Journal of Applied Sciences

ISSN 1812-5654

Journal of Applied Sciences 7 (23): 3649-3658, 2007
ISSN 1812-5654

Exports and Economic Growth in Saudi Arabia: A VAR Model Analysis

Hassan Alhajhoj
Department of Economics, King Faisal University, Saudi Arabia

Abstract: Kingdom of Saudi Arabia is a developing country and is rich in natural resources. The export sector plays an important role in the economic growth of a country. Basically, economic growth of a country depends on the nature and type of relationship between exports and domestic economic growth. Modern econometric techniques such as Vector Auto-Regression (VAR), Impulse Response Function (IFR) and the Granger-causality test were applied to determine long-term relationship between exports and domestic economic growth from 1970 to 2005. It was found that the export sector of Saudi Arabia caused a significant effect on the economic growth and a positive influence on other economic activities in the long run. Also, a long-term equilibrium existed among the various macroeconomic variables such as RGDP, RC, RG, RI, RX and RM considered in the study. It is apparent that a steady state condition can be reached between exports and economic growth in Saudi Arabia.

Key words: Exports, economic growth, unit roots, co-integration, vector auto-regression model, impulse response function, granger causality

INTRODUCTION

International trade is a subject of interest to economists since Adam Smith (1776) asserted that the international trade is essential for achieving economic efficiency through economies of scale and the gains obtained from it represent a principal source of national wealth. Ricardo (1817), who originated international trade theory, offered some modifications to Smith's study by introducing the concept of comparative advantage whereby trade facilitates gains in static efficiency, in addition to the gains associated with economies of scale (which had been the main focus of Smith's study).

Many studies have concluded that an increase in exports is associated with an increase in imports and the trade is the backbone of economic growth, especially in Less-Developed Countries (LDCs). For example, Bhattacharya and Anindya (1976), who studied the relationship between foreign trade and international development, concluded that export-led trade can serve as the potential super engine of growth because imports which enhance growth, depend upon export revenues. Emery (1976) pointed out that higher rates of economic growth tend to be associated with higher rates of export growth; conversely, most countries with low rates of export growth also tend to have low rates of economic growth. However, there are opposing views regarding the effect of exports on economic growth. Helleiner (1972) noted that the pro-trade economists rest their arguments on conventional comparative-advantage theory which states that the countries should produce and export that commodity which are relatively most suited to produce. In contrast, Helleiner (1972) noted that anti-trade economists have pointed out the possible detrimental effects upon development that can accrue from participation in the world economy with the arguments that the effect of such participation by LDCs has, on balance, been negative. In this regard, Todaro and Michael (1989) noted that the export efficiency of most LDCs is relatively weak compared to that of developed countries because the income elasticity of demand in the developed countries is greater than that of LDCs.

Many empirical studies used cross-sectional data and OLS techniques to yield evidence in support of the hypothesis that the exports are associated with economic growth (Balassa, 1978a, b; Williamson, 1978; Salvatore and Hatcher, 1991). However, Jung and Marshall (1985) found only weak support for the export-led growth hypothesis as a result of their study using cross-sectional data and maximum likelihood simultaneous techniques. Furthermore, Jin and Yu (1996) decided that the hypothesis should be rejected after testing the long-term relationship using Engel-Granger causality and co-integration tests. In contrast, Bodman (1996) applied a co-integration test to explore the long-term relationship between exports and economic growth in Australia and Canada and reported the existence of a strong relationship between exports and imports.

Recently, Dhawan and Biswal (1999) examined the relationship between export and the economic growth in India by employing the Vector Auto-Regression (VAR) model over the period from 1961 to 1993, using the variables of real GDP, real exports and terms of trade in the VAR model. They found an evidence for the existence of long-term co-integration among the variables and an increase in GDP produced by exports (at least in the short term). Similarly, Asafu-Adjaye and Chakraborty (1999) found an evidence in support of the hypothesis of export-led growth in LDCs. In contrast to these studies, Sharma and Panagiotidis (2003) examined the relationship between exports and economic growth during the period from 1971 to 2001 in India by employing a VAR model that included real GDP, real GDP without exports, real exports, real imports, real investment, population and employment. They failed to find support for the argument that exports increase GDP; also they did not find any evidence for the existence of co-integration among the aforementioned economic variables.

In Malaysia, Ghatak and Price (1997) studied the relationship between exports and growth in the Malaysian economy and reported that exports caused growth in real GDP, especially in manufactured exports. Following this, Keong *et al*. (2005) constructed a VAR model including the variables of GDP, exports, imports, labour and the exchange rate to examine the relationship between exports and economic growth in Malaysia during the period from 1960 to 2001. They found that both the exports and labour force stimulated the economic growth, whereas both the imports and exchange rate produced a negative effect on growth. They also detected a co-integrated relationship between exports and economic growth. Some studies also concluded that economic growth is caused by exports (Shah and Yuosf, 1990) whereas others have argued the reverse (Dutt and Ghosh, 1996). Still others have claimed that a reciprocal (two-way) relationship exists between exports and economic growth (Jin, 1995). It appears that the direction of causality and the nature of the long-term relationship vary among countries according to the structure of a given national economy and the historical role of exports in the production of goods and services in that particular economy.

