPEN} = 5.611809$	Yes
$\boldsymbol{LFDI_t}$	$F_{LFDI} = 10.580000$	Yes
$\boldsymbol{LK_t}$	$F_{LK} = 8.034396$	Yes

Note: the critical value bounds of the F-statistic were computed using Eviews 10 student lite version
Source: Author's own computation using data from the World Development Indicators

Following this conclusion, there is a long run relationship among the variables used and the VECM becomes relevant since all the variables are co-integrated. Therefore, instead of running individual ECM models, the VECM was run to determine direction of the long run and short run causal relationship.

4.6. Long Run Results

This subsection presents the estimation of the long run model.

Table 4.8: Estimation of the long run relationship

Dependent Variable: LGDP
Method: ARDL (1,1,1,1) :AIC
Sample: 1978 - 2016
Included observations: 36 after adjustment

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	-0.550114	1.324017	-0.415489	0.6810
LOPEN	0.096298	0.299498	0.321533	0.7502
LFDI	0.101619**	0.044684	2.274186	0.0308
LK	0.245095*	0.059513	4.118355	0.0003
R-squared	0.989663	Akaike info criterion		-4.646177
Adjusted R-squared	0.987078	Schwarz criterion		-4.294284
Durbin-Watson stat	2.251349	F-statistic		382.9455
		Prob(F-statistic)		0.000000

*Where *** mean significant at 10 percent, ** significant at 5 percent and * significant at 1 percent)*
Source: Author's own computation using data from the World Development Indicators

The results in Table 4.8 above indicates that trade openness has an insignificant long run effect on economic growth. However, FDI and Physical capital have a significant long run effect on economic growth. Specifically, at 5 percent level of significance, a 1 percent increase in FDI would increase economic growth by 0.102 percent, ceteris paribus. Similarly, at 1 percent level of significance, a 1 percent increase in physical capital would increase economic growth by 0.245 percent in the long run, ceteris paribus.

4.7. Granger Causality Test Based on the VECM Model

Upon obtaining the long run relationship among the variables of the model, the VECM Granger causality test was conducted to determine the effect and direction of the causality among economic growth, trade openness, FDI and physical capital. Table 4.9 below presents the results. The results indicate that there is no significant long run causality moving from trade openness, FDI and physical capital to economic growth. However, when trade openness is used as the dependent variable, a significant long run causality is observed at 1 percent level of significance flowing from economic growth, FDI and capital to trade openness. In addition, weak long run causality is observed when capital is used as the dependent variable at 10 percent level of significance. In the short run, trade openness and FDI granger cause economic growth at 10 percent level of significance. Specifically, in the short run, a 1 percent increase in trade openness would cause economic growth to increase by 0.088 percent, ceteris paribus. Similarly, a 1 percent increase in FDI would cause economic growth to reduce by 0.018 percent, ceteris paribus. Furthermore, Economic growth and physical capital were observed to granger cause trade openness in the short run at respective 5 percent and 1 percent levels of significance.

4.7.1. VECM Estimation

Table 4.9: Vector Error Correction Model (VECM)

Dependent Variable	**Type of Causality**				
	Short run				Long run
	$\Delta LGDP$	$\Delta OPEN$	$\Delta LFDI$	ΔLK	ECT_{t-1}
$\Delta \boldsymbol{LGDP}$	……	0.087610***	-0.018570***	0.006446	-0.021695
$\Delta \boldsymbol{LOPEN}$	-1.709212**	……	0.038889	-0.546750*	-0.175884*
$\Delta \boldsymbol{LFDI}$	1.740103	-0.244016	…….	-0.888281	0.016859
$\Delta \boldsymbol{LK}$	-1.573482	-0.137052	-0.008355	……	-0.117938***

Where *** mean significant at 10%, ** significant at 5% and * significant at 1%)

Source: Author's own computation using data from the World Development Indicators

Simply put, bi-directional short run causality was observed between trade openness and economic growth. Unidirectional short run causality was observed flowing from FDI to economic growth and from physical capital to trade openness. The results further indicate that there was no short run causality observed flowing from economic growth, trade openness and FDI to capital or from economic growth, trade openness and capital to FDI.

