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COINTEGRATION AND CAUSALITY BETWEEN ECONOMIC GROWTH, GOVERNMENT SECTOR AND PRIVATE SECTOR IN SAUDI ARABIA

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Abstract: *In an age when oil prices are abysmally low, an important element for sustaining the growth of an oil-dependent economy like Saudi Arabia is to minimize the role of government sector and to encourage the growth of private sector. In fact, this is an important aspect of economic diversification. Empirical studies on analysing the relationship between government sector, private sector and economic growth is missing for Saudi Arabia. Using Johansen test of cointegration for the period 1970-2015, this study finds out that the three variables are cointegrated for Saudi Arabia. The study further indicates that there is a long-run causality running from both government sector and private sector to gross domestic product. This causality is missing in the short run. Finally, the study recommends re-structuring the salaries and taxation in the private sector.*

Keywords: *Economic Growth, Government Sector, Private Sector, Saudi Arabia, Cointegration*

JEL classification codes: *E27; R15; F43.*

INTRODUCTION

In the current economic scenario when the oil prices have come off drastically, an oil dependent country like Kingdom of Saudi Arabia (henceforth referred to as Kingdom) faces a huge challenge to sustain itself economically. The best plausible way out of this is to diversify its economy. In the context of the Kingdom, economic diversification denotes decreasing its dependence on oil sector by creating an economy whose exports and revenues depend on the non-oil sector (ESCWA, 2001). This implies diminishing the role of government sector and encouraging the growth of private sector. In the Kingdom, the contribution of the private sector to GDP at current prices stood as 41.1 percent during 2014 compared to 37.6 percent in the preceding year. Its growth rate (at current prices) was 9.4 percent in the preceding year (51st Annual Report of SAMA). In fact, the private sector contribution to capital formation is greater than the government sector. For the year 2014, gross fixed capital formation at purchaser value at current prices for the non-oil private

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sector was higher at 359,477 million riyals than 264,462 million riyals of the government sector. Government sector's contribution to GDP at current prices was 16.8 percent in 2014 as compared to 15.8 percent in the previous year. The government sector (at current prices) had a growth rate of 6.6 percent during 2014 while it was 5.7 percent in the preceding year. A significant development was that the non-government gross final consumption expenditure was SAR 909.8 billion that was more than the government sector final consumption which stood at SAR 739.1 billion in 2014 (51st Annual Report of SAMA).

Empirical evidence to the question whether an increase in government expenditure leads to economic growth is still inconclusive (Al Shahrani and Al Sadiq, 2014). Government's investment in education, health and, infrastructure in particular raises labour productivity and promotes private investments. The alternate viewpoint is that the greater the size of the government, the more unfavourable its growth. Inefficient conduction of government operations are reasons for that. It has been claimed that public investments are many a time managed in an environment of high subsidy and low efficiency. The financing of these investments also may crowd out private investments. It is also blamed that monetary and fiscal policies lead to biased economic stimulus that adversely affects productivity. But even if all these claims are correct it's the government which is instrumental in maintaining a balance between profit seeking private enterprise and social interest and provides a "socially optimal direction for growth and development" (Ghani, 1998).

Saudi Arabia started to give importance to its private sector in late 2002 by permitting around twenty private companies to do the business (Saravia, 2002). The private sector is supposed to make required goods and services in a proficient and commercial manner while the government sectors contribute to provide a conducive business environment (Al Awaji, 1989). Saudi's succession to the World Trade Organization in 2005 added zeal to the liberalization and privatization initiatives. In the eighties, businesses only functioned as intermediaries between the local demand and international businesses. However, the things have changed drastically now. According to the 'Ease of Doing Business' published by the World Bank, Saudi Arabia's rank improved from 34th position in 2006 to 26th position in 2014. This index deals with factors related to establishing and functioning of local firms. Saudi Arabia has strong infrastructure in terms of roads, airports and seaports. In addition, oil exports provide the needed resources for expanding both economic and social goods. There is huge growth in businesses and the public sectors are into many a thing like manufacturing, retail, hotels, clinics and contracting. In fact the share of service sector in gross domestic product (GDP) at current prices has increased immensely from mere 15.96% in 1974 to 41.01% by 2014 (51st Annual Report of SAMA). In the Kingdom, small and medium enterprises (SMEs) are mainly found in wholesale and retail sector, real estate, and restaurant

and hotel business. Another aspect of private sector is family business. There are around two hundred family businesses of SAR 250 billion in domestic investments (Daghsh, 2004).

