

Relationship between Exports, Imports, and Economic Growth in Saudi Arabia: 1990-2011. Evidence from Co-Integration and Granger Causality Analysis

¹Majeed A Hussain and ²Afaf A. Saaed

¹Associate Professor of Econometrics,
American University in the Emirates, UAE- Dubai

²Associate Professor of Applied Economics,
Algonquin College, Ottawa, Canada

Corresponding Author: Majeed A Hussain

Abstract

The study examines the nexus of Exports, Imports and Economic growth in Saudi Arabia, using annual data for the period 1990- 2011. Granger Causality and Cointegration test were employed in the empirical analysis. Using Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) stationarity test, the variable proved to be integrated of the order one $I(1)$ at first difference. Johansen and Juselius Cointegration test was used to determine the presence or otherwise of a cointegrating vector in the variables. Both Trace and Maximum Eigenvalue indicated cointegration at 5% level of significance pointing to the fact that the variables have a long-run relationship. To determine the direction of causality among the variables, in the short run, the Pairwise Granger Causality was carried out. Economic growth was found to Granger Cause import. There was a unidirectional causality existing between export and import. But the result of the causation between Exports and economic growth and imports and economic growth was statistically insignificant.

Keywords: co integration, granger causality; exports; imports; economic growth

INTRODUCTION

The relationship between Export, Import and Economic growth was an important issue among economists, and many researchers tried to investigate this relationship. There are four possible propositions on a relationship between export and economic growth: export-led growth (ELG), growth-driven export (GDE), feedback relationship between export and economic growth and finally, it is possible that there is no relationship. Some of the researchers found unidirectional causality and some of them found bidirectional causality and of course some of them could not find any evidence for causality between export and GDP.

The export-led growth hypothesis (ELGH) assumes that export advancement is one of the key indicators of growth. It encourages that the overall progress of countries can be achieved not only by mounting the quantity of manpower and investment within the economy, but also by increasing exports.

Another relationship of causality from growth to export is called growth-led exports and it tells that there is unidirectional causality from economic growth to exports but not *vice versa*. There is also a possibility of two way causality link from exports to growth and from growth to exports.

Kaushik et al (2008) used Johansen's co-integration analysis and a vector error-correction model to investigate the relationship between economic growth, export growth, export instability and gross fixed capital formation (investment) in India during the period 1971- 2005. The empirical results suggested that there exists a unique long-run relationship among these variables and the Granger causal flow is unidirectional from real exports to real GDP. For example, *ceteris paribus*, a 1% increase in exports raises GDP by an estimated 0.42% in the long run.

The primary objective of this study is to estimate the long run relationship between economic growth, Export and import in Saudi Arabia for the period 1990-2011.

To achieve this objective the paper is structured as follows; following this brief introduction is section two which is concerned with review of related literature, section three deals with methodology of the study, section four is concerned with empirical analysis of result while section five summaries and concludes the study.

LITERATURE REVIEW

Many research work exist that examines the causal interaction of export, domestic demand and economic growth; Lin and Li (2002) examined the contribution

of foreign trade to China's economic growth and found that the previous studies carried on this subject underestimated the contribution of exports to GDP growth by overlooking the indirect impacts of exports on domestic consumption, investment, government expenditures and imports. They proposed a new estimation method and found that a ten percent increase in exports resulted in a one percent increase in GDP in the 1990s in China, when both direct and indirect contributions are considered.

Ramos (2002) investigated the Granger-causality between exports, imports, and economic growth in Portugal over the period 1865-1998. The role of the import variable in the investigation of exports output causality is emphasized, enabling one to test for the cases direct causality, indirect causality, and spurious causality between export growth and output growth. The empirical results do not confirm a unidirectional causality between the variables considered. There is a feedback effect between exports output growth and imports output growth. More interestingly, there is no kind of significant causality between import export growths. Both results seem to support the conclusion that the growth of output for the Portuguese economy during that period revealed a shape associated with a small dual economy in which the intra-industry transactions were very limited.

Li Yuhong et. al. (2010) did co-integration analyses with the data of import, export and economic, and the results suggests that growth of import greatly promoted economic growth of China, while that of export performed an opposite one.

