KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

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DEPARTMENT OF ECONOMICS

EXPORT PERFORMANCE ON ECONOMIC GROWTH IN GHANA

by

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DECLARATION

I hereby declare that this submission is my own work towards the M.A and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgment has been made in the text.

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DEDICATION

This thesis is dedicated to my mum, Bukari Fuleratu.

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ABSTRACT

Since 1983, Ghana has embraced a policy of trade liberalization as a strategy for growth after more than a decade of unprecedented economic decline. Trade liberalization – according to neoclassical trade theory - would result in reallocation of resources in line with a country's comparative advantage. This would lead to export-led growth.

The objective of this study was to assess the validity of the export-led growth hypothesis for Ghana using annual data from 1980-2009. Though there has been extensive research on the relationship between exports and economic growth, the results is mixed and ambiguous.

In this study, some modifications were made to previous methodology used to test for export-led growth hypothesis. Before analyzing the data quantitatively, descriptive analysis was done to identify the relationship among the variables. To avoid a possible specification bias, a vector autoregressive (VAR) model was built in the production function context. Since some variables in the production function are independent variables, bi-variate vector autoregressive model with exogenous variables was developed. The cointegration and causality test results obtained using this model was compared with that of bi-variate vector autoregressive model without exogenous variables.

The study found that there exist a positive relationship between export and economic growth in the long-run. Furthermore, the results obtained indicate bidirectional causality between export and economic growth in the long-run and unidirectional causality running from GDP to exports in the short-run.

In view of the positive relationship between export performance and economic growth, the study suggested that, attempt should be made to increase export as a way of enhancing GDP growth. To this end, government should assist Ghanaian firms to penetrate international markets by offering fiscal incentives such as reduction in export taxes or offering export subsidies, subsidized loans for exporters as well as training and capacity building to improve the quality and packaging of export products to enhance their competitiveness. In addition, opportunity should be provided (with government assistance) to Ghanaian exporters to participate in international trade fairs to expose "Made in Ghana" products and create new market for Ghanaian goods.

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CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

One of the fundamental questions in economics which has sustained debate over the years from Adam Smith, John Stuart Mill and John Maynard-Keynes to Harold and Domar, Robert Solow, Raul Prebisch and Hans Singer and to Jagdish Bhagwati and Paul Krugman is how a country can achieve high economic growth. An export-led growth strategy is regarded as one of the most enduring answers to this fundamental question.

An export-led growth strategy emphasizes the role of export in achieving economic growth. It states that, exports are very important in promoting economic growth. However, the question that remains unanswered is whether indeed a country is better served by orienting trade policies to export promotion. The neoclassical view has been that, countries will benefit by specializing in the production of commodities in which they have comparative advantage and exchange these for the commodities of their comparative disadvantage. For countries with small markets, like Ghana, exports enable them to expand their markets and hence take advantage of the economies of scale. Again, competition with countries will force a country to reduce inefficiency, and improve the quality of its products in order to compete favourably. This will improve skills and productivity in the country leading to an increase in output. Besides, for less developed countries that import a large proportion of their capital goods from industrialized countries, exports enable them to earn much needed foreign exchange. The importation of capital will make it easier to expand domestic production. The growth records of newly industrialized countries such as Hong Kong, Singapore, Korea, Taiwan, Malaysia and Thailand are cited as examples.

However, the 'radical' or neo Marxist on other hand see trade to be detrimental to growth. To them, export from less developed countries to developed countries constitutes an important mechanism through which the exploitation of poor countries occurs. Again, it is argued that less developed countries cannot compete with the industrialized countries in open world market due to their relatively lower skilled labour, and lower level of technology utilization. The resulting reduction in the demand for their goods in the world market could retard economic growth.

In view of the importance of the subject and the wide divergence in theoretical positions, many empirical studies have been conducted to assess the role of exports in economic growth. However, there is still no consensus on whether export causes economic growth or vice versa.

For example, Jung and Marshall (1985) analyse the relationship between the growth rate of real exports and the growth rate of real output for 37 developing countries using Granger causality test. Export-led growth is found in Costa Rica, Ecuador, Egypt and Indonesia. The study suggests that policy makers should promote export expansion policies so as to achieve high economic growth in these countries.

Some studies provide evidence of causality running from growth to export. An example is the study conducted by Afxentiou and Serletis (1991). They find unidirectional causality from output growth to export growth in Norway, Canada and Japan. No export-led growth is found in any of the 16 countries in their sample. This suggests that policy makers need not promote export expansion policies with the aim of high economic growth.

Other studies found a bi-directional causal relationship between export and economic growth. An impressive example of this is the study conducted by Chow (1987) for eight of the most successful export-oriented newly industrialized countries. With two exceptions, he finds bidirectional causality in each country. The implication is that, export and economic growth complement each other. This suggests that, policy makers should encourage export expansion policies in order to achieve high economic growth. Similarly, they should also encourage the production of non-export products in order to increase exports.

The last group of studies found no evidence of causal relationship between export and economic growth. An example of this is the study conducted by Ahmad and Kwan (1991) for 41 African countries and Hsiao (1987) for the then newly industrialized countries. The implication is that, export and economic growth are independent of each other.

From the above, it is clear that some studies support export-led growth while others do not. Though it is not easy to single out one reason for this, different country sets, time periods and variable definitions may be the reason for this. It is against this background that the objectives of this study are formulated.

1.1 Problem Statement

Trade in Ghana has gone through three distinct phases. Before the 1960, Ghana's trade policy was defined by her colonial masters. Essentially, trade was a two-way relation between Ghana and Great Britain whereby primary commodities were exported and manufactured products imported. The trade structure of Ghana during this period was driven by the interests of the colonial masters. The GDP growth was reasonably high during this period.

In the period from 1960 to 1983 (with the exception of brief period of 1967 – 1972), the trade policies in Ghana were informed by the doctrine of import –substitution industrialization. During this period, Ghana adopted inward oriented policies with significant trade restrictions. As a result, trade policies during this period were characterized by extensive state involvement in the economy both in the production and marketing. According to Danquah (2006), in 1966, 1972, 1975 -1976, 1979, 1980 -1983, growth rate was negative. The period was characterized by trade restrictions through tariffs and taxes that were justified on account of infant industry protection argument.

In view of the continued deterioration of Ghana's economic performance since 1970s, an Economic Recovery Programme (ERP) was lunched in 1983. The objective was to achieve higher rates of economic growth by increasing the efficiency of resource allocation, in particular by aligning domestic prices more closely with international prices. This period marked the beginning of trade liberalization and export promotion growth strategy.

While the ERP focused on stabilization and liberalization, the SAP (Structural Adjustment Programme) was aimed at consolidating the gains and maintaining the progress towards sustained growth. Indeed, exports response to the programme was remarkable.

Merchandise export rose from US$439.3 million in 1983 to US$896.80 million in 1990 and US$1,579.90 million in 1994. In the year 2000, it was US$2,832.40 million and again rose to US$2,802.2 million in 2005. It then went up in 2008 and 2009 to US$5,270 million and US$6041million respectively (World Bank).

At the same time, GDP seems to have increased steadily as it rose from US$4,057.3 million in 1983 to US$5,886 million in 1990. In 1999, it was US$7,709.9 million and rose to US$12,906 million in 2006. In 2007, it was US$24,632million and went up in 2009 to US$26,169million (World Bank).

From the above, exports and GDP appear to be moving upward together after 1983. But is there a reason for us to believe that growth in GDP is due to growth in exports? Again, is a positive trend in exports not due to a rise in GDP? Further more, is the rise in GDP not due to other factor(s) apart from exports? In any case, is there any link between exports and economic growth?

To this end, an empirical assessment of the linkage between export performance and economic growth is important. However, there is no recent empirical evidence assessing the performance of exports on economic growth.

1.2 Objective of the Study

The aim of this study is to explain the impact of exports on economic growth using annual data from 1980 to 2009. Specifically, the study sought to:

(a) Test a long term relationship between export and economic growth.

(b) Establish a causal link between export and economic growth in the short run.

(c) Establish a causal link between export and economic growth in the long run.

(d) Draw inferences on the effect of export on economic growth for policy consideration.

In essence, therefore, the study aims at seeking answers to the following questions:

(a) What is the relationship between exports and economic growth?

(b) Does growth in exports cause growth in GDP or vice versa?

(c) Is the growth in GDP due to other factor(s) apart from exports?

1.3 Hypotheses

The following hypotheses are tested:

There is no Long-run relationship between Export and Economic Growth.

Exports do not Cause Economic Growth in the Long-run.

Economic Growth does not Cause Exports Growth in the Long-run.

Exports do not Cause Economic Growth in the Short-run.

Economic Growth does not Cause Exports Growth in the Short-run.

1.4 Justification for the Study

Most of the previous work on export-led growth was conducted in static growth framework. This study will go beyond that by using a procedure which though not new but has not previously been applied to this problem at least in Ghanaian circumstances. The procedure will not only allow for the dynamic gains of trade to be captured but also helps to measure the strength of export-led growth in Ghana. Besides this, the previous studies on export- led growth conducted for Ghana have not addressed the role of import growth in the export-income relation. The role of import growth will be addressed in this study.

Again, since economic resources are scarce relative to their ends, optimum allocation of resources is required for growth and development to occur. The study would come out with recommendation for further studies on how best to utilize nation's resources judiciously to achieve growth and development.

1.5 Scope, Data Collection and Methodology

This study is limited to the impact of exports on economic growth in Ghana from 1980 to 2009. Indeed, twenty-nine years is adequate to reveal the links among the variables under consideration.

Data for the study was obtained from secondary sources such as International Monetary Fund (IMF), International Bank for Reconstruction and Development, Bank of Ghana and Ghana Statistical Service.

Information for the study, on other hand, was obtained from journals, seminar papers, articles and other unpublished materials.

In order to achieve the objective of the study, neoclassical trade theory was used to develop an augmented neoclassical production function. In a neoclassical production function, capital and labour are the inputs of production. However, in developing countries, capital is mostly imported. Import, however, has negative impact on growth. Failure to account for import according to Riezman and Whiteman (1996) could produce misleading results. Thus, the conceptual framework for the study is in the form: $y = f\{K, L, EXP, IMP\}$; where Y=GDP, K=capital, L=labour, EXP = exports and IMP = imports.

Before specifying the model, the stationarity or other wise was tested for using the Kitawoski-Phillips-Schmidt-Shin (KPSS) test for unit root. To establish a long-run relationship between exports and economic growth, cointegration test was conducted using Johansen's test for cointegration.

Granger-causality test was used to capture the short-run dynamics between export and economic growth. The long-term effects of export growth on GDP growth was investigated using bi-variate vector autoregressive (VAR) approach. The results were analyzed to suit the research objectives.

1.6 Organization of the Study

This work was organized into five chapters. Chapter two was presented in two parts. Part A reviewed theoretical and empirical literature on the study. Part B was devoted to export-led growth strategy in Ghana, equation for export and overview of Ghana's economy.

Chapter three introduced the methodology needed to carry out this study. The emphasis in this chapter was on economic theory and econometric method used.

Data analysis and presentation was done in chapter four.

Finally, chapter five contain summary of findings, limitations of the study, policy implication, explanation of result and conclusion.

CHAPTER TWO

LITERATURE REVIEW

This chapter is presented in two parts. Part A consists of theoretical and empirical review. Under theoretical review, models such as Harrod-Domar model, Arthur Lewis's two-sector model, Lewis-Ranis-Fei model, standard neoclassical growth model (Solow 1956, Swan 1956), Import-substitution industrialization and Export-led growth strategy are reviewed. The empirical review is grouped under cross-sectional studies and time series studies. Part B looks at Export-led growth strategy in Ghana, equation for export and overview of Ghana's economy.

2.1 Theoretical Review

One of the most enduring questions in economics is how a country can achieve high economic growth. In Harrod-Domar model, growth depends on the amount of capital invested. More physical capital would generate economic growth according to the model. For any take off, the model suggests that there should be mobilization of domestic and foreign saving in order to generate sufficient investment to accelerate economic growth. Economic growth therefore requires policies that encourage saving and /or generate technological advances which lower capital-output ratio (Gillis et al 1991).

However, in Arthur Lewis's two-sector model, growth stems from capital accumulation in the modern sector. In this model, the underdeveloped economy consists of two sectors: a traditional, overpopulated rural subsistence sector characterized by zero marginal labour productivity – a situation that permits Lewis to classify this as surplus labour in the sense that it can be withdrawn from the agricultural sector without any loss of output – and a high-productivity modern urban industrial sector into which labour from the subsistence sector is gradually transferred. The primary focus of the model is on both the process of labour transfer and the growth of output and employment in the modern sector. Both labour transfer and modern-sector employment growth are brought about by output expansion in that sector. The speed with which this expansion occurs is determined by the rate of industrial investment and capital accumulation in the modern sector. Such investment is made possible by the excess of modern-sector profits over wages on the assumption that capitalists reinvest all their profits. Finally, the level of wages in the urban industrial sector is assumed to be constant and higher than that in traditional sector so as to induce people to leave traditional sector and work in urban industrial sector. An increase in the amount of capital in the modern sector would therefore increase the marginal product of labour and hence total output in the sector without affecting the traditional sector. For Lewis, capital accumulation in the modern sector is the method for growing a less developed economy without doing any real damage to the traditional sector (Todaro 1997).