The role of GWGDP is somewhat controversial to determine the economic growth of a country. In debates about international trade theory, some economists believe that growth in the world economy will, over time, lead to a decline in trade. For example, the United States was disadvantaged by growth in the rest of the world during 1967-1980 and again during 1985-1988, which caused that countrys terms of trade to decline during these periods (Krugman and Obstfed, 1994). However, the developing countries, whose economies depend on oil export, will experience an economic growth at the time of increasing GWGDP, because there is high demand for oil at these times, which in turn improves the current account balance and GDP of oil-exporting countries. Since, Saudi Arabia is an oil-exporting country, it was considered appropriate to include the GWGDP variable in the present model to determine relationship between the exports and the economic growth.

According to Lutkepohl and Reimers (1992), innovation accounting (such as impulse-response analysis) can be used to obtain information concerning the interactions among the variables. As a practical matter, the two innovations of error terms ε_{yt} and ε_{zt} can be contemporaneously correlated if y_t has a contemporaneous effect on z_t and/or z_t has a contemporaneous effect on y_t. In obtaining IRFs and variance decomposition, a method such as the Choleski decomposition can be used to orthogonalise the innovations. The shape of the IRFs and the results of the variance decompositions can indicate whether the dynamic responses of the variables conform to theory. Assuming all variables in the VAR model are stationary, the impulse responses should converge to zero. In passing, it should be noted that a re-examination of the results is needed for each step if a non-decaying or explosive IRF is obtained.

The present study utilized Vector-Auto-Regression (VAR) to conduct analyses of time-series Saudi macroeconomic data during the period from 1970 to 2005. In addition, the Granger-causality test was applied to investigate the direction of causality between the macroeconomic factors under consideration. The main objective of this study was to use some of the econometric methodologies to investigate the relationship between exports and economic growth in Saudi Arabia, with special emphasis on the question of causality and the nature of long-term relationship.

MATERIALS AND METHODS

Econometric model: A Vector Auto-Regression (VAR) model was used to analyse the dynamic impact of random disturbances on the system of variables. The VAR model included the following six variables:

- Real Gross Domestic Product (RGDP)
- Real Private Consumption (RC)
- Real Government Expenditure (RG)
- Real Investment (RI)
- Real Exports (RX)
- Real Imports (RM)
- Growth Rate of World GDP (GWGDP)

Data collection: The data for GWGDP were obtained from the World Development Indicator of the World Bank

(Anonymous, 2005b). The time-series data for RGDP, RC, RG, RI, RX and RM for Saudi Arabia were obtained from annual data for the years 1970 to 2005 Anonymous (2005a). All variables were calculated in real terms by using the GDP deflator for 1990 (= 100). In order to accomplish the study objectives, gross fixed capital formation was taken as a proxy variable for RI.

The data were analyzed statistically using Eviews software, which was considered most appropriate for economic analysis and evaluation of different econometric parameters.

Data analysis: The following methods were used for data analysis and evaluation.

- Tests of stationarity
- Tests using Vector Auto-Regression (VAR)
- Tests using Impulse Response Function (IRF)
- Tests using Granger-Causality test.

Tests of stationarity: To assess the long-term co-integrated relationship among the different variables by applying the VAR model, Firstly, it was necessary to test for stationarity and the order of integration of the variables in the model. If some or all of the variables in the model are non-stationary (that is, showing a stochastic trend), conventional hypothesis-testing and confidence intervals will be unreliable. In the presence of non-stationary variables, there might be a so-called spurious regression. A spurious regression has a high R^2 and a t-statistic that appears to be significant, but actually have no economic meaning (Granger and Newbold, 1974).

Stationarity was, therefore, established by testing for unit roots in the variables by applying the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. The methodology for these tests is described:

Augmented Dickey-Fuller (ADF) test: The ADF test for a unit root is formulated in the following regression model:

$$\Delta y_t = \beta_0 + \delta Y_{t-1} + \gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta Y_{t-2} + \dots\dots\dots + \gamma_P \Delta Y_{t-P} + \mu_t \qquad (1)$$

where:

Y = {RGDP, RC, RG, RI, RX, RM, GWGDP} = a set of macroeconomic variables under study.

Δ = The differencing operator.

$\beta_0, \Delta, \gamma_1, \gamma_2, \gamma_P$ = Estimated parameters.

μ_t = White noise.

The null hypothesis in these circumstances can be expressed as follows:

H_0 : $\delta = 0$ (indicating Y_t has a stochastic trend; that is, non-stationary).

In contrast:

H_1 : $\delta \neq 0$ (indicating Y_t is stationary).

A time trend (t) can be added to Eq. 1 if Y_t is stationary around a deterministic linear process. If so, Eq. 1 can be written as follows:

$$\Delta Y_t = \beta_0 + \alpha t + \delta Y_{t-1} + \gamma_1 \Delta Y_{t-1} + \gamma_2 \Delta y_{t-2} + \dots\dots\dots + \gamma_P \Delta Y_{t-P} + \mu_t \qquad (2)$$

where:

t = A time trend.