The boost for Saudi economy came with the oil boom that started in 1970s (Ramady, 2010). Owing to this, huge investments flowed into capital-intensive industries related to petrochemical and industries. At the same time, during this process, small and medium enterprises (SMEs) were neglected because of 'not being glamorous enough, not being organized managerially and that the state bureaucracy gave more preferences to large businesses'. These SMEs suffer from access to finance, lack of proper service, managerial insufficiency, immature information technology structure and deficient market data (Al Kurdi, 2002). The problem of SMEs can be summed up as lack of quality, marketing, technology and experiences low quality, high prices, inadequate marketing, inadequate technology compounded with issues in procuring raw materials (SAGIA, 2004). Also the family businesses, though profiting, are marred with non-business social factors (Daghsh, 2004). It has centralized decision-making culture with hierarchy based on paternalism, obsessed with the size of their balance sheet and hide information on their profitability and market share (Ramady 2010).

Though the private sector contributes a substantial share in the gross domestic product (GDP), the salaries are half that of the government salaries. In 2014, the expenditure on GDP at purchaser's value at constant prices (2010-100) was more for the private final; consumption sector at 795673 million riyals than 627779 million riyals of the government final consumption expenditure. In addition, the share of income going to capital in the non-oil private sector is 75%. This implies that the corporate sector enjoys huge profits and only 25% goes to labour (Callen et.al, 2014). Moreover, government provides cheap energy, infrastructure and capital to the private sector. This resulted in huge foreign investments in private sectors without technological advantage. Unfortunately, the private sector concentrates on low technology and more factor intensive basic items like cement, petrochemicals, plastics etc. These basic products have a comparative advantage due to the support of the government policies and actions. The disadvantage of this growth model resulted in poor encouragement for improvement in productivity, investment in technology and engagements in research and development. It has been said that there is uni-directional causality on investment from government to private sector, but not vice-versa (Hertog, 2014).

Government plays its role in public investment through state owned firms and government expenditures. Government expenditure is of two types: current expenditure comprising salary, subsidy, transfer payments etc. and capital expenditures comprising human resource development, social services, health services, transportation, municipal services and housing. In the Kingdom, government invests in "general public services, defence, education, health, social

security and welfare service, housing and community amenities, other community and economic services". Private sector in the Kingdom is spread over ''agriculture & finishing, manufacturing, mining & quarrying, electricity, water & other utilities, building & construction, commerce, transport & communication and finance services". In terms of million riyals, the private sector increased from 53225 in 1970 to an amount of 989979 in 2015, while the government sector has increased from 50508 to 42966 in the same period and the gross domestic product increased immensely from 4844334 to 2520802 over the same period (51st Annual Report of SAMA). All these figures are of producers' value at constant prices (2010=100) and is pertaining to non-oil sector. In terms of percentage change, GDP, private sector and government sector showed an increase of 19.21%, 5.37% and 0.11% respectively.

REVIEW OF PAST LITERATURE

To probe into the relationship between economic growth and the private sector past literature was sought for. To the best of the efforts of the researcher, no exact literature was found which studied the role of the government and public sector together, for the Kingdom. Nevertheless, few studies have been found which are summarized here.

Ghali (1997) using the data for the period 1960-96, found no causality from government spending to per capital real output growth. However, there was a causality running vice versa. Based on the analysis the author recommended that the government should shrink its size and limit its role. Al-Qudair (2005) using the data for the period 1964-2001 found bi directional causality between government expenditure and revenues both in the short and long run. The study found that an increase in the government expenditure led to an increase in economic activities that finally ended up with an increase in non-oil revenues for government.

