The empirical investigation of import and export demand functions and the Orcutt hypothesis: Evidence from South Africa

Author: Samkelo Kholwa Myeni (University of Zululand, South Africa), Supervisor**:** Professor E. Contogiannis

Abstract

South African economy is subject to a huge balance of payments constraint that effectively retards the growth process before it is able to deliver higher per capita incomes to all South Africans. Whilst most studies that have embarked on addressing this phenomenon have used price and income elasticities as primary determinants of foreign trade, the present study uses the Orcutt hypothesis to investigate whether South Africa's trade flows respond to exchange rate changes faster than they respond to relative price changes. Particularly, we employ the vector error correction (VECM) technique to estimate both the import and export demand functions and generate the generalized impulse response functions based on cointegration and error correction procedure of Johansen and Juselius (1990) to test the Orcutt hypothesis. Our results of the cointegrated models indicate that South Africa's trade flows are predominantly influenced by income-both domestic and foreign-, relative prices, exchange rates. The results of the generalized impulse response analysis confirm the existence of Orcutt hypothesis in the South African import demand model and reject it in the case of export demand. The results suggest that it takes about 2 quarters and 1 quarter for South African import to adjust to changes in relative prices and nominal exchange rate, respectively. Meanwhile, on the other hand, the results suggest that it takes about to 2 and 4 quarters for South African export demand to respond to changes in relative prices and nominal exchange rate, respectively. Therefore, on the basis of these results, we recommend that in order to deal with a shock in imports South Africa should put more focus on exchange rate policy. Alternatively, in order to reduce balance of payment constraints, South Africa should focus more on strengthening domestic industries and expanding the domestic markets.

Keywords: South Africa, trade flows, exchange rate, relative prices and VAR-VECM

Introduction

In the empirical literature of international trade studies, the estimation of trade elasticities has been given a substantial attention due to the important implication they have on the formulation and development of major macro-economic policies related economic growth, international competitiveness, the balance of payments stability and industrial strategies (Bozok et al., 2015). The balance of payments instability and sluggish growth patterns are one of the chronic challenges facing most emerging economies and almost all developing countries today. The effect of 2008 financial crisis is still manifesting itself the balance of payments of these countries. Trade deficits gaps are quite huge compared to years back before the financial crisis. South Africa, in specific in 2013 recorded the highest current account deficit of 5.8% to gross domestic product. Current account deficits are usually by depletion of foreign exchange reserves and increased foreign capital outflow. Basically, there are two ways in which deficits can arise, a deficit can arise due to a persistent decline in capital inflows and increase in imports without a corresponding increase in exports. Therefore, these create a problem in the entire domestic economy because it leads into foreign borrowings in a form of official grants and loans which in turn creates more problem and lead to a decline in foreign direct investment due to increased debt servicing needs.

The only way in which these problems can be solved without increasing the debt burden of a country is through the formulation of proper policies governing the external trade profile of a country. However, these policies cannot just be formulated without adequate information of trade elasticities. Trade elasticities are very important for trade policy formulation and analysis because they serve as a prediction tool of trade flow's future behavior if there is a change in the foreign exchange market which affects relative prices of traded goods. The early contributions based on the estimation of trade elasticities in literature can be traced back on studies by Orcutt (1950), kreinin (1967), and Wilson and Takacs (1979) who modelled trade flows (imports and exports) as a function of its own prices. Later, it was then discovered that income is also the main determinant of trade flows, especially in a case of a growing economy. Vika (2009) simplified the inclusion of income variable by arguing that, in a two-country model, differences in income elasticities will always lead to a change in a country's trade balance even if the incomes in both countries grow at the same rate, holding the price variable constant. In theory, income elasticities

of exports determine how much of productivity growth in foreign output is translated into growth in exports. While, the income elasticity of import demand, on the other hand, shows how much of the productivity growth in domestic output is translated into growth in importing industries. Therefore, this technical implies that a country with higher import income elasticity (assuming an initial balanced trade) will experience a higher growth in its imports than exports, thereby worsening the negative gap between imports and exports and creating a downward pressure on the domestic currency(Vika,2009).

On policy-making perspective, there are two ways in which trade deficits could be reduced in a country. The method is by either devaluing the value a currency in order to stimulate export demand. The second method is by imposing import tariffs or providing export subsidy (commercial policy). Imposition of tariffs on imports will help to discourage imports, while the provision of export subsidy helps to increase exports without devaluing the currency. Both policies are equally effective depending on the structure of the economy, thus it is always very important for policymakers to have reliable tools to use in deciding which policy will be more appropriate to reach the desired objective. Thus, it has long been argued in many empirical studies that only reliable tool in deciding which policy tool to use between is knowing the reaction of trade flows(imports and exports) in response to changes in relative prices(relative price of imports and exports) and incomes(domestic income and foreign income).

One of the major puzzling matter found in the body of literature of trade elasticities which evoked a hot debate among many scholars and economists as well as economic concerned politicians, and generated a voluminous amount of empirical studies is the question of "do international trade flows respond quicker on exchange rate adjustments than they do to relative prices or vise verse?". The response to this question depends on both how often and by how much destination prices changes after an adjustment in the exchange rate has occurred (Lewis, 2014). Lewis (2014) also noticed two conditions in which exchange rate movements cannot exert a great influence on trade flows. First, he noticed that, if the prices are fixed in the local currency, exchange rate adjustments will not affect the behaviour of trade flows. Secondly, he also noticed that, if the exchange rate changes but the exporting industries decided not to pass through the exchange rate fully, this will also worsen the trade flow response.

The scrutiny of the exchange rate effect on trade flows actually began years after the abolishment of the Bretton Woods fixed exchange rate system. Earlier studies which have attempted to assess the effect of exchange rate on trade flows include (among others) studies by Junz and Rhomberg (1973); Wilson & Takacs (1979); Warner and Kreinin (1983); Bahmani-Oskooee (1986); Bahmani-Oskooee and Niroomand (1998); Bahmani-Oskooee & Kara (2003, 2005). Their findings were particularly mixed at best and they were heavily criticized for using non-stationary series. After these findings, many sets of empirical studies based on the estimation of trade elasticities (particularly in developed countries) began to emerge in literature, but very few in developing countries. These new sets of studies were based on extended models of trade functions which include nominal effective exchange rate as an additional explanatory variable.

In fact, it was Orcutt (1950) who first argued that a country's trade flows could respond to a change in exchange rate quicker than they do to a change in relative prices. He criticized the estimates of price elasticities arguing that their estimates are not statistically reliable for the prediction and they tend to reject the effectiveness of currency devaluation in influencing the behavior of trade flows of a country. In essence, this implies that policy decision undertaken only on the basis of price elasticities without precisely examining exchange rate elasticities can pose a great threat to the external balance of a country. Therefore, to prevent the risk of making unsound trade policy decision, policymakers should always have sufficient knowledge about the price elasticity and exchange rate elasticity of both import demand and exports. If trade flows are found to be highly responsive to changes in exchange rate, then it means that in order to manage a shock in a country's trade flows, policymakers would have to focus on exchange rate devaluation policy. Similar, if they are found to be highly responsive to changes in relative prices, then it implies that policymakers should concentrate on commercial policies.

There are only two worldwide accepted procedures of assessing the Orcutt (1950) hypothesis. The first one that has been extensively used in earlier studies is the one that imposes the lag structure on both relative prices and nominal exchange rate. The decision rule in this procedure is that if the lags in the exchange rates than the lags on relative prices, then the Orcutt hypothesis will be accepted. The second procedure is the impulse response analysis approach. The decision rule on this method is based on shocks, if the shocks for exchange rate are much shorter than shocks in relative prices, then Orcutt hypothesis is accepted and the opposite is true.

There are very few studies that have been done to test for this hypothesis in many developing countries including South Africa. Furthermore, empirical findings in countries where this hypothesis have been investigated are still mixed. Therefore, with this in respect, in this study we aim to do two things: firstly, estimating both imports and exports demand elasticities for South Africa and to investigate the existence of Orcutt (1950) hypothesis in the South African trade flows using quarterly time series data. This study is motivated by two things; firstly, this study is the first one to utilize the Johansen (1988; 1990) cointegration analysis to generate the impulse response functions from the VECM as suggested by Bahmani-Oskooee and Ebadi (2015) to investigate of Orcutt hypothesis in the context of South Africa. It will also be the first one to utilize VAR-VECM to examine the dynamic behavior in the South African trade flows. The reason why we utilize the GIRFs instead of IRFs is that GIRFs are not does not require any systematic ordering of variables in the system as opposed to the IRF generated from the VAR system. Thus, this is study makes the first contribution in the body of literature of South Africa. Secondly, most empirical studies based in the context of South Africa have been highly focused on the estimation import demand function and they are all based on single static equations. Therefore our study allows us to compare the results of multivariate equations with those produced by single equations found in most empirical studies. Like most African developing countries South Africa's most exported products are agricultural products while imports mainly consists of manufactured products and other commodities such as chemicals and petroleum. South Africa trade most of its products with industrial economies (United States, Germany, UK, and Japan) and newly industrialized economies such as China, Brazil and India.

The rest of the paper is organised as follows. Section II highlights the review of theoretical literature based on both trade elasticities and Orcutt (1950) hypothesis. Section III highlights the review of all empirical studies conducted both local and international. Section IV introduces methodological issues and interpretation of results. Section V provides concluding remarks policy recommendations based on the overall findings of the study.

II. THEORETICAL LITERATURE

Theories and models related to trade elasticities(functions)

There are three major theories of trade functions suggested in most international trade studies: the neoclassical trade theory of comparative advantage, the Keynesian Trade multiplier, and the new trade theory (imperfect competition). In each of these theories, the role of income and price in explaining the bahavior of trade flows is explained differently.

The first contribution into theory of comparative advantage was made by Heckscher (1919) and Ohlin (1933) which led to the birth of the H-O theory also known as the "factor proportion theory". In this theory Heckscher (1919) and Ohlin (1933) extend the Ricardain theory of comparative advantage by arguing that international trade is not only explained by differences in labor productivity but it also explained by differences in factor endowments between countries. This theory is particularly concerned with how the volumes and directions of international trade are influenced by differences in factor supplies between countries, while leaving the effect of a change in income unexplained. The general model of this theory assume that output of each economy is given by its production possibility frontier and employment is assumed to be fixed between countries. According to this theory, international trade between countries could be so beneficial if each country is allowed to specialize the in the production of a commodity whose production requires the extensive application of a country's cheap and abundant resource. And imports the commodity whose production requires the application of a country's expensive and scarce resource. In contrary to that, the Keynesian trade multiplier theory is focused on analyzing two hypothetical trading economies with constant prices, no international capital movement, and variable employment in each nation. In essence, this theory essential concentrate on analyzing the relationship between income and trade flows demand (imports and exports) in the short run at aggregate level (1999). According to this theory, trade flows demand functions can be defined by four ratios, marginal propensity to export/import (MPS/MPI), domestic income elasticity and foreign income elasticity. So basically, this theory leaves the effect of price variations on trade flows completely unexplained.

The new trade theory on the other hand primarily is focused on explaining the effects of scale economies, product differentiation and the effect of monopolistic market structures on

international trade between countries. The overall analysis of this theory is rooted on the assumptions of market structures that give rise to scale economies (increasing returns) (Hong, 1999). This theory relates a lot to Marshallian rule, the Oligopolistic approach, the Cournot approach and the Chamberlain approach in explaining the effect of imperfect competitive on international trade. The rationale of the **Cournot approach** is based on the view that economies of scale or increasing returns arise from the oligopolistic market structure and treats imperfect competition as the main actor (Wangwe, 2003). The advocates of this approach believe that increasing returns are possible only if domestic markets are fully protected to help domestic producers to increase their productivity levels. Such protection will also help to create an increased competitiveness among domestic industries resulting from lower average production costs. Trade between countries will actually lead to an increased the market penetration and competition on both domestic and foreign markets. The existence of oligopolistic market structures on both economies will make the demand for domestic produced commodities by foreign countries will exceed its domestic sales. Thus, in that way, each nation will be able to increase both its international competitiveness and domestic productivity at a lower average cost. **The Marshallian approach** is different from the Cournot approach in that, it allows perfect competition to exist and assumes that economies of scale are completely external to the firm. The conceptual foundation of this approach to the analyses of international trade under increasing returns is linked to Frank Graham's popular protection argument for tariffs (Krugman 1994). In the **Chamberlain Approach** increasing returns are assumed to occur in market structures where there is a greater choice of product variation and product differentiation. This approach predicts that simultaneous demand exported and imported differentiated goods and services in each country often leads to intra-industry trade in the industry and thereby reducing the domestic cost of production in each economy. In summary, what is common among all these three approaches of market structures is that they all create an impression that international trade leads to a larger market size, lower costs of production and more output, and thus, more trade.

Conceptual framework on Orcutt (1950) hypothesis

The assessment of Orcutt (1950) hypothesis has a great importance to policy makers concerned with the time length it takes for alternative policies such as export subsidy, import tariff and exchange rate devaluation to influence trade flows. Orcutt hypothesis allows us to observe the

speed and magnitude at which trade flows respond to changes in relative prices and to nominal effective exchange rate. The first variable (relative prices) measures the time path which could take import tariffs and export subsidies (commercial policy) to affect the behavior of trade flows. The second variable (exchange rate) measures the magnitude and the time length which could take exchange rate devaluation policy to affect trade flows.

An overdue(delayed) response of trade flows to changes in relative prices and exchange rate can be attributed to various economic factors that affect domestic and foreign consumption patterns such as recognition, decision, delivery, replacement and production lags (Ebadi, 2015). The **recognition lag** refers to the time length that takes buyers and sellers to recognize and adjust their consumption patterns to changes in exchange rate and relative prices, and this delay is expected to be longer in a case of international trade when compared to domestic economy due difficulties associated with information spillover effect, caused by different languages that exist between two trading countries and the distance that keeps them apart. However, Ebadi (2015) argues that global network communication (internet) has significantly reduced the effect of this lag, thus economic agents are now able to respond faster to changes in exchange rate and relative prices than they were years ago. The Internet as a global networking system has simplified the communication problem among economic agents such as consumers and producers around the world and level of information asymmetry have been reduced. This has helped policymakers to easily comprehend the overall economic conditions of their trading partners, thereby enabling concerned economic agents to make appropriate predictions about future changes in their consumption patterns and help them to adjust to those changes quickly than they were a few years ago.

The second lag, **decision lag**, is the time length that takes economic agents to substitute local products with products produced from a foreign country. It also refers to the time length that takes both local and foreign producers to apply different inputs in their production processes in order to remain competitive in the global market (Bahmani-Oskooee and Ebadi, 2016). The third lag, **"delivery lag"** this lag is caused by the distance that exists between two trading nations which directly or indirectly influences the length of time it takes producers to respond new demand in the market. This type of a gap can have a significant impact on a producer's power in a country where a change in relative price has occurred. Producers are normal sluggish to make

an immediate respond to a change in the global market till they receive their new orders, thus this also affects the time length that takes a country's trade flows to respond to changes in relative prices and exchange rate.

The fourth lag is **replacement lag**, just after the third lag has occurred; the subsequent lag that is discussed in most literature studies is the length of time that usually takes producers to replace old materials with new inventories of materials to adjust with changes in the global market (Bahmani-Oskooee and Ebadi, 2016). The main cause of these sluggish adjustments is that most producers' place their materials orders and hold binding contracts with the material producers. These contracts are normally regulated by the international trade regulations and they cannot be canceled easily. The fifth lag is **production lag**; this lag refers to the period of time that takes producers to change their production process as means of responding to new exchange rate policies or changes. All these lags they together influence the responsiveness of trade flows to changes in relative prices or exchange rates in the short run and long run. Therefore, for policy analysis, it is always important to take into consideration effect of this lags in applying trade policies.