In the Lewis-Ranis-Fei model, saving and investment are drivers of economic growth. This is consistent with the Harrod-Domar model but in context of less-developed countries. The model is an improvement over Lewis's model of unlimited supplies of labour because Lewis failed to present a satisfactory analysis of the growth of the agricultural sector. Ranis and Fei (1961) formalized Lewis's theory by combining it with Rostow's (1961) three 'linear-stages-of-growth' theory. They disassembled Lewis's two-stage economic development into three phases, defined by the marginal productivity of agricultural labour. They assume the economy to be stagnant in its pre-conditioning stage. The breakout point marks the creation of an infant non-agricultural sector and the entry into phase one. Agricultural labour starts to be reallocated to the non-agricultural sector. Due to the abundance of surplus agricultural labour, its marginal productivity is extremely low and average labour productivity defines the agricultural institutional wage. When the redundant agricultural labour force has been reallocated, the agricultural marginal productivity of labour starts to rise but is still lower than the institutional wage. This marks the shortage point at which the economy enters phase two of development. During phase two the remaining agricultural unemployment is gradually absorbed. At the end of this process the economy reaches the commercialization point and enters phase three where the agricultural labour market is fully commercialized (Ercolani and Wei 2010).

In the standard neoclassical growth model (Solow 1956, Swan 1956),investment in machinery is not a source of growth in the long-run. Saving, according to this model, will not sustain growth. It will only divert money from consumption today towards buying machinery for the production tomorrow which will not raise the long-term rate of growth. To this end, high-saving economies cannot achieve high sustain growth than low-saving economies. In both cases, growth would drop to zero as the unavoidable diminishing returns to increasing machines set in. the contribution of this model is however limited because it assumes technological change to be given exogenously and does not attempt to incorporate the mechanism within the economy to generate progress in technology.

Import-substitution industrialization postulates that developing countries could grow by producing substitutes for imports upon which they usually relied. This policy will promote rapid industrialization and therefore growth by erecting high barriers to foreign goods to encourage local production. Indeed, this approach to growth applies the infant industry argument for protection to one or more targeted industries. The government determines those sectors best suited for local industrialization, raises barriers to trade on the products produced in these sectors in order to encourage local investment, and then lowers the barriers over time as the industrialization process takes hold (Bear 1972).

The counter development strategy –export-led growth hypotheses (ELGH) –postulates that export expansion is one of the main determinants of growth. According to the strategy, the overall growth of countries is generated not only by increasing the amounts of labour and capital within the economy, but also by expanding exports. According to its advocates, export expansion serves as an "engine of growth".

To this end, Giles and Williams (2000) have outlined some reasons within trade theory to support the Export –Led Growth (ELG) proposition. According to them, export growth represents an increase in demand for the country's output and thus serves to increase real output.

Again, an expansion in exports promote specialization in the production of export products, which in turn may boost the productivity level and may cause the general level of skills to rise in the export sector. This will then lead to a reallocation of resources from the relatively inefficient non –tradable sector to the higher productive export sector. Indeed, the change in productivity will lead to output growth. This effect, according to them, is called Verdoorn's law, after P.J Verdoorn who suggested it in 1949.

The outward oriented trade policy also gives access to advanced technologies, learning by doing gains, and better management practices that may result in further efficiency gains.

Furthermore, an increase in exports will loosen a foreign exchange constraint which makes it easier to import inputs to meet domestic demand, and so enable output expansion.

Since domestic markets are too small for optimal scale to be achieved, export development of certain goods based upon a country's comparative advantage will allow the exploitation of economies of scale. This will lead to increased growth.

Besides, ELG is seen as part of the product and industry life cycle hypothesis. This hypothesis describes economic growth as a cycle that begins with exports of primary goods. Over time, economic growth and knowledge change the structure of the domestic economy, including consumer demand, which propels the more technology intensive domestic industry to begin exporting. As domestic demand ebbs, economic growth arises from technologically advanced exports (Giles and Williams 2000).

However, the support for ELG is not universal. According to Buffie (1992), the experiences in the East and Southeast Asian countries are unique in many ways and not necessarily replicable in other countries. Jaffee (1985), on other hand, question whether a reliance on exports to lead the economy will result in sustained long –term economic growth in LDCs due to the volatility and unpredictability in the world market.

Prebisch (1950) and Singer (1950) support the counter development strategy of protectionism or import substitution. Promotion of import substitution industries will help to develop a variety of industries, which may lead a country to be stuck producing goods from which the economic gains have been exhausted. Corden (1987), argue that, financing development via import substitution will be politically attractive as tariffs, quotas etc, may raise taxes in a hidden fashion.

Hamilton and Thompson (1994) see export promotion and import substitution strategies as complementary. The latter may be a necessary step for export –based growth.

There is also potential for growth -led exports (GLE) (Giles and Williams 2000). According to Bhagwati (1988), the GLE is likely unless antitrade bias results from the growth –induced supply and demand. Indeed, neoclassical trade theory supports this notion. This is because it suggests that other factors aside from exports are responsible for output growth.

A GLE or Orthodoxy is justified by Lancaster (1980) and Krugman (1984). According to them, economic growth leads to enhancement of skills and technology. The increased efficiency that comes as a result of this creates a comparative advantage for the country. This will then facilitate exports. Market failure that results with subsequent government intervention will also lead to GLE.

Finally, according to Pack (1988), there is potential for no causal relationship between exports and economic growth when the growth paths of the two time series are determined by other unrelated variables in the economic system.

2.2 Empirical Review

Empirical review is grouped under cross –sectional and time series studies. Procedure and limitations under each group are outlined.

2.2.1 Cross –Sectional Studies

In cross-sectional studies, various definitions of export and output are considered. In addition, various time periods are investigated and the number of countries dealt with varies. The common method adopted in this study is rank correlation and or simple correlation. A classic example is the study conducted by Michaely (1977). He used rank correlation method and the period for the study was from 1950 to 1973. By assessing a change in the proportion of exports to GNP relative to the rate of GNP growth in fourty –one countries, Michaely (1977) found a significant relationship at the 1 percent level for the Spearman rank correlation. To avoid the problem of autocorrelation between exports and GNP, he used the change in the share of exports in GNP to represent the growth of exports which was then regressed against the rate of change of per capita income.

The problem with this study is the use of conventional statistical tests for establishing association between exports and growth which reveal nothing about causation.

Another impressive example is the research conducted by Tyler (1991). He employed both rank correlations and OLS regression. Using a sample of 55 middle-income LDCs, Tyler (1981) related growth of export and of GNP over the period 1960 -77. His conclusion was that, there was "additional evidence demonstrating a strong cross –country association between export performance and GNP growth". However, in the regression analysis, the t –statistics for coefficient of total exports variable in the non –OPEC group was about 1.6, which made the estimated coefficient only marginally significant.

Apart from failing to distinguish between statistical association and statistical causation, this study implicitly assume that the regression parameters are constant across countries.

Goncalves and Richtering (1987) examine the role of export in economic growth using data from seventy developing countries. The period for the study is from 1960 to 1981. The large number of observations gives them enough scope to compare the results of different country groupings and especially to test the hypothesis that the export-GDP link is stronger for middle-income and higher income developing countries. They use three indicators of export performance, namely, the annual average growth rate and total export volume in 1975 prices; the average ratio of exports to GDP (both in current prices), and the increment in export / GDP ratio. The empirical analysis shows that, although at the aggregate level there apparently may exist a positive statistical rank correlation between the growth rates of export and GDP, this is not so evident when one takes into account other indicators of export performance. Thus, as far as the cluster analysis is concerned, their results show that the coefficient of the regressions of GDP growth on exports for any cluster is not statistically significant. The study therefore does not support export-led growth hypothesis.

Gregorio (1992) investigates the growth determinants in twelve Latin American countries during the period 1950 – 1985. In investigating this, he uses several approaches. First, he examines some basic indicators bearing on growth performance. Next, he undertakes growth accounting exercises, and finally, he carries out estimations using panel data. The results of this study indicate that the term of trade has no significant effect on growth. Thus, the study does not support export-led growth hypothesis.

The reasons why these investigations do not support export promotion while other studies do are different country sets, time periods and variable definitions.

2.2.2 Time Series Causality Studies

As a result of problems mentioned in cross –sectional studies above, another group of studies known as "the time series causality studies" come into being. The time series approach solve for some of the problems mentioned in cross –sectional studies.

Given the non –stationarity that characterizes the time series data, pre –testing for unit roots and cointegration are usually conducted using (a) the Augmented Dickey –Fuller (ADF), and / or Phillip –Perron (PP) tests and (b) Johansen (1988), Johansen and Jeselius's (1990) procedure and / or Engle –Granger cointegration approach respectively. Finally, the causality is tested for using the approach developed by Granger (1969). An impressive example of this study is that conducted by Jung and Marshall (1985). Using 37 developing countries, Jung and Marshall (1985) assess the relationship between the growth rate of real exports and the growth rate of real output. Depending on the outcome of Granger causality tests, they then characterize the countries in their sample as exhibiting one of four causal patterns: Export promotion (EP), Internally Generated Exports (IGE), Export –Reducing Growth (ERG), or Growth –Reducing Exports (GRE) (Riezman et al 1996). The characterization is made on the basis of the sign of the sum of the coefficients on lags of the causal variable in the equation for the dependent variable. They find evidence for the export –led growth hypothesis in Indonesia, Egypt, Costa Rica, and Ecuador out of 37 countries.

Chow (1987) performs a similar analysis on eight semi –industrialized countries using the data period 1960 -1980. He uses the growth rate of manufacturing output as a measure of industrial development. He finds bi –directional causality in each country with exception of two countries. According to Riezman et al (1996), direct comparisons with Jung and Marshall's results are hampered by the fact that Chow does not attempt to determine the sign of the relationship (ie, whether export growth causes positive or negative output growth), as well as by the use of different variables. The results for the countries such as the Brazil, Korea, Mexico and Taiwan that are common to the two samples differ across the studies. Jung and Marshall find strong evidence of causality from output to exports in Korea and Taiwan. However, no significant causality is found in Brazil or Mexico. The two papers draw similar inferences about the existence of causality in Israel, although Jung and Marshall argue that the effect is negative in each direction.

Afxentiou and Serletis (1991) examine the validity of ELG in 16 industrial countries. The study covers the period from 1950 to 1985. The countries included in the sample are Austria, Belgium, Canada, Denmark and Finland. Others are Germany, Iceland, Ireland, Japan and Netherlands. The rest are Norway, Spain, Sweden, Switzerland, UK and US.

After testing for unit root and cointegration, vector autoregressve (VAR) model is used to test for causality. Afxentiou and Serletis (1991) find no export –led growth in any of the 16 countries. However, they find unidirectional causality from output growth to export growth in Norway, Canada and Japan. The other causal relationship they find is bidirectional causality in the US.

Marin (1992) presents a vector autoregressive (VAR) analysis of data for four countries (Germany, United Kingdom, the United States and Japan). He uses quarterly data for manufactured exports, the terms of trade, OECD output and labour productivity. To verify whether exports and productivity have a long-run equilibrium relationship, Marin (1992) performs preliminary tests for the cointegration. He finds no conclusive evidence of cointegration between these two variables. However, he does find evidence of a cointegrating relationship among exports, productivity and the terms of trade in the United States, Germany and Japan. He tests for optimal lag-length of past information using Beyesian Information Criterion (BIC). To determine the causal relationship between exports and economic growth, he performs Granger-Causality test. His tests support the export-led growth hypothesis for the four countries. However, he finds that the "quantitative impact of exports on productivity is negligible" on the basis of the sum of the autoregressive coefficients on lagged values of exports in the productivity equation.

Al –Yousif (1997), tests the export –led growth (ELG) hypothesis in four Arab Gulf oil producing countries. These countries are Saudi Arabia, Kuwait, United Arab Emirates and Oman. The study covers the period 1973 -1993.

In order to examine the relationship between exports and economic growth, Al –Yousif (1997) estimates two models for each country. One of the models has basic form of the production function while the other is a sectoral model.

To determine the long –run relationship between exports and economic growth, Al –Yousif (1997) performs cointegration. He finds no long –run relationship between exports and economic growth. However, export is found to have positive and significant impact on economic growth in all the countries. The Durbin –Watson and Bruesch –Godfrey statistics show no evidence of serial correlation. Again, he tests for structural stability of the series using the Farely –Hininch test and finds that the growth equations for the four countries are structurally stable. Finally, he performs a specification test using White's and Hausman's specification tests and both models are found to be correctly specified.

Ram (1985) investigates the role of exports in economic growth using the production function model that treats exports as similar to a production input. His objective is to shed new light on the relationship between exports and economic growth using fairly standard models but employing larger data sets, focusing on certain specific issues, and handling some econometric questions relevant to such empirical work. His study adopts the specification used by Bala Balassa, William Tylor etc. He conducts the investigation for 1960 -70 and 1970 -77 separately so as to determine whether the importance of exports for economic growth increase over the 1970s.