Joharji and Starr (2010) using the data for the period 1969-2005 discovered that government's investment had a positive effect on the rate of growth in the long run. The study also found that government's investment led to an increase in the non-oil GDP. Another important finding of this study was that growth was affected more from current expenditure than from capital expenditure. The authors were of the opinion that might be due to non-economic investment projects and managerial issues. The study also identified few things like expanding the role of private sector and improving efficiency in public sector. These structural changes according to the authors would facilitate diversification of the economy.

Espinoza and Senhadji (2011), using the data for the period 1975-2009, were of the opinion that the Kingdom had to maintain its economic activity in the non-oil sector as it was important to provide fiscal stimulus to infrastructure and social

spending. The study further recommended that fiscal policy was an important policy measure to achieving diversification.

Al Shahrani and AlSadiq (2014) in a similar study for the period 1969-2010 found relationship among private investment, government investment and economic growth. The short run causes of growth were "private domestic investment, openness to trade, public investment, and expenditures on health care and education" while the long run determinants were" private domestic investment, capital expenditures, and spending on health care which included human capital". The study recommended that government should concentrate on infrastructure, social services and new projects in public services, research & development and human capital. It also advised private sector participation with the government sector. This according to them would lead to sustainable growth and diversification.

Kacem (2014), using the data for the period 1980-2011, found a long run causality running from social development and growth. This social development was almost entirely the domain of the government. He established the trickle up hypothesis and identified that in the long run factors like ''education, health, social services, infrastructure, regional development and diversifying industrial activities" would lead to economic growth.

Alodadi and Behin (2015) in their study for the period 1970-2011 found that growth in Saudi Arabia was because of oil exports, investment in oil sector and government expenditure. Private investments influence the growth in non-oil sectors, but the non-oil exports are not significant now. The authors highlighted private investment as one of the elements of future engine of growth, besides labour market reforms. Altaee (et.al., 2016) using data from 1980 to 2014 found that gross capital formation, export and financial development had a positive impact on the economic growth of the Kingdom.

And despite the fall in oil prices in a report of McKinsey, Al Kibsi (et. al., 2015) stated that "a productivity led transformation" would lead the Kingdom to double its GDP by 2030. Towards this, the kingdom needed to move on from the current "government led economic growth to a more market based approach". They further commented that this transition would lead to a more sustainable growth than oil boom led growth of the past. In fact we need to accept that the Kingdom is working as per the notion of comparative advantage (Haque, 2015). Owing to natural abundances, it has specialized in oil. But global circumstances have changed. The prices of oil have gone down to as low as 45 dollars a barrel in Sep, 2016 when compared to 140 dollar per barrel in Sep, 2013, that's within a span of three years. The only way out for an oil dependent country like Saudi Arabia is to diversify itself away from oil. For diversification, the private sector has to come forward. Towards this, this study aims to study the relationship between the economic growth, government sector and the private sector.

DATA SUMMARY

The data for economic growth (symbolized by GDP), private sector and government sector data has been taken at producers' value at constant prices (2010=100). The period of this data is 1970-2015. The data for this study is taken from the 51st Annual Report of Saudi Arabian Monetary Agency (SAMA).

Table 1
Correlation between variables

	(1)	(2)	(3)	(4)
Year	0.0240***			
	(0.0019)			
Govtsector	0.6296***	0.1004**		
		(0.0493)		(0.0475)
Privatesector		0.4845***	0.2346***	
			(0.0313)	(0.0372)
Constant	13.4959***	6.4417***	7.9682***	9.1273***
	(0.0527)	(0.5973)	(0.3941)	(0.1567)
No. of Observation	46	46	46	46
Log lik.	15.6912	16.9825	24.2258	98.0642
Adj-R2	0.7701	0.7826	0.8413	0.9933

Note: ***denotes significance at 1 percent, figures in parenthesis is standard errors

Table 1 presents the correlation of variables under study. For the variables the logarithm value of the raw data has been taken to reduce noise. GDP is regressed with all the variables and its combination as well as regressed with time. In first model, GDP is regressed with year time trend and it is found that there is a significant positive correlation. On an average the GDP in the last 45 years increased by 2.5 percent per year. In all the other models, similar results are found. Among all the variables, government sector has a greater association with GDP, followed by private sector. This is also observed in the below figure. It is clear that all the variables are moving faster and follow the common time trend and show positive association with GDP.

