International Journal of Economic Research

ISSN : 0972-9380

available at http: www.serialsjournals.com

Volume 14 • Number 17 • 2017

Determinants of Economic Growth in Saudi Arabia: An Economic Analysis using Vector Error Correction (VEC) Model

Fakhre Alam[1] and Mohammad Imdadul Haque[2]

[1] *College of Business Administration, The University of Hail, Saudi Arabia, E-mail: fakhreamu@gmail.com*
[2] *College of Business Administration, Prince Sattam bin Abdulaziz University, Saudi Arabia, E-mail: m.haque@psau.edu.sa*

Abstract: Saudi Arabia is one of the major oil producing and exporting countries of the world. In recent years, it has been taking measures to diversify its economy. It has also been spending a lot on education in recent years. Under this situation, it is important to analyze and determine what are the major factors that impact Saudi Arabia's economic growth? Econometric analysis using co-integration shows a long-run equilibrium relationship between gross domestic product as dependent variable and three variables namely gross fixed capital formation, exports and imports as explanatory variables. Moreover, estimated long-run relationship shows that while gross fixed capital formation and exports boost up gross domestic product, imports cause a fall in it in the long-run. Public expenditure on education does not have any significant impact on gross domestic product. The results of Vector Error Correction Model validates that there is a long-run equilibrium relationship between the above mentioned four variables in Saudi Arabia. Granger Causality/Block Erogeneity Wald Tests show that gross fixed capital formation and exports cause growth in gross domestic product in the short-run as well.

Keywords: Economic growth, Cointegration, Saudi Arabia.

1. INTRODUCTION

The sustainability and prosperity of a country depends on the macro economic factors. The basic Keynesian equation Y= C+I+G+ (X-I) holds its ground, where Y is the national income, C is consumption, I is investment, G is government expenditure, X is export and I is import. This identity states that growth can be led either by consumption, or by investment or by government expenditure or by net exports. Moreover, growth can be a combination of all these factors. It may be the case that some countries are strong in some aspects while others are strong in other components. Without falling into the debate of investment led growth versus export led growth the idea here is to understand the linkages between the macroeconomic variables. The idea is that if any one of the factors lags due to any reason it can be compensated by boosting the other factors. As a proposition, the revenue from exports have gone down for Saudi Arabia

owing to the fall in prices and this factor cannot be alone controlled by Saudi Arabia as the demand and price depends on factors which the country cannot control on its own. The way out could be improving, other factors like consumption, investment, or government expenditure. Towards this, we plan to study the linkages between its gross domestic product, consumption expenditure, gross capital stock and net export.

The first variable of interest is Private Consumption Expenditure. Consumption expenditure is a major component of aggregate demand and as per theory of consumption when consumption expenditure increases demand for goods and services currently being produced also increases which stimulates production of goods and services. Hence, it is expected to impact the growth in gross domestic product positively. The second variable of interest is Gross Fixed Capital Formation (GFCF). Increase in gross fixed capital formation also known as gross investment in a given period not only increases current demand for capital goods but it also enhances the future productive capacity of the economy. As such, it is hypothesized that growth in GFCF has a positive impact on growth of GDP. The third variable of interest is exports. Exports is likely to cause growth in GDP as it increases foreign demand for domestic goods and services. This could be truer for a country like Saudi Arabia which is mainly an oil exporting country. Increase in demand for its oil is very likely to increase growth in oil sector and hence its positive impact on GDP of the country. The fourth variable of interest is imports which is likely to have a negative impact on GDP mainly because it is a leakage from GDP. Growth in it increases demand for foreign goods and services and hence income and employment in foreign country. Therefore, as per literature on relationship between imports and GDP, it is hypothesized that imports reduces pace of GDP growth in Saudi Arabia.

The last variable of interest is Government expenditure on education which is an important component of public expenditure. Education and its spillover effects of education shifts the production function upward and raise productivity of the workforce in a country. Moreover, the human capital stock needs also to be incorporated into the model. In line with the endogenous growth theories the long run growth can be explained by endogenous factors, stock of human capital being one of them. This theory believed that skills and knowledge were decisive for the growth of an economy. These theories stressed on the spillover effects of education which leads to positive shifts of the production function. Education not only increases productivity of an individual worker but also increases the productivity of capital and other workers.