α = An estimated parameter for the time trend.

Phillip-Perron (PP) test: As an alternative test for stationarity, the Phillip-Perron (PP) test was used to examine the unit root process. The PP method estimates the non-augmented Dickey-Fuller test in equations Eq. 1 and 2 and modifies the t-ratio of the δ coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. The lag length ($_P$) is unknown, but it can be estimated using the Akaike Information Criterion (AIC).

Tests using Vector Auto-Regression (VAR) model: To investigate the long-term co-integrated relationship in a system of equations, the co-integrated VAR model considers the system to be a general framework with equilibrium demonstrating stationary behaviour. The model implies that certain linear combinations of the variables of the vector process are integrated at a lower level than the process itself. Any such co-integrated variables are presumed to be driven by the same persistent shocks. Thus, if the non-stationarity of one variable corresponds to the non-stationarity of another variable, there exists a linear combination between them that, in itself, becomes stationary. Therefore, the co-integrated relationships can be interpreted as long-term economic steady-state relationships.

A VAR model consists of κ equations (depending on the number of economic variables). In this study the model therefore had a system of seven equations. The VAR model treats every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. The approach of Pesaran *et al.* (2001) was adopted with some modifications to construct the VAR model for the present study. The model thus had the following structure:

$$\Delta Z_t = \mu + \sum_{i-1}^{p} \beta_i \Delta Z_{t-i} + \varepsilon_t \quad (3)$$

where:

- Z_t = The vector of time-series variables (RGDP, RC, RG, RI, RX, RM, GWGDP); called a column vector or vector matrix.
- Δ = The first difference operator.
- μ = Constant term.
- β_i = A matrix of VAR parameters (estimated coefficients) with lags i.
- ε_t = The vector of error terms.

As noted above, all variables in the system should be in a stationary process. In addition, the number of lags in each equation should be the same (and equal to i).

To determine the lag length ($_p$) of Z variables in the system of equations, two test procedures were utilised: (i) the Akaike information criterion (AIC) and (ii) the Schwarz information criterion (SIC), which is also known as the Schwarz Criterion (SC). Both the AIC and SC are based on the maximal value of likelihood function with an additional penalising factor related to the number of estimated parameters. The two criteria (AIC and SC) differ regarding the strength of the penalty associated with the increase in model parameters as a result of adding more lags. The rationale is to calculate the test criteria for different values of ($_p$) and then to choose the value of ($_p$) that corresponds to the smallest value.

The null hypothesis for the VAR model is that the estimated coefficients are zero. That is:

H_0: $\beta_i = 0$ (that is, the variables are not co-integrated).

The alternative hypothesis is that at least one of the coefficients is non-zero. The null hypothesis involves coefficients from all equations. Because the VAR model applied in this study was an unrestricted VAR model. The coefficients in the model were estimated by testing each equation by Ordinary Least Square (OLS).

Testing using Impulse Response Function (IRF): Even though, the VAR model allows the data (rather than the econometrician) to determine the dynamic structure of a model, it is important to characterise its dynamic structure clearly. Therefore, the Impulse Response Function (IRF) was included in the analyses to show how shocks to any one variable filter through the model to affect every other variable and eventually feed back onto the original variable itself.

IRF was employed to determine how each endogenous variable responded over time to shock in that variable or in other endogenous variables. In fact (effect), the IRF traces the response of the endogenous variables to such shocks.

Tests using granger causality test: The present study used an expanded version of the original test developed by Granger (1969). The Granger causality test in a bi-variate regression and is expressed as follows:

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \phi_i Y_{t-i} + \sum_{i=1}^{q} \delta_i X_{t-i} + \varepsilon_t \quad (4)$$

$$X_t = \beta_0 + \sum_{i=1}^{p} \pi_i X_{t-i} + \sum_{i=1}^{q} \lambda_i Y_{t-i} + \mu_t \quad (5)$$

where:

- α and β = Constant terms;
- ϕ, δ, π and λ = Estimated coefficients of lagged variables in the bivariate regression form.
- p and q = The optimal lag of the series Y and X.

In this case, the null hypothesis is that the coefficients of the lagged Xs in equation Eq. 4 are jointly equal to zero ($\delta_1 = \delta_2 = ... = \delta_i = 0$) and that the coefficients of the lagged Ys in equation Eq. 5 are jointly equal to zero ($\lambda_1 = \lambda_2 = ... = \lambda_i = 0$).

If the null hypothesis is rejected using the F-test, this will constitute evidence that X Granger-causes Y in equation Eq. 4 and that Y Granger-causes X in equation Eq. 5. This procedure was used to test for Granger causality between exports and the rest of macroeconomic variables in the study.