III. EMPIRICAL LITERATURE

Literature provides us with a number of studies which have attempted to estimate trade functions both local and international. However, literature on export demand function is still very scarce for South Africa when compared to other countries, especially developed countries. Among these studies we have country-specific studies, cross-sectional studies, and panel data based studies. Some studies are based on disaggregated models (product specific) while others are focused on aggregate models.

Ziramba(2008) utilized an unrestricted error correction model(UECM) based on Pesaran et al.,(2001) Bounds testing approach to analyse the aggregated import demand function for South African using annual time series data from 1970-2005. The results indicated that there is a long run cointegrating relationship between South African imports, relative prices of imports and domestic income. The long run price and income elasticities were found to be -1,43 and 2,04, respectively.

Meanwhile, Thaver and Ekanayake (2010) on the other hand also used the Bounds testing cointegration technique and error correction mechanism developed by Pesaran et al., (2001) to investigate the impact of apartheid and international sanctions on import demand function for South Africa using annual time series data from 1950 to 2008. The effect of apartheid and international sanctions was captured by two dummy variables, 1950-1994 and 1981-1994, respectively. The short run and the long run import elasticities were estimated using the autoregressive distributed lag model (ARDL). The results reported that apartheid had a significant short-run negative impact on the South African aggregate import demand and insignificant in the long run. While, international sanctions had a negative contribution in the short run but negative in the long run. In addition, the results also reflected that there is a positive association between South African imports and domestic economic activity and foreign reserves. While relative prices of imports exert a negative impact on imports.

Narayan and Narayan (2010) utilized the bounds tests for co-integration approach to re-estimate both import and export demand functions for Mauritius and South Africa using annual time series data. The results suggest that there exists a long run equilibrium relationship between import/exports, domestic income/foreign come, and relative prices on both countries. In the long run both income elasticity and relative price elasticity of imports have significant effects on imports demand functions for both countries, with income being the most important determinant. The results also show that Mauritius income variable is statistically significant and income insignificant for South Africa in the export demand models. While, relative prices of exports were found were found to statistically insignificant on both countries.

Zhou and Dube (2011) also employed the Bounds Testing approach to test for the validity of contegration in five different import demand functions for CIBS countries (China, India, Brazil and South Africa). These models include; the traditional import demand model used by Hong (1999) and Tang (2003), the Senhadji (1998) model, which modifies the traditional import demand model by replacing the RGDP with real GDP minus exports, the disaggregated import demand model which decomposes the real domestic activity variable into three broad categories, and lastly, the dynamic structural import demand model proposed by Xu (2002) which derives the import demand function using the intertemporal optimization approach. The results indicated that in all these five models the long-run income elasticity is much higher compared to earlier

studies and short run elasticities. In contradiction with other previous studies, this study indicated that both income and price variables are not statistically significantly negative for these countries.

Baiyegunhi and Sikhosana (2012) used annual time series from 1971 to 2007 to estimate the South African import demand function for wheat. The results of the Double logarithmic linear function indicate that per capita income proxied by real gross domestic product, wheat prices, price of sugar as a complement product of wheat and domestic production of wheat are all statistically significant in explaining any form of changes in import demand function for wheat in South Africa. Moreover, the income elasticities were found to have a positive effect on South African import demand function for wheat with an elasticity coefficient of 0.163. Meanwhile, import price was found to have a negative effect with an elasticity value of 0.1207. This results obtained by this study suggest that South African import demand function for wheat is highly sensitive to income changes than it does to changes in wheat prices.

Thaver (2012) utilized the error correction model (ECM) and cointegration analysis technique developed by Pesaran et al., (2001) to examine the long run disaggregated import demand function for South African from Tanzania using annually time series data (1980:2010). The results indicated that there is a stable long-run association between imported goods and services, ratio of domestic prices to Tanzanian import price, real foreign reserves, exchange rate volatility, consumption expenditure, investment, and South African exports of goods and services to Tanzania. Two dummy variables were also utilized in this study, the first dummy covers the period of 1980 to 1994 and the second one covers the period of 1996 to 2010. The purpose of including these dummy variables was to investigate the impact of apartheid and the post-apartheid policy commitments to increase South African trade volumes with other African countries, respectively. The results demonstrated that apartheid had a negative impact on South African import demand for Tanzanian commodities with a significant negative coefficient of (-14.24). While on the other hand, the coefficient of the second dummy variable suggest that policy commitments by Post-apartheid government to increase South African trade volumes with other African countries had a positive but an inelastic impact on South African imports from Tanzania.

Ekanayeka et al., (2012) studied the effects of the real exchange rate volatility on South Africa's imports and exports with the European Union during the period of 1980 to 2009 using quarterly time series data. The results of the bounds testing approach to cointegration, and error-correction model revealed that South Africa's imports is positively related on domestic productivity levels and foreign exchange reserves but depends negatively on relative import prices and exchange rate volatility. In addition, exports are positively related on foreign income but depend negatively on relative export prices and exchange rate volatility. Furthermore, the study established a mixed effect of the exchange volatility in the short-run and in the long-run.

Triplett and Thaver (2015) estimated South African import demand function with China using the Bounds testing approach of the Pesaran et al., (2001) using time series data from 1993 to 2012. The results showed that there is an evidence of long-run relationship between import demand and relative price of imports and domestic income. The long-run elasticity estimates suggested that income is the most important factor in the determination of South Africa's import from China. Moreover, the effect of real relative price was found to be positive. They therefore predicted that South Africa's trade deficit with China will continue to widen despite a real depreciation of the rand.

Maziya et al., (2016) used the LSDV fixed effects model to examine the determinants of export demand for Swazi sugar and the effect of the EU reform on exports for Swazi sugar on selected markets (SACU, EU, USA and COMESA). The study utilized a panel data approach by using time series data from 1997 to 2012 on annual basis. In this study export prices, Importer's GDP and the EU reform were found to be significant in explaining the export demand for Swazi sugar with coefficients of -121.069 and -2.682, respectively. The coefficient of EU suggested that EU reform had an overall positive impact on export demand for Swazi sugar. Export prices, foreign income, producer prices and real exchange rate were found to be inelastic with coefficients of 0.35289, 0.00168, and 0.04256 and 0.28572, respectively, for all the markets (SACU, EU, USA and COMESA). All explanatory variables in the individual markets were found to be highly elastic. The study, therefore, recommended that Swaziland needs to exploit the EU change and contribute more on sugar production as it was not adversely influenced by the EU reform.

Nwogwugwu et al., (2015) used the ARDL Bounds testing approach to estimate Nigeria's price and income elasticities of import demand using time series data from 1970 to 2013. The results for cointegration indicated a long run relationship between Nigerian import demand, relative price of imports and domestic income as proxied by real GDP. The estimates of price and income elasticities were found to be 0.03 and 0.55, respectively. It was therefore concluded that real GDP is the main determinant of import demand in Nigeria. Among other critical issues, this study also further investigated the credibility of the imperfect substitution framework in the Nigerian economy.

The result reflected that the long run coefficient of domestic prices which was also regarded as the cross price elasticity of imports with respect to home made goods was statistically insignificant with an estimate of 0.0062. Hence, evidence of imperfect substitution between foreign made goods and domestically produced goods was found to hold in the Nigerian foreign trade sector. The results from the short run dynamics of the model obtained from the parsimony error correction model reflected that about 67 percent of the disequilibrium between the long term and short term of Nigerian's import demand function is corrected each year. It was therefore recommended that the use of currency devaluation as an import substitution tool is not good for Nigerians economy, whereas the use of higher taxes and interest rates as a tool of expenditure switching policies should be expected to have an insignificant impact on Nigeria's trade balance.

Alam (2016) investigated the effects exchange rate volatility along with other fundamental determinants of import demand functions for Pakistan using quarterly time series data (1982 Q1 to 2008 Q2) using a vector auto regression (VAR) model. The variance decomposition (VDCS) and impulse response functions (IRFS) were also critical analyzed to investigate the dynamic interactions among the variables in the VAR system. The forecast error variance decomposition based on a vector autoregressive (VAR) model was also used to estimate real income of home country, relative price of import, real effective exchange rate and real effective exchange rate volatility. The forecast results of error variance decomposition and impulse response function suggested that the effect of shocks in exchange rate volatility had an insignificant impact on Pakistan's import demand, whereas shocks in gross domestic product was found to have a significant effect on Pakistan's import demand.

Culha and Kalafatcilar (2014) utilized an annual time series data from 2003 to 2013 to investigate the sectorial disparities in Turkish export demand. In specific, the study was particularly on three Turkish exports destinations; Euro Area, Middle East, and Africa. The results of the Vector autoregressive (VAR) model show that Turkish demand elasticity of exports is substantially higher in high income countries, mainly in the Euro Area. In contrary to the other regions, the results reports that elasticity estimates of real effective exchange rate of Turkish exports in Middle east and Africa is both statistically significant and high in absolute values. This suggests that Turkish exports to MEA are highly driven by exchange rate movements.

Sultan (2014) utilized a bounds testing approach to cointergration developed by Pesaran *et al.*, (2001) to estimate Saudi Arabia's export demand function using an annual time series data from 1980 to 2010. The results demonstrated that there is a long run equilibrium relationship between export demand, world income, and real effective exchange rate. The elasticity estimates of Saudi Arabia's exports demand with respect to foreign income, and real effective exchange rate was found to be greater than one (elastic) in both long run and short run. However, when compared, short run elasticity was found to be substantially higher in the short run than in long run in both variables.

Moreover, Thaver and Bova (2014) utilized the Bounds testing approach to cointegration to estimate Ecuador's export demand function with U.S spanning from the period of 1965 to 2011 with special emphasis on dollarization's impact on Ecuador's exports. The study used two models. In the first model, exports were regressed on real exchange rate volatility, U.S real GDP, relative prices, and Dollarization. In the second model, real exports were regressed on U.S real GDP, real exchange rate volatility, and dollarization. On both models, the study confirmed the existence of a unique cointegration relationship between exports and its regressors. The result also indicated that GDP is positive and elastic, while volatility is positive and inelastic. Relative prices in model 1 and real exchange rate in model 2 was found to be statistically insignificant, while dollarization is significant, but negative and inelastic to determine Ecuador's exports to the U.S.

Altintas and Turker (2014) evaluated Turkish exports and imports demand functions by examining the effects of national income, foreign direct investment, real exchange rates, and

relative prices of Turkish imports and exports using annual time series data from 1987-2011. The study utilised a unit root, cointegration analysis and Granger causality analysis through Vector Autoregressive model to estimate exports and imports demand function. The results suggested that there is one-way short term Granger causality relationship between Turkish export demand, foreign income, real exchange rate and export price. In the import model, the results reported that there is one-way long run Granger causality relationship Turkish Import demand, real GDP, foreign direct investment, and real exchange rate. The study also reported a single way causality links from foreign direct investment, real exchange rate and import price to Turkey's import demand.

Memood et al., (2013) utilized an ARDL estimation procedure to bounds testing and cointegration approach to examine the determinants of Tunisia's imports demand function. The sample size used by this study was from 1980 to 2009. Their findings reflected that there exists a long run relationship between imports, households' consumption and exports of goods and services in Tunisia. In contrast, the results also reflected that in the long run Tunisia's import demand is highly elastic to changes in household consumption and exports, and inelastic to changes in domestic investment and relative prices. While, in the short run an inelastic behaviour is revealed between imports demand and its regressors (household consumption, investment, exports and relative prices).

Nassr (2013) investigated the effect of gross domestic product, consumer price index, exchange rate on Palestine import demand function using quarterly time series data from 1997 to 2010. The results revealed that there is a positive relationship between Palestine's import demand, consumer price index and gross domestic product. There was no relationship found running from exchange rate to Palestine's import demand. According to the researcher, this due to the fact that Palestine's economy is highly dependent on foreign trade.

Ibrahim (2015) estimated demand function for Saudi Arabia merchandise imports using the Ordinary Least squares and the error correction model during the period (1975-2011). The results indicated both in the short run and long run Saudi Arabian merchandise import demand is significant and positive related to changes in real gross domestic product, gross fixed capital formation, private consumption expenditure, gross consumption expenditure and relative prices.

On the other hand, in both short run and long run, international reserves had a positive but insignificant impact on Saudi Arabian's merchandise import demand.

Elite (2013) estimated the Marshall-Lerner Condition of Namibia. The study used the time series data from 1991 to 2011. In this study, both import and export demand models were regressed on two variables; domestic income/foreign income and real effective exchange rate. The results of the cointegrated auto regressive model indicated that world income has a positive effect on exports, while real exchange rate appreciation discourages exports. Imports were found to respond positively to both domestic incomes and on exchange rate appreciation. Both exports and imports respond significantly to a change in exchange rate.

Yeboah et al., (2015) examined the export demand function for U.S meat products to Some Asian countries using annual time series data from 1980 to 2013. He regressed exports on the per capita GDP of the importing Asian countries, exchange rate of the currency of the importing Asian countries to the U.S Dollar and WTO membership. The results suggested that there is a positive relationship between GDP per capita, exchange rate and the quantity of meat exported by the United State.

Bozok et al., (2015) also, used a bilateral trade data to estimate the long run income and price elasticities of Turkey with 67 countries from selected group of geographic regions (EU27, other European countries, Asia, MENA. Developed and developing countries. The sample size of the study covered the period 200Q1-2004Q4. For empirical estimation, DOLS, Mean Group and Common Correlated Effects Mean Group estimation techniques were utilized. The end results of these authors were relatively the same with those estimated by Culha and Kalafatcilar (2014). They found that, estimates of income elasticity of Turkish imports are statistically significant in all groups of countries, and income elasticity estimates of exports to all European countries (EU27 and other European countries) and advanced economies are highly elastic. While, price elasticity estimates on the other hand are only statistically significant to the EU27 countries, MENA and developing countries, and insignificant to the industrialized countries.

1.1.1. Empirical Literature on Orcutt(1950) Hypothesis

There are two strands of studies presented by literature regarding the investigation of Orcutt hypothesis using time series data. The first strand of literature used the lag imposition procedure

to judge the validity of the Orcutt hypothesis. The second strand uses the impulse response analysis to judge the validity of the hypothesis. While in the first approach the decision rule is based on lag lengths, the second approach the decision rule solely depends on how long it takes shocks on exchange rate or relative prices to die out in the system.

Empirical findings of most studies based on this topic are still mixed at best; some studies have supported the hypothesis while some have rejected it. Studies that supported the Orcutt hypothesis emanate from studies by Bahmani-Oskooee (1984) who tested for the Orcutt hypothesis in seven developing countries using an Almon Procedure to impose a distributed lag structure on both the relative prices and the exchange rate, Tegene (1989;1991) who tested this hypothesis for seven African nations using a VAR model. However, all these studies were heavily criticized for non-stationary data without accounting for integrating and cointegrating properties of variables, which their makes their results statistically unreliable (Bahmani-Oskooee and Kara, 2003; Bahmani-Oskooee, 2005; 2008 and Bahamni-Oskooee and Ebadi, 2015).

The following is the review of most recent empirical studies that have produced, both local and international to test for Orcutt hypothesis. However, the researcher could not find any recent literature concentrated in the context of South Africa. The first literature regarding the Orcutt hypothesis is by Bahmani-Oskooee (1984) who used quarterly data from floating exchange rate regime which covers the period of 1973 to 1980 to test for the Orcutt's (1950) hypothesis in a sample of seven developing countries (Brazil, Greece, India, Israel, Korea, South Africa, and Thailand). This hypothesis was tested using the Almon procedure to impose different lags length on exchange rate and relative prices. The results obtained before imposing appropriate lags were as follows: For import demand model, the results indicated that relative price coefficients are significant and negative for South Africa, Korea, and Thailand. The exchange rate coefficients were found to be significant and have expected positive sign only for Brazil and Greece. However, the study reported contrary results in the case of Israel. The estimated coefficients for income are significant and positive for all countries except for India and Israel.