Saudi Arabia is primarily earning from oil exports. Of late, the revenue from oil exports has drastically reduced due to the fall in oil prices. For the country to sustain itself, it has to look for alternatives. Before looking for alternatives, it is imperative to understand the linkages working in the economy. However, studying all the factors simultaneously would lead to issues in estimation. Hence, among the variables stated above, we need to select few factors. First, we ignore tourism and financial development. Nevertheless, these two are very important factors but we ignore them now. This is both the limitation of this study and gives scope to further research. The variables those are finally included in the model gross domestic product, consumption expenditure, gross capital stock, education and net export all in real terms. The remainder of the study can be organized as review of past literature followed by data and methodology, analysis and finally the conclusions of the study.

2. LITERATURE REVIEW

For Saudi Arabia, there have been studies that attempted to study the linkages between various macroeconomic factors like government consumption expenditure, private investment, public investment,

domestic demand, exports, gross capital formation, financial development, government expenditure, tourism, education and economic growth. Eid (2015) in his study for the period 1969-2014 found a long term relation between government consumption expenditure and non-oil private GDP. However, this relationship was missing between non-oil private sector and government gross fixed capital expenditure. Alodadi and Benhin (2015) in their study for the period 1970 and 2011, found that exports (particularly oil exports), investments in oil sector, government expenditure, private investments and religious tourism were key factors causing the economic growth of Saudi Arabia. In a related study, Alodadi and Benhin (2015) found that private investment, international tourist arrivals and public investment were the important contributions to growth. Moreover, the non-oil sector exports had no important effect on economic growth. Abdalla and Abdelbaki (2014) in their study for the period 1980-2007 found that exports and gross capital formation were the main determinants of economic growth for Saudi Arabia. The causality was unidirectional from exports to economic growth, foreign direct investment and to gross capital formation and bi directional between economic growth and gross capital formation. In a study on Middle Eastern countries for the period 1968 to 2004, Tnse (2007) found that in Saudi Arabia there was a long relationship between economic growth, domestic demand and exports. Further, it found bi directional causality between exports and economic growth, between investment and economic growth and between exports and investments. Hafnidah and Abdullah (2016) found long run relationship between financial development, government expenditure, investment and net export for the period 1990 to 2012 for 4 OIC countries, Saudi Arabia being one of them. The study also found bi directional causality between investment and growth and unidirectional causality between financial development and growth.

Al-Yousif (2008) studied the relation between expenditure on education and economic growth in GCC countries for the period 1977-2004 using ECM and Granger causality. The study used education expenditure as a proxy of human capital. For Saudi Arabia, the study reported that significant unidirectional causality from ratio of education to GDP in the long run but in the short run there was no causality. Dandan (2013) found a long run cointegrating relationship between educational expenditures and economic growth in Saudi Arabia for the period 1994-2011. It studied both school education and higher education with relation to non oil GDP. Ageli (2013) studied the relationship between education expenditure and economic growth period 1970 to 2012. It found a cointegrating relationship between per capita income and education expenditure's share in national output. It used both real GDP and non-oil GDP in its analysis.

While looking at similar studies for other countries an interesting feature was found. The reviewed studies gave different results for same countries for the same time period. Like in a recent study in Malaysia, Albiman (2016) for the period 1967-2010, found that there was no cointegrating relationship between economic growth, export, import and domestic investments. Export and economic growth granger cause domestic investments. Impulse response function showed that economic growth changed both negatively and positively to shocks in domestic investments, import and exports. Kogid (2010) for the period 1970-2007 found a cointegrating relationship between economic growth, consumption expenditure, government expenditure, export, exchange rate and FDI for Malaysia. Among these factors consumption expenditure and export were the most important as individual test showed that only these two variables cause economic growth while the remaining variables namely, government expenditure, exchange rate and FDI do not cause growth. Later, Karim (2012) for the data from first quarter 1991 to second quarter 2010 found that there was no significant effect of fixed investment and house hold consumption on growth in the long run, but in the short run the variables influence output growth. In another study Hussein (*et al.,* 2013) using data

for the period 1970-2010 for Malaysia openness, foreign direct investment, government development expenditure and gross fixed capital formation were cointegrated in the long run. But in the short run government development expenditure and gross fixed capital formation were insignificant. Also, Granger causality results show unidirectional causality running from openness to economic growth, economic growth to government development expenditure and from economic growth to gross fixed capital formation.