4.8. Discussion of the Findings

This study sought to investigate the linkage between trade openness and economic growth on the Zambian economy. Two additional variables were incorporated as control variables to form a multivariate model. The hypotheses were; (1) Trade openness has a causal effect on economic growth, (2) Economic growth has a causal effect on trade openness, and (3) Individual short run effect of trade openness, FDI, and physical capital on economic growth, is different from their individual long run effect.

ARDL bound approach to co-integration was employed to determine whether there was a long run relationship among the variables of the model. The findings revealed that there was a significant long run relationship among the variables. These results are consistent with Khobai and Mavikela (2017). Additionally, FDI and physical capital were found to significantly affect economic growth in the long run and this is consistent with the finding of Adhikary (2011). Trade openness was found to have an insignificant long run effect on economic growth.

Whereas physical capital was found to have a significant long run effect on economic growth, the variable became insignificant in the short run. Both trade openness and FDI were found to have a significant short run effect on economic growth. Trade openness was found to have a significant positive short run effect on economic growth while FDI was found to have a significant negative short run effect on economic growth. These results are consistent with Keho (2017), and Malefane and Odhiambo (2018) who observed a positive effect of trade openness on economic growth. This is, however, contrary to the findings of Adhikary (2011) who conducted a study in Bangladesh. Whereas FDI was found to have a significant positive effect on economic growth in the long run, the results were opposite in the short run in that FDI was later found to have a significant negative effect on economic growth. Hence, the third hypothesis made in this study on the difference between the individual effect of trade openness, FDI, and physical capital on economic growth for the short run and long run results could not be rejected.

The VECM Granger causality was employed to determine the direction of causality both in the long run and short run. The findings of this study revealed that there was no significant long run causality flowing from trade openness, FDI and capital to economic growth. This is contrary to the findings of Khobai and Mavikela (2017) who found a significant long run causality in the stated direction for the Argentine economy. The findings of this study further showed a significant long run causality flowing from economic growth, FDI and capital to trade openness. Weak long run causality was observed flowing from trade openness, economic growth and FDI to physical capital.

In addition, bi-directional short run causality was observed between trade openness and economic growth. These results are consistent with the findings of Idris et al (2016). That is, trade openness was found to cause economic growth and economic growth was found to cause trade in the short run. This provides statistical short run evidence to support the first and second hypotheses made in this study. This means that trade openness statistically granger cause economic growth and economic growth statistically granger cause trade openness.

In terms of trade relationships, it appears that trade openness is good for the growth of the Zambian economy. Further, since exports are a positive function of GDP, increasing the volumes of exports and thus increasing trade openness would lead to an increase in the growth of the Zambian economy. Openness to trading with other countries can reduce the volatility in GDP by reducing exposure to domestic shocks and allowing countries to diversify the sources of demand and supply across countries (World Bank, 2014). No significant short run causality was observed flowing from economic growth, trade openness and capital to FDI. This finding is consistent with the results obtained by Khobai and Mavikela (2017). Similarly, no significant short run causality was observed flowing from economic growth, trade openness and FDI to physical capital. Unidirectional short run causality was observed flowing from physical capital to trade openness. Furthermore, strong evidence of unidirectional short run causality flowing from FDI to economic growth was found. This result is consistent with Dutta et al (2017).

CHAPTER FIVE

CONCLUSION AND POLICY RECOMMENDATIONS

5.1. Introduction

This study sought to investigate the linkage between economic growth and trade openness using time series data of Zambia for the period 1978 to 2016. Two additional variables (FDI, and physical capital) were incorporated to form a multivariate framework. The study employed the autoregressive distributed lag bound approach to co-integration to determine the presence of the long run relationship, and Granger causality test by use of the vector error correction mechanism was used to determine the direction of causality among the variables both in the short run and long run.