Asafu-Adjaye *et al* (1999) consider three variables: exports, real output and imports (for the period 1960-1994). They do not find any evidence of the existence of a causal relationship between these variables for the case of India and no support for the ELG hypothesis, which is not too surprising given India's economic history and trade policies.

Carbajal, Canfield and De la Cruz (2008) examined both the existence of causality, in the Granger Sense, and its direction between Gross Domestic Product (GDP), Exports, Imports and Foreign Direct Investment in Mexico (FDI).

Ullah et al (2009) investigated Export-led-growth by time series econometric techniques (Unit root test, Co-integration and Granger causality through Vector Error Correction Model) over the period of 1970 to 2008 for Pakistan. In this paper, the results reveal that export expansion leads to economic growth. They also checked whether there is uni-directional or bidirectional causality between economic growth, real exports, real imports.

Li, Jiyang and Wen (2009) studied the relationship between foreign trade and economic growth in China, using econometric models. They carried out an empiric study with the data of China belonging to the period 1990 -2007. According to the result of Granger Causality Analysis, there was causality between foreign trade and economic growth. According to the results of Unit Root Test, it revealed that the time series is stable after the first difference. the results of Co-integration Test indicated that between foreign trade and economic growth, there was a long term stable balanced relationship. Each 1% of increase in foreign trade made bigger the economy as much as 0.65%. According to the results of error correction Model, a short termed fluctuation to occur in economy will make an effect on economic growth in the same direction. If any deviation does not occur from long term balanced value of economic growth, in the next year, economic growth will improve in the rate of 14 %.

Abhayaratne (1996) studied the effect of foreign trade on economic growth between the years 1960 and 1992, using the curve of causality and co-integration. The assumption that foreign trade had an incentive effect on economic growth was not confirmed by the results of study.

Wong, (2008) examined the importance of exports and domestic demand to economic growth in ASEAN-5, namely Indonesia, Malaysia, the Philippines, Singapore and Thailand before Asia financial crisis, 1997- 1998. The results of the Granger causality test show some evidence of bidirectional Granger causality between exports and economic growth. A successful sustained economic growth requires growth in both exports and domestic demand. Moreover, economic growth will increase domestic demand and exports. There is no strong evidence to suggest that the export-led growth (ELG) strategy is a main cause to Asia financial crisis.

Ahmad and Harnhirun (1996) examined causality between exports and economic growth for five countries of the Association of Southeast Asian Nations (ASEAN). The countries were Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Their model is a bivariate two-equation vector autore- gression (VAR) covering the period 1966-1986. Ahmad and Harnhirun were able to test for cointegration in only four of the countries since exports and GDP for Thailand were not inte- grated in the same order. In the remaining four countries, they found that exports and GDP were not cointegrated; consequently, the error correction term could not be included in their model. Based on their results, Granger causality is supported from GDP to exports for each of the four countries. This finding runs against the common belief that Southeast Asian countries were exceptionally successful in achieving

economic growth by following export promotion policies.

Dutt and Ghosh (1996) studied causality between exports and economic growth for a relatively large sample of countries using the methodology of the error correction model (ECM). For the countries in which they found cointegration, the VEC model was estimated, and tests for Granger causality were performed. Canada and the United States were two of the countries in their sample, which covered the period 1953-1991. Dutt and Ghosh found no causality for Canada between exports and GDP in either direction, but they found causality from GDP to exports for the United States. In other countries the results were mixed. Some countries experienced export-led growth, others the opposite (growth-led exports), some showed bidirectional causality, and others demonstrated no causality. Their model differs from the present analysis since Dutt and Ghosh utilized a bivariate two-equation ECM model. An interesting feature of the empirical part of this paper is that the authors pointed out the source of causality for each country, that is, short- or long-run causality. This was based on the F- and t-tests, respectively. Restricted and unrestricted VAR models were employed by Ghartey (1993) to examine any causal relation between exports and economic growth for Taiwan, Japan, and the United States.