It is evident that different studies have reported different results related to presence/absence of cointegration among macroeconomic variables over more or less the same period. This further strengthens the purpose of studying the nature of relationship among macroeconomic variables in the context of Saudi Arabia.

3. DATA AND METHODOLOGY

This study is based on data from secondary sources. The data used in this study were secured from the website of Saudi Arabian Monetary Authority (*http://www.sama.gov.sa/en-US/EconomicReports/Pages/YearlyStatistics.aspx*). Unfortunately, the researchers did not find all data required for all relevant variables to be included in the model for analysis which is main limitation of this study. Sometimes, data are available on all variables but some observations are missing for some periods. Researchers of this study were also faced with similar situation and accordingly chose 1985-2014 as their study period. Considering the above mentioned data availability limitations the model include total six variables namely gross domestic product (GDP) , private consumption expenditure (PCONEXP), gross fixed capital formation (GFCF), exports (EXPORTS), imports (IMPORTS), and public expenditure on education (EDUCEXP) all in real terms in terms of 1985 prices. There is a need for long time series data on variables for time series analysis. The study period chosen is long enough for drawing valid statistical inferences from the time series analysis. Data on consumption expenditure and gross fixed capital formation were available in nominal terms. They were converted in real terms using general price index available.

In order to identify the determinants of equilibrium long-run growth in real gross domestic product and quantitative measure of their effects on it we had a choice between using Vector Auto Regressive (VAR) model and Vector Error Correction Model (VECM). VAR model is appropriate when all the variables are stationary (I_0) and there is no co-integration between the variables. On the other hand when each variable is non-stationary (I_1) and there is also co-integration between the variables VECM is the right model to be applied. Since the data on these variables are in time series, we cannot directly run the above regression and use usual t, F, and R and d statistics to judge the validity of the estimated model. Hence, stationarity test on each series is a must before making a choice for applying VAR model or VECM on the variables. Considering above limitations with predictability of regression model involving variables with time series data we will conduct popular Augmented Dickey Fuller unit root test to check for stationarity of each series included in the model in logarithmic form.

Augmented Dickey Fuller (ADF) Unit Root Test

Augmented Dickey Fuller (ADF) unit root test is used to test for unit root. The models used for this purpose are

$$\Delta Y_t = \delta Y_{t-1} + \Sigma_{i=1}^{m} \gamma \Delta Y_{t-i} + u_t$$

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \Sigma_{i=1}^{m} \gamma_i^{\Delta} Y_{t-i} + u_t$$

$$\Delta Y_t = \alpha + \beta t + \delta Y_{t-1} + \Sigma_{i=1}^{m} \gamma \Delta Y_{t-i} + u_t$$

Where Y_t denotes observations on series Y in year t, u_t is a white noise error term. We estimate the above three models and choose the one which is most appropriate using different statistical criteria i.e. t, F, R and d statistics. In each of the above model the null hypothesis to be tested is

H_N: $\delta = 0$ by using τ – *statistic*. If the absolute value of computed is more than the absolute critical value of it at chosen level of significance, we reject the null hypothesis and conclude that the series under consideration is stationary.

However, if each variable is found to be integrated of order 1 and the residual series from the estimated regression model of variables all taken in level forms is found to be stationary, then the estimated regression could be valid provided that it passes above statistical criteria and it represents the long-run relationship also called equilibrium relationship among the variables involved.