To study the nature of relation between time series data sets the command *xcorr* is used in STATA. The cross correlogram graph demonstrates the correlation between GDP, government sector and private sector. Horizontal axis is defined as lag and the vertical axis measures the cross correlation of the two variables. In the left side of figure cross correlation with GDP and government sector is presented, while the right side of figure presents the cross correlation with GDP and private sector. The results indicate that at lag 0, there is a positive correlation between GDP and government sector. This implies that an increase in government sector leads to an immediate increase in GDP and this holds for all the lag values. The

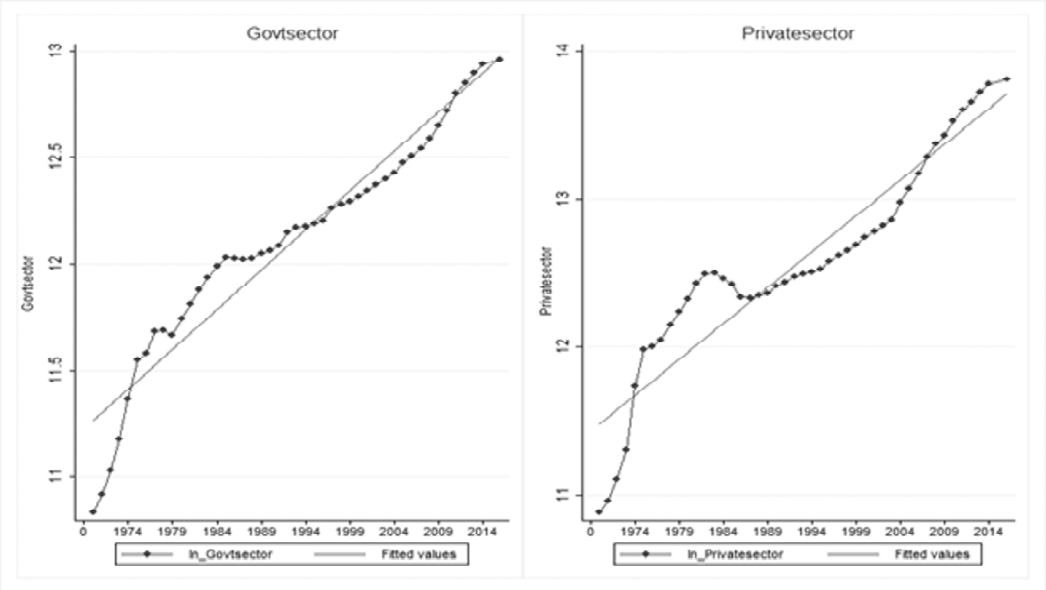

Figure 1: Year wise trends of all the indicators

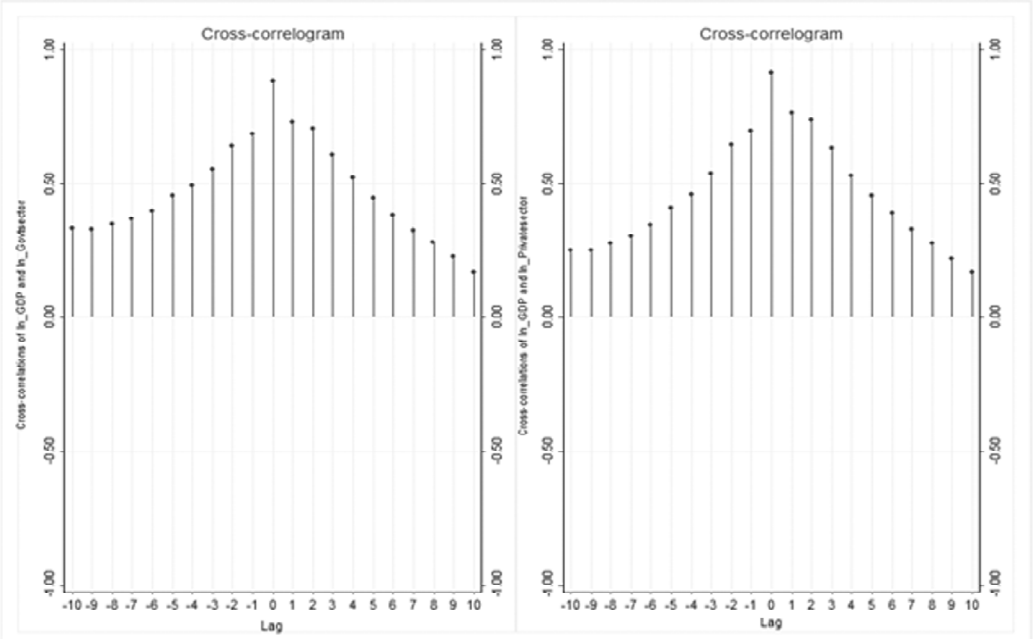

Figure 2: Correlograms: cross correlation of GDP with Government and Private sector

figure also confirms the similar pattern for private sector. Therefore it can be concluded that there is positive and significant correlation of government and private sector with GDP.

EMPIRICAL METHODOLOGY AND RESULTS

This study tries to assess the relationship of GDP with government sector and private sector using cointegration. Cointegration refers to the condition when two or more than two time series datasets have a stochastic trend. Natural log of the all the variables have been taken to reduce noise from the datasets. It also helps to interpret the coefficients directly as the elasticity of the dependent variable with respect to independent variable.

At the outset, the variables are tested for signs of stationarity. The Equation 1 below denotes the test for unit root. It is autoregressive process of degree one, symbolised as AR(1) process.

$$Y_t = Y_{t-1} + \in_t \quad (1)$$

With; $\in_t \sim IN\ [0, \sigma 2_e]$

From this equation it can be shown that subtracting (as data) on both the sides leads to a stationary process even when it is non stationary, i.e. (2)

$$Y_t - Y_{t-1} = \Delta Y_t = \in_t \quad (2)$$