For export demand model, the relative price coefficients were found to be negative and significant for Brazil, India, and Israel. In addition, the income coefficients were found to be positive and significant only for South Africa and India, whereas, in case of Israel, it was found

to have an unexpected significant negative sign. The exchange rate coefficients were found to have a significant negative sign for the result of Greece, South Africa and Israel.
The estimated coefficients of exchange rate and relative prices as major variables for testing Orcutt hypothesis after imposing appropriate lags were as follows: The exchange rate coefficients were found to have expected signs except for Brazilian exports, South African imports, Korean, Israel and Thai import and export equations. Income coefficients were also positive and statistically significant in most countries. The Orcutt's hypothesis was confirmed in nine of out 14 equations. The exchange rate and prices were found to have equal lag length only in the case of Greek import, South Africa and the Thai. This hypothesis was only rejected in the case of Brazilian and Thai export equations in which price lags were found to be shorter than exchange rate lags.

Bahmani-Oskooee and Kara (2008) used the ARDL approach to test for the Orcutt's hypothesis in a sample of 12 developing countries (Columbia, Greece, Hong Kong, Hungary, Israel, Korea, Pakistan, Philippines, Poland, Singapore, South African, and Turkey). The Orcutt's hypothesis accepted only in the import demand function for Columbia, Hungary, Pakistan, and Poland. The resulted reflected the same lags for exchange rate and prices on both export and import demand models in the case of Israel, Korea, the Philippines, Singapore, Turkey Greece, Hong Kong, and South Korea. The same is true for export demand function.

Tegene (1989) used Bahmani-Oskooee (1984) procedure to examine the effect of relative prices and effective exchange rates on trade flows for a sample seven African lower income countries using quarterly time series data from 1973-1985. These countries include Ethiopia, Cote d'Ivoire, Kenya, Malawi, Mauritius, Tunisia, and Zambia. The import results illustrated that coefficients of import relative prices are statistical significant and carries expected negative sign in all countries. However, contrary results were reported where the coefficients of exchange rate were only found to be negative and significant in the case of Malawi and Mauritius. The income coefficients for Ethiopia, Kenya, Cote d'Ivoire, Mauritius, Tunisia and Zambia were found to be positive and significant except for Malawi. The export results reflected expected significant negative coefficients for relative prices for all countries. In addition, exchange rate coefficients were only found to be significant and negative in the case of Cote d'Ivoire, Malawi, Mauritius,

and Tunisia. The coefficients of the other two countries were found to be positive but insignificant. Moreover, the study also reported positive and significant Income coefficients for Ethiopia, Kenya, and Tunisia in the export model. Using lag imposition producer, he established that trade flows are much more sensitive to changes in exchange rate than they do to changes in relative prices in all seven selected low income countries. Thus, supporting the Orcutt (1950) hypothesis.

However, these results were in contrary with the findings established by Tegene (1991) where he used a vector autoregressive (VAR) model to investigate Orcutt's hypothesis for Ethiopia for the period of 1973-1985. He applied a VAR model in both exports and imports models particularly to investigate the Granger-causality effect between export, relative price, and exchange rate in the export equation and between import, relative price and exchange rate in the import equation. The results established one-way causality effect running from relative prices and exchange rates to imports and exports but with no significant feedback. It was also found that Ethiopian exports and imports have similar response to adjustments in exchange rate and relative prices.

Bahmani-Oskooee and Ebadi (2014) tested the Orcutt hypothesis in 8 industrial countries (Canada, Japan, Spain, UK, USA, Germany, Italy and Australia) using quarterly data from 1973I–2013IV. They used the generalized Impulse response analysis to one standard deviation to innovations in relative prices and one standard deviation to innovations in exchange rate. The analysis of this approach basically looks at how long is the impact each shock last in the system. Based on the analysis of this approach, for Orcutt hypothesis to hold, the impact of exchange rate innovations should be shorter than the impact of shocks in relative prices. The approach of this study was based on cointegration and ECM approach of Johnsen and Julielius (1990) in which the order of lags is the identical in all variables. The results reported that out eight countries Orcutt hypothesis was only accepted in the import demand model of Germany and Japan and in the export demand model for the United State.

Bahmani-Oskooee and Ebadi (2016) tested Orcutt hypothesis using an error correction model. The study used a time series data for several industrialized countries for a sample period 1973 to 2013 which covers two sub-periods; the post-1990 and pre-1990. The selection of this sub-periods were selected on the basis of the assumption that the speed of with which trade flows

adjust to changes in exchange rate and relative prices were much faster during post-1990 as compared to pre-1990 due to technological advancement that took place the 1990s. This hypothesis was supported in 10 out of 16 trade models estimated for 8 the selected countries. However, when tested for the entire period study could not find any support for the Orcutt hypothesis in all cases.

Bahmani-Oskooee and Ebadi (2015) also utilized the impulse response analysis approach to test for the Orcutt hypothesis from six developing countries (namely; Hong Kong, Turkey, Thailand, Singapore, Korea, and Pakistan). The study reported similar results as in the case of industrial countries. Similar results are also found in a study conducted by Omsakin *et al.*, (2010) for selected ECOWAS countries. This study used the Bounds testing approach and the ARDL model to specify the error correction model for import and export demand function for ECOWAS countries. The results suggested that ECOWAS imports respond quicker to exchange rate changes than it does to changes to relative prices. While exports respond quickly to changes in relative prices than they do to changes in exchange rate.

Bahmani-Oskooee and Hosney (2015) investigated the Orcutt's hypothesis for 59 industries between Egypt and European Union using the ARDL approach. For import demand, the short-run coefficients indicated that only 20 out of 59 industries support Orcutt's hypothesis since the lag length of nominal exchange rate was shorter than the lag length on relative prices. However, most of these industries captured in this study were small industries except for Vegetable and fruit, Manufactures of metals, Office machines, Professional and scientific apparatus. The results also indicated the rejection of Orcutt hypothesis in nine industries in which four of them were large industries (Iron and steel, Machinery specialized for particular industries, General industries machinery, Telecommunication and sound-recording and producing apparatus). The lag length for exchange rate and relative prices was found to be the same in 30 remaining industries. Among these industries very few of them were big industries. The long-run coefficients illustrated that Egypt's income coefficients are significant for 32 industries in which 21 of them is negative. The relative prices were found to have a significant and negative sign in 47 of 59 industries. The nominal exchange rate was found to carry an expected negative sign and statistically significant in 11 industries.

For export demand short-run coefficients Orcutt's conjecture is supported in 21 industries, among which four of them are large industries (Cork and wood, Machinery specialized for particular industries, General industrial machinery, Road vehicles). However, in seven industries results indicate the opposite and illustrated the same lag length in 31 industries. Additionally, the long-run coefficients of European income were found to be significant in 32 industries among which 21 of them were positive and 11 of them were negative. Moreover, the exports price was found to have an expected statistically significant negative sign in 38 industries. In the import demand case, exchange rate coefficients reflected a positive and significant sign in 24 industries.

Bahmani-Oskooee and Durmaz (2015) used monthly time series data for commodity trade and price of 54 industries that engage in trade between the United State and Turkey to investigate the evidence of Orcutt hypothesis from January 1996 to December 2014. A maximum of 10 lags was chosen following the Akaike's information criterion. For import demand, almost 30% of Turkish importing industries supported the Orcutt hypothesis and was rejected in 13 industries. Meanwhile, in 25 industries the results reflected the same number of lags for both exchange rate and relative prices. In the long run nominal exchange rate and relative prices was found to carry an expected negative coefficient in 23 and 18 Turkish importing industries, respectively. For the United State export model to Turkey, the results indicated that in the short run the Orcutt hypothesis was found to hold in 20 and rejected in 4 U.S exporting industries. The study also reported that income variable was only positive and significantly in 11 U.S exporting industries, meanwhile nominal exchange rate was found to carry its expected negative coefficients in 13 cases.

In this study we follow the second strand of literature which employs the generalized impulse response analysis to investigate Orcutt hypothesis. Rather than focusing on imposition of lag lengths this approach relies upon analyzing the impulses of exchange rate and relative prices. The advantage of using the generalized impulse response is that it is not sensitive to the ordering of variables in the VAR system. So using this approach will also make a massive contribution into the body of literature since this issue was not taken into account by previous studies. Both import and export elasticity estimates are derived from the VAR system.

IV. METHODOLOGY AND RESULTS INTERPRETATION

The primary objective of this study is to estimate trade functions and investigate the Orcutt (1950) hypothesis in South Africa as an alternative way of scrutinizing the dynamics or the bahavior of trade flows of any economy. Therefore, the objective of this chapter is twofold. Firstly, it outlines the empirical estimation approaches used to quantify the relationship between trade flows and its regressors and to test for Orcutt (1950) hypothesis. Secondly, it provides the presentation and interpretation of all empirical findings.

Data issues and preliminary analysis of data

This study uses time series data sourced from South African Reserve Bank (SARB) website and International Monetary Fund (IMF) in quarterly frequencies. For import demand model we used 223 observations starting from 1960q1 to 2016 q3. Due to data constraints, the empirical analysis for export demand function will only start from 1990Q1 to 2016Q3 making a total of 100 observations in quarterly frequencies. As presented in chapter 4, time series data for import, export and domestic income (gross domestic product) are sourced in millions of Rands. Meanwhile, the other remaining variables are sourced as indices. All series under investigation will be transformed into logarithmic using Eviews 9.5 version except those sourced in percentage form. The benefit of logarithmic transformation is that it allows the researcher to interpret all estimated coefficients as partial elasticities.

After transforming all variables into logarithmic form, the second step we took before conducting any empirical analysis is we examined the basic features of the data series being investigated in order to understand and observe any internal structure of the series (such as outliers, autocorrelation and seasonal changes) that should be accounted for in judging the validity of the estimated results.

Graphical inspection of the data

The graphical inspection of data utilized in this study is conducted by plotting the observations of each variable against time, both in levels and first differenced form. Consequently, figure 5.1(a) and 5.1(b) below display the results of graphical plots of each variable included in model 1(import demand) and 2(export demand), respectively. The results show that all variables are

likely to be non-stationary. From the results, domestic income(Y), foreign income(yw), exports(x), imports(m) and relative price of exports are showing an upward trend. Relative import prices and nominal effective exchange rate on the other hand, indicate a downward trend. In contrast, figure 5.2(a) and 5.2(b) indicate that after first differencing all variables are more likely to become stationary as they tend to revert around their mean. Hence, from this stage we may suspect that our series are integrated of order one I (1). However, in order to make conclusive judgement and to confirm the researcher's suspicion statistically reliable unit tests are computed in section 5.3 of this chapter.

Figure 5.1(a)

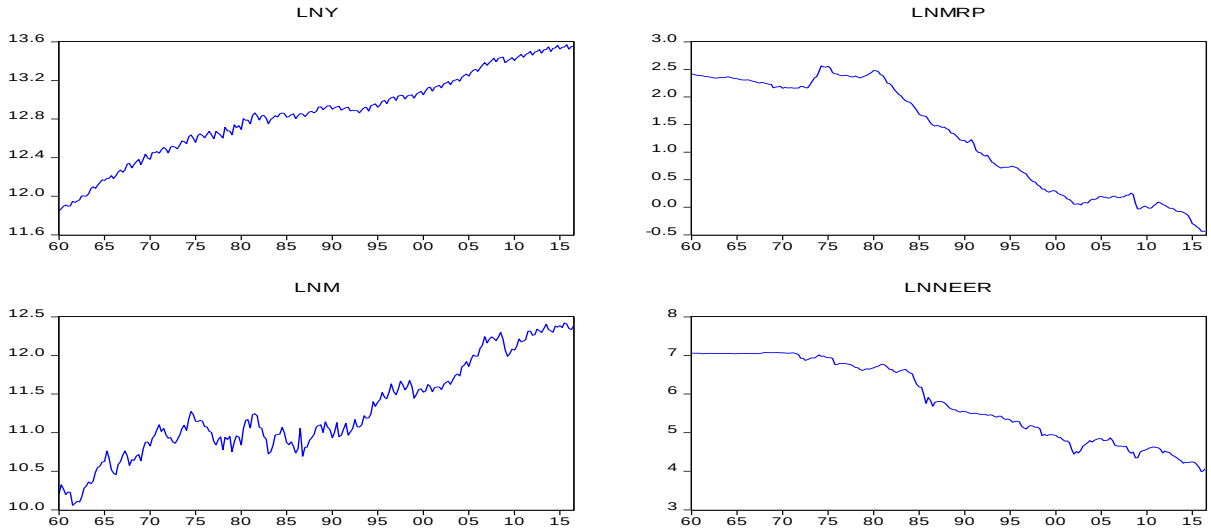


Figure 5.1(a')

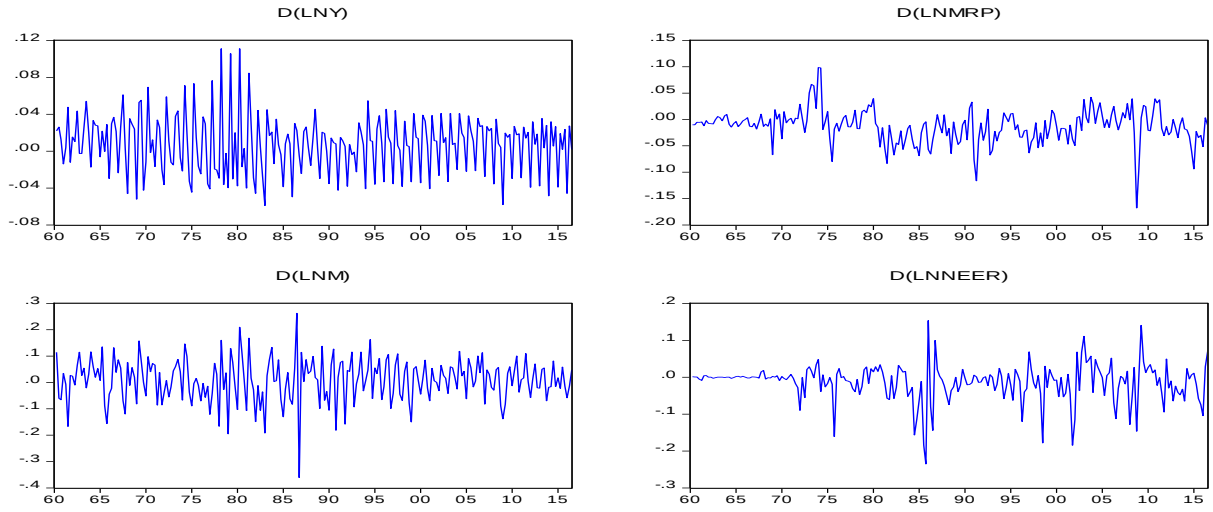


Figure 5.1(b)