Johansen Co-integration Test

Johansen (1995) cointegration is the most common method to estimate cointegration among time series variables. For n I(1) variables to be modeled together there may be n-1 cointegration relationships which is called as rank. Towards this the null hypothesis $r = 0$ and alternate hypothesis $r \geq 1$ is tested for determining rank 1 of cointegration. On failing to reject $r = 0$, it implies that absence of any cointegrating relationship between the variables. Further analysis involves the VAR framework. A rejection of the null hypothesis $r = 0$ signifies presence of cointegrating relationship hence the next step with null hypothesis $r \leq 1$ needs to be tested against the alternate hypothesis of $r \geq 2$. On being unable to reject the null hypothesis, VEC is to be estimated. But if the hypothesis of $r \leq 1$ is rejected, then additional tests with null hypothesis of $r \leq 2$ and alternate hypothesis of $r \geq 3$, are conducted. On further rejection the hypothesis are tested with additional ranks. Finally rank (r) with the smallest value is taken as the no of cointegrating relationship

Vector Error Correction Model (VECM)

If cointegration is detected between series there exists a long-run equilibrium relationship between these variables and VECM is applied to assess the nature of both short and long-run relationship between the variables. In the absence of co-integration VAR model is more appropriate and it is applied after differencing all the series to ensure that each of them become stationary.

VECM also requires mentioning number of co-integrating equations among the endogenous variables in the model. The five variables LGDP, LPCONEXP, LGFCF and LIMPORTS and EXPORTS are considered as endogenous variables in the light of economic theory and the remaining one variable LEDUCEXP as exogenous variable.

4. RESULTS AND DISCUSSION

Stationarity Test

The ADF test result under null hypotheses that LGDP has a unit root is not rejected even at 10 percent level of significance (Table 1). So, LGDP series has a unit root or it is non-stationary in level form.

Table 1

Null Hypothesis	*Augmented Dickey-Fuller test statistic (t-Statistic)*	*Test critical values 5% level*	*Probability**
LGDP has a unit root	-1.165001	-2.967767**	0.6755
LPCONEXP has a unit root	2.243688	-2.986225**	0.9999
LGFCF) has a unit root	-2.147614	-3.580623***	0.4986
LIMPORTS has a unit root	-1.522275	-3.580623***	0.7973
LEXPORTS has a unit root	-2.943316	-3.574244***	0.1645
LEDUEXP has a unit root	-0.122388	-2.967767**	0.9378

* MacKinnon (1996) one-sided p-values.
** With only Constant.
*** With Constant and linear trend.

But when we apply ADF test on first difference of LGDP series the null hypothesis that there is a unit root in the first differenced series is rejected at even 1 percent level of significance indicating that the LGDP series becomes stationary after first differencing.

Similarly, when we apply ADF test on LPCONEXP, LGFCF, LIMPORTS, LEXPORTS, and LEDUCEXP all are found to have unit root meaning all these variables are non-stationary in level form. But after first differencing each of them (LPCONEXP, LGFCF, LIMPORTS, LEXPORTS) becomes stationary. Thus, all the six series included in the analysis are found to be stationary after first differencing i.e. each variable in logarithm form is integrated of first order and hence preconditions for estimating vector error correction model are met.

ADF test conducted on each of the six series in logarithmic form showed that none of them is stationary. The null hypothesis that each of them contains unit root is not rejected (Table 1). However, ADF test conducted on each of the above variable on their first differenced series showed that all of them are now stationary (Table 2). Therefore, each of the original series is found to be I(1) i.e. becomes stationary after first differencing. Since, the time series variables to be included in the model are not I (0) we cannot run VAR model.

Table 2

Null Hypothesis	*Augmented Dickey-Fuller test statistic (t-Statistic)*	*Test critical values 5% level*	*Probability**
DLGDP has a unit root	-4.819782	-1.953381**	0.0000
DLPCONEXP has a unit root	-3.942918	-3.603202***	0.0251
DLGFCF has a unit root	-3.469431	-2.971853****	0.0167
DLIMPORTS has a unit root	-4.182266	-3.580623***	0.0138
DLEXPORTS has a unit root	-4.580545	-3.587527***	0.0058
DLEDUEXP has a unit root	-9.216987	-2.971853****	0.0000

* MacKinnon (1996) one-sided p-values.
** With none.
*** With only Constant.
**** With Constant and linear trend.