5.2. Conclusion

The Augmented Dickey-Fuller and the Phillips-Perron unit root test results indicated that trade openness and FDI were stationary at their levels meaning they are I(0), while economic growth and physical capital were stationary at their first difference meaning they are I(1). This provided basis for employing the ARDL bound approach to co-integration. A lag of one was adopted based on the Akaike Information Criterion and the long run relationship was significant among economic growth, trade openness, FDI and physical capital. FDI and Physical capital were found to have a significant positive individual effect on economic growth in the long run, ceteris paribus. Trade openness on the other hand was found to have an insignificant long run effect on economic growth, but its coefficient agrees with the a priori expected positive. The study also found a significant positive effect of trade openness on economic growth and a significant negative effect of FDI on economic growth in the short run.

The Granger causality test results based on the VECM indicated that there is no significant long run causality flowing from trade openness, FDI and physical capital to economic growth on the Zambian economy. However, significant long run causality was observed flowing from economic growth, FDI and physical capital to trade openness. Additionally, weak long run causality was found flowing from economic growth, trade openness and FDI to physical capital. The short run results of the VECM indicated the presence of a significant bi-directional causality between trade openness and economic growth. That is, trade openness significantly causes economic growth in

the short run and economic growth significantly causes trade openness in the same time horizon. Further, unidirectional causality was observed flowing from FDI to economic growth, and from capital to trade openness.

5.3. Policy Recommendations

The policy implications in this study are direct. Zambia needs growth policies that are directed at opening the economy to international trade. That is, loose short run trade openness policies are necessary for the growth of the economy. This implies that a substantial portion of the economic expansion of Zambia involves the external sector. This is evident from the positive short run effect of trade openness on economic growth. Policy makers need to reduce trade restrictions if the nation is to achieve short run growth.

Policy makers may also consider policies aimed at boosting physical capital and FDI to achieve long run economic growth. The higher the physical capital, the greater the rate of economic growth in the long run. Similarly, the greater the FDI volumes, the greater the rate of economic growth in the long run. This is evident from the significant individual long run effect of FDI and physical capital on economic growth in the findings. FDI was found to have a significant positive long run effect on economic growth perhaps because Zambia became more attractive to foreign investors for multiple prospects (labour availability, cheap wage rate, etc.) especially after the 1991 economic liberalization.

In addition, there is need for further studies that focus on trade openness and economic growth on the Zambian economy using local data sources and adding other variables which may affect economic growth. If data gets to be readily available, other researcher may consider conducting further research by using actual FDI data and employing other measures of trade openness. Such openness measures include the index of openness which captures the effects of residual openness resulting from taking the country's size and geography into account.

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APPENDIX

Appendix 1: ARDL Bound Test and the Long Run Results (LGDP as Dependent Variable)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LGDP)
Selected Model: ARDL(1, 1, 1, 1)
Case 2: Restricted Constant and No Trend
Date: 05/14/19 Time: 15:00
Sample: 1978 2016
Included observations: 36

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.077440	0.180547	-0.428916	0.6713
LGDP(-1)*	-0.140770	0.048607	-2.896083	0.0073
LOPEN(-1)	0.013556	0.045112	0.300494	0.7660
LFDI(-1)	0.014305	0.004873	2.935401	0.0066
LK(-1)	0.034502	0.010931	3.156471	0.0038
D(LOPEN)	-0.058898	0.039570	-1.488445	0.1478
D(LFDI)	0.037255	0.006664	5.590533	0.0000
D(LK)	-0.018479	0.032280	-0.572470	0.5716

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOPEN	0.096298	0.299498	0.321533	0.7502
LFDI	0.101619	0.044684	2.274186	0.0308
LK	0.245095	0.059513	4.118355	0.0003
C	-0.550114	1.324017	-0.415489	0.6810