Again, he takes a closer look at the differential in the impact of exports in the low -income and the middle –income LDCs for both periods, thus examining the widely held belief that exports are probably not important for growth in the low –income LDCs. He conducts a test to see whether the assumption of homoscedasticity is reasonable and whether a single –equation model is adequate. The results of the study indicate that export performance is important for economic growth. Besides, the impact of export performance on growth is small in the low –income LDCs over the period 1960 -70 but the impact differential almost disappears in 1970 -77.

Finally, he used the test statistics proposed by White to test for heteroscedasticity and other specification errors and the result indicates the absence of both problems.

Njikam (2003) tested for the ELG hypothesis in 21 sub –Saharan African countries. These countries are Benin, Burkina –Faso, Cameroon, Central Africa Republic, Cote –D' Ivoire, Democratic Republic of Congo (DRC) and Gabon. Others are Ghana, Kenya, Madagascar, Malawi, Mali, Nigeria and Niger. The rest are Republic of Congo, Senegal, Sierra –Leone, Sudan, Tanzania, Togo and Zambia.

The study aims at: (a) testing the causal relationship between exports and economic growth. (b) establishing the direction of causality if the relationship in (a) above exists and (c), examining whether the direction of causality is reversed when countries change from import –substitution strategy to exports promotion strategies.

To examine whether agriculture and manufactured exports cause economic growth and vice versa in the above countries, Njikam (2003) employs autoregressive models. The author tests for stationary on the series using the ADF test. The minimum final prediction error (FPE) and Schwarz –Bayesian (SBC) Criteria are used by Njikam (2003) to determine the optimum lag –length of past information. Again, he uses the Granger –causality technique to determine the direction of causation.

To verify the direction of causation and to test the significance of the restricted coefficients, Njikam (2003) uses the wald test (WT) and the likelihood ratio test (LRT). He finds that, real GDP and real exports are stationary in all countries during the exports promotion period. The optimum lag length for all variables is found to vary across countries. In Burkina-Faso, Cameroon, Cote-d' Ivoire, DRC, Ghana, Madagascar, Malawi and Zambia, unidirectional causation is found from agricultural exports to economic growth. In Cameroon, Mali and Malawi however, he finds unidirectional causation from manufactured exports to real GDP growth.

Again, the author finds unidirectional causation from real GDP to agricultural exports in Mali, Nigeria, Kenya, Senegal and Tanzania. Besides, he finds unidirectional causation from real GDP to manufactured exports in Benin, Cote-D' Ivoire, Gabon, Ghana, Madagascar and Togo. This implies that total export growth depends on the economic growth in these countries.

Finally, bidirectional causation between agricultural exports and economic growth is found in Burkina –Faso, DRC and Madagascar. This therefore leads to an acceptance of the ELG and the economic growth –led export hypotheses in these countries.

To conclude, it can be deduced from the above studies that most of the authors saw the need to adopt time series approaches because the question on export –led growth is essentially dynamic one. However, the results remain mixed and ambiguous. This may be due to either specification bias or exclusion of import or different time periods. This thesis corrects these problems.

2.3 Export –Led Growth Strategies in Ghana

The role of exports in economic growth of Ghana cannot be over emphasized. A change in export affects almost all sectors of the economy. It is in recognition of this that the Ghana Export Promotion Council (GEPC) was established as a statutory agency in 1963. The mission of the GEPC was to promote exports in any manner which the council thought necessary or desirable (Owusu-Afriyie et al 2002).

For some time now, Ghana's export trade has been dominated by cocoa beans, gold and other minerals and timber exports. Ghana's economy was in shambles in 1980 due to increasing population, increasing expenditure on social development, the collapse in commodity prices on international markets, increasing costs on imported manufactured products and the oil shocks of 1973/74. With assistance from the Bretton Wood Institutions and other donors, the Government of Ghana launched an economic recovery programme (ERP) to resuscitate the economy. The ERP was thus predicated on an export –led strategy for growth (Owusu-Afriyie et al 2002).

In implementing the ERP, initial attention was focused on the resuscitation of the traditional export sectors as well as the services and infrastructures needed to support them. Indeed, the targeted sectors responded positively by showing significant increases in export volumes and earnings. In the case of cocoa, for example, export volumes rose from a low of 150,000 tons in 1981 to 350,000 tons by 1986 (Owusu-Afriyie et al 2002).

Nevertheless, the balance of trade continued to suffer significant deficits. This persistent deficit in the national trade balance constitutes the heart of the development challenge that confronts Ghana's economic managers.

A further response under the ERP was to adopt strategies for diversification and value addition in Ghana's exports. It is in direct response to this that a re-organized and re-surgent GEPC launched the 3-year Non-Traditional Export Development Plan in 1987 to cover the years 1988 -1990. This short term Export Strategy has been followed by a Medium Term Five Year Plan (1990 - 1995), the Trade and Investment Programme (TIP) funded by USAID, and its sequel Trade and Investment Reform Programme (TIRP) (Owusu-Afriyie et al 2002).

Following the implementation of these Export Development and Promotion Strategies, Ghana's non –traditional exports (NTEs) have grown from under US$2 million in 1984 to over US$400 million in 1999, and up to US$460 million as at the end of 2001 (Owusu-Afriyie et al 2002).

The export expansion that is witnessed in Ghana as a result of trade liberalization has created employment to many Ghanaians. This is because labour is the factor used extensively in the production of export commodities. The effect of this is the reduction of poverty in the country.

According to Boateng et al (1990), 30% of Ghanaian in 1987 were poor while 10% were hard-core poor. About 80 percent of those in the hard-core poverty class were non-cocoa farmers and non-“white collar” workers.

2.4 The Equation for Export

Since Ghana is a small open economy, any major development or problem in the world economy such as declining levels of commodity prices and rising crude oil prices would have significant impact on its domestic economy. Ghana’s principal export commodities are cocoa, timber, gold, manganese and diamond with oil recently becoming important export commodity. Ghana, however, has no influence in determining the world price. It can therefore be said that Ghana is a price taker in the global market. It is assumed that the volume of exports from Ghana depends on the relative price of exports and foreign demand. The equation for export therefore includes real world income and the ratio of export price to the price of foreign substitutes. The equation also incorporates the price of foreign exchange in the black market. The inclusion of black market exchange rate is based on the assumption that the exchange rate system in Ghana consists of a dual rate regime in which an official floating nominal exchange rate co-exists with a quasi-illegal parallel market for foreign exchange. Also commercial transactions are settled partly in the official market at the exchange rate which is set at the interbank market and partly at black market exchange rate.

Ghana has a slow response to any changes in demand because of the long gestation periods associated with the production of its principal exports. Again, primary exports such as minerals are exhaustible resources. The production of other commodities like cocoa cannot be easily expanded because of the opportunity cost involve in the use of the resources to produce them. From the above, it can be deduced that the response of exports to demand may be very small.

Following Khan et al (1990), Ghartey and Rao (1990), Agenor and Montiel (1999), Guarda and Pieretti (2000), and Musila (2002), Ameyaw (2005) formulates the export function as follows:

$$\frac{VXt}{PXt} = F(\left(\frac{PXt}{PWt}\right), BEXt, \left(\frac{YWt}{PWt}\right)) \qquad \text{(eq 1)}$$

Where:

VXt is the nominal value of exports of goods and services, PXt is the unit export price index, BEXt is the black market exchange rate, YWt is the world nominal income, PWt is the world unit price of tradable goods.

2.5 Overview of Ghana's Export Profile

During the 50's, Ghana's major exports were mainly raw materials in the form of cocoa beans, minerals, timber logs and cola nuts.

After independence, however, Ghana became very anxious to industrialize. Consequently, there were changes in the composition of her export trade. In the 1970s, primary products continued to be Ghana's major export with cocoa remaining the principal export commodity.

With industrialization as a way of diversifying the economy however, some raw materials were process before being exported. Gradually, Ghana was changing from the export of pure primary products to export of processed products like sawn timber, cocoa products etc. Again, manufacturing products like textiles, minerals and aluminium products were being exported. In the early part of the 80's, Ghana's export structure was the same as in the 1970s.

The Economic Recovery Programme (ERP), which was lunched in 1983, had great effect on Ghana's external trade. In order to earn more foreign exchange from export, Ghana embarked on the promotion of non –traditional export.

In 2001, the presidential special initiative on accelerated export development was lunch. This programme was aim at promoting export. It covers integrated action programme for cassava starch production and export action programme for garments and textiles. Also, entrepreneurs were encouraged to take advantage of the African Growth and Opportunity Act of the U.S government and export commodities to the U.S.A (ISSER 2004)

In spite of the effort made above, merchandise export earnings fell from US$1,936.2 million in 2000 to US$1,842.8 million in 2001. The abysmal performance of exports was attributed to the underperformance of cocoa and gold which account for over 50% of total export earnings (ISSER 2006).

Minerals, cocoa and timber continue to be Ghana's main export commodities in 2006 with mineral sector being the main export earner. The mineral sector accounts for 37.3% of export revenue in 2006 up from 36.9% in 2005. The value of cocoa export rose from US$908.4 million in 2005 to US$1,187.4 in 2006. However, their contribution to total merchandise export earnings fell slightly from 32.4% in 2005 to 32.2% in 2006. Also, timber earnings fell from US$226.5 million in 2005 to US$199.5 million in 2006 (ISSSER 2007).

Export value from non –traditional export (NTE) sub sector increased from US$777.6 million in 2005 to US$892.9 million in 2006 (ISSER 2007).

Europe maintained its position as a major market for Ghana's exports (mainly cocoa and NTEs) in 2008 followed by the United States (7.67%). The two major destinations for Ghana's exports as of the first two quarters of 2008 were the Netherlands (14.02%) and the United Kingdom (9.23%). These two countries were also the top two destinations in 2006 and 2007(ISSER 2008).

This chapter has reviewed the work of previous authors on the subject matter of the study. This review will form the basis for the methodological orientation in the next chapter and the analysis of the findings of the study.

CHAPTER THREE

METHODOLOGY OF THE STUDY

This chapter is devoted to the conceptual framework of the empirical model of the study. The chapter consists of two sections namely: (a) theoretical model and (b) econometrics methods.

3.1 Theoretical Model

The impact of trade on economic development and the role of trade as "the engine of growth" are rooted in the principles of comparative advantage. The principles of comparative advantage can be traced back to nineteenth century free trade models associated with David Ricardo and John Stuart Mill, which were modified by trade theories embodied in the factor proportions or Hechsher-Ohlin (1933) theory and Stolper-Samuelson (1941) and Rybzsnski (1945) effects. These models predict that countries will benefit from trade by specializing in the production of goods in which they have comparative advantage and exchange part of these goods with the other nations for the commodity of their comparative disadvantage. This means the countries will enjoy both static and dynamic gains of trade.

The static gains of trade include the maximization of welfare of both producers and consumers via economies-of-scale. The dynamic version, however, incorporates investment in line with a country's changing comparative advantage which minimizes the present value of the resource costs of its future demand. The neoclassical trade theory used in this study is based on principles of comparative advantage.

The export-led growth hypothesis which emanates from the principles of comparative advantage emphasizes the role of export in promoting economic growth. It states that, in addition to capital and labor, export is one of the main drivers of growth. For this to be tested, neoclassical trade theory will be used to develop augmented neoclassical production function.

In a neoclassical production function, capital and labor are the inputs of production. Thus, capital and labor are treated as independent variables in the production function and will be considered as exogenous variables in the study. Based on the export-led growth hypothesis which states that in addition to capital and labour, export is one of the key determinants of growth, export is treated as input of production and included in the production function.

In Ghana, just like any developing country, capital is mostly imported. Imports, thus, have positive impact on capital accumulation in developing countries. However, import at the same time has negative impact on growth. Import thus acts as a confounding variable and will be included in the model in addition to capital, labor and export. Failure to account for import can produce misleading results (Riezman and Whiteman, 1996).

The augmented neoclassical production function is therefore in the form

$$y = f\{K, L, EXP, IMP\}$$

where y = aggregate output, K = capital, L = labor force, EXP = export and IMP = import. In terms of priori restrictions, capital, labor and export are expected to be positive. This is because, the more the capital, labor and export of goods, the more the output. Import, however is expected to be negative because it reduces expenditure on output (Lipsey, 1983).

3.2 Econometric Methods

The aim of this study is to determine whether or not export is driving income. This determination is possible by looking at time series. However, the use of time-series data presents opportunities and challenges for addressing causality. To overcome these challenges, three steps are usually followed. These are:

(a) Test for unit root to ensure that all variables included in the study are stationary.
(b) Test for cointegration to determine the possibility of long-term relationship.
(c) Causality test to determine the direction of causality between export and growth.

The above steps will be followed in this study.