DATA AND METHODOLOGY

Data Description

We used annual data Saudi Arabia observations on logarithm of GDP, logarithm of exports of goods and services, and logarithm of imports of goods and services. Annual data on all variables are available from 1990 to 2011 from World Development Indicators. All the variables are taken in their natural logarithms to avoid the problems of heteroscedasticity.

Model Specification

This paper uses error correction model (ECM) to identify the relationship between Export, Import and Economic growth in Saudi Arabia.

$$GDP_t = f(Ex, Im) \quad (1.1)$$

In an explicit and econometric form, equation (1) can be stated as

$$GDP_t = \alpha_0 + \alpha_1 Ex_t + \alpha_2 Im_t + \varepsilon_t \quad (1.2)$$

Where

GDP_t is Economic growth, Ex_t is Export and Im_t is Import, α_0 is the constant term, 't' is the time trend, and ε is the stochastic random term.

Unit Root Test

In order to investigate the stationarity properties of the data, a univariate analysis of each of the three time series GDP, exports, and imports, was carried

out by testing for the presence of a unit root. Augmented Dickey Fuller ADF, t-tests and Phillips and Perron-tests for the individual time series and their first differences are shown in Table 1.1 and 1.2. The lag length for the ADF tests was selected to ensure that the residuals were white noise. It is obvious from the ADF and Phillips and Perron tests that at conventional levels of significance, none of the variables represents a stationary process., ADF and PP tests computed using the first difference of GDP , Ex , and m indicate that these tests are individually significant at the 1% and 5% level of significance. As differencing once produces stationarity, I conclude that each of the series GDP , Ex , and m is integrated in order 1,

The Co integration Test

Cointegration, an econometric property of time series variable, is a precondition for the existence of a long run or equilibrium economic relationship between two or more variables having unit roots (i.e. Integrated of order one). The Johansen approach can determine the number of co-integrated vectors for any given number of non-stationary variables of the same order. Two or more random variables are said to be cointegrated if each of the series are themselves non-stationary. This test may be regarded as a long run equilibrium relationship among the variables. The purpose of the Cointegration tests is to determine whether a group of non-stationary series is cointegrated or not.

Having concluded from the ADF results that each time series is non-stationary, i.e it is integrated of order one $I(1)$, we proceed to the second step, which requires that the two time series be co-integrated. In other words, we have to examine whether or not there exists a long run relationship between variables (stable and Non-spurious co-integrated relationship). In our case, the mission is to determine whether or not export (EX) and economic growth (GDP) variables have a long-run relationship in a bivariate framework. Engle and Granger (1987) introduced the concept of cointegration, where economic variables might reach a long-run equilibrium that reflects a stable relationship among them. For the variables to be co-integrated, they must be integrated of order one (non-stationary) and the linear combination of them is stationary $I(0)$.

Granger Causality Test

Causality is a kind of statistical feedback concept which is widely used in the building of forecasting models. Historically, Granger (1969) and Sim (1972) were the ones who formalized the application of causality in economics. Granger causality test is a technique for determining whether one time series is significant in forecasting another (Granger, 1969). The standard Granger causality test (Granger, 1988) seeks to determine whether past values of a variable

helps to predict changes in another variable. The definition states that in the conditional distribution, lagged values of GDP_t add no information to explanation of movements of EX_t beyond that provided by lagged values of EX_t itself (Green, 2003). We should take note of the fact that the Granger causality technique measures the information given by one variable in explaining the latest value of another variable. In addition, it also says that variable GDP is Granger caused by variable EX_t if variable EX_t assists in predicting the value of variable GDP. If this is the case, it means that the lagged values of variable EX_t are statistically significant in explaining variable GDP. The null hypothesis (H_0) that we test in this case is that the EX_t variable does not Granger cause variable GDP and variable GDP does not Granger cause variable EX_t . In summary, one variable (EX_t) is said to Granger cause another variable (GDP_t) if the lagged values of EX_t can predict GDP_t and vice-versa.