EC = LGDP - (0.0963*LOPEN + 0.1016*LFDI + 0.2451*LK -0.5501)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	11.40403	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	36		Finite Sample: n=40	
		10%	2.592	3.454
		5%	3.1	4.088
		1%	4.31	5.544
			Finite Sample: n=35	
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816

Appendix 2: ARDL Bound Test Results (LOPEN as Dependent Variable)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LOPEN)
Selected Model: ARDL(1, 1, 1, 0)
Case 2: Restricted Constant and No Trend
Date: 01/04/19 Time: 09:21
Sample: 1978 2016
Included observations: 36

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.633297	0.815834	0.776257	0.4439
LOPEN(-1)*	-0.636563	0.163611	-3.890700	0.0005
LGDP(-1)	0.325539	0.193825	1.679553	0.1038
LFDI(-1)	0.003962	0.022607	0.175245	0.8621
LK**	-0.013509	0.052096	-0.259303	0.7972
D(LGDP)	-1.497885	0.783885	-1.910849	0.0660
D(LFDI)	0.082685	0.034330	2.408560	0.0226

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.511402	0.255308	2.003077	0.0546
LFDI	0.006224	0.035590	0.174871	0.8624
LK	-0.021221	0.079426	-0.267180	0.7912
C	0.994870	1.154741	0.861553	0.3960

EC = LOPEN - (0.5114*LGDP + 0.0062*LFDI -0.0212*LK + 0.9949)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	4.550791	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	36		Finite Sample: n=40	
		10%	2.592	3.454
		5%	3.1	4.088
		1%	4.31	5.544
			Finite Sample: n=35	
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816

Appendix 3: ARDL Bound Test Results (LFDI as Dependent Variable)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LFDI)
Selected Model: ARDL(1, 1, 1, 1)
Case 2: Restricted Constant and No Trend
Date: 01/04/19 Time: 09:24
Sample: 1978 2016
Included observations: 36

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.522873	3.529842	0.148129	0.8833
LFDI(-1)*	-0.377404	0.081949	-4.605347	0.0001
LGDP(-1)	2.356355	0.984151	2.394304	0.0236
LOPEN(-1)	-0.295914	0.879081	-0.336618	0.7389
LK(-1)	-0.405292	0.236001	-1.717334	0.0970
D(LGDP)	14.15814	2.532521	5.590533	0.0000
D(LOPEN)	1.071306	0.775335	1.381733	0.1780
D(LK)	1.575178	0.558583	2.819953	0.0087

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	6.243583	2.760377	2.261859	0.0317
LOPEN	-0.784078	2.321442	-0.337755	0.7381
LK	-1.073894	0.737404	-1.456318	0.1564
C	1.385445	9.429169	0.146932	0.8842

EC = LFDI - (6.2436*LGDP -0.7841*LOPEN -1.0739*LK + 1.3854)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	8.464016	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	36		Finite Sample: n=40	
		10%	2.592	3.454
		5%	3.1	4.088
		1%	4.31	5.544
			Finite Sample: n=35	
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816

Appendix 4: ARDL Bound Test Results (LK as Dependent Variable)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LK)
Selected Model: ARDL(1, 0, 0, 0)
Case 2: Restricted Constant and No Trend
Date: 01/04/19 Time: 09:25
Sample: 1978 2016
Included observations: 37

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.148145	0.905939	1.267354	0.2142
LK(-1)*	0.024523	0.062885	0.389971	0.6991
LGDP**	-0.618445	0.263602	-2.346132	0.0253
LOPEN**	0.172587	0.194642	0.886694	0.3819
LFDI**	0.103579	0.019928	5.197688	0.0000

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	25.21867	56.17026	0.448968	0.6565
LOPEN	-7.037696	15.93177	-0.441740	0.6616
LFDI	-4.223718	11.10791	-0.380244	0.7063
C	-46.81856	129.3367	-0.361990	0.7197