3.2.1 Unit root test

Many economic time series exhibit behavior or non-stationarity in the mean. An important econometric task is determining the most appropriate form of the trend in the data. If the data are trending, then some form of trend removal is required. Two common trend removal or de-trending procedures are first differencing and time-trend regression. Unit root tests can be used to determine if trending data should be first differenced or regressed on deterministic functions of the time to render the data stationary. The most commonly used unit root test which will be employed in this study is Kitawoski-Phillips-Schmidt-Shin (KPSS) test.

3.2.2 VAR Specification and Estimation

This study adopts a VAR approach to determine the effects of exports growth on the growth of GDP. The methodology will allow for the identification of both the short-term and long-term cumulative effects by taking into account the dynamic feedback between exports and growth.

Since VAR models without exogenous variables are frequently used for study on ELG strategy, this type of model will be developed in this study. The result of this can be compared with VAR models with both the endogenous and the exogenous variables. To this end, two types of bi-variate VAR models will be developed. The bi-variate VAR model with only endogenous variables with p-lags is shown below.

$$GDP_t = c_1 + B_{11}^1 GDP_{t-1} + B_{12}^1 EXP_{t-1} + \cdots + B_{11}^p GDP_{t-p} + \cdots B_{12}^p EXP_{t-p} + \varepsilon_{1t} \quad \text{(eq.2)}$$

$$EXP_t = c_2 + B_{21}^1 GDP_{t-1} + B_{22}^1 EXP_{t-1} + \cdots + B_{21}^p GDP_{t-p} + \cdots B_{22}^p EXP_{t-p} + \varepsilon_{2t} \quad \text{(eq.3)}$$

Where gross domestic product (GDP) and export (EXP) are jointly determined by a two variable VAR. The constant is the exogenous variable. C, B_{11}, B_{12}, B_{21}, and B_{22} are the parameters to be estimated. ε_{1t} and ε_{2t} are the error terms assumed to be white noise and uncorrelated.

In the above model, the current GDP is influenced by current and past values of export, and current export is influenced by current and past values of GDP. The model therefore captures the feedback effects allowing current and past values of the variable in the system. Equation (2) and (3) can be written compactly as

$$y_t = A_1 . y_{t-1} + A_2 . y_{t-2} + \cdots + A_p . y_{t-p} + \varepsilon_t \quad \text{(eq.4)}$$

Where y_t is k vector of endogenous variables, A_1 -----A_p are matrices of coefficients to be estimated.

As pointed out earlier, the result obtained from bi-variate VAR model without exogenous variables will be compared with the result of bi-variate VAR models with both the endogenous and the exogenous variables. The inclusion of exogenous variables in the model is meant to reduce the problem of possible misspecification and multicollinearity associated with VAR models without exogenous variable. The bi-variate VAR model with both endogenous and exogenous variables is:

GDP_t=c_1 + $B_{11}^1 GDP_{t-1}$ + $B_{12}^1 EXP_{t-1}$ +-----+ $B_{11}^p GDP_{t-p}$ + ------ $B_{12}^p EXP_{t-p}$ + $A_1 GFCF_t$ +$A_2 LAB_t$ + $A_3 IMP_t$ + ε_{1t} (eq.5)

EXP_t=c_2 + $B_{21}^1 GDP_{t-1}$ + $B_{22}^1 EXP_{t-1}$ +-----+ $B_{21}^p GDP_{t-p}$ + ------ $B_{22}^p EXP_{t-p}$ + $A_4 GFCF_t$ + $A_5 LAB_t$ + $A_6 IMP_t$ + ε_{2t} (eq.6)

Where GDP and export are jointly determined by two variable VAR, the constant (c), gross fixed capital formation (GFCF), labor force (LAB) and import (IMP) are the exogenous variables. Equation (4) and (5) can be written compactly as

y_t =$A_1.y_{t-1}$ + $A_2.y_{t-2}$ +------+$A_p.y_{t-p}$ + $B.x_t$ + ε_t

Where y_t is *k* vector of endogenous variables, x_t *is* a *d* vector of exogenous variables, A_1,-----, A_p and *B* are matrices of coefficient to be estimated.

Finally, Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn information criterion (HQ) will be used to select the final VAR models.

3.2.3 Cointegration test using Johansen's methodology

According to Engle and Granger (1987), if econometric variables contain a unit-root, then there is the possibility of cointegration. Cointegration is simply the process of establishing equilibrium or long-run relationship among non-stationary variables. In this study, this relationship will be tested for using Johansen's methodology. The econometric specification of the relationship will be captured in the various bi-variate models with and without exogenous variables all expressed in logarithmic form. Below is the specification of the relationship for bi-variate model with exogenous variables.

$$\ln y_t = \beta_0 + \beta_1 \ln EXP_t + \beta_2 \ln GFCF_t + \beta_3 \ln LAB_t - \beta_4 \ln IMP_t + \varepsilon_t \qquad \text{(eq.7)}$$

Where y is aggregate output, GFCF is real gross fixed capital formation; EXP is total exports of goods and services. IMP is the total imports of goods and services; LAB is labor force and ε_t is the error term.

The maximum eigenvalue and the trace tests will be applied to estimate the number of cointegrating vectors.

According to the Granger representation theorem, if two variables are cointegrated, then the relationship between the two can be expressed as error correction model (ECM). Put differently, a cointegrated systerm can always be represented by an error correction model (ECM). Below is an example of an ECM with one lag for each variable for bi-variate model without exogenous variables.

$$\Delta lnGDP_t = a_0 + a_1 \Delta lnGDP_{t-1} + a_2 \Delta lnEXP_{t-1} - \chi_1 \varepsilon_{t-1} + \mu_{1t}$$

(eq.8)

$$\Delta lnEXP_t = B_0 + B_1 \Delta lnGDP_{t-1} + B_2 \Delta lnEXP_{t-1} - \mathcal{X}_2 \varepsilon_{t-1} + \mu_{2t}$$

(eq.9)

Similarly, an ECM with one lag for each variable for bi-variate model with exogenous variable is given as

$\triangle lnGDP_t = a_0 + a_1 \triangle lnGDP_{t-1} + a_2 \triangle lnEXP_{t-1} + a_3 \triangle lnGFCF_{t-1} + a_4 \triangle lnLAB_{t-1} - a_5 \triangle lnIMP_{t-1} - \mathcal{X}_1 \varepsilon_{t-1} + \mu_{1t}$ (eq.10)

$\triangle lnEXP_t = B_0 + B_1 \triangle lnGDP_{t-1} + B_2 \triangle lnEXP_{t-1} + B_3 \triangle lnGFCF + B_4 \triangle lnLAB_{t-1} - B_5 \triangle lnIMP_{t-1} - \mathcal{X}_2 \varepsilon_{t-1} + \mu_{2t}$ (eq 11)

ε_{t-1} is the lagged error term obtained from long-run cointegrating regression when χ_1 and $\chi_2 \neq 0$. If there is a long run relationship between export and GDP, this can be tested through ε_{t-1} if $\mathcal{X}_1 \neq 0$ an $\mathcal{X}_2 \neq 0$.

3.2.4 Model Residual Diagnostics

In this study, two different tests will be conducted to ensure that the selected lag lengths best fit the selected VAR models. If the residuals of all models are white noise and normally distributed, then the selected lag lengths best fit the selected VAR model.

For normality testing, the Jarque-Bera test and white test for heteroscedasticity will be used. For uncorrelated residuals diagnostic checks, portemantau residual autocorrelation test (Ljung-Box test) will be used. The final VAR model will be estimated using likelihood estimation procedure.

3.2.5 Granger-Causality Test

The study adopts the Granger-causality procedure based on ECM to determine the causal relationship between export and economic growth. The error correction models of both the bi-variate models with or without exogenous variables are expanded and shown below:

(a) Bi-variate model without exogenous variables with error correction term

$$\triangle lnGDP_t = a_0 + \sum_{i=1}^{p} a_{1i} \triangle lnGDP_{t-i} + \sum_{i=1}^{p} a_{2i} \triangle lnEXP_{t-i} - \chi_1 \varepsilon_{t-1} + \mu_{1t} \quad \text{(eq.12)}$$

$$\triangle lnEXP_t = B_0 + \sum_{i=1}^{p} B_{1i} \triangle lnGDP_{t-i} + \sum_{i=1}^{p} B_{2i} \triangle lnEXP_{t-i} - \chi_2 \varepsilon_{t-1} + \mu_{2t} \quad \text{(eq.13)}$$

(b) Bi-variate model with exogenous variable and error correction term

$$\triangle lnGDP_t = a_0 + \sum_{i=1}^{p} a_{1i} \triangle lnGDP_{t-i} + \sum_{i=1}^{p} a_{2i} \triangle lnEXP_{t-i} - \sum_{i=1}^{b} a_{3i} \triangle lnGFCF_{t-i} + \sum_{i=1}^{b} a_{4i} \triangle lnLAB_{t-1} - \sum_{i=1}^{b} a_{5i} \triangle \ln IMP_{t-i} - \chi_1 \varepsilon_{t-1} + \mu_{1t}$$

(eq.14)

$$\triangle lnEXP_t = B_0 + \sum_{i=1}^{p} B_{1i} \triangle lnGDP_{t-i} + \sum_{i=1}^{p} B_{2i} \triangle lnEXP_{t-i} - \sum_{i=1}^{b} B_{3i} \triangle lnGFCF_{t-i} + \sum_{i=1}^{b} B_{4i} \triangle lnLAB_{t-1} - \sum_{i=1}^{b} B_{5i} \triangle \ln IMP_{t-i} - \chi_2 \varepsilon_{t-1} + \mu_{2t}$$

(eq.15)

The joint hypotheses for Granger non-causality for both types of bi-variate models are:

Exports Growth does not cause Economic Growth.

This implies a test on the coefficients of export in equation (12) and (14)

$H_0 : a_{2i} = a_{22}$ …………….. $a_{2p} = \chi_1 = 0$

Economic Growth does not cause Export Growth.

The above hypothesis implies a test on the coefficients of GDP in equation (13) and (15).

$H_0 : B_{1i} = B_{12}$ …………….. $B_{1p} = \chi_2 = 0$

Exports do not cause Economic Growth in the Long-run.

This hypothesis implies that there is no significant cointegrating relation in equation (12) and (14).

$H_0 : \ \chi_1 = 0$

Economic Growth does not cause Exports Growth in the Long-run.

The above hypothesis implies that χ_2 in equation (13) and (15) do not have significant cointegrating relation.

$H_0 : \ \chi_2 = 0$

Exports do not cause Economic Growth in the Shot-run.

The above hypothesis implies that coefficients of export in equation (12) and (14) do not have significant impact on GDP.

$H_0 : a_{21} = a_{22}$ =---------------- $a_{2p} = 0$

Economic Growth does not cause Exports Growth in the Short-run.

The hypothesis implies the coefficients of GDP in equation (13) and (14) do not have significant impact on export.

$H_0 : B_{11} = B_{12}$ =---------------- $B_{1p} = 0$

In this chapter, we have outlined the methodology of the study. The methods explained here will be used to analyse the data collected in the next chapter.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS OF THE STUDY

In this chapter, the results of the study are presented and discussed. The chapter is divided into seven sections. Section one presents the qualitative analysis of the variables used for the study. Section two, examines the time series properties of the variable used. Section three, four, five and six presents and discusses the results of lag length selection, cointegration, models residuals diagnostics, and granger causality tests respectively. Section seven compares the results of VAR (P) and VARX (Pb).

4.1 Discriptive Analysis

Real GDP, real export, real import, gross fixed capital formation and labour force are the macroeconomic variables used in this study. Figure 4.1, 4.2, 4.3, 4.4 and 4.5 below represent the trend in the above indicators.