RESULTS AND DISCUSSION

Economy of Saudi Arabia: In case of Saudi Arabia, the macro-economic trends were summarised from 1970 to 2005 (Fig. 1). The data indicates the movements in Real Gross Domestic Product (RGDP), Real Consumption (RC), Real Government Expenditure (RG), Real Investment (RI), Real Exports (RX) and Real Imports (RM) during this period. Although all economic variables showed a general tendency to increase but also shoed fluctuation during the period under consideration. It was of interest to note that the exports (RX) and investment level (RI) both declined between 1982 and 1990 which can be attributed to crises in oil markets during the 1980s and somewhat is also associated to the political upheaval in the region at that time. However, the trends in these variables showed positive movements in the 1990s. Furthermore, despite some fluctuations, the Real Private Consumption (RC) and real Government Expenditure (RG)

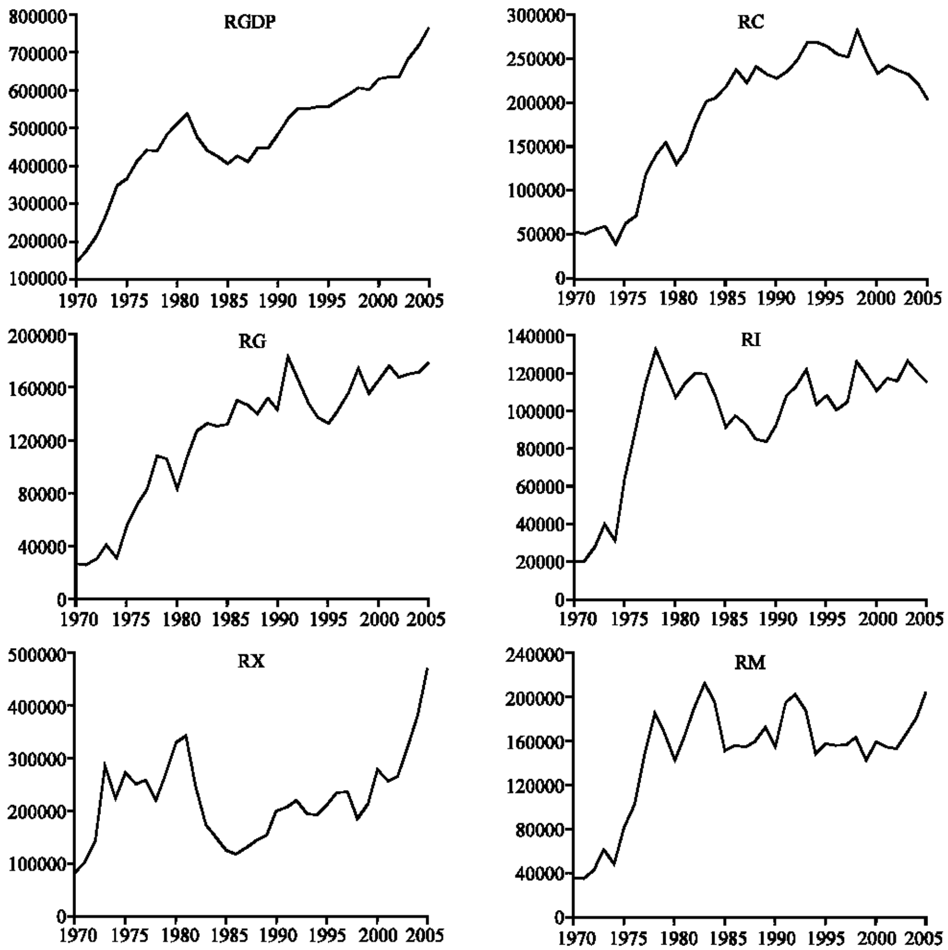

Fig. 1: Trends in macroeconomic variables in Saudi Arabia (1970-2005) (Million Riyals in constant prices). Source: Anonymous (2005a) Various Issues. The author calculated the real level of all variables mentioned above by using GDP deflator (1990 = 100) RGDP = Real Gross Domestic Product, RC = Real Consumption, RG = Real Government Expenditure, RI = Real Investment, RX = Real Exports, RM = Real Imports

showed an overall increase during the period from 1970 to 2005. Given these trends, it is of interest that the real GDP (RGDP) did not follow the trends that might have been expected. In particular, the RGDP demonstrated a general upward trend from 1970 to 2005 except the period between 1980 and 1986. This raised an interesting questions about the effect of exports on economic growth in Saudi Arabia, especially when the Saudi economy is known for its dependence on export revenues.

The trends identified for different economic variables in Fig. 1 indicated that any useful analysis of the complex relationship between exports and economic growth in the Saudi context must apply advanced econometric techniques. Most of the empirical studies for the relationship between exports and economic growth used old econometric methodologies such as single-equation Ordinary Least Squares (OLS) (Balassa, 1978a), co-integration (Jin and Yu, 1996) and Granger-causality procedures (Jung and Marshall, 1985). However, to avoid the misleading results that can be obtained from these econometric techniques, more recent studies have applied Vector Auto-Regression (VAR) to study the co-integration of macroeconomic factors.

Stationarity tests: The Dickey-Fuller (DF) test and the Phillips-Perron (PP) test were applied to test each variable for stationarity (including constant without trend and constant with trend) (Table 1).