EC = LK - (25.2187*LGDP -7.0377*LOPEN -4.2237*LFDI -46.8186)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	6.903202	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	37		Finite Sample: n=40	
		10%	2.592	3.454
		5%	3.1	4.088
		1%	4.31	5.544
			Finite Sample: n=35	
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816

Appendix 5: VECM with LGDP as Dependent Variable

Dependent Variable: D(LGDP)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 01/04/19 Time: 09:06
Sample (adjusted): 1980 2016
Included observations: 35 after adjustments
D(LGDP) = C(1)*(LGDP(-1) + 2.68753009548*LOPEN(-1) - 0.317249184033*LFDI(-1) - 0.33915343881*LK(-1) - 5.06011315172) + C(2)*D(LGDP(-1)) + C(3)*D(LOPEN(-1)) + C(4)*D(LFDI(-1)) + C(5) *D(LK(-1)) + C(6)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.021695	0.013605	-1.594609	0.1216
C(2)	0.227225	0.241287	0.941718	0.3541
C(3)	0.087610	0.046991	1.864421	0.0724
C(4)	-0.018570	0.010312	-1.800723	0.0822
C(5)	0.006446	0.045003	0.143245	0.8871
C(6)	0.010074	0.005865	1.717695	0.0965

R-squared	0.365742	Mean dependent var	0.009961
Adjusted R-squared	0.256387	S.D. dependent var	0.037620
S.E. of regression	0.032441	Akaike info criterion	-3.863977
Sum squared resid	0.030520	Schwarz criterion	-3.597346
Log likelihood	73.61959	Hannan-Quinn criter.	-3.771936
F-statistic	3.344542	Durbin-Watson stat	2.170146
Prob(F-statistic)	0.016606		

Appendix 6: VECM with LOPEN as Dependent Variable

Dependent Variable: D(LOPEN)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 01/04/19 Time: 09:11
Sample (adjusted): 1980 2016
Included observations: 35 after adjustments
D(LOPEN) = C(7)*(LGDP(-1) + 2.68753009548*LOPEN(-1) - 0.317249184033*LFDI(-1) - 0.33915343881*LK(-1) - 5.06011315172) + C(8)*D(LGDP(-1)) + C(9)*D(LOPEN(-1)) + C(10)*D(LFDI(-1)) + C(11) *D(LK(-1)) + C(12)

	Coefficient	Std. Error	t-Statistic	Prob.
C(7)	-0.175884	0.044871	-3.919759	0.0005
C(8)	-1.709212	0.795794	-2.147806	0.0402
C(9)	-0.115388	0.154981	-0.744532	0.4625
C(10)	0.038889	0.034011	1.143403	0.2622
C(11)	-0.546750	0.148427	-3.683642	0.0009
C(12)	0.033253	0.019343	1.719141	0.0962

R-squared	0.472777	Mean dependent var	-9.93E-05
Adjusted R-squared	0.381877	S.D. dependent var	0.136089
S.E. of regression	0.106995	Akaike info criterion	-1.477272
Sum squared resid	0.331988	Schwarz criterion	-1.210640
Log likelihood	31.85225	Hannan-Quinn criter.	-1.385231
F-statistic	5.201039	Durbin-Watson stat	2.325720
Prob(F-statistic)	0.001581		

Appendix 7: VECM with LFDI as Dependent Variable

Dependent Variable: D(LFDI)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 01/04/19 Time: 09:13
Sample (adjusted): 1980 2016
Included observations: 34 after adjustments
D(LFDI) = C(13)*(LGDP(-1) + 2.68753009548*LOPEN(-1) - 0.317249184033*LFDI(-1) - 0.33915343881*LK(-1) - 5.06011315172) + C(14)*D(LGDP(-1)) + C(15)*D(LOPEN(-1)) + C(16)*D(LFDI(-1)) + C(17)*D(LK(-1)) + C(18)