Optimum Lag Selection

Lag selection criteria are applied for choosing number of lags to be used in VAR or VECM model. Eviews uses five different types of criteria for selecting number of lags. Most often there is found to be conflicts in suggested number of lags by them. Under such situation, the researchers generally prefer using Schwarz information criterion (SC) for choosing total number of lags. Given the conflicts in lags suggested by various criteria, we use only one lagged term in the model based on SC criterion (Table 3).

Table 3
Lag selection

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	122.3032	NA	1.68e-10	-8.318758	-7.838818	-8.176047
1	211.9820	132.8575*	1.48e-12*	-13.10978	-11.42999*	-12.61029
2	235.6686	26.31846	2.14e-12	-13.01249	-10.13285	-12.15622
3	272.9594	27.62279	1.88e-12	-13.92292*	-9.843432	-12.70987*

* indicates lag order selected by the criterion

Johansen Test of Cointegration

The next logical step before applying VECM model is to identify the total number of co-integration between the five stochastic endogenous variables namely LGDP, LCONEXP, LGFCF, LEXPORTS and LIMPORTS with one exogenous variables namely LEDUEXP. The results of the popular Johansen test of co-integration between the above mentioned variables are given in Table 4. Both the Trace test and Maximum Eigen Value test suggest two co-integrating equations-one between LGDP, LGFCF, LEXPORTS and LEXPORTS and the other one between LPCONEXP, LGFCF, LEXPORTS and LEXPORTS. The study is mainly interested in first cointegration as it will help in identifying factors determining long-run growth in gross domestic product.

Table 4
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.706429	94.40667	69.81889	0.0002
At most 1 *	0.664374	60.08885	47.85613	0.0024
At most 2	0.502506	29.51962	29.79707	0.0538
At most 3	0.241793	9.970797	15.49471	0.2830
At most 4	0.076238	2.220433	3.841466	0.1362

Trace test indicates 2 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 No. of CE(s)	*Eigenvalue*	*Max-Eigen Statistics*	*0.05 Critical Value*	*Prob.***
None *	0.706429	Statistic	33.87687	0.0443
At most 1 *	0.664374	30.56924	27.58434	0.0201
At most 2	0.502506	19.54882	21.13162	0.0820
At most 3	0.241793	7.750365	14.26460	0.4046
At most 4	0.076238	2.220433	3.841466	0.1362

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Vector Auto-regression and Vector Error-Correction Models

The application of Vector Error correction Model (VECM) requires number of cointegrating equations present among the variables. For this purpose popular Johansen cointegration test was performed. Both the Trace test and Maximum Eigen value test indicated two cointegrating equations among the five endogenous variables namely, LGDP, LPCONEXP, LGFCF and LIMPORTS and LEXPORTS with LEDUEXP as an exogenous variable.

We applied VEC model instead of unrestricted VAR model on the chosen variables taking LGDP, LPCONEXP, LGFCF LEXPORTS and LIMPORTS as endogenous variables and LEDUEXP as exogenous variables and two co-integration among them. Having estimated the VEC model we applied standard diagnostic test on residuals and coefficients of the estimated model. The VEC model passed the entire

Table 5
Vector Error Correction Model

	Coefficient	*Std. Error*	*t-Statistic*	*Prob.*
C(1)	-0.322885	0.069783	-4.62699	0.0002
C(2)	0.318663	0.069791	4.565945	0.0002
C(3)	-0.330731	0.151202	-2.18734	0.0414
C(4)	0.205837	0.250975	0.820148	0.4223
C(5)	0.294164	0.143372	2.051743	0.0542
C(6)	0.115762	0.046836	2.471627	0.0231
C(7)	-0.044696	0.110656	-0.40392	0.6908
C(8)	-0.368383	0.228456	-1.61249	0.1233
C(9)	0.037552	0.0225	1.669016	0.1115

D(LGDP) = C(1)*(LGDP(-1) - 4.64559474073*LGFCF(-1) - 1.71645110036 *LEXPORTS(-1) + 2.62635445482*LIMPORTS(-1) - 12.3076642437) + C(2)*(LPCONEXP(-1) - 5.12084517959*LGFCF(-1) + 1.71345134688*LEXPORTS(-1) + 2.81353068159*LIMPORTS(-1) - 7.65975834738) + C(3)*D(LGDP(-1)) + C(4)*D(LPCONEXP(-1)) + C(5)*D(LGFCF(-1)) + C(6)*D(LEXPORTS(-1)) + C(7)*D(LIMPORTS(-1)) + C(8) + C(9) *LEDUCEXP

diagnostic test like LM test for autocorrelation, normality test and heteroskedasticity test on residuals (Table 6; Table 7; Table 8).