The spirit of Engle and Granger (1987) lies in the idea that if the two variables are integrated as order one, $I(1)$, and both residuals are $I(0)$, this indicates that the two variables are cointegrated. The Granger theorem states that if this is the case, the two variables could be generated by a dynamic relationship from GDP to EX_t and, vice versa.

Therefore, a time series EX_t is said to Granger-cause GDP if it can be shown through a series of F-tests on lagged values of EX_t (and with lagged values of GDP also known) that those EX_t values predict statistically significant information about future values of GDP. In the context of this analysis, the Granger method involves the estimation of the following equations

$$DLnGDP_{it} = \eta_{it} + \sum \alpha_{11} dLnGDP_{it-1} + \sum \beta_{11} dLnEX_{it-1} + \lambda ECM_{it} + \varepsilon_{1t} \quad (1.4)$$

$$DLnEX_{it} = \eta_{it} + \sum \alpha_{12} dLnEX_{it-1} + \sum \beta_{12} dLnGDP_{it-1} + \lambda ECM_{it} + \varepsilon_{2t} \quad (1.5)$$

Where, GDP_t and EX_t represent gross domestic product and export respectively, ε_{it} is uncorrelated stationary random process, and subscript t denotes the time period (Year). D represents first order difference calculation; ECM_{it} represents the errors of long term balance which is obtained from the long run co-integrating relationship between economic growths Export. and Import If $\lambda = 0$ is rejected, error correcting mechanism happens, and the tested long term causality is reliable, otherwise, it could be unreliable. If $\beta_1 = 0$ is rejected, and then the short term

causality is proved, otherwise the short term causality doesn't exist.

In equation 1.4, failing to reject $H_0: \alpha_{11} = \beta_{11} = 0$ implies that Exports (EX_t) does not Granger cause economic growth (GDP_t). On the other hand, in equation 1.5, failing to reject $H_0: \alpha_{12} = \beta_{12} = 0$ implies that economic growth via GDP growth does not Granger cause Exports (EX_t)

From equation (1.4), $dLnEX_{it-1}$ Granger causes $dLnGDP_{it}$ if the coefficient of the lagged values of EX_t as a group (β_{11}) is significantly different from zero based on F-test (i.e., statistically significant). Similarly, from equation (1.5), $dLnGDP_{it-1}$ Granger causes $dLnEX_{it}$ if β_{12} is statistically significant

However, many studies have shown that majority of time series Variables are non stationary or integrated of order 1 (Engle and Granger, 1987). The time series properties of the data at hand are therefore studied in the outset. Formal tests will be carried out to find the time series properties of the variables. If the variables are $I(1)$, Engle and Granger (1987) assert that causality must exist in, at least, one direction. The Granger causality test is then augmented with an error correction term (ECT) and the error correcting models could be built as above equations (1.4 and 1.5):

Empirical Analysis

Ordinary Least Square Technique:

This section presents the nexus between export and economic growth in terms of OLS Technique.

LGDP=	5.83 + 0.138 LEX + 0.674LM
s.e	1.125 0.046 0.0604
t-value (5.182)	(2.990) (11.146)
P-value	0.0001 0.0075 0.000

$$R^2=0.94 \quad F\text{-statistics}=162 \quad p\text{-value}=0.000$$

In ordinary least square Method, we reject the hypothesis that there is no relationship between the variable and the results of the Ordinary Least Squares Regression are summarized in the above estimated equation. The empirical analysis on basis of ordinary Least Square Method suggests that there is positive relationship between export and GDP and vice versa.

The Stationarity Test (Unit Root Test)

(Unit Root test for Stationarity at Levels and First difference (ADF))

Table 1.1: Tests for Unit root: ADF

Variable	C.V	ADF Level with constant only		ADF First Difference with constant only		Probability
		T-Statistic	Probability	C.V	T-Statistic	
LGDP 1% level 5% level 10% level	-3.788030 -3.012363 -2.646119	0.7172	0.9895	-3.808546 -3.020686 -2.650413	-4.5019	0.023**
LEX 1% level 5% level 10% level	-3.788030 -3.012363 -2.646119	-2.7056	0.0897	-3.808546 -3.020686 -2.650413	5.0122	0.0009*
LM 1% level 5% level 10% level	-3.808546 -3.020686 -2.650413	0.4002	0.9779	-3.808546 -3.020686 -2.650413	3.0671	0.045**

Note: * and **Significance at 1% level. and 5% level respectively..