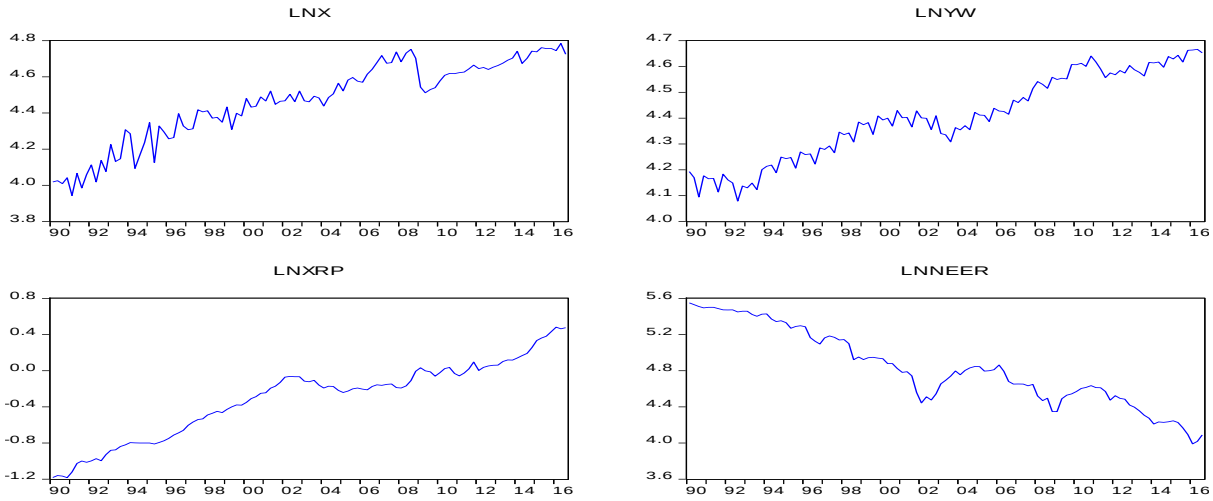
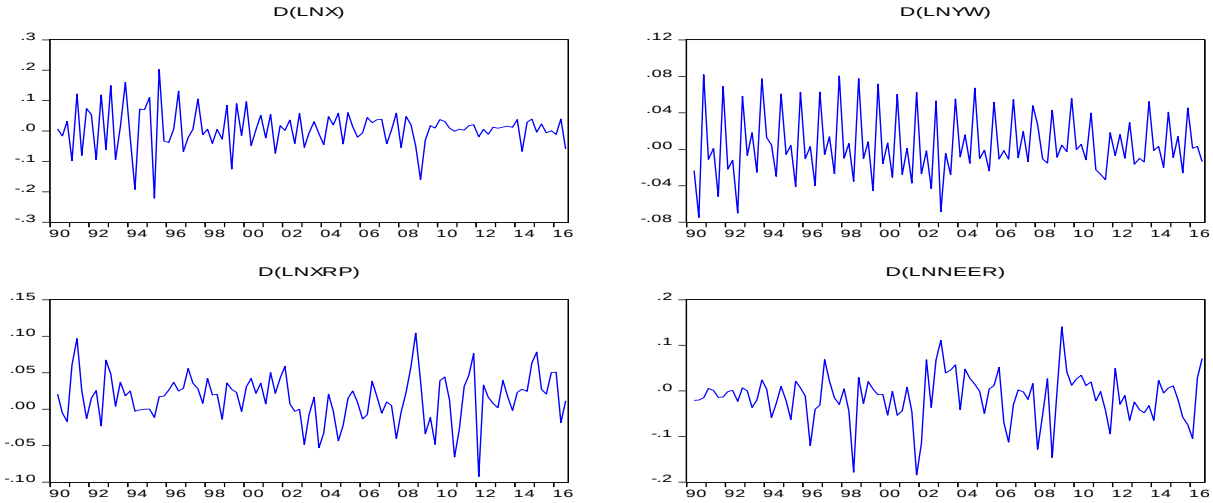


Figure 5.1(b')



Covariance matrix

Economic theory suggests a positive relationship between domestic income and import, foreign income and export, a negative relationship between import and its relative prices, exports and its relative prices, and that nominal effective exchange rate has a negative relationship with both export and import. Therefore, the main aim of this small sub-section is to verify this theoretical postulation in the series employed in this study using covariance matrix generated by Eviews 9.5.

As expected and asserted by the economic theory, the results displayed in table 5.2(a)and 5.2(b) below demonstrate a positive correlation between import and domestic income, exports and foreign income. The results also support the assertion that there is negative relationship between

imports and its relative prices but rejected it in the case of exports (see, table 5.2(b). The results also supported the idea that nominal effective exchange rate is negatively correlated with both import and exports.

Table 5.2(a)

	LNY	LNMRP	LNM	LNNEER
LNY	1.000000	-0.883517	0.941708	-0.919879
LNMRP	-0.883517	1.000000	-0.875208	0.985600
LNM	0.941708	-0.875208	1.000000	-0.884470
LNNEER	-0.919879	0.985600	-0.884470	1.000000

Source: own estimation results

Table 5.2(b)

	LNX	LNYW	LNXRP	LNNEER
LNX	1.000000	0.916383	0.936680	-0.923142
LNYW	0.916383	1.000000	0.934855	-0.937414
LNXRP	0.936680	0.934855	1.000000	-0.979242
LNNEER	-0.923142	-0.937414	-0.979242	1.000000

Source: own estimation results

Stationarity tests/unit root testing

In this study we utilized the Augmented Dickey-Fuller (ADF) tests and the Philips Parron (PP) tests to conduct unit root test in each variable, in both levels and first difference form. Both the ADF and the PP tests examine the null hypothesis which state that the series has a unit root. The decision rule undertaken in this study regarding the stationarity of each variable on both tests (ADF and PP) is taken on the basis of comparing the calculated statistic values with the corresponding MacKinnon (1996) critical values. If the calculated statistic value is found to be greater than the corresponding Mackinnon (1996) critical value, then the null hypothesis is reject in favor of the alternative hypothesis. This will therefore draw a conclusion that the series is has no unit root. Alternatively, if the calculated statistic value is found to be less than the critical value, then we conclude that the series has a unit root.

As per table 5.3 below, the results of both tests (ADF and P-P) indicates the null hypothesis cannot be rejected when $LNX, LNM, LNMRP, LNXRP, LNNEER, LNY$ and $LNYW$ are in levels. At first differencing, both tests concur that the null hypothesis should be rejected in all variables. Therefore, this concludes that all the series used in this study are first difference stationary I (1).

However, one may notice that some variables are demonstrating some stationarity condition in their level forms in none formula. We decided to ignore this condition in this study since in practice economic variables are expected to contain either trend or intercept or both. So our major interest was on the first two equations (intercept and trend and intercept) on both tests. Therefore, the final conclusion that we can make about these results is that all variables are having the same order of integration, and they are more likely to have a long run relationship(cointegrated). Hence, they are in a suitable condition to be applied in a VAR/VECM model.

Table 5.3

	Variables	*Model*	***ADF statistic***	***P-P statistic***	*Conclusion*
Levels	*Lnx*	*Intercept* *Trend and inter* *None*	*-0.592186* *-1.546487* *-4.143271*	*-0.775536* *-4.324475* *3.178856*	*Non-stationary*
	Lnxrp	*Intercept* *Trend and inter* *None*	*1.176115* *-3.036963* *-3.127426****	*1.073055* *-3.028400* *-2.746061****	*Non-stationary*
	Lnyw	*Intercept* *Trend and inter* *None*	*-2.782472* *-1.080982* *3.498412*	*-2.441334* *-1.825331* *-4.570824*	*Non-stationary*
	Lnneer	*Intercept* *Trend and inter* *None*	*0.101104* *-2.756709* *-2.546639***	*0.392366* *-2.516283* *-3.194267***	*Non-stationary*
	Lnm	*Intercept* *Trend and inter* *None*	*-0.758969* *-1.867809* *-2.639153*	*-0.695814* *-2.655044* *-2.285335*	*Non-stationary*
	Lnmrp	*Intercept* *Trend and inter* *None*	*0.358842* *-2.009797* *-1.686716*	*0.651143* *-1.781427* *-2.182540***	*Non-stationary*
	Lny	*Intercept* *Trend and inter* *None*	*-2.235863* *-3.067648* *3.101370*	*-2.729575* *-3.217374* *6.213428*	*Non-stationary*
1st Difference	*D(lnx)*	*Intercept* *Trend and inter* *None*	*-14.75168**** *-14.71944**** *-6.468262****	*-31.13419**** *-31.05431**** *-27.20270****	*Stationary*
	D(XRP)	*Intercept* *Trend and inter* *None*	*-16.55192**** *-16.71371**** *-3.688342****	*-16.48059**** *-16.64671**** *-15.55169****	*Stationary*
	D(YW)	*Intercept* *Trend and inter* *None*	*-3.634508**** *-5.959513**** *-2.118368***	*-28.50655**** *-30.88063**** *-22.62690****	*Stationary*

	D(lnneer)	*Intercept* *Trend and inter* *None*	*-6.578748**** *-6.607399**** *-5.959478****	*-12.65959**** *-12.66935**** *-12.27842****	*Stationary*
	D(Lnm)	*Intercept* *Trend and inter* *None*	*-5.727805**** *-5.713393**** *-4.983167****	*-17.39460**** *-17.3517***** *-16.83984****	*Stationary*
	D(lnmrp)	*Intercept* *Trend and inter* *None*	*-4.527688**** *-5.456619**** *-3.727086****	*-9.797267**** *-9.854153**** *-9.280969****	*Stationary*
	D(Lny)	*Intercept* *Trend and inter* *None*	*-4.142677**** *-4.485534**** *-2.298318***	*-22.84123**** *-24.34228**** *-18.44458****	*Stationary*

VAR MODEL SELECTION PROCESS

This section of this chapter is rooted on three tasks: The selection of an appropriate VAR lag length, VAR stability test, and deciding on the appropriate model for the Johansen Cointegrating VAR model necessary for the identification of the appropriate number of cointegrating rank of the VAR-VECM model.

VAR lag-order (p) selection, presentation and discussion of results for both models.

The optimal lag utilized in this study are generated from the unrestricted VAR output produced by Eviews. According to Braun and Mittnik (1993) estimates of a VAR model whose lag length differs from the true lag length are inconsistent as are the impulse response functions and variance decompositions derived from the estimates of a VAR. on the other hand, Lutkepoli (1993) also argued that over-fitting of lag length increases the mean-square-forecast errors of the VAR, while under-fitting them generates auto-correlated errors.

Accordingly, the results of Model 1 reported in table 5.4(a) and displayed in the appendix section (Appendix B) indicate an optimal lag length of 5 lags for import demand model. These results were decided on the basis of both the Aikaike, and Swartz information criteria and they are also supported by the estimates of FPE and HQ tests. For Model 2 the results reported in table 5.4(b) demonstrate that the Swartz information criteria chooses an appropriate lag length of 1 lag, while AIC, FPE and HQ criteria suggest an appropriate minimum lag length of 6 lags. In this case, considering the size of our sample, the researcher decided to adopt the estimates of 6 lags as an appropriate lag length for export demand model as recommended by FPE and AIC as well as the

HQ. Therefore, this concludes that the fifth order($p = 5$) and sixth order($p = 6$) VAR for import and export demand model should be estimated in this study, respectively.

Table 5.4(a) Model 1 (import demand)

Lag selection criterion.						
lag	LogL	LR	FPE	AIC	SIC	HQ
0	-11.99568	NA	1.36e-05	0.146079	0.207980	0.17079
1	1490.160	2935.719	1.73e-11	-13.42612	-13.11661	-13.30112
2	1533.684	83.47091	1.35e-11	-13.67748	-13.12037	-13.45248
3	1575.678	79.00299	1.06e-11	-13.91487	-13.11016	-13.58987
4	1679.455	191.4414	4.78e-12	-14.71648	-13.66417	14.29148
5	1733.707	98.09982	3.37e-12*	-15.06581*	-13.76590*	-14.54082*
6	1746.097	21.95230	3.49e-12	-15.03285	-13.48533	-1440785

** indicates lag order selected by the criterion*

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 5.4(b) Model 2(export demand)

Lag selection criterion.						
lag	LogL	LR	FPE	AIC	SC	HQ
1	709.6089	N/A	9.65e-12	-14.01230	-13.59289*	-13.84261
2	737.0566	50.45924	7.67e-12	-14.24357	-13.40474	-13.90418
3	753.3537	28.64346	7.65e-12	-14.24957	-12.99133	-13.74048
4	78.2975	45.17845	6.17e-12	14.47066	12.79300	-13.79187
5	830.3880	79.94368	3.14e-12	-15.15937	-13.06230	-14.31089*
6	853.6550	35.25186*	2.75e-12*	-15.30616*	-12.78968	-14.28799
7	862.2736	13.79636	3.21e-12	-15.17724	-12.24135	-13.98938

** indicates lag order selected by the criterion*

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Unrestricted VAR stability tests and cointegration

The AR root and the polynomial characteristic root table is utilized in this study to examine the stability of the VAR processes estimated in this study. According to Lutkepohl(2004b) if all the

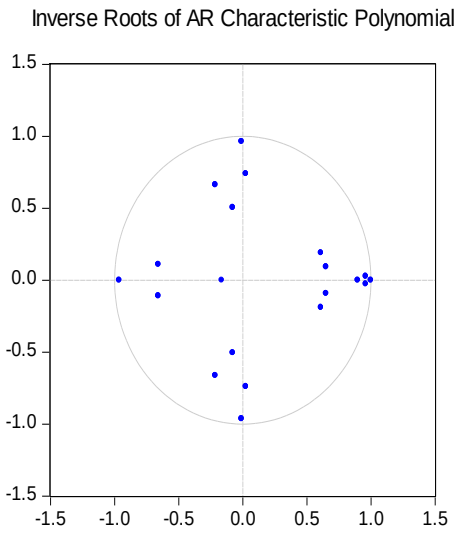
roots has a less than one modulus, it essential means that all variables included in the VAR system are actually $I(0)$ and they require no first differencing. However, this actually contradict with the postulation of the Johansen contegration approach which suggest that once cointegrating relationships have been identified in the system it automatically cancel out the relevance of VAR system and necessitated the use of the VECM. Hence, because of that and for quality purposes once the cointegration relationships have been detected in the system we will just proceed with the VECM as suggested by Johansen and Jeselius (1990). Hence, from the results based on the AR root tables the highest modulus is 0.998 in model 1 and 0.999 in model 2 which is almost very close to 1. The polynomial characteristic root circle on the other hand, show that most points within the circle are too attached to the root circle. Therefore, these results do not perfectly fulfil the stability condition of the VAR system. The best solution towards this problem is to proceed with the VECM. However, we should first test for cointegration as suggested by Johansen and Jelselius(1990).

Model 1(import demand)

Roots of Characteristic Polynomial
Endogenous variables: LNY LNMRP LNM LNNEER
Exogenous variables: C
Lag specification: 1 5
Date: 03/26/17 Time: 15:30

Root	Modulus
0.998763	0.998763
-0.964045	0.964045
-0.009237 - 0.962589i	0.962634
-0.009237 + 0.962589i	0.962634
0.959961 - 0.027403i	0.960352
0.959961 + 0.027403i	0.960352
0.897072	0.897072
0.023883 - 0.739714i	0.740100
0.023883 + 0.739714i	0.740100
-0.214317 - 0.662892i	0.696676
-0.214317 + 0.662892i	0.696676
-0.658295 - 0.108520i	0.667180
-0.658295 + 0.108520i	0.667180
0.649333 + 0.093504i	0.656031
0.649333 - 0.093504i	0.656031
0.611059 + 0.189608i	0.639800
0.611059 - 0.189608i	0.639800
-0.078237 - 0.505018i	0.511042
-0.078237 + 0.505018i	0.511042
-0.164961	0.164961

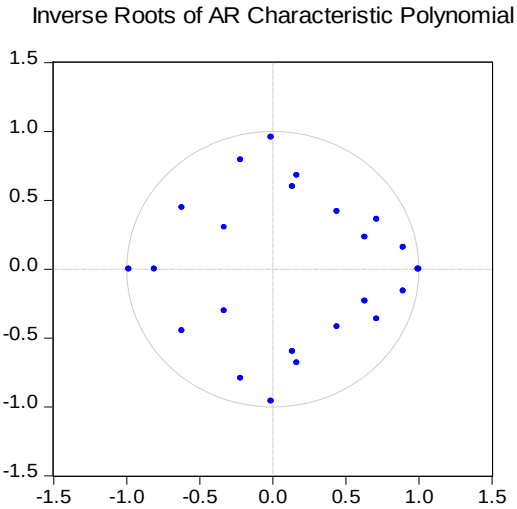
No root lies outside the unit circle.
VAR satisfies the stability condition.