Table 6
VEC Residual Normality Tests

Component	*Skewness*	*Chi-sq*	*df*	*Prob.*	*Kurtosis*	*Chi-sq*	*df*	*Prob.*	*Jarque-Bera*	*df*	*Prob.*
1	0.272192	0.345747	1	0.5565	2.484517	0.310010	1	0.5777	0.655756	2	0.7205
2	0.184690	0.159182	1	0.6899	2.883580	0.015813	1	0.8999	0.174994	2	0.9162
3	-0.853756	3.401532	1	0.0651	2.958899	0.001971	1	0.9646	3.403502	2	0.1824
4	-0.158171	0.116751	1	0.7326	3.526007	0.322797	1	0.5699	0.439548	2	0.8027
5	-0.281753	0.370461	1	0.5428	2.079629	0.988263	1	0.3202	1.358724	2	0.5069
Joint		4.393672	5	0.4942		1.638853	5	0.8965	6.032525	10	0.8125

Table 7
VEC Residual Serial Correlation LM Tests

Lags	*LM-Stat*	*Prob*
1	23.72764	0.5352
2	23.99366	0.5197
3	15.71712	0.9230
4	14.19060	0.9583
5	27.75156	0.3194
6	18.23110	0.8324
7	22.52481	0.6053
8	21.63471	0.6567
9	22.55993	0.6032
10	19.65001	0.7649

Probs from chi-square with 25 df.

VEC model is a system model. Since the VEC Model includes five endogenous variables it estimates five separate model one for each endogenous variable in terms of remaining endogenous variables and other exogenous variables. This study is mainly interested in the first equation of the VEC model and its estimated results given in Table 5. The nine estimated parameters C1, C2, ……C9 belong to this equation. The coefficients C1 is associated with first cointegrating relation included in the model. The value of C1 is -0.322885 which is negative and also statistically significant at 1 % level. Hence, the associated cointegrating equation is valid and there is a long-run or equilibrium relationship between LGDP, LGFCF, LEXPORTS and LIMPORTS. If there is a deviation from the long-run relationship negative and significant value of C1 ensures restoration of long-run relationship between the above mentioned five stochastic endogenous variables.

The result of vector error correction model is given below (Table 5). The residuals of the model passed both the normality test and no-autocorrelation test. VEC Residual Normality Tests under the null

hypothesis that residuals are multivariate normally distributed is not rejected at even 10 percent (Table 6). Similarly, VEC residual serial correlation LM test under null hypothesis of no serial correlation is not rejected up to lag 10 at 1 percent level (Table7). Moreover, null hypothesis that the residuals are homoscedastic is not rejected at even 10 percent level (Table 8).

Table 8
VEC Residual Heteroskedasticity Tests:
No Cross Terms (only levels and squares)

		Joint test:			
Chi-sq		*Df*		*Prob.*	
239.4515		240		0.4079	
Individual components					
Dependent	R-squared	F(16,11)	Prob.	Chi-sq(16)	Prob.
res2*res2	0.597682	1.021346	0.4989	16.73509	0.4029
res3*res3	0.340938	0.355649	0.9703	9.546253	0.8892
res4*res4	0.394529	0.447980	0.9297	11.04681	0.8066
res5*res5	0.274643	0.260309	0.9925	7.690003	0.9576
res2*res1	0.598487	1.024774	0.4965	16.75764	0.4014
res3*res1	0.229691	0.204999	0.9977	6.431349	0.9827
res3*res2	0.834120	3.457073	0.0212	23.35537	0.1046
res4*res1	0.346932	0.365223	0.9670	9.714094	0.8811
res4*res2	0.652634	1.291681	0.3391	18.27376	0.3081
res4*res3	0.324073	0.329622	0.9783	9.074044	0.9103
res5*res1	0.406784	0.471438	0.9166	11.38996	0.7848
res5*res2	0.648991	1.271140	0.3494	18.17175	0.3139
res5*res3	0.241805	0.219258	0.9968	6.770526	0.9774
res5*res4	0.381746	0.424502	0.9418	10.68889	0.8283