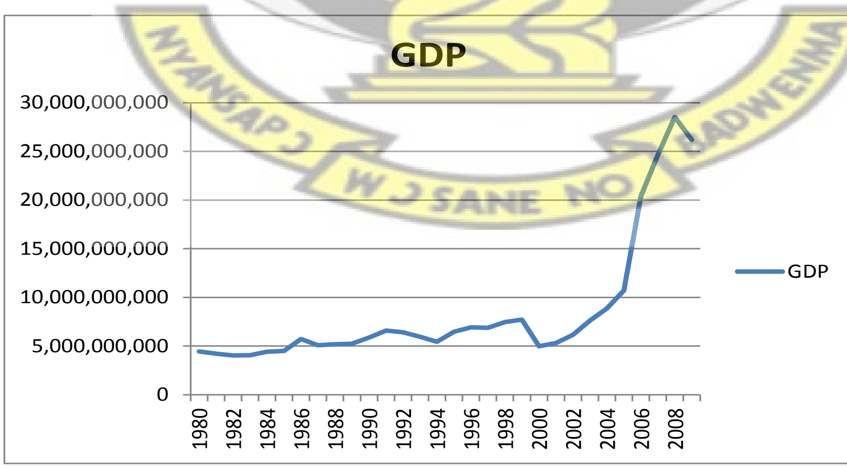

Figure 4.1 Real GDP (1980 – 2009)

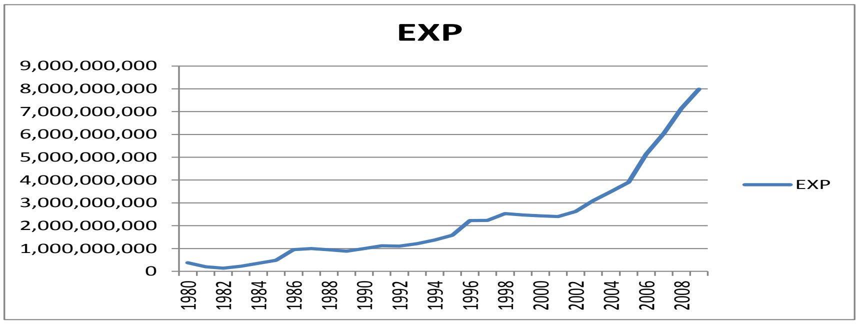

Figure 4.2 Real export (1980 – 2009)

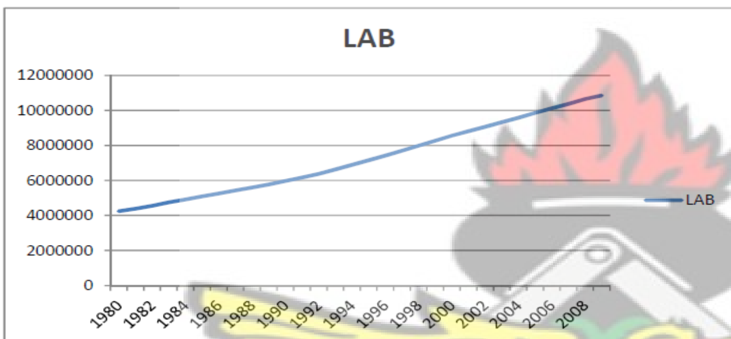

Figure 4.3 Total labour force (1980 – 2009)

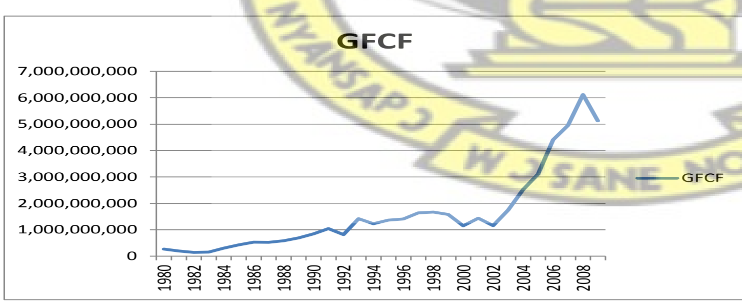

figure 4.4 Gross fixed capital formation (1980 – 2009)

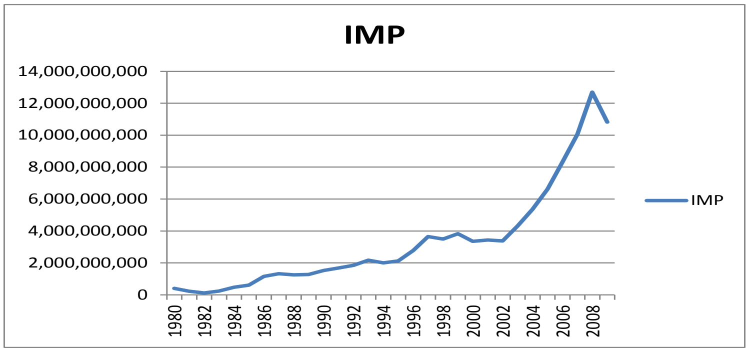

Figure 4.5 Real import (1980 – 2009)

From the above, it can be seen that all the macroeconomic variables are trending upward. Table 4.1 below shows the descriptive statistics of these variables. The data are expressed in their real forms.

TABLE 4.1: Descriptive Statistics for the variables (expressed in real forms).

Descriptive statistics	**GDP**	**EXP**	**GFCF**	**LAB**	**IMP**
Mean	8,535,296,413	2,221,191,273	1,619,103,937	7,257,247	3,350,451,293
Max	28,526,922,399	7,982,089,347	6,119,680,499	10,849,673	12,690,121,348
Min	4,035,994,542	134,733,899	142,530,342	4,241,493	120,354,802

Source: Author's calculation.

The annual average GDP for the period under study is $ 8,535,296,413.The highest GDP (28,526,922,399) was recorded in2008 during which the economy grew by 7.3 per cent. This was attributed to strong growth in agriculture, industry and services.

Real export which had declined from early 80s rose in the mid 80s and has since follow positive trend. The highest export was recorded in 2009; a year after highest GDP was recorded. However, GDP fell in that year from the previous figure. Although labor force grew throughout the 1980s, the structure of employment remained relatively stable with annual average of 7,257,247.

Gross fixed capital formation had since 1980s been rising steadily with annual average of $1,619,103,937. Finally, real import has risen throughout the period with an average of $3,350,451,293.

4.2 Unit Root Tests

To ensure that all the variables used in this study are stationary or cointegrated so as to avoid spurious regression, unit root tests were conducted. The tests were conducted using Kitawoski-Phillips-Schmidt-Shin (KPSS) test. The critical value applied to KPSS tests was 5 per cent level of significance. The KPSS test for stationarity involves testing the null hypothesis of stationarity. In appendix A, KPSS test results are presented.

From the appendix A, it can be seen that the null hypothesis of sationarity by the KPSS test cannot be accepted for all the variables. The test shows that the series are non-stationary in first difference with constant and trend.

4.3 Lag Length Selection

In order to estimate the appropriate number of lags entering both the VAR (P) and the VARX (P,b), the following model selection criteria were used:

(1) Akaike information criterion(AIC),

(2) Schwarz information criterion(SBC) and

(3) Hannan- Quinn information criterion (HQ) .

The optimum number of lags (P) or (P,b) is when the AIC, SBC and HQ are minimum as shown in the table below.

Table 4.2 : Lag Order Selection Criteria

Endogenous variables: LNEXPORT LNGDP

Exogenous variables: C

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-22.10083	NA	0.020436	1.785247	1.881235	1.813789
1	35.50775	102.4153*	0.000386*	-2.185759*	-1.897796*	-2.100133*
2	36.44964	1.534934	0.000487	-1.959233	-1.479293	-1.816521
3	38.93469	3.681554	0.000554	-1.847014	-1.175099	-1.647218

* 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

Using the least square estimation procedure, it can be observed in the table 3 above that the three model selection criteria are minimum for VAR (P) when the model uses 1 lag.

Similarly, using least square estimation procedure, the three model selection criteria are minimum for VAR (P,b) when the model uses 2 lags. This is shown below.

Table 4.3 :VAR Lag Order Selection Criteria

Endogenous variables: LNGDP LNEXPORT

Exogenous variables: C LNGFCF LNIMPORT LNLABOR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	41.82055	NA	0.000281	-2.505226	-2.121274	-2.39157
1	52.67987	16.89227	0.000171	-3.013323	-2.437396	-2.842070
2	60.26365	10.67348*	0.000134*	-3.278789*	-2.510886*	-3.050451*
3	64.08090	4.806899	0.000141	-3.265252	-2.305372	-2.979829

* indicates lag order selected by the criterion

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

The optimum number of lag(s) for each model is used to test for cointegration between GDP and export.

4.4 Johansen's Test for cointegration

Appendix B summarizes the Johansen's cointegration test applied on variables in the models. Examining the results carefully, it is apparent that the null hypothesis of no cointegrating equation is rejected at 5% for VAR (P) and at both 5% and 1% level of significance for VAR (P,b). However, the null hypothesis that there exists at most one cointegrating vector for VAR (P) is not.

The maximum eigenvalue for no cointegrating vector for VAR (P) is 23.138 while the critical value at 5% level is 18.96 hence the rejection of null hypothesis. Similarly, the maximum eigenvalue for at most one cointegrating vector for VAR (P) is 2.967 while the critical value at 5% level of significance is 12.25. From the above, it is clear that the null hypothesis that there is at most one cointegrating vector for VAR (P) cannot be rejected at 5% level of significance.

However, for VARX (P,b), the maximum eigenvalue for null hypothesis that there is no cointegrating vactor(s) is 30.764. The critical value at 1% and 5% level of significance is 15.67 and 20.20 respectively. Since the maximum eigenvalue is greater than critical values, the null hypothesis that there is no cointegrating vector(s) at 5% and 1% level of significantce is rejected. Thus, the tests show evidence of two cointegrating relationship for VARX (P,b).

The above findings establish the existence of long-run equilibrium relationship between GDP and export for both VAR (P) and VARX (P,b).

4.5 Models Residuals Diagnostics

To determine the adequacy of the selected econometric models, normality tests and test for autocorrelation were conducted. Using portemantau test for autocorrelation, we fail to reject the null hypothesis that there is no serial correlation up to specified number of lags for both VAR (P) and VARX (P,b). For normality tests, Jarque-Bera test and White test for heteroscedasticity were employed. Using chi-Square statistics for white test, we accept the null hypothesis of homoscedasticity. For Jarque-Bera test, it can be observed in Appendix C that the residuals are normally distributed at 5% level of significance since P-value is greater than 0.05. From the above, it is clear that the selected econometric models passed all diagnostics test.

4.6 Granger-Causality

To determine the causality between exports and economic growth, Granger causality tests were performed. The lagged coefficients of the independent variables are used to determine the short-run causality between export and economic growth. However, the long-run causality is determined by the lagged error correction terms included in the model.

4.6.1 Causality from Exports to GDP for bi-variate VAR model without Exogenous Variables

Below is the results of Pairwise Granger causality tests for vector autoregressive model without exogenous variables (VAR(P)).

Table 4.4: Pairwise granger causality test

Null Hypothesis	Obs	F-statistics	Probability
DLN GDP does not Granger cause DLN EXPORT	28	5.00613	0.03441
DLN EXPORT does not Granger cause DLN GDP		0.98396	0.33073

From the table, it can be observed that the null hypothesis that exports do not granger cause economic growth cannot be rejected at 5% level of significance since the reported P-value is 0.33075. This means, in the short-run, export-led growth hypothesis is not valid for Ghana.

The result of long run causality test is shown in table 4.5 below.

Ho: Export does not Granger cause Economic Growth in the Long run

Table 4.5 : Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1000.805	(1, 23)	0.0000
Chi-square	1000.805	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
Ectx	1.023272	0.032346

Restrictions are linear in coefficients.

Using the F-statistics in table 4.5, the null hypothesis that export does not granger cause economic growth cannot be accepted considering the p-value. The coefficient of error correction term 1.02 (102%) indicates a very strong causal relationship between export and economic growth.

4.6.2 Causality from GDP to Exports for bi-variate VAR model without Exogenous Variables.

The results of Pairwise granger causality test for growth-led export hypothesis is presented in table 4.6 below.

Table 4.6: Pairwise granger causality test

Null Hypothesis	Obs	F-statistics	Probability
DLN GDP does not Granger cause DLN EXPORT	28	5.00613	0.03441
DLN EXPORT does not Granger cause DLN GDP		0.98396	0.33073

At 5% level of significance, it can be seen that the null hypothesis that GDP does not granger cause economic growth cannot be accepted since the reported P-value is 0.0344. The result indicates a unidirectional causality running from GGP to export in the short run. The implication of this finding is that, in the short-run, growth-led export hypothesis holds for Ghana.

The long run causality result is presented in table 4.8 below.

Ho: GDP does not Granger cause Export in the Long run

Table 4.7 : Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	27.19408	(1, 23)	0.0000
Chi-square	27.19408	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
ECTG1	1.041250	0.199672

Restrictions are linear in coefficients

From the wald test results in table 4.9 above, it can be seen that the reported p-value is less than F statistics. Thus, the null hypothesis that GDP does not granger cause export in the long run cannot be accepted. The finding therefore establishes a bidirectional causality between GDP and export in the long run. The causality running from GDP to export is stronger than the causality running from export to GDP. This is because the coefficient of error correction term in table 4.8 above is 1.04.

From the above analysis, it is clear that export-led growth hypothesis is not valid for Ghana in the short-run using bi-variate VAR model without exogenous variables. In the long-run however, there is bidirectional causality between GDP and exports.

4.6.3 Causality from Export to GDP for bi-variate VAR model with Exogenous Variables

Table 4.9 presents the results of short-run tests for export-led growth hypothesis under the null hypothesis that export does not granger-cause economic growth.

Ho: Export does not Granger cause GDP in the Short run

Table 4.8 : Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.062598	(2, 19)	0.9395
Chi-square	0.125196	2	0.9393

From Wald test results, the reported F-statistics is 0.0626 while the p-value is 0.9395. Since the p-value is greater than F-statistics, we are unable to reject the null hypothesis. Thus, in the short-run, export does not granger cause economic growth.

Similarly, the F-statistics for long-run causality from export to GDP under the null hypothesis that export does not granger cause economic growth is 1.9381. The reported p-value is 0.1800. This is shown in table 4.10 below.

Ho: Export does not Granger cause GDP in the Long run

Table 4.9 : Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.938106	(1, 19)	0.1800
Chi-square	1.938106	1	0.1639

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
ECX1	0.860309	0.617967

Restrictions are linear in coefficients.