Model 2(export demand)

Roots of Characteristic Polynomial
Endogenous variables: LNYW LNXRP LNX LNNEER
Exogenous variables:
Lag specification: 1 6
Date: 08/05/17 Time: 12:15

Root	Modulus
0.999254	0.999254
0.994211	0.994211
-0.985328	0.985328
-0.011506 + 0.957808i	0.957877
-0.011506 - 0.957808i	0.957877
0.894149 - 0.158214i	0.908038
0.894149 + 0.158214i	0.908038
-0.219236 + 0.793008i	0.822755
-0.219236 - 0.793008i	0.822755
-0.809561	0.809561
0.712736 - 0.361624i	0.799227
0.712736 + 0.361624i	0.799227
-0.620879 - 0.446044i	0.764490
-0.620879 + 0.446044i	0.764490
0.166252 - 0.681260i	0.701252
0.166252 + 0.681260i	0.701252
0.630936 + 0.232060i	0.672259
0.630936 - 0.232060i	0.672259
0.135589 + 0.598108i	0.613285
0.135589 - 0.598108i	0.613285
0.441121 + 0.419209i	0.608543
0.441121 - 0.419209i	0.608543
-0.330432 - 0.302912i	0.448265
-0.330432 + 0.302912i	0.448265



No root lies outside the unit circle.
VAR satisfies the stability condition.

VECM ESTIMATION PROCESS

The results of the AR root table and the polynomial characteristic together with the cointegration tests already discussed in the above sections they indicate that the series under investigation are actually integrated of order $I(1)$ therefore they can be best analyzed within the VECM framework. Therefore, to take this on we start by verifying the issue of cointegration among the series using Johansen cointegration test before we plug them into a VECM system. If cointegration is identified it will therefore be a solid proof that the variables are indeed sharing a long run relationship and they need to be estimated in the VECM system. However, before we do that we start by identifying the deterministic component of that needs to be ascertained in the Johansen cointegration test from the Unrestricted VAR.

Model identification for cointegrating relations

In order for cointegrated VAR) model to be correctly specified or estimated the correct identification of a number of cointegrating relations by model is necessary. Cointegrating relationships in cointegrated VAR equations can be explained in five model cases (as discussed in the previous chapter). **Case 1:** constant- with no trend and intercept model, **Case 2:** constant-with intercept but no trend model, **Case 3:** Linear-with intercept but no trend model, **Case 4:** Linear- with trend and intercept model and **Case 5:** quadratic-with intercept and trend model. Case 2, 3 and 4 are normal labelled as structural intercept VAR with no trends, unstructured intercept VAR with no trends and unstructured intercept VAR with structured trends, respectively. In practice, models presented by case 1 and 5 are rarely used because they are too far away from true exhibition behavior of most macroeconomic time series. They can only be applied if there are strong economic reasons. Thus, only models presented by case 2, 3 and 4 will be considered in this study. The decision rule regarding the appropriate model for this study will be decided following the Pantula Principle advocated by Johansen (1992). According to Johansen (1992) the appropriate way of choosing a suitable model should be that all cases are estimated and the smallest r value based on Trace and Max-Eig statistic is adopted. Hence, as per the results presented in table 5.5(a) (model 1) and table 5.5(b)(model 2) below show that the lowest r value decided by both Trace and Max-Eig statistic is falling under case 3 on both models (respectively) as suggested by the Pantula principle. Also note that case 3 suggests that the series under investigation contain a linear deterministic trend component, therefore the

VECM system should be based on intercept and contain no trend on both models should be applied.

Table 5.5(a) Model 1(import demand)

Data Trend:	None	None	Linear	Linear	Quadratic
Test type	No intercept No trend	With intercept No trend	With intercept No trend	Intercept Trend	Intercept Trend
Trace	2	2	1	1	4
Max-Eig	2	2	1	1	0
*critical values based on Mackinnon-Haug-Michelis(1999)					

Table 5.5(b) Model 2(export demand)

Data Trend:	None	None	Linear	Linear	Quadratic
Test type	No intercept No trend	With intercept No trend	With intercept No trend	Intercept Trend	Intercept Trend
Trace	2	2	1	1	1
Max-Eig	0	1	1	1	1
*critical values based on Mackinnon-Haug-Michelis(1999)					

Identification of contegrating vectors

The long run relationship tested in this study involve the long run cointegrating properties of data on logarithmic of imports, domestic income, relative prices, and logarithmic of nominal effective exchange rate. Therefore, as discussed in the previous chapter the Johansen cointegration test is based on two likelihood ratios; trace and Maximum-Eigenvalue statistic. Each of these tests test cointegration in a different approach but they usual provide similar results. The Trace statistic test the null hypothesis that $r \leq k$ (assuming that r and k presents the number of cointegrating vectors and variables, respectively) against the alternative. The maximum-Eigenvalue on the other hand examine the null hypothesis of the number of cointegrating variables is r against the $r + 1$ alternative hypothesis(Vuyeka,2015). For both tests, the decision rule states that if the calculated statistic value exceed the corresponding critical value, then the null hypothesis is reject and the opposite is true if the calculated statistic is less than the corresponding critical value. Moreover, both tests are sequential testing technique(Vukeya,2015). That is to say, if the number of cointegrating relationships is at most zero, the null hypothesis is rejected in favor of the alternative.

As per the results presented in table 5.6(a) and 5.6(b) below, both Trace and Max-eigenvalue reject the null hypothesis of $r = 0$ since their statistic values 51.60236 and 28.53385 (respectively) exceeds their corresponding critical values 47.85613 and 27.58434, respectively. However, both tests could not reject the hypothesis of at most 1 cointegrating vector exist in the system since their statistic values are less than their corresponding critical values. Therefore, this conclude that only one cointegrating equation exists among on model 1 and 2, respectively. Hence, this justify that VECM is appropriate to use in this study to estimate short run dynamics on import and export demand models and to generate plausible impulse response functions for the analysis of Orcutt's conjecture.

MODEL 1(import demand)

Hypothesized No. of CE(s)	**Table 5.6(a):Johansen cointegration test**			
	Trace test	5%critical value	Max-Eigenvalue	5%critical value
None*	51.60236	47.85613	28.53385	27.58434
At most 1	23.06851	29.79707	12.98623	21.13162
At most 2	10.08228	15.49471	9.694366	14.26460
At most 3	0.387974	3.841466	0.387974	3.841466

Note * denote rejection of the null hypothesis at the 5% level

MODEL 2(export demand)

Hypothesized No. of CE(s)	**Table 5.6(b):Johansen cointegration test**			
	Trace test	5%critical value	Max-Eigenvalue	5%critical value
None*	55.56211	47.85613	29.17160	27.58434
At most 1	26.39051	29.79707	16.27981	21.13162
At most 2	10.11070	15.49471	8.128742	14.26460
At most 3	1.981962	3.841466	1.981962	3.841466

Note * denote rejection of the null hypothesis at the 5% level

Vector error correction (VECM) estimated results and interpretation

As a results of cointegration, the VECM results of 1 contegrating relationships for both models are estimated and presented in table B11(a) and B11(b) in appendix section B. In the estimation process, imports and exports in their respective models were normalized to 1 to allow for meaningful economically interpretation of the results. The appropriate number of lags for model 1 is 4 lags (p-1) and 5 lags for model 2 as decided by AIC, SC, FPE and HQ as shown in section 5.4 above (see, table 5.4(a) and 5.4(b), respectively). As indicated by table 5.5(a) and b above, assumption 3 of using trend and no intercept was utilized on both models. Prior the estimation it

has also been quite essential for us to keep the correct order of variables in the system. Below is the justification of the ordering of variables utilized in VECM results. Estimated models:

Import demand function

$$\Delta M_t = \beta_0 + \sum_{p=0}^{n} \beta_1 \Delta M_{t-p} + \sum_{p=0}^{n} \beta_2 \, \Delta MRP_{t-p} + \sum_{p=0}^{n} \beta_3 \Delta Y_{t-p} + \sum_{p=0}^{n} \beta_4 \, \Delta neer_{t-p} + \mu_t$$

$$\Delta Y_t = \beta_0 + \sum_{p=0}^{n} \beta_1 \Delta M_{t-p} + \sum_{p=0}^{n} \beta_2 \, \Delta MRP_{t-p} + \sum_{p=0}^{n} \beta_3 \Delta Y_{t-p} + \sum_{p=0}^{n} \beta_4 \, \Delta neer_{t-p} + v_t$$

$$\Delta MRP_t = \beta_0 + \sum_{p=0}^{n} \beta_1 \Delta M_{t-p} + \sum_{p=0}^{n} \beta_2 \, \Delta MRP_{t-p} + \sum_{p=0}^{n} \beta_3 \Delta Y_{t-p} + \sum_{p=0}^{n} \beta_4 \, \Delta neer_{t-p} + \varepsilon_t$$

$$\Delta Neer_t = \beta_0 + \sum_{p=0}^{n} \beta_1 \Delta M_{t-p} + \sum_{p=0}^{n} \beta_2 \, \Delta MRP_{t-p} + \sum_{p=0}^{n} \beta_3 \Delta Y_{t-p} + \sum_{p=0}^{n} \beta_4 \, \Delta neer_{t-p} + \omega_t$$

Export demand function

$$\Delta X_t = \beta_0 + \sum_{p=0}^{n} \beta_1 \Delta X_{t-p} + \sum_{p=0}^{n} \beta_2 \Delta XRP_{t-p} + \sum_{p=0}^{n} \beta_3 \, \Delta YW_{t-p} + \sum_{p=0}^{n} \beta_4 \Delta neer_{t-p} + \omega_t$$

$$\Delta XRP_t = \beta_0 + \sum_{p=0}^{n} \beta_1 \Delta X_{t-p} + \sum_{p=0}^{n} \beta_2 \Delta XRP_{t-p} + \sum_{p=0}^{n} \beta_3 \, \Delta YW_{t-p} + \sum_{p=0}^{n} \beta_4 \Delta neer_{t-p} + \epsilon_t$$

$$\Delta YW_t = \beta_0 + \sum_{p=0}^{n} \beta_1 \Delta X_{t-p} + \sum_{p=0}^{n} \beta_2 \Delta XRP_{t-p} + \sum_{p=0}^{n} \beta_3 \, \Delta YW_{t-p} + \sum_{p=0}^{n} \beta_4 \Delta neer_{t-p} + \mu_t$$

$$\Delta Neer_t = \beta_0 + \sum_{p=0}^{n} \beta_1 \Delta X_{t-p} + \sum_{p=0}^{n} \beta_2 \Delta XRP_{t-p} + \sum_{p=0}^{n} \beta_3 \, \Delta YW_{t-p} + \sum_{p=0}^{n} \beta_4 \Delta neer_{t-p} + v_t$$

(a.)Long run estimates of import and export demand models.

Equation 5.7.1 below illustrate the long run effects of the natural log of domestic income, relative price of imports, as well as the natural log of nominal effective exchange rate on South African imports. The values are underneath [] represent the t-statistics of each long run coefficient.

$$lnM = 14.02348 + 1.732lnY - 0.655lnMRP + 0.665lnNEER \quad (5.7.1)$$

$$[-9.95697] \quad [3.67191] \quad [-3.22520]$$

According to the results, when domestic income (lnY), import relative price ($lnMRP$) and nominal effective exchange rate ($lnNEER$) are equal to zero, the long run total value of the South African import would be equal to a constant value of14.02348.

The individually coefficient signs of all variables are in correspondence with all theoretical and prior expectations of this study stated in the previous chapter and they are all statistically significant except relative price of imports($lnMRP$) whose coefficient is found to be insignificant. The results show that the long run income elasticity of South African import demand is 1.73, meaning that a 1% increase in domestic income will cause demand for imported goods and services in South Africa to increase by 1.73% per quarter, holding other factors constant. The estimated price elasticity for imports demand (as measured proxied by relative price of imports) is-0.65. This implies that in 1 quarter, a 1% increase in the price ratio of domestic price relative to foreign import price will cause approximately 0.65% reduction in import demand, assuming that other factors have remained unchanged in the economy. The estimated import demand elasticity on nominal effective exchange rate on the other hand indicate that a 1% fall (depreciation) in domestic currency (rand) will retard South Africa's demand for foreign produced goods by 0.66% per quarter, ceteris paribus. Therefore, from these results we can clearly see that South Africa's demand for imported goods is highly driven by changes in domestic economic activities not by prices and exchange rate. In the long run, improvements in domestic economic activities will eventually translate into massive growth in South African importing industries. However, the results also indicate that importing industries are very much sensitive to changes in nominal exchange rate in the long run than they are to changes in prices.

$$lnX = 4.743101 + 0.352506lnYW - 0.025467lnXRP - 0.380067lnNEER \quad (5.7.2)$$

$$[-1.80395] \qquad [0.14906] \qquad [2.17650]$$

The individual coefficients of the equilibrium relationship for exports shown by Equation 5.7.2 above suggest that South African export of goods and services shares a significant positive relationship with world income(YW) and negative relationship with both relative price of exports ($lnXRP$)and nominal effective exchange rate ($lnNNER$)in the long run. The estimated income elasticity of demand for South African exports is 0.35%. This indicates that, a 1% increase in world income result to a 0.35% increase in exports per quarter, holding all other variables constant. As expected, relative prices of export and nominal effective exchange rate on the other hand have been found to share a significant negative relationship with exports. According to the results, (as indicated by equation 5.7.2) the price and exchange rate elasticity estimates of export is -0.03% and -0.38% respectively. These results suggest that, in the long run a 1% increase in relative prices of exports will cause export to drop by 0.03% per quarter, *ceteris paribus*. A 1% increase in nominal effective exchange rate (appreciation) will cut down exports demand by 0.38% per quarter, *ceteris paribus*.

Looking at these results, it is quite interesting to note that world income is highly statistical significant in explaining changes in South African exports even though it not perfectly elastic as expected. However, this particularly indicates that in the long run, 0.38% of South Africa's export performance (per quarter) is highly dependent on income based buoyant demand from abroad. It also shows that the occurrence of a shock in the industrialized countries' productivity levels will negatively affect the welfare of South African exporting industries. Any improvement in world income will eventually translate into growth in South African exporting industries.

However, we cannot just draw conclusions on the basis of these results without considering the short run dynamics of each model as well as the impulse response functions which combines both the short run and long analysis by analysis response of each variable to innovations due to each explanatory variable in the system. Therefore, the following section is focused on presentation and interpretation of all short run coefficients for both models (1 and 2). Accordingly, impulse response functions, variance decomposition and granger causality tests are also presented and interpreted in the subsequent sections after Short run dynamics, respectively.

b.) Short run dynamics of import and export demand functions

According to the Granger representation theorem (1987), once cointegration have been identified the most appropriate way of specifying a relationship between variables is to estimate an error correction model(Maura,2013). Hence, the results of Johansen cointegration test estimated in the previous section (see, table 5.6a and 5.6b) indicate that both model 1 and 2 has only one cointegrtaing vectors in their systems, respectively. Therefore, this justifies that an error correction model should be estimated in this study. Accordingly, two error correction terms were estimated in this study. The first one is for import demand and the other is for export demand model.

In a time-series model, the error correction term is targeted to measure the speed of adjustment or the amount of time taken by the cointegrated equation to restore the long run equilibrium of dependent variable if a shock occurs in the system. The coefficient of the error term has to be negative and significant at all times. Equation 5.7.3 and 5.7.4 below presents the short term dynamics of South African import and export demand models(respectively) and their respective error correction terms(ECT).

$$\Delta m_t = -0.127319ECT + 0.775\Delta y_{t-1} + 0.444\Delta y_{t-2} + 0.733\Delta y_{t-3} + 1.173\Delta y_{t-4} + 0.094\Delta mrp_{t-1} + 0.325\Delta mrp_{t-2} + 0.312\Delta mrp_{t-3} - 0.040\Delta mrp_{t-4} - 0.219\Delta m_{t-1} - 0.129\Delta m_{t-2} - 0.187\Delta m_{t-3} + 0.154\Delta m_{t-4} + 0.080\Delta neer_{t-1} + 0.333\Delta neer_{t-2} - 0.118\Delta neer_{t-3} + 0.170\Delta neer_{t-4} \dots\dots\dots\dots\dots (\mathbf{5.7.3})$$

Equation 5.7.3 above indicates that the error correction coefficient for import demand model is -0.127319 and it is negative and significant at 1% level of significance. This signifies that about 13% of the deviations from the long term equilibrium of equation 5.7.1 are restored quarterly, as imports move towards restoring its equilibrium.