The results indicate that the null hypothesis proposing non-stationarity of unit roots in the time series could not be rejected in both constant with trend and constant without trend for all variables except GWGDP (Table 1). This last variable was, therefore, the only variable to have no stochastic trend at level the null

Table 1: Results of unit root tests

Variables	ADF test: Constant without trend	ADF test: Constant with trend	PP test: Constant without trend	PP test: Constant with trend
Level				
RGDP	-1.5098	-2.6091	-1.4752	-2.3661
RC	-1.8927	-0.0565	-1.8744	0.6105
RG	-1.7284	-2.1334	-2.3535	-1.9527
RI	-2.5621	-2.0579	-2.5334	-2.1242
RX	-1.2574	-1.4212	-0.8934	-1.1263
RM	-2.5391	-2.5398	-2.2803	-1.9333
GWGDP	-2.9349***	-5.7409*	-5.0765*	-5.7479*
First difference				
RGDP	-3.6406*	-3.5594**	-3.5639**	-3.4798**
RC	-4.9270*	-4.4474*	-4.9261*	-7.1900*
RG	-6.4642*	-6.5939*	-6.8049*	-13.7617*
RI	-4.5654*	-4.7820*	-4.5654*	-4.7801*
RX	-4.7321*	-3.2188***	-4.7056*	-4.6649*
RM	-4.9090*	-4.9240*	-4.8270*	-4.9063*

The lag length is based on SIC. *, ** and ***: Imply that we can reject the null hypothesis that the time series has a stochastic trend or contain a unit root at 1, 5 and 10% significance level, respectively

Table 2: Results of estimated Vector Auto-Regression (VAR) model

Variables	ΔRGDP	ΔRC	ΔRG	ΔRI	ΔRX	ΔRM	GWGDP
$\Delta RGDP_{t-1}$	0.8835	0.0200	0.0979	0.2274	1.2251	-0.0055	0.0305
$\Delta RGDP_{t-2}$	0.0563	0.2549	0.3070	0.1144	-0.2621	0.0875	-0.0306
ΔRC_{t-1}	-0.8671	0.3927	-0.2121	-0.2342	-1.6000	-0.0948	-0.0423
ΔRC_{t-2}	0.6232	0.2460	-0.0111	-0.0998	0.1852	-0.0518	0.0311
ΔRG_{t-1}	0.0452	-0.0420	0.6096	-0.0256	-0.4693	0.0598	-0.0498
ΔRG_{t-2}	0.5292	-0.3249	-0.3002	-0.2502	0.5249	0.0838	0.0404
ΔRI_{t-1}	0.9364	-0.0671	-0.3769	0.5157	-0.3079	-0.0971	-0.0709
ΔRI_{t-2}	-0.8735	-0.7652	-0.4078	-0.4679	0.6178	-0.0473	0.0274
ΔRX_{t-1}	0.1662	-0.1697	-0.0764	-0.1602	0.0392	0.0206	-0.0436
ΔRX_{t-2}	-0.2070	-0.0297	-0.3121	-0.0989	-0.4760	0.0213	0.0347
ΔRM_{t-1}	-0.2562	0.4023	0.2496	0.1758	0.2305	0.8707	0.0164
ΔRM_{t-2}	0.1091	0.3256	0.2373	0.2378	-0.3211	-0.1304	-0.0382
$GWGDP_{t-1}$	43.2160	-22.3030	-24.8112	-12.2263	2.0155	-27.1052	3.7704
$GWGDP_{t-2}$	23.4865	21.7102	17.9996	14.6734	-22.4940	12.5583	-3.1620
R^2	0.9790	0.9670	0.9220	0.8930	0.8000	0.8320	0.8030
Adj-R^2	0.9640	0.9430	0.8640	0.8150	0.6540	0.7000	0.6580
F-statistics	65.8450	45.7580	39.0810	31.4290	23.4620	25.7650	24.1730
Specification tests for the VAR model	Test for residual autocorrelation: LM(2) = 47.88[0.0185] Tests for Normality: Skewness (2) = 0.075, χ^2 = 0.0326 [0.8567] Kurtosis (2) = 0.756, χ^2 = 7.1324 [0.2176] Jarque-Bera (2) = 7.165 [0.5278]						

The above table includes the estimated coefficients in the system of VAR model (system of equations), The lag length in the VAR model is based on the AIC and SIC criterions (# of lag is 2), No. in square brackets represents probability values, No. in parenthesis for LM test represents the number of lag, No. in parenthesis for tests of normality represent the number of components

hypothesis can therefore be rejected for this variable at the 1% significance level. The tests were, therefore, applied again at first difference for all variables those were found to be non-stationary at level. (GWGDP was excluded from these tests at first difference because it had previously been found to be stationary at level). The results indicate that the null hypothesis (proposing non-stationarity of unit roots in the time series) should be rejected at first difference (Table 1). This implies that all variables in Table 1 had one order of integration [I (1)] whereas the variable of GWGDP had zero order of integration [I (0)].

VAR tests: Having established stationarity for the macroeconomic variables at first difference (except for GWGDP, which showed stationarity at level), it was then possible to conduct the test of co-integration for long-term equilibrium by applying the VAR model (Table 2).