Therefore, the null hypothesis that in the long-run export does not granger cause economic growth cannot be accepted. The causality between the two variables is about 86%.

4.6.4Causality from GDP to Export with VAR model with Exogenous Variables

The result of short-run test for growth-led export hypothesis is presented in table 4.11.

Ho: GDP does not granger cause export

Table 4.10 : Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	4.587938	(2, 19)	0.0237
Chi-square	9.175876	2	0.0102

From the table, it can be observed that the reported F-statistics under the null hypothesis that growth does not Granger cause export is 4.5879. The corresponding p-value for the same hypothesis is 0.0237. From the above, it is obvious that the null hypothesis cannot be accepted. In the short-run therefore, growth- led export hypothesis is valid for Ghana.

In the same way, the reported F-statistics in table 4.12 under the null hypothesis that GDP does not Granger cause export in the long-run is 3.9200.

Table 4.11 : Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	3.920027	(1, 19)	0.0624
Chi-square	3.920027	1	0.0477

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
ECTG1	0.733458	0.370451

Restrictions are linear in coefficients.

The reported p-value for the null hypothesis is 0.0624. Since the p-value is less than the F-statistics, the null hypothesis is rejected. Thus, using bi variate VAR model with exogenous variables, unidirectional causality running from GDP to export is found in the short-run while bidirectional causality is found between GDP and export in the long-run.

4.7 Comparative Analysis

In testing for the export-led growth hypothesis, the results of vector autoregressive model without exogenous variables are not so much different from the results of vector autoregressive model with exogenous variables. For cointegraion test, the results differ slightly. For vector autoregressive model without exogenous variable, one cointegrating relationship is found. This is presented in table 4.13.

Table 4.12 : Maximum-eigenvalue test for VAR (P)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.562366	23.13845	18.96	23.65
At most 1	0.100541	2.966927	12.25	16.26

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level
Max-eigenvalue test indicates no cointegration at the 1% level

However, for vector autoregressive model with exogenous variables, two cointegrating relationship is found. This is shown in table 4.14

Table 4.13 : Maximum-eigenvalue test for VAR (Pb)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.679987	30.76365	15.67	20.20
At most 1 **	0.430024	15.17835	9.24	12.97

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 2 cointegrating equation(s) at both 5% and 1% levels

However, both models establish the existence of long-run equilibrium relationship between export and economic growth.

In both models, unidirectional causality running from GDP to export is found in the short-run. In the long-run however, bidirectional causality is found between export and GDP. In terms of strength of long run causality between the two models, the causality running from GDP to export for vector autoregressive without exogenous variables is stronger than that of vector autoregressive model with exogenous variables. Again, the causality running from export to GDP for vector autoregressive model without exogenous variable is stronger than that of vector autoregressive model with exogenous variables.

This chapter presented the findings of the empirical studies. This follows from the analysis of the data collected. The next chapter summarizes the key findings and offers some recommendations based on the findings of the study.

CHAPTER FIVE

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

This chapter presents the major findings of the study. It also offers recommendations to enhance export performance on economic growth.

5.1Summary of Findings

The findings of the study are summarized below.

Tests for stationarity indicated that all the series were non-stationary in levels with trend. The series became stationary when their first difference was taking. For the purpose of comparative analysis, two different bi-variate vector autoregressive models were developed. These were vector autoregressive model with and without exogenous variables.

With respect to bi-variate vector autoregressive model without exogenous variables, one cointegrating vector was found. However, two cointegrating vectors were found with bi-variate vector autoregressive model with exogenous variables.

Cointegration test indicated a positive relationship between GDP and export. This is consistent with neoclassical trade theory.

The study found unidirectional causality running from GDP to export for both models in the short-run while bidirectional causality between GDP and export was found in the long-run.

The result could be explained by the fact that, Ghana's principal export commodities are cocoa, timber, gold and other minerals. The gestation period associated with production of these commodities is long. In view of this, when export promotion strategy is adopted, it takes a long time for full impact to be felt, ie there is a lag between policy implementation and the effect of policy on export. This explains why export does not contribute to growth in the short run but in the long- run .

5.2 Policy Implication

As pointed out earlier, granger causality tests indicate that there is unidirectional causality running from GDP to export in the short-run and bidirectional causality in the log-run. The implication of the finding is that export-led growth hypothesis is not valid for Ghana in the short-run. However, in the long-run it is valid because export and economic growth complement each other. This means, export promotion strategies adopted today will have their greatest effect on GDP in the long run.

5.3 Recommendations

Based on the above findings, the following policy directions are recommended to improve export performance on economic growth.

In view of positive relationship between export performance and economic growth, attempt should be made to increase export as a way of enhancing GDP growth. Such policy measures facilitate export by domestic firms and diversify our export commodities and export markets.

Government should therefore assist Ghanaian firms (especially small and medium-size producers) to penetrate international markets by offering fiscal incentives such as reduction in export taxes or offering export subsidies, subsidized loans for exporters as well as training and capacity building to improve the quality and packaging of export products to enhance their competitiveness.

In addition, opportunity should be provided (with government assistance) to Ghanaian exporters to participate in international trade fairs to expose "Made in Ghana" products and create new markets for Ghanaian goods. Since some of the benefits emanating from such activities leak out in the form of externalities, the initial participation of a firm in an international trade fair should be subsidized by the government.

To achieve sustainable growth, attempt should be made to diversify from primary exports into manufactured and service exports. This will reduce adverse effects of export instability on growth. The existing policy on improving non-traditional exports is an example of such initiative. This policy should be extended to other potentially exportable commodities such as manufacturing and service to broaden the export base.

Since there is a lag between export growth and economic performance, policymakers should also pay attention to other variables of growth such as private investment and consumption that can have immediate effect on exports in order to minimize the effect of economic cycle.

5.4 Limitation of Finding

Attempts were made to ensure the validity of the study and its generalization. However, like all academic endeavors, there are certain weaknesses of the study which could be addressed by future authors.

In finding the long-run relationship between GDP and export, the critical value of exogenous variables were not reported by Eviews. It therefore becomes difficult to say whether the signs of the exogenous variables conform to priori expectation.

In addition, the inability to obtain data on labour and capital before 1980 has led to the use of small sample size which obviously will limit the generalization of the study.

5.5 Conclusion

For both models, the study found unidirectional causality running from GDP to export in the short run and bidirectional causality between GDP and export in the long run. Thus, in the long run, there is evidence in support of export-led growth hypothesis as well as reverse causality for Ghana. Therefore, for Ghana to achieve high economic growth, policies aimed at export expansion should be promoted. Besides, it is also necessary to devote resources on the non-export goods and services production in order to increase export.

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APPENDICES

APPENDIX A: Kwiatkowski-Phillips-Schmidt-Shin) KPSS TEST FOR UNIT ROOT:

Kpss in levels:

Null Hypothesis: LNEXPORT is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.188848
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.059018
HAC corrected variance (Bartlett kernel)	0.107803

Null Hypothesis: LNGDP is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West using Bartlett kernel)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.127216
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.043357
HAC corrected variance (Bartlett kernel)	0.111802

Null Hypothesis: LNGFCF is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West using Bartlett kernel)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.097933
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.100822
HAC corrected variance (Bartlett kernel)	0.247825

KPSS Test Equation
Dependent Variable: LNGFCF
Method: Least Squares
Date: 03/29/11 Time: 14:24
Sample: 1980 2009
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.17539	0.117074	163.7892	0.0000
@TREND(1980)	0.109822	0.006933	15.84096	0.0000
R-squared	0.899619	Mean dependent var		20.76781
Adjusted R-squared	0.896033	S.D. dependent var		1.019325
S.E. of regression	0.328669	Akaike info criterion		0.676812
Sum squared resid	3.024660	Schwarz criterion		0.770225
Log likelihood	-8.152177	F-statistic		250.9360
Durbin-Watson stat	0.579674	Prob(F-statistic)		0.000000

Null Hypothesis: LNIMPORT is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West using Bartlett kernel)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.112901
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.129020
HAC corrected variance (Bartlett kernel)	0.300296

KPSS Test Equation
Dependent Variable: LNIMPORT
Method: Least Squares
Date: 03/29/11 Time: 14:25
Sample: 1980 2009
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.55303	0.132437	147.6403	0.0000
@TREND(1980)	0.128225	0.007843	16.34988	0.0000
R-squared	0.905187	Mean dependent var		21.41229

Adjusted R-squared	0.901801	S.D. dependent var	1.186467
S.E. of regression	0.371800	Akaike info criterion	0.923420
Sum squared resid	3.870589	Schwarz criterion	1.016833
Log likelihood	-11.85130	F-statistic	267.3184
Durbin-Watson stat	0.596674	Prob(F-statistic)	0.000000

Null Hypothesis: LNLABOR is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West using Bartlett kernel)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.144846
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000173
HAC corrected variance (Bartlett kernel)	0.000585

KPSS Test Equation
Dependent Variable: LNLABOR
Method: Least Squares
Date: 03/29/11 Time: 14:25
Sample: 1980 2009
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.27379	0.004852	3147.891	0.0000
@TREND(1980)	0.033315	0.000287	115.9484	0.0000

R-squared	0.997922	Mean dependent var	15.75686
Adjusted R-squared	0.997847	S.D. dependent var	0.293593
S.E. of regression	0.013622	Akaike info criterion	-5.689981
Sum squared resid	0.005195	Schwarz criterion	-5.596568
Log likelihood	87.34972	F-statistic	13444.03
Durbin-Watson stat	0.111282	Prob(F-statistic)	0.000000

KPSS FOR FIRST DIFFERENCE

Null Hypothesis: D(LNEXPORT) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.094615
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.021595
HAC corrected variance (Bartlett kernel)	0.023872

KPSS Test Equation
Dependent Variable: D(LNEXPORT)
Method: Least Squares
Date: 03/26/11 Time: 21:34
Sample(adjusted): 1981 2009
Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.072846	0.058057	-1.254725	0.2203
@TREND(1980)	0.009237	0.003380	2.732676	0.0109

R-squared	0.216654	Mean dependent var	0.065710
Adjusted R-squared	0.187641	S.D. dependent var	0.168973
S.E. of regression	0.152297	Akaike info criterion	-0.859492
Sum squared resid	0.626251	Schwarz criterion	-0.765196
Log likelihood	14.46264	F-statistic	7.467519
Durbin-Watson stat	1.822723	Prob(F-statistic)	0.010944

Null Hypothesis: D(LNGDP) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West using Bartlett kernel)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.094438
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.015700
HAC corrected variance (Bartlett kernel)	0.014280

KPSS Test Equation
Dependent Variable: D(LNGDP)

Method: Least Squares
Date: 03/26/11 Time: 21:36
Sample(adjusted): 1981 2009
Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.019139	0.049502	-0.386634	0.7021
@TREND(1980)	0.004537	0.002882	1.574201	0.1271
R-squared	0.084066	Mean dependent var		0.048916
Adjusted R-squared	0.050143	S.D. dependent var		0.133239
S.E. of regression	0.129856	Akaike info criterion		-1.178315
Sum squared resid	0.455287	Schwarz criterion		-1.084019
Log likelihood	19.08557	F-statistic		2.478108
Durbin-Watson stat	1.829111	Prob(F-statistic)		0.127087

Null Hypothesis: D(LNGFCF) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 5 (Newey-West using Bartlett kernel)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.093682
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.059358
HAC corrected variance (Bartlett kernel)	0.049609

KPSS Test Equation
Dependent Variable: D(LNGFCF)
Method: Least Squares
Date: 03/26/11 Time: 21:37
Sample(adjusted): 1981 2009
Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.052169	0.096254	0.541989	0.5923
@TREND(1980)	0.003961	0.005604	0.706840	0.4857
R-squared	0.018168	Mean dependent var		0.111587
Adjusted R-squared	-0.018196	S.D. dependent var		0.250230
S.E. of regression	0.252497	Akaike info criterion		0.151636
Sum squared resid	1.721375	Schwarz criterion		0.245932
Log likelihood	-0.198715	F-statistic		0.499623
Durbin-Watson stat	1.844863	Prob(F-statistic)		0.485722

Null Hypothesis: D(LNIMPORT) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West using Bartlett kernel)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.063383
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.079165
HAC corrected variance (Bartlett kernel)	0.090780

KPSS Test Equation
Dependent Variable: D(LNIMPORT)
Method: Least Squares
Date: 03/26/11 Time: 21:43
Sample(adjusted): 1981 2009
Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.084252	0.111160	0.757935	0.4551
@TREND(1980)	0.002446	0.006472	0.377883	0.7085

R-squared	0.005261	Mean dependent var	0.120937
Adjusted R-squared	-0.031581	S.D. dependent var	0.287100
S.E. of regression	0.291598	Akaike info criterion	0.439592
Sum squared resid	2.295797	Schwarz criterion	0.533889
Log likelihood	-4.374090	F-statistic	0.142795
Durbin-Watson stat	1.227842	Prob(F-statistic)	0.708472

Null Hypothesis: D(LNLABOR) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West using Bartlett kernel)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.125859
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	1.09E-05
HAC corrected variance (Bartlett kernel)	3.39E-05