The result also indicates that in the short run, a change in a value of gross domestic product (proxy variable for domestic income) from the previous quarter has a significant positive impact on South African imports. A 1% increase in economic activity from the previous quarter cause South Africa's import to increase by 0.44% in the next quarter, assuming other factors remaining the same. The result also indicates that, in the short run South African imports are insignificantly positively related to their relative prices. A 1% change in the ratio of domestic prices relative to

foreign import prices cause South Africa's import to increase by less than 1% (0.094) in the next quarter. Moreover, it has also been established that, in the short run, a one period lag appreciation of rand in its nominal terms shares an insignificant positive with import demand. As per the results, a 1% appreciation of a rand in the foreign exchange market causes South African import demand to increase by less than 1% (0.080) in the following quarter. However, this relationship is not maintained throughout. In the third period lag, the results demonstrate that the rand appreciation would actually have a negative impact on South Africa's import, and that relationship is found be statistically significant at 10% level of significance.

$$\begin{aligned}\Delta X_t = & -2.216202ECT + 0.557\Delta YW_{t-1} - 0.336\Delta YW_{t-2} + 0.276\Delta YW_{t-3} + 0.412\Delta YW_{t-4} \\ & - 0.527\Delta YW_{t-5} - 0.120\Delta XRP_{t-1} - 0.263\Delta XRP_{t-2} - 0.274\Delta XRP_{t-3} \\ & + 0.228\Delta XRP_{t-4} - 0.254\Delta XRP_{t-5} - 0.411\Delta X_{t-1} - 0.082\Delta X_{t-2} + 0.038\Delta X_{t-3} \\ & + 0.187\Delta X_{t-4} + 0.085\Delta X_{t-5} - 0.007\Delta NEER_{t-1} - 0.080\Delta NEER_{t-2} \\ & + 0.090\Delta NEER_{t-3} + 0.260\Delta NEER_{t-4} \\ & - 0.122\Delta NEER_{t-5} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . (\mathbf{5.7.4})\end{aligned}$$

From Equation 5.7.4 stated above it reflected that the coefficient of error correction term (ECT) for export demand is -2.216 and statistically significant at the 10% level. This indicates that only 2.22% of the deviations between long-term and short-term exports is corrected by the system each quarter. In contrary with the long run estimate reported in equation 5.7.3 above, here it can be seen that in the short run, world income (YW)lagged by one quarter has an insignificant positive influence on exports. The estimates indicate that in the short run a one percent increase in world income will cause domestic exports to rise by less than one percent per quarter, ceteris paribus. This means that South Africa's export demand is relatively inelastic in the short run as it has also been revealed in the long run equation stated above. Relative prices and nominal effective exchange rate on the other hand also has insignificant negative impact on exports. In the short run, the results suggest that a 1% increase in relative exports prices and nominal exchange rate lagged by one quarter will lead to a less than one percent fall in demand for exports per quarter, *ceteris paribus*.

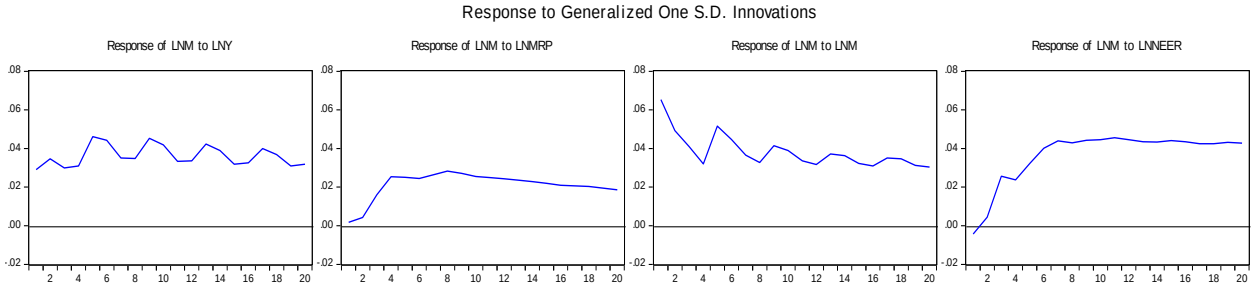
Impulse response analysis

Since VECM estimates tend to provide conflicting coefficients in various lags, it is therefore always recommended that the analysis of impulse responses within the system is investigated.

The impulse response analysis is important because it reveals the interconnection and patterns between variables with the VAR/VECM system. Therefore, for this study, in particular, impulse responses are necessary to trace the interconnection between South African trade flows, domestic/foreign income, relative prices and nominal effective exchange rate. Instead of relying up on Cholesky decomposition, we utilized the generalized impulse response because of its ability to take into account all historical patterns of correlated shocks in the system (Mazenda, 2013). Mazenda(2013) argues that, in circumstances where the series are $I(1)$ or non-stationary, impulse response functions will have to be generated from the VECM to ensure that the estimates of forecasts error variance are consistent and the predictions are asymptotically optimal. Another benefit of utilizing this approach instead of Cholesky decomposition, is that it does not require any orthogonalisation of shocks and ordering of variables in the system, thereby, avoiding any possibility of obtaining spurious results. Accordingly, figure 5.3(a) below represent the generalized version of impulse responses for South African import demand to shocks in domestic income, relative import prices and nominal effective exchange rate, respectively.

From these variables, we expect a positive shock on domestic income, and nominal effective exchange rate (units of foreign currency per unit of domestic currency) to have a positive impact on import demand. Meanwhile, the impact of a shock on relative prices of imports cannot be clearly predicted due to contradictory findings obtained by various studies regarding this variable. Conversely, it is also expected that a positive shock in world income will affect exports volumes positive, while shocks on nominal exchange rate and relative prices of exports are expected to exert a positive impact on exports. The length of the impulse response function computed in this study only captures the period of 5 years, that's 20 quarters.

Figure 5.2(a)

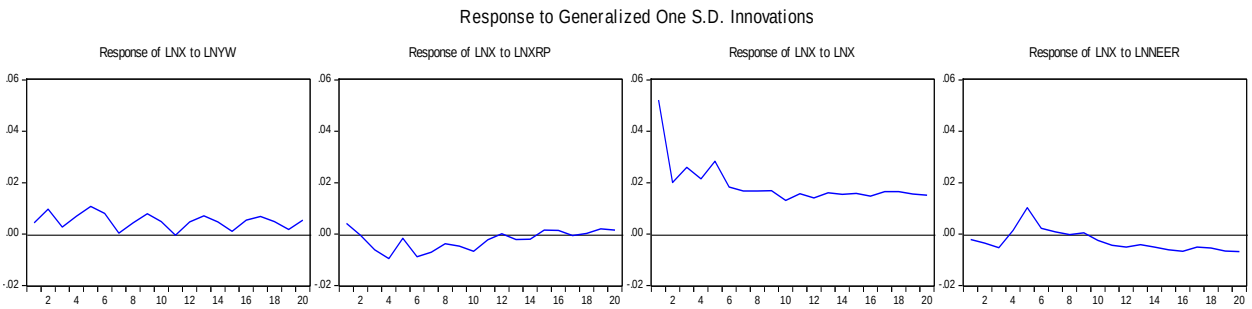


Basically, figure 5.2(a) above reflect how import demand (LNM) respond to positive shocks from domestic income(LNY), nominal effective exchange rate($LNNEER$) and negative shocks

from its relative prices($LNMRP$). According to the results, a positive shock in domestic income (LNY) leads to a positive shock in import demand (LNM), which starts to spike in the first quarter and stabilizes at a higher level from quarter 5 onwards. A negative shock in relative prices of imports($LNMRP$) will cause a positive shock in import demand (LNM) which start to effect clearly at the beginning of second quarter and stabilizes at a lower level just as from quarter 4 onwards. Most interestingly, the results also establish that a positive shock any negative shock on imports will actually cause the level of imports on the subsequent quarters to fall. Lastly, a one standard deviation positive shock on nominal effective exchange rate($LNNEER$) will actually lead to a positive shock in imports which start to effect immediately after the shock has happened and stabilizing at higher levels as from quarter 7 onwards. Therefore, this is an indication that imports are much more sensitive to changes to exchange rate than they do to changes in relative prices. furthermore, the overall results have also confirmed all what have been suggested by the short run equations stated above about the relationship between imports and relative prices, domestic income and nominal effective exchange rate.

Moreover, figure 5.2(b) below show the impulse response function related to the export-domestic income-relative prices-and nominal effective exchange rate interconnection. According to the results, exports demand (LNX)respond positive to shocks in world income($lnYW$). However, this effect is quite subdued and eventually returns back to zero in quarter 8 and rise again up to quarter 9 and start diminish. In addition, a shock on nominal effective exchange rate is also found to have a subdued positive effect on exports. In the first quarter, export respond negative to a shock from ($LNNEER$) movements and persists up to quarter 3 where it starts to react positive and becomes negative again after quarter 5. The same relationship is also established with respect to relative prices of exports. As per the results, exports respond negative to shocks resulting from relative price changes. It is also worth mentioning that, exports seem to be highly responsive to shocks in relative prices than it does to shocks caused by nominal effective exchange rate movements.

Figure 5.2(b)



VARIANCE DECOMPOSITION

The analysis of variance decomposition undertaken in this study covers the period of 20 quarters. According to Enders (2004:278), VDC are highly valuable for revealing the interconnection among variables in a VAR or VECM system. While impulse response functions efforts to investigate the impact of a shock to given endogenous variable to other variables within the VAR system, the variance decompositions analysis on the other hand, fragment the variations of each variable in the VAR system into component shocks (Brooks, 2008:299). Thereby investigating the relative importance of innovations of each variable in influencing the variations of each variable in the VAR system. In essence, this tests determines how much of the s −step forecast error variance of each dependent variable in the VAR system is explained its own shocks and by shocks from each explanatory variable in system (Mazenda, 2013). Table 5.7(a), present the table presentation of variance decomposition of model 1 (import demand). The variance decomposition for model 2 (export demand) is presented in table 5.7(b). The overall results of both models are also displayed in the appendix section of this study.

TABLE 5.7(a)

Variance Decomposition of LNM:

Period	S.E.	LNY	LNMRP	LNM	LNNEER
1	0.065351	19.67158	0.036250	80.29217	0.000000
2	0.083473	29.29313	0.028889	69.80824	0.869742
3	0.098624	30.20104	1.761861	59.99533	8.041768
4	0.110189	32.08120	5.503063	51.61881	10.79693
5	0.130544	35.37204	6.335399	44.06259	14.22997
6	0.147926	36.47130	6.761307	38.01140	18.75599
7	0.161629	35.26167	7.665373	34.02911	23.04385
8	0.173558	34.59268	8.674189	30.82097	25.91216
9	0.187751	35.38382	8.836140	28.00856	27.77148
10	0.200023	35.55008	8.910579	26.02017	29.51917
11	0.210030	34.77096	9.130621	24.64965	31.44877
12	0.219131	34.29737	9.299170	23.41373	32.98973
13	0.229233	34.74319	9.199374	22.22647	33.83097
14	0.238358	34.80664	9.130080	21.38263	34.68064
15	0.246112	34.32660	9.138304	20.76112	35.77398
16	0.253398	34.03525	9.104524	20.13815	36.72207
17	0.261415	34.31743	8.955685	19.48770	37.23918
18	0.268830	34.33321	8.847837	19.01964	37.79931
19	0.275310	33.99780	8.788486	18.65652	38.55719
20	0.281537	33.79264	8.701090	18.26674	39.23953

The results presented by table 5.7(a) above Show the proportion of the forecast error variance in imports explained by its own innovations and innovations in domestic income, relative price of imports and nominal effective exchange rate. Brooks (2002; 342) noted that in the first period, most of the forecast error variance in endogenous variable are explained by its own shocks.

Our results demonstrate that, 80.29% of total variations in imports values are mostly due to its own shocks in the first period. Nonetheless, domestic income has also been found to be the most important explanatory variable explaining about 19.67% of variations in imports values in the first period. At period 10, nominal effective exchange rate is shown to be the most important variable explaining 29.52% of total changes in imports demand. Shocks on imports only explain about 26.02% of variations in the amount of imports. In addition, domestic income has also been found to be the second important variables which explain 35.55% of total variations in imports. Relative import prices on the other hand only explain 8.91% of forecast error variance in imports demand. The same power of influence is also observed at period 20, where exchange rate is also revealed as the first variable with much influence on variations in imports and domestic income being the second explanatory variable.

What can be noted most importantly from these results is that in the long run, South Africa's imports are income induced since most of variations in imports are explained by shocks in

domestic income (see, period 7, 8, 9 and 10). According Maura (2013) income-induced imports are a strong indication of a country's ability to maintain its balance of payments equilibrium during periods of higher levels of economic growth.

TABLE 5.7(b)

Variance Decomposition of LNX:

Period	S.E.	LNYW	LNXRP	LNX	LNNEER
1	0.052211	0.691263	0.600684	98.70805	0.000000
2	0.056686	3.486301	0.523451	95.42650	0.563744
3	0.063426	2.960621	1.358515	93.52120	2.159666
4	0.068149	3.593508	3.174541	91.21011	2.021837
5	0.075098	5.021171	2.675744	88.71449	3.588590
6	0.078268	5.676019	3.771939	87.20675	3.345289
7	0.080505	5.366518	4.339398	87.06746	3.226626
8	0.082474	5.398836	4.348219	87.12310	3.129842
9	0.084681	5.996142	4.448074	86.54938	3.006402
10	0.086314	6.081732	4.898481	85.68999	3.329796
11	0.087993	5.854667	4.779814	85.75138	3.614139
12	0.089353	5.959686	4.635496	85.52356	3.881257
13	0.091189	6.323494	4.508489	85.06823	4.099783
14	0.092846	6.359558	4.401635	84.80234	4.436470
15	0.094364	6.168301	4.285207	84.85892	4.687568
16	0.095850	6.303626	4.173697	84.47444	5.048236
17	0.097612	6.564152	4.029256	84.18251	5.224081
18	0.099235	6.591787	3.898817	84.11426	5.395139
19	0.100645	6.440523	3.830897	84.10158	5.626999
20	0.102092	6.545419	3.742724	83.79431	5.917552

The results in table 5.7(b) above demonstrate that about 99% of forecast error variance of South Africa's exports is explained by variations of its own shocks in the first quarter. While world income and relative prices are only responsible for 0.69 and 60 percent of variations in forecast error variance of South African exports. In the fifth quarter, foreign income explains about 5% of movements in exports, while nominal effective exchange rate and relative export prices only constitute 3% and 4% each, respectively. The conclusion that can be drawn from these results is that changes South African exports are highly influenced by its own shocks. Furthermore, it can also be noted that the overall results of variance decomposition appear to support the findings of the VECM (section 5.4.5a) and impulse response functions (section 5.4.6) reported above. According to the results of the VECM it has been established that in the long run imports are too sensitive to domestic income changes with an elasticity value of 1.73%, while exports have been found to be inelastic to changes in world income with an estimated long run elasticity value of

0.35%. Hence, the results of the Variance decomposition analysis also reveal the same phenomenon.