The estimated VEC model suggests two cointegration relations – one among LGDP, LGFC, EXPORTS and LIMPORTS and the other one among LPCONEXP, LGFCF, LEXPORTS and LIMPORTS. The negative and significant value of coefficients C (1) at 1 percent level validates the error correction mechanism. That is if there is disequilibrium the equilibrium relationships are restored in the long-run automatically through process of adjustment. Around 32% of the disequilibrium is corrected in a year.

In order to identify the direction of causality among the five stochastic variables VEC Granger Causality/Block Erogeneity Wald Tests was conducted. The results of this test are given in the table below (Table 9). It was again found that each of gross fixed capital formation and exports causes significant change in gross domestic product. Consumption expenditure, gross fixed capital formation, exports and imports together also cause significant change in gross domestic product.

Table 9
VEC Granger Causality/Block Exogeneity Wald Tests

	Independent variable					
Dependent Variable	*Chi square -statistics of lagged 1st differenced term [p-value]*					*ECTt-1 coefficient (t-ratio)*
	D(LGDP)	*D(LPCONEXP)*	*D(LGFCF)*	*D(LEXPORTS)*	*D(LIMPORTS)*	
D(LGDP)		0.672643 [0.4121]	4.209650* [0.0402]	6.108940* [0.0134]	0.163150 [0.6863]	- 0.322885* (0.06978)
D(LPCONEXP)	0.098297 [0.7539]		0.553919 [0.4567]	0.335229 [0.5626]	0.056804 [0.8116]	0.129744 (0.07239)
D(LGFCF)	1.097430 [0.2948]	0.379665 [0.5378]		0.104682 [0.7463]	0.009500 [0.9224]	0.153876 (0.20338)
D(LEXPORTS)	0.568623 [0.4508]	1.278892 [0.2581]	0.346761 [0.5560]		1.186785 [0.2760]	-0.27499 (-0.43065)
D(LIMPORTS)	1.792378 [0.1806]	0.328312 [0.5667]	0.199891 [0.6548]	2.831991 [0.0924]		0.090446 (0.24789)

Note: * denotes significant at 5% significance level. (t-statistic are in parenthesis & p-values in squared brackets)

5. CONCLUSION

Saudi Arabian Economy is mostly an oil based economy. It is one of the major oil producing and exporting countries of the world. However, in recent years, it has been taking measures to diversify its economy in view of the constantly falling oil prices in the international market and hence shrinking oil revenue coming from oil exports. In recent years, Saudi Arabia has also been spending a lot on education in its effort to improve and increase human capital stock as it has been facing shortage of it and currently it is heavily dependent on external sources. Under this background this study mainly aimed at identifying the major factors which drive economic growth in Saudi Arabia.

The analysis in this study included total six variables namely gross domestic product, private consumption expenditure, gross capital formation, exports, imports and public expenditure on education. Since the data used on these variables for the analysis were time series, unit root test was conducted on each variable using Dickey Fuller unit root test. All the variables were found to be non-stationary in level form. But each of them became stationary after first differencing.

Moreover, Johansen co-integration test was conducted to search for co-integrating relationships among these variables if any. It suggested two co-integrating relationships between them. Therefore, Vector Error Correction Model (VECM) was preferred to Vector Auto Regressive Model. The results of estimated VECM with two co-integrations were found to be valid.

Vector Error Correction Model, VEC Granger Causality/Block Exogeneity Wald Tests and co-integrating equations that show a long-run equilibrium relationship between gross domestic product as dependent variable and three variables namely gross fixed capital formation, exports and imports as explanatory variables. The results of Vector Error Correction Model validates that there is a long-run equilibrium relationship between the above mentioned four variables. Since, this long-run relationship

does not shed any light on the direction of causality between them VEC Granger Causality/Block Erogeneity Wald Tests was conducted to determine the direction of causality between them. It was found that gross fixed capital formation, and exports cause growth in gross domestic product in the short-run. Moreover, estimated long-run relationship shows that while gross fixed capital formation and exports boost up gross domestic product imports cause a fall in it in the long-run. Public expenditure on education does not have any significant impact on gross domestic product.