KPSS Test Equation
Dependent Variable: D(LNLABOR)
Method: Least Squares
Date: 03/26/11 Time: 21:46
Sample(adjusted): 1981 2009
Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.037848	0.001303	29.03829	0.0000
@TREND(1980)	-0.000349	7.59E-05	-4.605222	0.0001
R-squared	0.439928	Mean dependent var		0.032606
Adjusted R-squared	0.419184	S.D. dependent var		0.004486
S.E. of regression	0.003419	Akaike info criterion		-8.452406
Sum squared resid	0.000316	Schwarz criterion		-8.358110
Log likelihood	124.5599	F-statistic		21.20807
Durbin-Watson stat	0.526718	Prob(F-statistic)		0.000088

APPENDIX B: JOHANSON COINTEGRATION TEST FOR VAR (P)

MODEL SELECTION

Date: 03/29/11 Time: 09:43
Sample: 1980 2009
Included observations: 28
Series: LNEXPORT LNGDP
Lags interval: 1 to 1

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model					

(columns)					
Trace	0	0	0	1	1
Max-Eig	0	0	0	1	1
Log Likelihood by Rank (rows) and Model (columns)					
0	32.22017	32.22017	34.79393	34.79393	36.40243
1	35.14963	35.51612	37.13333	46.36316	46.81801
2	35.46817	37.62098	37.62098	47.84662	47.84662
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	-2.015726	-2.015726	-2.056709	-2.056709	-2.028745
1	-1.939259	-1.894008	-1.938095	-2.525940*	-2.487001
2	-1.676298	-1.687213	-1.687213	-2.274759	-2.274759
Schwarz Criteria by Rank (rows) and Model (columns)					
0	-1.825411	-1.825411	-1.771237	-1.771237	-1.648115
1	-1.558629	-1.465800	-1.462308	-2.002574*	-1.916056
2	-1.105353	-1.021111	-1.021111	-1.513499	-1.513499

RESULT: Both the AIC and SIC selects model 4 (intercept and trend)

Johansson cointegration equations

Date: 03/29/11 Time: 09:45
Sample(adjusted): 1982 2009
Included observations: 28 after adjusting endpoints
Trend assumption: Linear deterministic trend (restricted)
Series: LNEXPORT LNGDP
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test

Hypothesized	Trace	5 Percent	1 Percent

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None *	0.562366	26.10538	25.32	30.45
At most 1	0.100541	2.966927	12.25	16.26

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 1 cointegrating equation(s) at the 5% level
Trace test indicates no cointegration at the 1% level

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.562366	23.13845	18.96	23.65
At most 1	0.100541	2.966927	12.25	16.26

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level
Max-eigenvalue test indicates no cointegration at the 1% level

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LNEXPORT	LNGDP	@TREND(81)
-6.819694	4.174713	0.500352
-1.305403	5.640861	-0.151525

Unrestricted Adjustment Coefficients (alpha):

D(LNEXPORT)	0.102123	-0.009814
D(LNGDP)	0.013648	-0.040658

1 Cointegrating Equation(s): Log likelihood 46.36316

Normalized cointegrating coefficients (std.err. in parentheses)

LNEXPORT	LNGDP	@TREND(81)
1.000000	-0.612155	-0.073369
	(0.15427)	(0.00641)

Adjustment coefficients (std.err. in parentheses)

D(LNEXPORT)	-0.696449
	(0.13260)
D(LNGDP)	-0.093072
	(0.17929)

VECM

Vector Error Correction Estimates
Date: 03/29/11 Time: 09:48
Sample(adjusted): 1982 2009
Included observations: 28 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
LNEXPORT(-1)	1.000000	
LNGDP(-1)	-0.612155	
	(0.15427)	
	[-3.96818]	
@TREND(80)	-0.073369	
	(0.00641)	
	[-11.4399]	
C	-6.228099	
Error Correction:	D(LNEXPORT)	D(LNGDP)
CointEq1	-0.696449	-0.093072
	(0.13260)	(0.17929)
	[-5.25207]	[-0.51913]
D(LNEXPORT(-1))	-0.114804	0.068517
	(0.13094)	(0.17704)
	[-0.87677]	[0.38703]
D(LNGDP(-1))	-0.002124	0.066489
	(0.16773)	(0.22678)
	[-0.01266]	[0.29319]
C	0.088874	0.045044
	(0.02173)	(0.02938)
	[4.09032]	[1.53333]
R-squared	0.573748	0.045635
Adj. R-squared	0.520467	-0.073661
Sum sq. resids	0.254072	0.464440
S.E. equation	0.102890	0.139110
F-statistic	10.76824	0.382535
Log likelihood	26.10249	17.65752
Akaike AIC	-1.578750	-0.975537
Schwarz SC	-1.388435	-0.785222
Mean dependent	0.081537	0.052500
S.D. dependent	0.148581	0.134253
Determinant Residual Covariance		0.000170
Log Likelihood		46.36316
Log Likelihood (d.f. adjusted)		42.04694
Akaike Information Criteria		-2.217639
Schwarz Criteria		-1.694272

Dependent Variable: DLINEXPORT
Method: Least Squares
Date: 03/29/11 Time: 10:01
Sample(adjusted): 1983 2009
Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNGDP	1.748185	0.189083	9.245585	0.0000
ECTX1	0.350449	0.704167	0.497679	0.6232
C	-18.30711	4.276020	-4.281344	0.0003

R-squared	0.786596	Mean dependent var	21.22171
Adjusted R-squared	0.768813	S.D. dependent var	0.731589
S.E. of regression	0.351762	Akaike info criterion	0.852716
Sum squared resid	2.969677	Schwarz criterion	0.996698
Log likelihood	-8.511661	F-statistic	44.23144
Durbin-Watson stat	0.435380	Prob(F-statistic)	0.000000

Model selection for cointegration

Date: 03/29/11 Time: 13:27
Sample: 1980 2009
Included observations: 27
Series: LNGDP LNEXPORT
Exogenous series: LNGFCF LNIMPORT LNLABOR
Warning: Rank Test critical values derived assuming no exogenous series
Lags interval: 1 to 2

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	1	2	2	2	2
Max-Eig	1	2	2	2	2

Log Likelihood by Rank (rows) and Model (columns)					
0	41.10990	41.10990	43.43439	43.43439	46.95528
1	49.80404	56.49172	58.45974	58.65743	60.31309
2	51.00503	64.08090	64.08090	65.33448	65.33448
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	-2.452585	-2.452585	-2.476621	-2.476621	-2.589280
1	-2.800299	-3.221609	-3.293314	-3.233883	-3.282451
2	-2.592965	-3.413400*	-3.413400	-3.358110	-3.358110
Schwarz Criteria by Rank (rows) and Model (columns)					
0	-2.068633	-2.068633	-1.996682	-1.996682	-2.013352
1	-2.224372	-2.597687	-2.621399*	-2.513974	-2.514548
2	-1.825062	-2.549508	-2.549508	-2.398231	-2.398231

USING THE LR=2(Lur-Lr)=2(64.08090-58.4597)=11.24 comparing with the chi-square critical of 42.7 we fail to reject the HO: no trend. Hence we accept model 2.

Johanson Cointegration for VAR (P,b)

Date: 03/29/11 Time: 13:30
Sample(adjusted): 1983 2009
Included observations: 27 after adjusting endpoints
Trend assumption: No deterministic trend (restricted constant)
Series: LNGDP LNEXPORT
Exogenous series: LNGFCF LNIMPORT LNLABOR
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.679987	45.94200	19.96	24.60
At most 1 **	0.430024	15.17835	9.24	12.97

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 2 cointegrating equation(s) at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.679987	30.76365	15.67	20.20
At most 1 **	0.430024	15.17835	9.24	12.97

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 2 cointegrating equation(s) at both 5% and 1% levels

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LNGDP	LNEXPORT	C
-14.34184	13.72749	476.5694
-7.040573	0.364996	213.2178

Unrestricted Adjustment Coefficients (alpha):

D(LNGDP)	0.063408	0.055283
D(LNEXPORT)	-0.049490	0.065776

1 Cointegrating Equation(s): Log likelihood 56.49172

Normalized cointegrating coefficients (std.err. in parentheses)

LNGDP	LNEXPORT	C
1.000000	-0.957164	-33.22931
	(0.07724)	(2.64785)

Adjustment coefficients (std.err. in parentheses)

D(LNGDP)	-0.909388
	(0.31213)
D(LNEXPORT)	0.709781
	(0.34842)

APPENDIX C: MODEL RESIDUALS DIAGNOSTICS

A: PORTEMANTAU TEST FOR AUTOCORRELATION

VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h
Date: 03/29/11 Time: 14:03
Sample: 1980 2009
Included observations: 29

Lags	LM-Stat	Prob
1	1.050030	0.9021
2	3.715517	0.4459
3	1.823722	0.7681
4	1.417152	0.8412
5	0.887287	0.9264
6	1.413085	0.8419
7	0.186256	0.9959
8	1.966077	0.7420
9	1.125309	0.8902
10	2.200932	0.6989
11	4.517541	0.3405
12	3.080560	0.5444

Probs from chi-square with 4 df.

Decision: we fail to reject hence no autocorrelation

NORMALITY

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
H0: residuals are multivariate normal
Date: 03/29/11 Time: 14:06
Sample: 1980 2009
Included observations: 29

Component	Skewness	Chi-sq	df	Prob.
1	-0.337442	0.550358	1	0.4582
2	-1.975261	18.85800	1	0.0000

Joint		19.40835	2	0.0001

Component	Kurtosis	Chi-sq	df	Prob.
1	3.090593	0.009917	1	0.9207
2	8.364726	34.77618	1	0.0000
Joint		34.78610	2	0.0000

Component	Jarque-Bera	df	Prob.
1	0.560274	2	0.7557
2	53.63418	2	0.0000
Joint	54.19445	4	0.0000

USING THE JARQUE-BERA TEST we reject the null hypothesis and conclude that the var model is normally distributed

WHITE TEST FOR HETERO

HO: HOMOSCEDASTIC

VAR Residual Heteroskedasticity Tests: Includes Cross Terms
Date: 03/29/11 Time: 14:11
Sample: 1980 2009
Included observations: 29

Joint test:

Chi-sq	df	Prob.
15.06034	15	0.4471

Individual components:

Dependent	R-squared	F(5,23)	Prob.	Chi-sq(5)	Prob.
res1*res1	0.336281	2.330644	0.0750	9.752148	0.0826
res2*res2	0.073967	0.367426	0.8656	2.145044	0.8287
res2*res1	0.175564	0.979570	0.4512	5.091347	0.4048

APPENDIX D :VAR MODEL FOR EXPORT AND GDP

Vector Autoregression Estimates
Date: 03/29/11 Time: 09:41
Sample(adjusted): 1981 2009
Included observations: 29 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

	LNEXPORT	LNGDP
LNEXPORT(-1)	0.892977	0.076260
	(0.08863)	(0.07566)
	[10.0755]	[1.00795]
LNGDP(-1)	0.360380	0.921833
	(0.17157)	(0.14646)
	[2.10046]	[6.29389]
C	-5.804952	0.198344
	(2.38100)	(2.03258)
	[-2.43803]	[0.09758]
R-squared	0.962006	0.901552
Adj. R-squared	0.959084	0.893979
Sum sq. resids	0.642469	0.468194
S.E. equation	0.157195	0.134192
F-statistic	329.1624	119.0490
Log likelihood	14.09190	18.68022
Akaike AIC	-0.764959	-1.081394
Schwarz SC	-0.623514	-0.939950
Mean dependent	21.25319	22.63125
S.D. dependent	0.777126	0.412126
Determinant Residual Covariance		0.000357
Log Likelihood (d.f. adjusted)		32.79672
Akaike Information Criteria		-1.848050
Schwarz Criteria		-1.565161

APPENDIX E :PAIRWISE GRANGER CAUSALITY

Pairwise Granger Causality Tests
Date: 03/29/11 Time: 10:49
Sample: 1980 2009

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
DLNGDP does not Granger Cause DLINEXPORT	28	5.00613	0.03441
DLINEXPORT does not Granger Cause DLNGDP		0.98396	0.33073

RESULTS: this implies that in the short run there is unidirectional (one way) causality from GDP to exports

VEC GRANGER CAUSALITY

A. export equation

Dependent Variable: DLINEXPORT
Method: Least Squares
Date: 03/29/11 Time: 10:52
Sample(adjusted): 1983 2009
Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNEXPORT_1	0.900936	0.058335	15.44414	0.0000
DLNGDP_1	0.348311	0.121236	2.872992	0.0086
ECTX1	1.041250	0.199672	5.214794	0.0000
C	-5.683846	1.770914	-3.209555	0.0039
R-squared	0.983427	Mean dependent var	21.22171	
Adjusted R-squared	0.981265	S.D. dependent var	0.731589	
S.E. of regression	0.100137	Akaike info criterion	-1.628608	
Sum squared resid	0.230629	Schwarz criterion	-1.436632	
Log likelihood	25.98621	F-statistic	454.9271	
Durbin-Watson stat	1.138837	Prob(F-statistic)	0.000000	