Mackinnon (1991) critical value for rejection of hypothesis of unit root applied.

Source: Author's Estimation using Eviews 6

Unit Root test for Stationarity at First Difference (PP)

Table 1.2 Tests for Unit root:PP

Variable	C.V	PP Level with constant only		PP First Difference with constant only		Probability
		T-Statistic	Probability	C.V	T-Statistic	
LGDP 1% level 5% level 10% level	-3.788030 -3.012363 -2.646119	2.4624	0.9999	-3.808546 -3.020686 -2.650413	-4.5040	0.0023**
LEX 1% level 5% level 10% level	-3.788030 -3.012363 -2.646119	-2.7056	0.0897	-3.808546 -3.020686 -2.650413	15.3516	0.000**
LM 1% level 5% level 10% level	-3.808546 -3.020686 -2.650413	0.1813	0.9644	-3.808546 -3.020686 -2.650413	-3.1076	0.0432*

Note: * and **significance at 1% level. And 5% level respectively..

Mackinnon (1991) critical value for rejection of hypothesis of unit root applied.

Source: Author's Estimation using Eviews 6

Co integration Test Result

The normalized cointegrating equation is

$$LGDP = -1.803LEX + 0.3226 Lm \quad (7)$$

relationship between Exports to Economic growth (LM→LGDP). In the third equation, there existed a uni-directional causality running from Import to Export (LM→LEX)

Pairwise Granger Causality Test

The results of Pairwise Granger Causality between economic growth (GDP) and export (EX) are contained in **Table 1.4**. The results reveal the existence of a unidirectional causality which runs from Economic growth (LRGDP) to Import (LEX) and from LM to LEX. From the result of the second equation, there existed no statistically discernible

Generally, it could be noted that there is existence of dynamic relationship existing among economic growth,. Export and Import. However, worthy of note is that Causality ran from economic growth to export and from Import to export. This means that increase/growth in the economy of Saudi Arabia by variables which may not have been taken note of this study causes increase in the level of export.

Table 1.3. Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.779046	40.18340	29.79707	0.0023
At most 1	0.378000	9.987360	15.49471	0.2817
At most 2	0.024254	0.491058	3.841466	0.4835
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.779046	30.19604	21.13162	0.0020
At most 1	0.378000	9.496302	14.26460	0.2471
At most 2	0.024254	0.491058	3.841466	0.4835
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Author's Estimation using Eviews 6

Table: 1.4 Pairwise Granger Causality Tests

Pairwise Granger Causality Tests			
Date: 04/22/13 Time: 05:12			
Sample: 1990 2011			
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Prob.
LEX does not Granger Cause LGDP	21	0.55337	0.4665
LGDP does not Granger Cause LEX		7.57572	0.0131
LM does not Granger Cause LGDP	21	0.15568	0.6978
LGDP does not Granger Cause LM		3.98254	0.0613
LM does not Granger Cause LEX	21	4.57103	0.0465
LEX does not Granger Cause LM		1.12584	0.3027

CONCLUSION

The study focuses on finding a relationship between economic growth, exports and imports in Saudi Arabia using annual data sourced from World Development Indicators for the period 1990-2011. The econometric methodology employed was the Cointegration and Granger Causality test. First, the stationarity properties of the data and the order of integration of the data were tested using both the Augmented Dickey-Fuller (ADF) test and the Phillip-Perron (PP) test. We found that the variables were non-stationary in levels, but stationary in first differences; that is, they are integrated of order one I(1)). Since we used single equation model(s), the application of Johansen multivariate approach to cointegration was necessary to test for the long-run relationship among the variables. The result showed existence long run of cointegration among the variables tested. The result of the Granger causality test shows a unidirectional relationship between Export (Ex) and import (M); but the result of the

causation between Exports and economic growth and imports and economic growth was statistically insignificant.