REFERENCES

Albiman, M., & Suleiman N.N. (2016), The Relationship among Export, Import, Capital Formation and Economic Growth in Malaysia. *Journal of Global Economics*, 4, 186.

Abdalla, M.A & Abdelbaki, H.H. (2014), Determinants of Economic Growth in GCC Economies. *Asian Journal of Research in Business Economics and Management,* 4(11), 46-62.

Ageli, M. M. (2013), Does Education Expenditure Promote Economic Growth in Saudi Arabia? An Econometric Analysis, *International Journal of Social Science Research,* 1(1), 1-10.

Alodadi, A. & Benhin, J. (2015), Long-term Economic Growth in Oil-Rich Saudi Arabia: What is the role for non-oil sectors? *Economic Issues*, 20(1), 109-129.

Alodadi, A. & James Benhin, J. (2015), The Main Determinants of Economic Growth and the Role of Non-Oil Sectors in Oil Countries' Economies: The Case of Saudi Arabia, *International Journal of Business Tourism and Applied Science*, 2(2), 1-7.

Al-Yousif Y.K. (2008), Education expenditure and economic growth: some empirical evidence from the GCC Countries. *Journal of Developing Areas*, 42(1), 69–80.

Dandan, M. M. (2013), Educational Expenditure and Economic Growth: Evidence from Saudi, *International Research Journal of Finance and Economics*, 112, 155-161.

Dritsakis, N.., Varelas, E. & Adamopoulos, A. (2006), The Main Determinants of Economic Growth: An Empirical Investigation with Granger Causality Analysis for Greece, *European Research Studies*. IX, (3-4), 47-58.

Eid, A. G. (2015), Budgetary Institutions, Fiscal Policy, and Economic Growth: The Case of Saudi Arabia, *Working Paper 967*.

Hafnida, S. M. & Abdullah, H. (2016), Financial Development And Economic Growth: An Empirical Investigation on 4 OIC countries, *International Journal of Social Science and Economic Research*, 1(9), 1400-1410.

Hussin, F., Ros, N.M. & Noor, M.S.Z. (2013), Determinants of Economic Growth In Malaysia 1970-2010, *Asian Journal of Empirical Research*, 3(9),1165-1176.

Johansen, S. (1995), *Likelihood-Based Inference in Cointegrated Vector Autoregressive Models*. Oxford: Clarendon Press.

Karim, Z.A., Karim, B.A., & Zaidi, M.A.S. (2012), Fixed Investment, Household Consumption, and Economic Growth: A Structural Vector Error correction Model (SVECM) Study Of Malaysia, *International Journal of Business and Society*, 13(1), 63 – 76.

Kogid, M., Mulok, D., Beatrice, L.F.Y. & Mansur, K. (2010), Determinant Factors of Economic Growth in Malaysia: Multivariate Cointegration and Causality Analysis, *European Journal of Economics, Finance and Administrative Sciences*, 24, 123-137.

Makdisi, S., Fattah, Z. & Limam, I. (2000), Determinants of Growth In The Mena Countries, *World Bank sponsored Workshop on the Global Development Network*, Prague, June 9-11.

Tnse, W.H. (2007), Exports, Domestic Demand and Economic Growth: Some Empirical Evidence for the Middle East Countries, *Journal of Economic Cooperation*, 28(2), 57-82.

Tridico, P. (2007), The determinants of economic growth in emerging economies: a comparative analysis, *Departmental Working Papers of Economics - University 'Roma Tre' 0075,* Department of Economics - University Roma Tre.

Yusoff, M. & Febrina, I. (2012), Trade Openness, Exchange Rate, Gross Domestic Investment, and Growth in Indonesia, *The Asian Conference on the Social Sciences Official Conference Proceedings.* International Islamic University Malaysia, Malaysia.