	Coefficient	Std. Error	t-Statistic	Prob.
C(13)	0.016859	0.334479	0.050402	0.9602
C(14)	1.740103	5.598945	0.310791	0.7583
C(15)	-0.244016	1.074124	-0.227177	0.8219
C(16)	-0.370265	0.235678	-1.571064	0.1274
C(17)	-0.888281	1.057764	-0.839773	0.4081
C(18)	0.176834	0.133980	1.319855	0.1976

R-squared	0.204770	Mean dependent var	0.112095
Adjusted R-squared	0.062765	S.D. dependent var	0.764647
S.E. of regression	0.740262	Akaike info criterion	2.395159
Sum squared resid	15.34364	Schwarz criterion	2.664516
Log likelihood	-34.71770	Hannan-Quinn criter.	2.487017
F-statistic	1.441991	Durbin-Watson stat	2.458199
Prob(F-statistic)	0.240241		

Appendix 8: VECM with LK as Dependent Variable

Dependent Variable: D(LK)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 01/04/19 Time: 09:16
Sample (adjusted): 1980 2016
Included observations: 35 after adjustments
D(LK) = C(19)*(LGDP(-1) + 2.68753009548*LOPEN(-1) - 0.317249184033 *LFDI(-1) - 0.33915343881*LK(-1) - 5.06011315172) + C(20) *D(LGDP(-1)) + C(21)*D(LOPEN(-1)) + C(22)*D(LFDI(-1)) + C(23) *D(LK(-1)) + C(24)

	Coefficient	Std. Error	t-Statistic	Prob.
C(19)	-0.117938	0.060512	-1.948986	0.0610
C(20)	-1.573482	1.073195	-1.466166	0.1534
C(21)	-0.137052	0.209005	-0.655735	0.5172
C(22)	-0.008355	0.045867	-0.182166	0.8567
C(23)	0.219276	0.200166	1.095475	0.2823
C(24)	0.056942	0.026085	2.182924	0.0373

R-squared	0.267236	Mean dependent var	0.049892
Adjusted R-squared	0.140897	S.D. dependent var	0.155674
S.E. of regression	0.144291	Akaike info criterion	-0.879163
Sum squared resid	0.603778	Schwarz criterion	-0.612532
Log likelihood	21.38535	Hannan-Quinn criter.	-0.787122
F-statistic	2.115237	Durbin-Watson stat	2.039978
Prob(F-statistic)	0.091981		

Appendix 9: Heteroscedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.139339	Prob. F(7,28)	0.3677
Obs*R-squared	7.980831	Prob. Chi-Square(7)	0.3343
Scaled explained SS	4.475925	Prob. Chi-Square(7)	0.7236

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/14/19 Time: 15:04
Sample: 1979 2016
Included observations: 36

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005209	0.004117	1.265193	0.2162
LGDP(-1)	0.000803	0.001108	0.724876	0.4745
LOPEN	-0.001093	0.000902	-1.211389	0.2359
LOPEN(-1)	0.000121	0.000827	0.146836	0.8843
LFDI	-0.000188	0.000152	-1.233999	0.2275
LFDI(-1)	0.000221	0.000135	1.632519	0.1138
LK	-5.53E-05	0.000736	-0.075124	0.9406
LK(-1)	-0.000270	0.000791	-0.341786	0.7351

R-squared	0.221690	Mean dependent var	0.000360
Adjusted R-squared	0.027112	S.D. dependent var	0.000498
S.E. of regression	0.000491	Akaike info criterion	-12.20786
Sum squared resid	6.75E-06	Schwarz criterion	-11.85597
Log likelihood	227.7415	Hannan-Quinn criter.	-12.08504
F-statistic	1.139339	Durbin-Watson stat	2.322871
Prob(F-statistic)	0.367696		