The Table 2 indicates that lag length in the system was two (based on the AIC and SIC criteria). The overall results for goodness of fit (calculated by R^2 and adjusted-R^2) indicate that the estimated regressions were mostly explained by the independent variables on the right side of the equations. In addition, the F-test indicates that the null hypothesis (proposing no co-integration among macroeconomic variables) should be rejected at the 5% significance level which means that long-term equilibrium exists among all the variables. It is apparent that a steady state can be reached in the long term.

Table 3: Johansen co-integration test for real GDP, real exports, real imports

Hypothesized No. of CE(s)	Eigen value	Trace statistic	0.05 critical value	Prob.	Max-eigen Statistic	0.05 critical value	Prob.
None*	0.493805	46.42201	29.79707	0.0003	22.46751	21.1316	0.0323
At most 1*	0.449367	23.95450	15.49471	0.0021	19.69067	14.2646	0.0063
At most 2*	0.121208	4.263829	3.841466	0.0389	4.263829	3.84146	0.0389

Trace test indicates 3 co-integrating equations at the 0.05 level. Max-eigen value test indicates 3 co-integrating equations at the 0.05 level. *: Rejection of the null hypothesis of no co-integration at 0.05 level

In addition, specification tests for the VAR model were conducted (as shown in the lower part of Table 2). The test for residual autocorrelation (using two lags) indicated that the null hypothesis (proposing serial correlation in the VAR system) should be rejected on the basis of the LM test which implies that the VAR model was robust. However, on the basis of normality tests such as skewness, kurtosis and Jarque-Bera (J-B), the null hypothesis (proposing normality distribution errors) could not be rejected. Normality distribution errors in the system could have been caused by outliers in the VAR model especially in RGDP, RG, RI and RX in the late 1970s, mid 1980s and early 1990s. The outliers that arose during the period 1970 to 2005, which can be identified by checking the figure of first difference of each variable, can be attributed to such factors as the high oil prices in the 1970s and the wars in the region in the 1980s and early 1990s (which caused significant variation in the series).

The Johansen co-integration test was used to confirm the existence of export-led GDP increase in Saudi Arabia. The test included the variables of RGDP, RX and RM. The null hypothesis (proposing no co-integration) was tested by checking the trace and maxeigen statistics (Table 3).

The results indicate that the null hypothesis (proposing no co-integration) should be rejected at the 5% significance level. This supports the above findings of the existence of a long-term equilibrium relationship between exports and GDP in Saudi Arabia.

IRF tests: For the purposes of the IRF analysis, a response in a variable was defined as being a reaction of at least one standard deviation. The results of IRF analysis are shown in Fig. 2 and the following results were apparent (note: D indicates the first difference in the variable):

- Shock to DRGDP elicited no response from DRX.
- Shock to DRX elicited a positive response from DRGDP.
- Sshock to DRC elicited a positive response from DRG.
- Shock to DRI, elicited a positive response from DRG.
- Shock to GWGDP elicited a positive response from DRGDP.
- Shock to DRM elicited a positive response from DRG
- Sshock to GWGDP elicited a positive response from DRG.

Figure 2 demonstrate that the positive responses expired after 2-4 years. The analysis shows that changes in all variables approach zero as the effects of the shock dampen out. This finding indicates that there is a significant relationship between exports and economic growth in Saudi Arabia.

Granger-causality tests: Given that all variables in a causality analysis should have the same order of integration, the variable of GWGDP was excluded from the Granger-causality analysis because this variable had a different order of integration [I (0)] from the other variables. The Granger-causality test was then conducted on all other variables using the real level of data from the time series.

The null hypotheses for these tests can be formulated as follows:

- RX does not Granger-cause RGDP and vice versa.
- RX does not Granger-cause RC and vice versa.
- RX does not Granger-cause RG and vice versa.
- RX does not Granger-cause RI and vice versa.
- RX does not Granger-cause RM and vice versa.

Table 4 shows that the first null hypothesis (proposing that exports do not Granger-cause gross domestic product) should be rejected at the 5% significance level; however, the converse of the null hypothesis (proposing that gross domestic exports do not Granger-cause exports) could not be rejected.

The results also show that the second null hypothesis (proposing that exports do not Granger-cause consumption) should also be rejected at the 5% significance level; however, the converse of the null hypothesis (proposing that consumption does not Granger cause exports) could not be rejected. The third null hypothesis (proposing that exports do not Granger-cause government expenditure) could not be rejected; similarly, the converse of the null hypothesis (proposing that expenditure does not Granger cause exports) could also not be rejected.