BLOCK EXOGENEITY WALD TESTS

Table 5.8(a)

Dependent variable: D(LNM)

Excluded	Chi-sq	df	Prob.
D(LNY)	23.00845	4	0.0001
D(LNMRP)	11.98714	4	0.0174
D(LNNEER)	16.94733	4	0.0020
All	73.83857	12	0.0000

The results of the Granger causality tests presented in the table above show that domestic income (lnY), relative price of imports (lnRMP) and the nominal effective exchange rate Granger cause imports, significant at 5% level of significance (respectively) except nominal exchange rate which is significant at 1% level.

Figure 5.8(b)

—

Dependent variable: D(LNX)

Excluded	Chi-sq	df	Prob.
D(LNYW)	11.61664	5	0.0404
D(LNXRP)	7.096391	5	0.2136
D(LNNEER)	7.859224	5	0.1642
All	27.70879	15	0.0235

Accordingly, on exports side, the results of granger causality tests show that only world income granger cause changes in South African exports at 5% level of significance. The other two variables; relative prices of exports and nominal effective exchange rate have also been found insignificant to cause any variations in exports. Again, these results also confirm the results produced by the VECM models, impulse response and variance decomposition. From this results, it is clearly observed that the granger causality effect between south African imports and domestic income is highly significant compared to other variables, followed by nominal effective

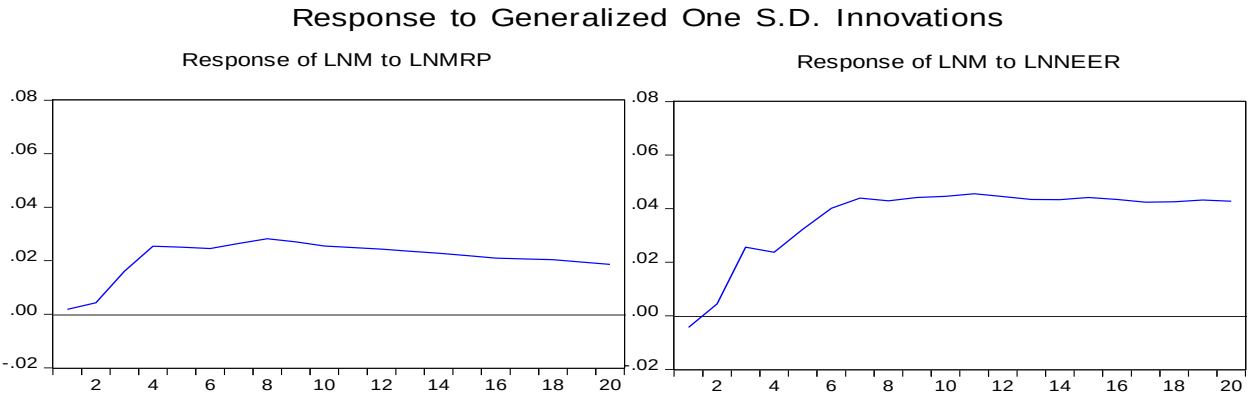
exchange rate. On export side, the same findings have also been established, both relative prices and nominal exchange rate are indeed insignificant to granger cause changes in exports that is the reason why their elasticity estimates were too low.

ORCUTT (1950) HYPOTHESIS

The second primary objective of this study as mentioned in chapter 1, is to test for the Orcutt hypothesis (effect of exchange rate and relative prices on trade flows) on both models. We do this by critical re-analyze the impulse response functions of nominal effective exchange rate and relative prices.

Model 1(import demand)

Figure 5.3(a)

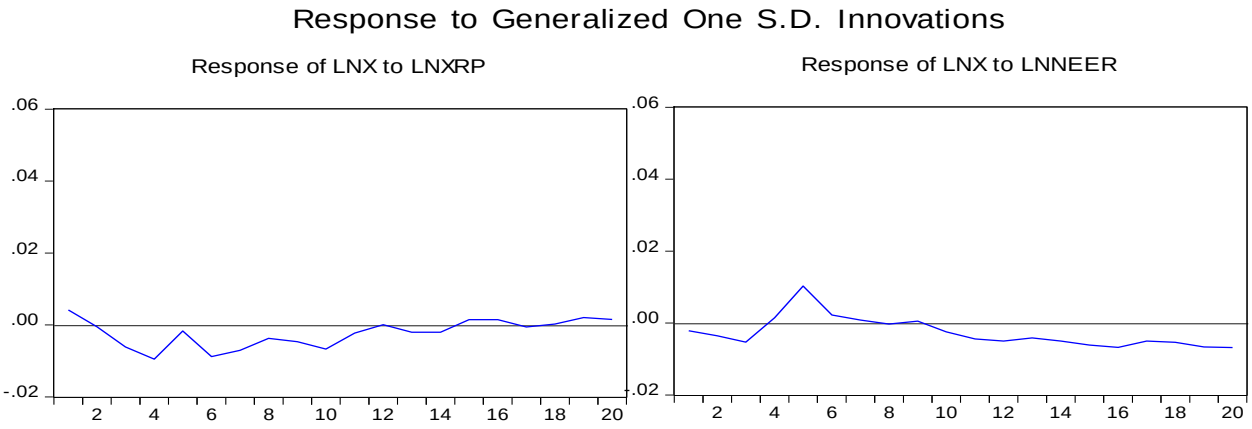


As already stated above, one standard deviation shock on both relative prices of imports and effective exchange rate affect imports volumes positively. From the results reflected by figure 5.3(a), it can also be clearly observed that the period-by-period response of imports on nominal effective exchange rate start immediately after the shock has occurred (quarter 1) and stabilizes at higher levels of imports as from quarter 7, while response on relative price shocks are delayed by one period, start off low and accelerating from the second quarter and stabilize at quarter 4. Thus, supporting the Orcutt's conjecture which states that "trade flows respond quickly to exchange rate changes than they do to relative prices". This therefore concludes that in order to maintain a shock in imports, policymakers would have to focus more on exchange rate policies than on relative prices. These results also reveal that its takes time for South African importing

industries to notice and respond to changes in relative prices, while they demonstrate a great sense of emergency to fluctuations of a currency.

Model 2(Export demand)

Figure 5.3(b)



From figure 5.3(b) shown above we can observe that a one standard deviation shock on relative price of exports affect exports volumes negative and becomes positive after quarter 18. Meanwhile, shocks on nominal exchange rate on the other hand has a subdued effect on export volumes. Initially, the impact of a shock is negative up to quarter 4 where it becomes positive but does last longer as it becomes negative again after quarter 9. Such impact may suggest the existence of J-curve effect on South Africa's exports. Nonetheless, what can be noticed based on these results is that the impact of price shocks on exports are immediately, while responses on exchange rate shocks are slightly sluggish in the first periods, they start to show a clear impact after the second quarter. Thus, rejecting the presence of Orcutt hypothesis on the export demand side of South African trade flows. These therefore suggest that exchange rate devaluation policies are still not yet effective to correct shocks effects on South African trade flows on export demand side.

Summarizing the results of figure 5.3(a) and 5.3(b), it has been established that the impact price shocks on are felt long after the shock has occurred in the import demand model, while on the export demand it has been observed that the impact of price shocks on exports are immediately. For Orcutt hypothesis to hold the impact of a price shocks should be felt long after the shock has occurred when compared to shocks due to exchange rate movements. Therefore, according to

this results and as has been outlined in the above discussion it becomes clear that Orcutt hypothesis does not hold in the South African export demand model, but it is sustained in the import demand model.

DIAGNOSTIC TEST FOR VECM SYSTEM

The estimated VECM models (1 and 2) have been diagnosed for both serial correlation and normality of errors. The LM tests was utilized for serial correlation and the results are displayed in the appendix section B. According to the results both models are free from serial correlation. However, model 1 failed to fulfill the normality condition, while model 2 have been found to contain normal distributed errors.

SINGLE EQUATIONS

It is a general practice among many empirical studies to use single cointegrated equations to verify the findings of Johansen cointegration test. Just like the JJ test, these models are able identify the existence of cointegration in the model via Engle-granger and Philips outliaris tests. To fulfil our verification purpose we adopted the use of FMOLS, DOLS and CCR models to verify the findings of VECM reported above. Table 5.8(a), and (b) below presents a summary of cointegrating equations for import demand and export demand functions, respectively.

Table 5.8(a)

Model	Variables	Coefficients	P-Values
FMOLS	lnY	1.378651	0.0000
	$lnmrp$	-0.586507	0.0003
	$lnneer$	0.561079	0.0006
DOLS	lnY	1.398105	0.0000
	$lnmrp$	-0.578975	0.0007
	$lnneer$	0.564170	0.0035
CCR	lnY	1.374597	0.0000
	$lnmrp$	-0.584615	0.0002
	$lnneer$	0.557619	0.0019

Source: *compiled by the researcher using results produced by Eviews 9.5*

The results of all three cointegration equations (FMOLS, DOLS and CCR) presented in table 5.9.2a above demonstrate that all the estimated coefficients in each regression model are statistically significant from zero and have expected signs. It is further observed that both domestic income and nominal effective exchange rate have a significant positive impact on

South African import demand at 1% level of significance. As expected, relative prices of import on the other hand are found to have a significant negative impact on the demand for imported goods and services, at 1% level. According to the results, the Import elasticity estimates produced by FMOLS with respect to domestic income, relative import prices and nominal effective exchange rate are 1.38%, -0.59% and 0.56%, respectively. For DOLS regression model the elasticity estimate of import is 1.40% with respect to income, -0.58% with respect to relative prices of import, and 0.56% with respect to nominal effective exchange rate. Lastly, the elasticity estimates of CCR suggest that income elasticity of import is 1.37%, price elasticity is -0.58%, and 0.56% for nominal effective exchange rate. From these results it can be observed that all the estimated coefficients of domestic income produced by these three regression models (FMOLS, DOLS, and CCR) are relatively similar to the VECM estimates reported in equation (5.9.1) above. Therefore, these confirm that indeed, South Africa's import demand is positively related to domestic income, nominal exchange rate and negatively related to variations in its own prices. According to the estimate, South African imports are highly elastic to income changes and inelastic to changes on both relative price of imports and on nominal effective exchange rate.

Table 5.8(b)

Model	Variable	Coefficient	P-Values
FMOLS	$lnYw$	0.402018	0.0493
	$lnxrp$	0.341289	0.0141
	$lnneer$	-0.000123	0.9993
DOLS	$lnYw$	0.374048	0.1095
	$lnxrp$	0.333244	0.0529
	$lnneer$	-0.025063	0.8856
CCR	$lnYw$	0.398782	0.0556
	$lnxrp$	0.342127	0.0116
	$lnneer$	-0.000418	0.9976

Source: *compiled by the researcher using results produced by Eviews 9.5*

For exports, the results of the FMOLS, DOLS and CCR summarized in the table above, demonstrate that foreign income is the main determinant of the South African export demand function among these variables but it is also inelastic as suggested by the estimates of the VECM. It can also be noted from the results that coefficients of foreign income and nominal effective exchange rate appear to have expected signs and support the findings established by the VECM estimates discussed in the previous sub-section. However, all three models, show nominal effective exchange coefficient is insignificant long run. Such findings can be linked with

the results of impulse response functions discussed in the preceding subsection which suggested that impulse responses of exports can only be observed only in the short run not in the long run. Therefore, on the basis of these findings we may conclude that changes in nominal effective exchange rate does not have a power to influence the behavior of exports in South Africa in the long run.

According to the results of the first model (FMOLS), a 1% increase in foreign income of advanced economies will cause South African exported goods and services to increase by 40% per quarter, assuming other things have remained the same. For nominal effective exchange rate, a 1% appreciation in the South African rand will cause our exports to fall by less than 1% per quarter, *ceteris paribus*. The coefficient of relative export prices is 0.34%, implying that a 1% increase in relative price of exports, will cause exports volumes to increase by less than 1% in each quarter, ceteris paribus.

Moreover, the individual coefficients produced by DOLS model suggest that the income elasticity of South African exports is 0.37%, which is somehow slightly less than the estimates of the FMOLS. This implies that a 1% increase in economic productivity of industrialized economies will cause South African exports to increase by less than 1% per quarter, ceteris paribus. Export price elasticity is estimated to be 0.33%, implying that a 1% increase in prices of exports cause exports to improve by 0.33% per quarter, holding other variables fixed. Lastly, the exchange rate export elasticity is -0.03%, indicating that a 1% appreciation in rand will cause exports to retard by less than 1% per quarter, assuming other things have remained unchanged.

Furthermore, the individual estimates of CCR model show that income elasticity of exports is 0.40% which is the same as the one established by the FMOLS. The economic implication of this estimate is the same as the one reported under FMOLS. The price and exchange rate elasticity are 0.34 and -0.004, respectively. The interpretation and economically reasoning behind is also the same with the ones discussed above.

Cointegration tests based on single equations

The second objective of utilizing FMOLS, DOLS and CCR model was to verify cointegrating properties in the series. As discussed in chapter 4, these three tests employ the Engle-Granger (1987) and the Phillips-Ouliaris to investigate cointegrating properties in the series. Accordingly,

from the results displayed in the appendix **section c** both Engle granger and Phillips-Ouliaris indicate that there is some existence of cointegrating properties within the series employed in this study concurring with the results obtained by the Johansen cointegration test for multivariate equations.

Diagnostic tests for Single equations.

Normality test have been computed to as a diagnostic test for single equations. With this test we want to verify if errors of each regression model are following the Gaussian process or not. The null hypothesis of this test states that errors are normal distributed. Accordingly, the results shown in the appendix **section c** accept this hypothesis and reject the alternative which therefore concludes that residuals of each regression model are normal distributed.

SUMMARY OF THE OVERALL RESULTS

The main purpose of this study was to estimate the import and export demand functions and test for the Orcutt (1950) hypothesis in the South Africa trade flows. As shown and discussed above, VAR/VECM estimation was used to quantify the effect of price, income and nominal effective exchange rate on South African trade flows. The Fully-Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS) and the CCR contegration were also utilized to verify the estimates of the VECM. The Orcutt (1950) hypothesis was tested using the Generalized impulse response functions generated from the Johansen Vector error correction model. Hence, table 5.9(a) and (b) below present the summary of the VECM elasticity estimates of imports and exports with respect to its relative price, domestic/foreign income, and nominal effective exchange rate together with the estimates of the Single static equations, respectively. The coefficients of the Short run elasticity reported are based on one period lag of each variable. Our main purpose of displaying summary of the overall results is to compare the estimated estimates produced by the VECM with those obtain by the single equations. What we observe from these two sets of models is that all coefficients carry expected signs, the elasticity estimates of single equations are slightly less than those produced by the VECM. Both sets of models confirm that income elasticity is greater than price elasticity. According to the results of single equations, nominal exchange rate is insignificant to explain variations in export demand in the long run. The estimates of VECM also show that short run estimates are less than all long run estimates.

Table 5.9(a)

	Multivariate Model		Single equations		
VARIABLE	VECM		FMOLS	DOLS	CCR
	Long run	Short run			
LnY	1.73	0.78	1.38	1.40	1.37
$LnMRP$	-0.65	0.09	-0.59	-0.58	-0.58
$LnNEER$	0.66	0.08	0.56	0.56	0.56

Source: own estimation

Table 5.9(b)

	Multivariate Model		Single equations		
VARIABLE	VECM		FMOLS	DOLS	CCR
	Long run	Short run			
$LnYw$	0.35	0.56	0.40	0.37	0.40
$LnXRP$	-0.03	-0.12	0.34	0.33	0.34
$LnNEER$	-0.38	-0.01	-0.0001	-0.03	-0.0004

Source: own estimation

V. CONCLUSION

In this study we estimated the trade functions of South Africa and investigated the Orcutt hypothesis by applying Vector error correction model and Impulse response functions as being portrayed in the previous section. First of all, the introductory phase of the chapter dealt with data issues and computation of preliminary tests and unit root tests, as well as cointegration tests. After the cointegration test was detected, we then proceeded to specify and estimate the VECM models for both import and export demand functions. Within the process of all empirical estimation summary of results were also displayed and interpreted accordingly. Subsequently to that We also generated the generalized impulse response functions from the VECM models to tests for the Orcutt hypothesis. To verify the results produced by the VECM, we also computed all three sets of long run single equations (FMOLS, DOLS and CCR). Diagnostic tests were also generated and interpreted for each model. In the last part we concluded by a summary of all estimated elasticities from both sets of models (VECM and single equations).