APPENDIX F : VAR MODEL WITH EXOGENOUS VARIABLES

Vector Autoregression Estimates
Date: 03/29/11 Time: 13:24
Sample(adjusted): 1982 2009
Included observations: 28 after adjusting Endpoints
Standard errors in ( ) & t-statistics in [ ]

	LNGDP	LNEXPORT
LNGDP(-1)	0.473122	0.284966
	(0.23761)	(0.23984)
	[1.99120]	[1.18815]

LNGDP(-2)	-0.642787	-0.185396
	(0.22439)	(0.22650)
	[-2.86464]	[-0.81854]
LNEXPORT(-1)	0.386316	0.312013
	(0.23711)	(0.23934)
	[1.62927]	[1.30365]
LNEXPORT(-2)	0.327425	0.258384
	(0.20354)	(0.20545)
	[1.60867]	[1.25765]
C	34.31992	-7.471180
	(11.2289)	(11.3344)
	[3.05640]	[-0.65916]
LNGFCF	0.514283	0.191115
	(0.13964)	(0.14095)
	[3.68299]	[1.35591]
LNIMPORT	0.014451	-0.016777
	(0.13753)	(0.13882)
	[0.10508]	[-0.12085]
LNLABOR	-2.154654	0.683215
	(0.85054)	(0.85854)
	[-2.53327]	[0.79579]
R-squared	0.948224	0.985411
Adj. R-squared	0.930103	0.980305
Sum sq. resids	0.234509	0.238938
S.E. equation	0.108284	0.109302
F-statistic	52.32579	192.9884
Log likelihood	27.22427	26.96232
Akaike AIC	-1.373162	-1.354451
Schwarz SC	-0.992532	-0.973821
Mean dependent	22.64795	21.27878
S.D. dependent	0.409575	0.778845
Determinant Residual Covariance		0.000119
Log Likelihood (d.f. adjusted)		46.99467
Akaike Information Criteria		-2.213905
Schwarz Criteria		-1.452645

Model selection for cointegration

Date: 03/29/11 Time: 13:27
Sample: 1980 2009
Included observations: 27
Series: LNGDP LNEXPORT
Exogenous series: LNGFCF LNIMPORT LNLABOR
Warning: Rank Test critical values derived assuming no exogenous series
Lags interval: 1 to 2

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Selected (5% level) Number of Cointegrating Relations by Model (columns)					
Trace	1	2	2	2	2
Max-Eig	1	2	2	2	2
Log Likelihood by Rank (rows) and Model (columns)					
0	41.10990	41.10990	43.43439	43.43439	46.95528
1	49.80404	56.49172	58.45974	58.65743	60.31309
2	51.00503	64.08090	64.08090	65.33448	65.33448
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	-2.452585	-2.452585	-2.476621	-2.476621	-2.589280
1	-2.800299	-3.221609	-3.293314	-3.233883	-3.282451
2	-2.592965	-3.413400*	-3.413400	-3.358110	-3.358110
Schwarz Criteria by Rank (rows) and Model (columns)					
0	-2.068633	-2.068633	-1.996682	-1.996682	-2.013352
1	-2.224372	-2.597687	-2.621399*	-2.513974	-2.514548
2	-1.825062	-2.549508	-2.549508	-2.398231	-2.398231

USING THE LR=2(Lur-Lr)=2(64.08090-58.4597)=11.24 comparing with the chi-square critical of 42.7 we fail to reject the HO: no trend. Hence we accept model 2.

Johansson Cointegration

Date: 03/29/11 Time: 13:30
Sample(adjusted): 1983 2009
Included observations: 27 after adjusting endpoints
Trend assumption: No deterministic trend (restricted constant)
Series: LNGDP LNEXPORT
Exogenous series: LNGFCF LNIMPORT LNLABOR
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.679987	45.94200	19.96	24.60
At most 1 **	0.430024	15.17835	9.24	12.97

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 2 cointegrating equation(s) at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.679987	30.76365	15.67	20.20
At most 1 **	0.430024	15.17835	9.24	12.97

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Max-eigenvalue test indicates 2 cointegrating equation(s) at both 5% and 1% levels

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LNGDP	LNEXPORT	C
-14.34184	13.72749	476.5694
-7.040573	0.364996	213.2178

Unrestricted Adjustment Coefficients (alpha):

D(LNGDP)	0.063408	0.055283
D(LNEXPORT)	-0.049490	0.065776

1 Cointegrating Equation(s): Log likelihood 56.49172

Normalized cointegrating coefficients (std.err. in parentheses)

LNGDP	LNEXPORT	C
1.000000	-0.957164	-33.22931
	(0.07724)	(2.64785)

Adjustment coefficients (std.err. in parentheses)

D(LNGDP)	-0.909388
	(0.31213)
D(LNEXPORT)	0.709781
	(0.34842)

Even though the maximum eigen value indicates two cointegration equation only one is reported. Also the critical values of the exogenous variables are not reported by eviews [“If you choose to include exogenous
variables, be aware that the critical values reported by EViews *do not account* for these variables”….. EViews 4 User’s Guide. Page 550)

Vector Error Correction Estimates
Date: 03/29/11 Time: 13:44
Sample(adjusted): 1983 2009
Included observations: 27 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNGDP(-1)	1.000000
LNEXPORT(-1)	-0.957164
	(0.07724)
	[-12.3919]
C	-33.22931
	(2.64785)
	[-12.5495]

Error Correction:	D(LNGDP)	D(LNEXPORT)
CointEq1	-0.909388	0.709781

	(0.31213)	(0.34842)
	[-2.91351]	[2.03716]
D(LNGDP(-1))	0.519224	-0.160961
	(0.23813)	(0.26582)
	[2.18041]	[-0.60553]
D(LNGDP(-2))	0.051786	-0.116240
	(0.19696)	(0.21986)
	[0.26293]	[-0.52871]
D(LNEXPORT(-1))	-0.420231	-0.084248
	(0.21086)	(0.23537)
	[-1.99298]	[-0.35794]
D(LNEXPORT(-2))	-0.277715	-0.091201
	(0.19849)	(0.22157)
	[-1.39915]	[-0.41162]
LNGFCF	0.407184	-0.078807
	(0.17499)	(0.19534)
	[2.32686]	[-0.40344]
LNIMPORT	-0.022473	0.035704
	(0.15121)	(0.16879)
	[-0.14862]	[0.21153]
LNLABOR	-2.283367	1.451625
	(0.72347)	(0.80759)
	[-3.15612]	[1.79749]
R-squared	0.490343	0.437450
Adj. R-squared	0.302575	0.230194
Sum sq. resids	0.242982	0.302767
S.E. equation	0.113086	0.126234
F-statistic	2.611428	2.110680
Log likelihood	25.28181	22.31216
Akaike AIC	-1.280134	-1.060160
Schwarz SC	-0.896182	-0.676209
Mean dependent	0.056117	0.090285
S.D. dependent	0.135413	0.143875
Determinant Residual Covariance		0.000105
Log Likelihood		56.49172
Log Likelihood (d.f. adjusted)		47.00398
Akaike Information Criteria		-2.074369
Schwarz Criteria		-1.162483

APPENDIX G : VEC GRANGER CAUSALITY FOR VAR (P)

A. export equation

Dependent Variable: DLINEXPORT
Method: Least Squares
Date: 03/29/11 Time: 10:52
Sample(adjusted): 1983 2009
Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNEXPORT_1	0.900936	0.058335	15.44414	0.0000
DLNGDP_1	0.348311	0.121236	2.872992	0.0086
ECTX1	1.041250	0.199672	5.214794	0.0000
C	-5.683846	1.770914	-3.209555	0.0039
R-squared	0.983427	Mean dependent var	21.22171	
Adjusted R-squared	0.981265	S.D. dependent var	0.731589	
S.E. of regression	0.100137	Akaike info criterion	-1.628608	
Sum squared resid	0.230629	Schwarz criterion	-1.436632	
Log likelihood	25.98621	F-statistic	454.9271	
Durbin-Watson stat	1.138837	Prob(F-statistic)	0.000000	

WALD TEST

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	8.254083	(1, 23)	0.0086
Chi-square	8.254083	1	0.0041

Normalized Restriction (= 0)	Value	Std. Err.
DLNGDP_1	0.348311	0.121236

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	27.19408	(1, 23)	0.0000
Chi-square	27.19408	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
ECTX1	1.041250	0.199672

Restrictions are linear in coefficients.

GDP equation

Dependent Variable: DLNGDP
Method: Least Squares
Date: 03/29/11 Time: 11:00
Sample(adjusted): 1983 2009
Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNGDP_1	1.105232	0.026399	41.86680	0.0000
DLNEXPORT_1	-0.025133	0.012762	-1.969331	0.0611
ECTG1	1.023272	0.032346	31.63550	0.0000
C	-1.790908	0.380986	-4.700717	0.0001

R-squared	0.997100	Mean dependent var	22.61144
Adjusted R-squared	0.996722	S.D. dependent var	0.368033
S.E. of regression	0.021071	Akaike info criterion	-4.745847
Sum squared resid	0.010212	Schwarz criterion	-4.553871
Log likelihood	68.06894	F-statistic	2636.204
Durbin-Watson stat	0.781221	Prob(F-statistic)	0.000000

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	3.878265	(1, 23)	0.0611
Chi-square	3.878265	1	0.0489

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
Export	-0.025133	0.012762

Restrictions are linear in coefficients.

Results: Using the F statistics EXPORT does not granger cause GDP (at 5%) in the short run. Confirming the pairwise granger causality test.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1000.805	(1, 23)	0.0000
Chi-square	1000.805	1	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
Ectg	1.023272	0.032346

Restrictions are linear in coefficients.

APPENDIX G : VECM CAUSALITY FOR VAR WITH LAB, IMPORT AND GFCF AS EXOGENOUS

1. GDP EQUATION

Dependent Variable: DLNGDP
Method: Least Squares
Date: 04/18/11 Time: 16:57
Sample(adjusted): 1985 2009
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNGDP_1	-0.027214	0.266872	-0.101974	0.9198
DLNGDP_2	0.488278	0.372452	1.310983	0.2055
DLNEXPORT_1	-0.007672	0.328908	-0.023325	0.9816
DLNEXPORT_2	-0.092114	0.273489	-0.336812	0.7400
ECTG_1	-0.860309	0.617967	-1.392159	0.1800
C	0.047264	0.051415	0.919273	0.3695

R-squared	0.182209	Mean dependent var	0.057041
Adjusted R-squared	-0.032999	S.D. dependent var	0.140442
S.E. of regression	0.142741	Akaike info criterion	-0.850008
Sum squared resid	0.387124	Schwarz criterion	-0.557478
Log likelihood	16.62510	F-statistic	0.846664
Durbin-Watson stat	2.051672	Prob(F-statistic)	0.533705

Testing for Granger causality
HO: export does not granger cause GDP

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.062598	(2, 19)	0.9395
Chi-square	0.125196	2	0.9393

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
Normalized Restriction (= 0)	Value	Std. Err.
ECTX1	0.860309	0.328908

Restrictions are linear in coefficients.

DECISION: From the F statistics shown above we fail to reject the null thus export in the short run does not granger cause GDP.

TESTING FOR LONG RUN GRANGER CAUSALITY

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.938106	(1, 19)	0.1800
Chi-square	1.938106	1	0.1639

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(5)	0.860309	0.617967

Restrictions are linear in coefficients.

DECISION: The result shows that in the long run there exist a causal relation btn export and gdp.

2. export equation

Dependent Variable: DLNEXPORT
Method: Least Squares
Date: 04/18/11 Time: 17:07
Sample(adjusted): 1985 2009
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNEXPORT_1	-0.673972	0.259290	-2.599295	0.0176
DLNEXPORT_2	0.101030	0.217730	0.464014	0.6479
DLNGDP_1	0.376951	0.163856	2.300507	0.0329
DLNGDP_2	0.461660	0.196303	2.351775	0.0296
ECTX_1	-0.733458	0.370451	-1.979906	0.0624
C	0.126007	0.033277	3.786576	0.0012

R-squared	0.342353	Mean dependent var	0.103650
Adjusted R-squared	0.169288	S.D. dependent var	0.106276
S.E. of regression	0.096863	Akaike info criterion	-1.625467
Sum squared resid	0.178268	Schwarz criterion	-1.332937
Log likelihood	26.31834	F-statistic	1.978174
Durbin-Watson stat	2.173071	Prob(F-statistic)	0.128348

TEST FOR GRANGER CUASALITY

Ho: GDP does not granger cause export

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	4.587938	(2. 19)	0.0237
Chi-square	9.175876	2	0.0102

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
ECTG1	0.733458	0.163856

Restrictions are linear in coefficients.

Decision: We fail to accept the null and hence GDP in the short run granger cause export.

LONG RUN CAUSALITY
Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	3.920027	(1, 19)	0.0624
Chi-square	3.920027	1	0.0477

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(5)	0.733458	0.370451

Restrictions are linear in coefficients.

Decision:
We reject the null and conclude that a long run causality btn gdp and export