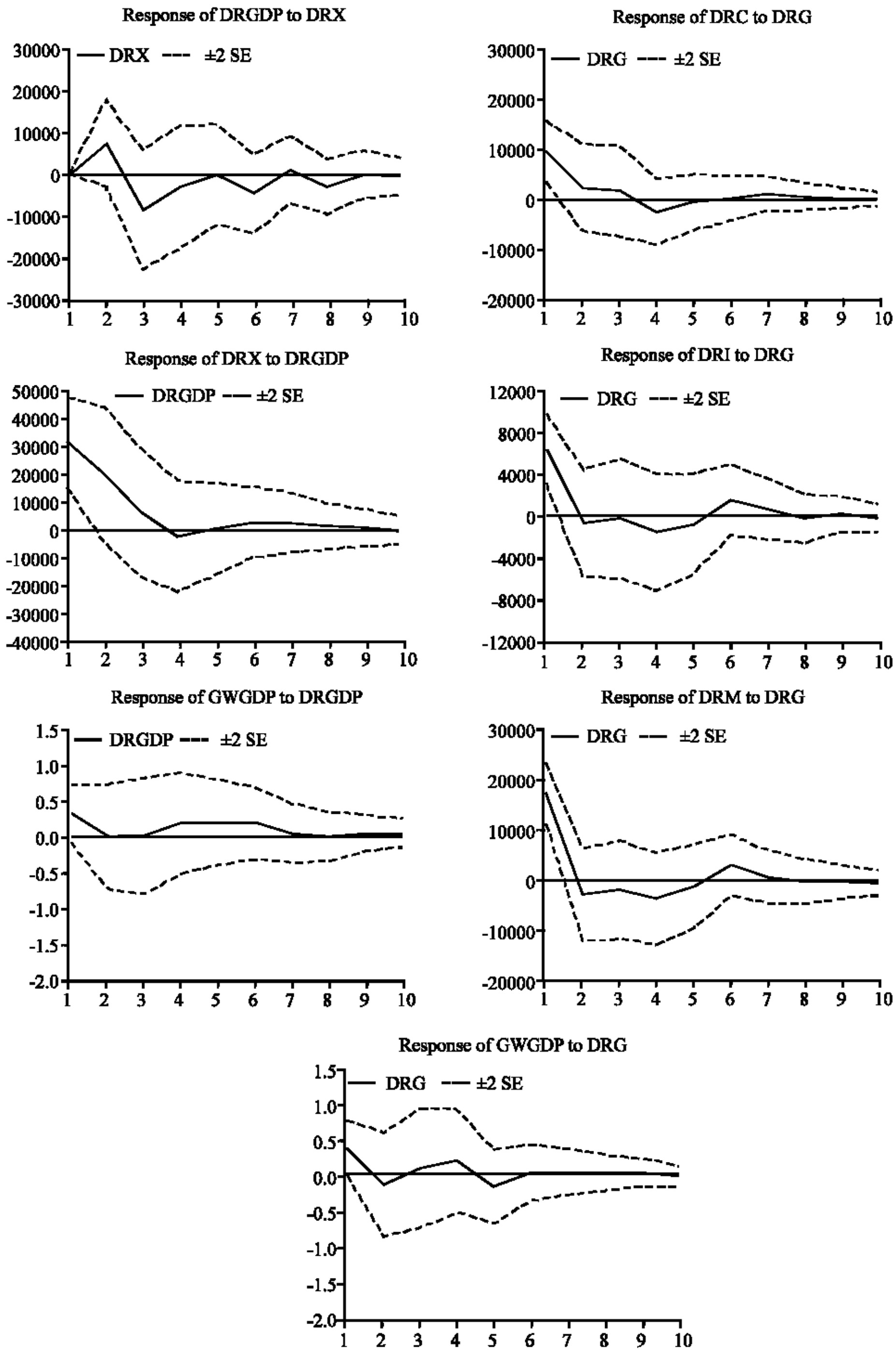

Fig. 2: Results of impulse response function. Response to Cholestry 1SD innovations ±2 SE

The results also show that the fourth null hypothesis (proposing that exports do not Granger-cause investment) should be rejected at the 5% percent level; however, the converse of the null hypothesis (proposing that investment does not Granger-cause exports) could not be rejected.

Finally, the fifth null hypothesis (proposing that exports do not Granger-cause imports) should be rejected at the 1% significance level; however, the converse of the null hypothesis (proposing that imports do not Granger-cause exports) could not be rejected.

Table 4: Results of granger-causality tests

Lags: 2

Null hypothesis	Obs	F-statistic	Probability
RX does not Granger cause RGDP	34	5.24005	0.01141
RGDP does not Granger cause	RX	2.15853	0.13369
RX does not Granger cause RC	34	3.84576	0.03300
RC does not Granger cause	RX	2.07556	0.14373
RX does not Granger cause RG	34	0.77998	0.46779
RG does not Granger cause	RX	0.91551	0.41157
RX does not Granger cause RI	34	3.53257	0.04236
RI does not Granger cause	RX	0.31280	0.73383
RM does not Granger cause RX	34	0.83098	0.44573
RX does not Granger cause	RM	3.01305	0.06473

The above Tests include the Granger-causality between real exports (RX) and the following economic factors: RGDP = Real gross domestic Product, RC = Real consumption, RG =Real government expenditure, RI = Real investment RM = Real imports, GWGDP= Growth of World Gross Domestic Product was not included in the Granger Causality test because the GWGDP factor does not have the same order of integration as other economic factors in the study

The overall results from Table 4 provided an evidence that the exports have a strong relationship with economic growth in Saudi Arabia. This supports the proposition that the export sector plays a major role in the overall development and economic growth of the country. In addition, because the causality analysis showed that the exports have a positive impact on most other aspects of economic activity, the results of the present study also indicate that the export sector is a significant component in the growth of other economic sectors in Saudi Arabia.