Therefore, according to the results it appears that application of exchange rate devaluation policy would be much more relevant in curbing an unnecessary imports in South Africa. As per the results, a 1% increase in South African economic activity will lead to 1.73% increase in imports demand. From the results it also appears that promotion and provision of exports subsidies can

be very helpful for South African economy in reducing the current existing negative gap between exports and imports. In summary, these suggest that, South Africa still need to focus more on strengthening domestic industries and expanding the domestic markets to increase the competitive of our economy in the global market.

LIST OF REFERENCES

Alam, S. (2015). "The Dynamic Effect of Exchange Rate Volatility on Pakistanâ€™s Exports: Application of VDC and IRF." International Journal of Economics and Empirical Research (IJEER) **3**(10): 507-525.

Alitintas, H. a. T., O (2014). "The dynamics of export and import demand functions in Turkery: cointegration and multivariate granger causality analysis." AESS.International Journal of Asian Social Science. journal homepage: http://www.aessweb.com/journals/5007 **4(5): 676-689**.

Allen, T. and D. Atkin (2016). Volatility and the Gains from Trade, National Bureau of Economic Research.

Amer, A. O. B. (2014). a time series study of libya's import and growth implications from trade liberalisation, Universiti Sains Islam Malaysia.

Anand, R., et al. (2016). "South Africa's Exports Performance: Any Role for Structural Factors?".

Asteriou, D. and S. G. Hall (2011). "ARIMA models and the Box-Jenkins methodology." Applied Econometrics **2**(2): 265-286.

Atique, R. and K. Malik (2012). "Impact of domestic and external debt on the economic growth of Pakistan." World Applied Sciences Journal **20**(1): 120-129.

Bahmani-Oskooee, M. (1984). "On the effects of effective exchange rates on trade flows." Indian Journal of Economics **256**: 57-67.

Bahmani-Oskooee, M. (1986). "Determinants of international trade flows: the case of developing countries." Journal of Development Economics **20**(1): 107-123.

Bahmani-Oskooee, M. and O. Kara (2008). "Relative responsiveness of trade flows to a change in prices and exchange rate in developing countries." Journal of Economic Development **33**(1): 147-163.

Baiyegunhi, L.J.S. & Sikhosana, A.M., 2012. An estimation of import demand function for wheat in South Africa: 1971-2007. African Journal of Agricultural Research. 7(37):5175-5180.

Bashier, A.-A. and A. J. Siam (2014). "Immigration and economic growth in Jordan: FMOLS approach." Int J Humanit Soc Sci Educ **1**(9): 85-92.

Bathalomew, D. (2010). "An econometric estimation of the aggregate import demand function for Sierra Leone." Journal of Monetary and Economic Integration **10**(4).

Behar, A. and L. Edwards (2002). Estimating elasticities of demand and supply for South African manufactured exports using a vector error correction model, University of Cape Town.

Butts, H. C. and I. S. Mitchell (2012). "An empirical analysis of small country import demand function: a case of Guyana." JEL classification.Problems and perspectives in management, Volume 10, issue1.

Chani, M. I., et al., (2011). "Determination of import demand in Pakistan: The role of expenditure components." Theoretical and Applied Economics **18**(8).

Chris, B. (2002). "Introductory econometrics for finance." Cambridge University Press. Campbell Y. John., Andrew w. Lo., and A. Craig McKinley.(2006) The econometrics of financial markets (1st Indian sub-continent ed). New age international (p) limited publication.

Dickey, D. A. and W. A. Fuller (1981). "Likelihood ratio statistics for autoregressive time series with a unit root." Econometrica: Journal of the Econometric Society: 1057-1072.

Dixit, A. and V. Norman (1980). Theory of international trade: A dual, general equilibrium approach, Cambridge University Press.

Durmaz, N. and J. Lee (2015). "An empirical analysis of import demand function for Turkey: An ARDL bounds testing approach." The Journal of Developing Areas **49**(4): 215-226.

Ebadi, E. (2015). "Relative Responsiveness of Trade Flows to a Change in Prices and Exchange Rate." Theses and dissertations. UWM digital commons.

Ekanayake, E. and R. L. Thaver (2011). "The Impact of Dollar-Rand Volatility on US Exports to South Africa." International Journal of Business and Finance Research **5**(3): 73-85.

Ekanayake, E., et al. (2012). "The effects of exchange rate volatility on South Africa's trade with the European Union." The International Journal of Business and Finance Research **6**(3): 13-26.

Emran, M. S. and F. Shilpi (2010). "Estimating an import demand function in developing countries: A structural econometric approach with applications to India and Sri Lanka." Review of International Economics **18**(2): 307-319.

Engle, r. f. & c. W. J. granger (1987), "co-integration and error correction: representation, estimation, and testing," econometrica, Vol. 55, no. 2 (March 1987), pp. 251-276.

Erasmus, C. (1978). "Elasticities and lag structures in South African imports." Journal for Studies in Economics and Econometrics **3**: 27-51.

Ethier, W. (1979). "Internationally decreasing costs and world trade." Journal of international economics **9**(1): 1-24.

Grossman, G. M. (1992). Imperfect competition and international trade, The MIT Press.

Haghnevis, h., et al. (2014) "estimating the import demand function of petroleum exporting countries (opec) using co-integration panel analysis."

Hajat, M. and U. Kollamparambil (2011) "the determinants of export supply in the south african manufacturing sector: an industry level panel data analysis."

Harris, R. I. (1995). "Using cointegration analysis in econometric modelling."

Hausmann, R., et al. (2014). The atlas of economic complexity: Mapping paths to prosperity, Mit Press.

Head, K. and T. Mayer (2013). "Gravity equations: Workhorse, toolkit, and cookbook." CEPII working papers.

Helpman, E. (1981). "International trade in the presence of product differentiation, economies of scale and monopolistic competition: A Chamberlin-Heckscher-Ohlin approach." Journal of international economics **11**(3): 305-340.

Hibbert, K., et al. (2012). "An econometric analysis of Jamaica's import demand function with the US and UK." The International Journal of Business and Finance Research **6**(1): 109-120.

Hong, P., 1999. Import Elasticities Revisited. Department of Economic and Social Affairs", Discussion Paper No. 10, United Nations. (Online; cited 24/09/2008 11:55 a.m.) Available from URL: http://www.un.org/esa/papers.htm"
Imbs, J. and I. Mejean (2010). Trade elasticities: a final report for the European Commission, Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Johansen, S. (1988). "Statistical analysis of cointegration vectors." Journal of economic dynamics and control **12**(2): 231-254.

Johansen, S. (1991). "Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models." Econometrica: Journal of the Econometric Society: 1551-1580.

Johansen, S. and K. Juselius (1990). "Maximum likelihood estimation and inference on cointegration—with applications to the demand for money." Oxford Bulletin of Economics and statistics **52**(2): 169-210.

Jordaan, A. C. (2015). "Determining South Africa's export potential to Australia: A panel data approach." South African Journal of Economic and Management Sciences **18**(3): 354-365.

Junz, H. B. and R. R. Rhomberg (1973). "Price competitiveness in export trade among industrial countries." The American Economic Review **63**(2): 412-418.

Kareem, F. O. (2014). Modeling and Estimation of Gravity Equation in the Presence of Zero Trade: A Validation of Hypotheses Using Africa's Trade Data. 140th Seminar, December 13-15, 2013, Perugia, Italy, European Association of Agricultural Economists.

Ketenci, N. (2013). "The effect of global financial crisis on trade elasticities: Evidence from BRIICS countries and Turkey."

Krugman, P. R. (1987). "Increasing returns and the theory of international trade, *advances in economic theory*, *fifth world congress* (Bewley, T.F Ed.),." Cambridge university Press.

Lerner, A. P. (1944) "The Economics of Control (New York, 1944)." Lerner The Economics of Control 1944.

Lütkepohl, H. (1993). "Introduction to multiple time series." Springer Verlag, Berlin.

MacKinnon, J. G. (1990). Critical values for cointegration tests, Department of Economics, University of California.

Majeed, S. and A. Waheed (2012). "Analyzing the Import Demand Function with Expenditure Components: Evidence from Pakistan." Transition Studies Review **19**(2): 245-259.

Maqbool, S. (2014). "Estimation of Import Function (a Case Study) of Pakistan." Available at SSRN 2507262.

Marshall, A. (1923). "Money, credit and commerce". London:Macmillan and Co.

Mazenda, A. (2014). "The effect of foreign direct investment on economic growth: evidence from South Africa." Mediterranean Journal of Social Sciences **5**(10): 95.

Maziya, L. K., Tijani, A.A, and Masuku, M.B (2015). "Estimation of export demand function for Swazi sugar: a panel data analysis." International Journal of Sustainable Agricultural Research, (journal homepage: http://www.pakinsight.com/?ic=journal&journal=70) **2016, 3(1): 1-18**.

Mpofu, M. (2014). The effect of foreign portfolio investment on economic growth in South Africa, Stellenbosch: Stellenbosch University.

Mukhtar, T. and S. Rasheed (2010). "Testing long run relationship between exports and imports: Evidence from Pakistan." Journal of Economic Cooperation and Development **31**(1): 41-58.

Murad, S. (2012). "Bilateral export and import demand functions of Bangladesh: a cointegration approach."

Musyoka, M. (2010). Using Double-Log Imperfect Import Substitutes Model to Estimate Compensated Elasticities and Welfare Impacts. 2010 AAAE Third Conference/AEASA 48th Conference, September 19-23, 2010, Cape Town, South Africa, African Association of Agricultural Economists (AAAE) & Agricultural Economics Association of South Africa (AEASA).

Narayan, S. and P. K. Narayan (2010). "Estimating import and export demand elasticities for Mauritius and South Africa." Australian economic papers **49**(3): 241-252.

Nwogwugwu, U. C., et al., (2015) "Price and Income Elasticities of Import Demand in Nigeria: Evidence from the Bound Testing Procedure." Journal development and economic stability. www.eajournals.org . Vol.3, No.4 pp91-103,

Omisakin, O., et al. (2010). "Relative responsiveness of trade flows to changes in exchange rate and prices in selected ECOWAS countries: Does Orcutt hypothesis hold?" Journal of Economics and International Finance **2**(6): 102.

Orcutt, G. H. (1950). "Measurement of price elasticities in international trade." The Review of Economics and Statistics: 117-132.

Ozcicek, O. and W. DOUGLAS McMILLIN (1999). "Lag length selection in vector autoregressive models: symmetric and asymmetric lags." Applied Economics **31**(4): 517-524.

Pesaran, M. H., et al., (2001). "Bounds testing approaches to the analysis of level relationships." Journal of applied econometrics **16**(3): 289-326.

Phillips, P. C. (1995). "Fully modified least squares and vector autoregression." Econometrica: Journal of the Econometric Society: 1023-1078.

Phillips, P. C. and B. E. Hansen (1990). "Statistical inference in instrumental variables regression with I (1) processes." The Review of Economic Studies **57**(1): 99-125.

Phillips, P. C. and P. Perron (1988). "Testing for a unit root in time series regression." Biometrika **75**(2): 335-346.

Pöyhönen, P. (1963). "A tentative model for the volume of trade between countries." Weltwirtschaftliches Archiv: 93-100.

Rashid, A. and T. Razzaq (2010). Estimating Import-Demand Function in ARDL Framework, Economics and Econometrics Research Institute (EERI), Brussels.

Rautala, V. (2015) "Gravity Models of International Trade: Estimating the Elasticity of Distance with Finnish International Trade Flows."

Riaz, F., et al. (2011). "Estimation of import and export demand functions using bilateral trade data: The case of Pakistan." Business and Economic Horizons(06): 40-53.

Senhadji, A. (1998), "Time-Series Estimation of Structural Import Demand Equations: A Cross-Country Analysis," IMF Staff Papers, 45(2), 236-268.

Senhadji, A. S. and C. E. Montenegro (1999). "Time series analysis of export demand equations: a cross-country analysis." IMF Economic Review **46**(3): 259-273.

Soltani, M. and S. H. Saghaian (2012). Export Demand Function Estimation for US Raisins. 2012 Annual Meeting, February 4-7, 2012, Birmingham, Alabama, Southern Agricultural Economics Association.

Stock, J. H. and M. W. Watson (2001). "Vector autoregressions." The Journal of Economic Perspectives **15**(4): 101-115.

Strauss, l. (2015). "understanding South Africa's current account deficit : foreign direct investment income." African Development Bank Group **AEB Vol.6**(issue 4).

Sultan, Z. A. (2014). "Saudi's export demand function: The ARDL approach." Journal of economics and sustainable development. ISSN2222-1700(paper). Vol.5,No.3.

Tegene, A. (1991). "Trade flows, relative prices, and effective exchange rates: a VAR on Ethiopian data." Applied Economics **23**(8): 1369-1376.

Thaver, R. (2012). "what drives South Africa disaggregated import demand function with Tanzania: an empiricak analysis." journal of AIB-SE **6**(1).

Thaver, R. L. and C. Bova (2013). "an estimation of Ecuador's export demand function on trade with the us: 1965-2011". Global Conference on Business & Finance Proceedings, Institute for Business & Finance Research.

Thaver, R. L. and E. Ekanayake (2010). "The Impact of Apartheid and International Sanctions on South Africa's Import Demand Function: An Empirical Analysis." The International Journal of Business and Finance Research **4**(4): 11-22.

Thaver, R. L., et al. (2012). "An Estimation of the Impact Of GEAR and NEPAD on South Africa's Disaggregated Import Demand Function with Nigeria." The International Journal of Business and Finance Research **6**(2): 69-79.

Tinbergen, J. (1962). *Shaping the World Economy; Suggestions for an International Economic Policy*. *Books (Jan Tinbergen)*. Twentieth Century Fund, New York. Retrieved from http://hdl.handle.net/1765/16826

Triplett, R. E. and R. L. Thaver (2015). "South Africa'S Import Demand Function with China: A Cointegration Approach." The International Journal of Business and Finance Research **9**(3): 33-44.

Tang, T.C., and H.A. Mohammad (2000), "An Aggregate Import Demand Function for Malaysia: A Cointegration and Error-Correction Analysis," Utara Management Review, I(1), 43-57.

Wangwe, S. (2003). Exporting Africa: Technology, Industrialism and Trade, Routledge.

Xu, X. (2002), "The Dynamic-Optimizing Approach to Import Demand: A Structural Model," *Economics Letters*, 74, 265-270.

Yahia, A. F. (2015). "An econometric estimation and evaluation of the import function in the Libyan economy." journal of economics, business and management **Vol,3. No,10**.

Yeboah, O., et al. (2015). Estimation of Export Demand for US Meat Products. 2015 Annual Meeting, January 31-February 3, 2015, Atlanta, Georgia, Southern Agricultural Economics Association.

Yucel, O. a. K., M (2014). "a glance at income and price elasticity of Turkey's exports: the importance of regional disparities." CBT research notes in economics(05/ 09).

Yue, Y. (2010). "An Econometric Estimation of Import demand function for Cote d'ivoire." International Journal of Business and Management **5**(2): 77.

Zhou, Y. and S. Dube (2011). "Import Demand Functions: Evidence from CIBS." Journal of Economic Development **36**(4): 73.

Warner, D. and M. E. Kreinin (1983). "Determinants of international trade flows." The review of Economics and Statistics: 96-104.

Wilson, J. F. and W. E. Takacs (1979). "Differential responses to price and exchange rate influences in the foreign trade of selected industrial countries." The review of Economics and Statistics: 267-279.