Appendix 10: Serial Correlations Test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.567830	Prob. F(1,27)	0.4576
Obs*R-squared	0.741512	Prob. Chi-Square(1)	0.3892

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 05/14/19 Time: 15:03
Sample: 1979 2016
Included observations: 36
Presample and interior missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	0.009124	0.050461	0.180806	0.8579
LOPEN	-0.007754	0.041185	-0.188272	0.8521
LOPEN(-1)	-0.002005	0.036647	-0.054710	0.9568
LFDI	0.002071	0.007257	0.285394	0.7775
LFDI(-1)	-0.001177	0.006187	-0.190227	0.8506
LK	-0.008310	0.034350	-0.241912	0.8107
LK(-1)	0.005965	0.035836	0.166452	0.8690
C	0.010635	0.182504	0.058275	0.9540
RESID(-1)	-0.166850	0.221421	-0.753545	0.4576

R-squared	0.020598	Mean dependent var	1.98E-16
Adjusted R-squared	-0.269596	S.D. dependent var	0.019252
S.E. of regression	0.021692	Akaike info criterion	-4.611434
Sum squared resid	0.012705	Schwarz criterion	-4.215554
Log likelihood	92.00581	Hannan-Quinn criter.	-4.473261
F-statistic	0.070979	Durbin-Watson stat	2.034101
Prob(F-statistic)	0.999695		

Appendix 11: Data Set (1978 - 2016)

Year	FDI	Real GDP per Capita	Trade Openness	Gross fixed Capital Formation
1978	38,600,000	1,376	69.99	2,880,114,981
1979	35,200,000	1,290	82.25	2,334,803,224
1980	61,700,000	1,284	88.10	2,584,987,464
1981	-38,400,000	1,318	72.27	2,639,668,451
1982	39,000,000	1,238	61.98	2,318,324,022
1983	25,700,000	1,173	64.26	1,854,659,218
1984	17,200,000	1,131	68.29	1,587,246,721
1985	51,500,000	1,114	74.13	1,489,120,567
1986	28,300,000	1,088	87.61	1,262,906,075
1987	74,500,000	1,085	75.25	1,190,247,778
1988	93,300,000	1,121	59.89	1,085,380,132
1989	163,700,000	1,079	66.09	922,835,281
1990	202,700,000	1,045	99.15	970,025,722
1991	34,300,000	1,018	70.14	635,994,593
1992	45,000,000	975	83.86	620,691,910
1993	314,400,000	1,015	79.36	779,923,139
1994	40,000,000	904	66.65	658,815,346
1995	97,000,000	906	69.23	796,771,279
1996	117,100,000	936	63.82	941,783,652
1997	207,400,000	944	59.49	1,071,184,726
1998	198,000,000	913	61.22	1,358,476,469
1999	162,000,000	929	60.35	1,646,337,633

2000	121,700,000	938	60.66	2,065,659,828
2001	145,000,000	961	65.32	2,704,155,281
2002	298,390,000	978	63.98	3,029,735,577
2003	347,000,000	1,018	62.17	3,545,871,192
2004	364,040,000	1,061	68.32	3,425,995,731
2005	356,940,000	1,108	64.82	3,507,908,754
2006	615,790,000	1,163	60.34	3,803,660,849
2007	1,323,900,000	1,227	68.81	4,419,767,160
2008	938,620,000	1,286	61.53	4,952,982,381
2009	694,800,000	1,365	58.62	5,060,328,219
2010	1,729,300,000	1,463	67.37	5,247,670,348
2011	1,108,500,000	1,500	72.32	6,146,056,105
2012	1,731,500,000	1,566	77.52	5,550,796,137
2013	2,099,800,000	1,596	80.63	6,296,297,414
2014	1,507,800,000	1,621	78.49	7,851,331,120
2015	1,582,666,667	1,618	80.80	10,016,544,592
2016	662,813,935	1,627	72.88	9,404,676,907