CONCLUSIONS

The effect of exports on economic growth remains a controversial issue among economists. In an attempt to clarify some of the issues involved, the present study investigated the relationship between exports and economic growth in Saudi Arabia. By applying the modern econometric techniques, the study was able to identify important aspects of the long-term relationship between these variables from 1970 to 2005. The VAR model consisting of a system of seven equations provided support for the preposition that exports have led economic growth in Saudi Arabia. The results also indicate co-integrations between exports and economic growth, thus implying that a steady state can be reached in the long term. The Impulse Response Function (IRF) analysis indicated that shock in real exports generates significant responses in real gross domestic product in Saudi Arabia. Finally, the causality tests show that exports Granger-cause economic growth.

In summary, the results of this study supports the preposition that the export sector plays a major role in economic growth in Saudi Arabia and that this sector leads growth in other economic activities in the long term.

REFERENCES

Anonymous, 2005a. Saudi Arabian Monetry Agency (SAMA) Report, Riyadh, Saudi Arabia.

Anonymous, 2005b. World Development Indicator. World Bank, Washington DC.

Asafu-Adjaye, J. and D. Chakraborty, 1999. Export-led growth and import compression: Further time series evidence from LDCs. Aust. Econ. Papers, 38: 164-175.

Balassa, B., 1978a. Exports and economic growth: Future evidence. J. Dev. Econ., 5: 181-189.

Balassa, B., 1978b. Exports-led growth hypothesis: Cointegration and causality analysis for Taiwan. Applied Econ. Lett., 5: 699-701.

Bhattacharya, A.K., 1976. Foreign Trade and International Development. Lextington Books.

Bodman, M.P., 1996. On export-led growth in Australia and Canada: Cointegration, causality and structural stability. Aust. Econ. Paper, 35: 282-299.

Dhawan, U. and B. Biswal, 1999. Re-examining export led growth hypothesis: A multivariate cointegration analysis for India. Applied Econ., 31: 525-530.

Dutt, S.D. and D. Ghosh, 1996. The exports growth-economic growth nexus: A causality analysis. J. Dev. Areas, 30: 167-181.

Emery, R.F., 1976. The Relation of Exports and Economic Growth. Kyklos.

Eviews, 2004. Quantitative Micro Software. LLC, Irvine CA, USA.

Ghatak, S. and S.W. Price, 1997. Export composition and economic growth: Cointegration and causality evidence for India. Weltwirtschaftliches Arch., 133: 538-553.

Granger, C.W.J., 1969. Investigation causal relationships by econometric models and cross-spectral methods. Econometrica, 37: 424-438.

Granger, C.W.J. and P. Newbold, 1974. Spurious regression in econometrics. J. Econometrics, 2: 111-120.

Helleiner, G.K., 1972. International Trade and Economic Development. Penguin Books.

Jin, J.C., 1995. Export-led growth and the four little dragon. J. Int. Trade Econ. Dev., 42: 203-215.

Jin, J.C. and E.S.H. Yu, 1996. Export-led growth and the US economy: Another look. Applied Economics Lett., 3: 341-344.

Jung, W.S. and P.J. Marshall, 1985. Export, growth and causality in developing countries. J. Dev. Econ., 18: 1-13.

Keong, C.C., Z. Yusop and V. Sen, 2005. Export-led growth hypothesis in Malaysia: An investigation using bounds test. Sunway Acad. J., 2: 13-22.

Krugman, P.R. and M. Obstfed, 1994. International Economics: Theory and Policy. 3rd Edn., Harper Collins College Publisher, New York, USA.

Lutkepohl, Helmut and Hans-Eggert Reimers, 1992. Impulse response analysis of cointegrated systems. J. Econ. Dynamics Control, 16: 53-78.

Pesaran, H.M., Y. Shin and R.J. Smith, 2001. Bounds testing approaches to the analysis of long-run relationship. J. Applied Econ., 16: 289-326.

Ricardo, D., 1817. Principles of Political Economy and Taxation. Gonner, E.C.K. (Ed.), 2001. Adamant Media Corporation.

Salvatore, D. and T. Hatcher, 1991. Inward and outward oriented trade strategies. J. Dev. Stud., 27: 7-25.

Shah, M. and M.B. Yuosf, 1990. Export and Economics Growth: A Case of Malaysia in Trade and Development in Malaysia. Mohammed, B. (Ed.), Yusoff University Pertanian Malaysia, Malaysia, pp: 83-92.

Sharma, A. and T. Panagiotidis, 2003. An analysis of exports and growth in india: Cointegration and causality evidence (1971-2001). Rev. Dev. Econ., 9: 232-248.

Smith, A. and Edwin Cannon, 1994. The Wealth of Nations. Modern Library Edition. Random House, Inc., Toronto, Canada.

Todaro and P. Michael, 1989. Economic Development in the Third World. Longman, New York, London.

Williamson, R., 1978. The role of exports and foreign capital in Latin American economic growth. Southern Econ. J., 45: 410-420.