REFERENCES

- Asafu-Adjaye, J and D Chakraborty. (1999), 'Export-led Growth and Import Compression: Further Time Series Evidence From LDCs', Australian Economic Papers, 38, pp. 164-75.
- Abhayaratne, A. S. P. (1996), "Foreign Trade and Economic Growth Evidence From Sri Lanka 1960-1992", Applied Economics Letters, Volume 3, Number 9.
- Ahmad, Jaleel, and Somchai Harnhirun. 1996. Cointegration and causality between exports and economic growth: Evidence from the ASEAN countries. Canadian Journal of Economics 29:S413-6.

Carbajal, E., Canfield, C., & De la Cruz, J. L. (2008). Economic Growth, Foreign Direct Investment and International Trade: Evidence on Causality in the Mexican Economy. Paper presented at the annual meeting of the BALAS Annual Conference, Universidad de los Andes School of Management, Bogota, D.C., and Colombia.2009-05-23.

Dutt, Swarna D., and Dipak Ghosh. 1996. The export growth-Economic growth nexus: A causality analysis. *Journal of Developing Areas* 30:167-82.

Kaushik, K. K., Arbenser, L. N., & Klein, K. K. (2008). Export Growth, Export Instability, Investment and Economic Growth in India: A Time series Analysis. *Journal of Developing Areas*, April 1

Ramos, F. F. R. (2002). Exports, imports, and economic growth in Portugal: evidence from causality and cointegration analysis. *Economic Modelling*, 18, 613-623

Ullah, Zaman, Farooq & Javid. (2009). Cointegration and Causality between Exports and Economic Growth in Pakistan. *European Journal of Social Sciences – Volume 10, Number 2* (2009)

Uche U C & Chimobi O P,(2010) Export, Domestic Demand and Economic Growth in Nigeria: Granger Causality Analysis, *International Journal of Business and management*,Vol.5, no.4, April, 2010

Ghartey, Edward E. 1993. Causal relationship between exports and economic growth: Some empirical evidence in Taiwan, Japan and the U.S. *Applied Economics* 25:1145-52

Grossman G, Helpman E. *Innovation and Growth in the Global Economy*. Cambridge, MA: MIT Press; 1991.

JIANG L. F. ve Wen, L. (2009), “An Econometric Model of The Relationship Between Foreign Trade and Economic Growth in China”, Second International Conference on Information and Computing Science.

Rivera-Batiz L, Romer P. Economic integration and endogenous growth. *Journal of Economics* 1991; 106; 531_556.

Romer P. Endogenous technological change. *Journal of Politic Economics* 1990; 98; 71_102.

Wong, Hock Tsen, (2008) Exports And Domestic Demand: Some Empirical Evidence In Asean

Yuhong Li, Zhongwen Chen & Changjian San (2010), Research on the Relationship between Foreign Trade and the GDP Growth of East China—Empirical Analysis Based on Causality, *Modern Economy*, Vol. 1, pp. 118-124

APPENDIX

Lags: 2

Pairwise Granger Causality Tests			
Sample: 1990 2011			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
LEX does not Granger Cause LGDP	20	1.14484	0.3446
LGDP does not Granger Cause LEX		3.37681	0.0615
LM does not Granger Cause LGDP	20	0.42433	0.6618
LGDP does not Granger Cause LM		3.65547	0.0509
LM does not Granger Cause LEX	20	1.85718	0.1903
LEX does not Granger Cause LM		0.63334	0.5444

Lag 3

Pairwise Granger Causality Tests			
Date: 04/22/13 Time: 05:10			
Sample: 1990 2011			
Lags: 3			
Null Hypothesis:	Obs	F-Statistic	Prob.
LEX does not Granger Cause LGDP	19	0.15074	0.9272
LGDP does not Granger Cause LEX		0.90485	0.4674
LM does not Granger Cause LGDP	19	1.74601	0.2109
LGDP does not Granger Cause LM		2.10085	0.1536
LM does not Granger Cause LEX	19	2.51259	0.1080
LEX does not Granger Cause LM		3.69589	0.0430

Source: Author's Estimation using Eviews 6