This study used Phillips Perron test for stationarity (Table 2). Phillips and Perron test of stationarity is more comprehensive than the traditional Dickey Fuller as it incorporates an automatic correction to the DF procedure to allow for autocorrelated residuals (Al Ezzee, 2011). If the data is stationary, it should not be used for studying relationships as the regression becomes spurious with invalid OLS estimates. Here all the variables are non-stationary at level but when converted into first difference, they become stationary

Table 2
Phillips-Perron test for unit root

	Test Statistics Z(t)	*1% Critical Value*	*5% Critical Value*	*10% Critical Value*	*MacKinnon approximate p-value for Z(t)*
GDP	-2.08	-3.62	-2.95	-2.61	0.25
Lagged(GDP)	-4.98	-3.63	-2.95	-2.61	0.00
Govtsector	-2.69	-3.62	-2.95	-2.61	0.08
Lagged(Govtsector)	-3.11	-3.63	-2.95	-2.61	0.03
Privatesector	-1.90	-3.62	-2.95	-2.61	0.33
Lagged(Privatesector)	-2.79	-3.63	-2.95	-2.61	0.06

The cointegrating vectors are identified using maximum likelihood (ML) method established by Johansen (1988, 1995). Variables are cointegrated if the linear combination of the variables under study is stationary. Once the presence of cointegration is observed then the Vector Error Correction Model (VECM) is applied to observe the long run associations of these relationships. There are few steps

involved in developing VECM model such as lag selection and Johannsen test of cointegration.

LAG SELECTION

To establish cointegration in the model, it is imperative to decide the number of lags to be used in the VECM. These lags are needed as past values affect today's values. Too many a lags leads to errors in forecasts, and fewer lags may lead to missing relevant information. Using STATA module *varsoc*, the lag-order selection statistics for Vector Error Correction Model (VECMs) is obtained. The module reports the Likelihood ratio criteria (LR), Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC) lag order selection statistics for a series of vector auto regressions of order 1. The results are shown in Table 3.

Table 3
Lag-order selection statistics

Lag	*LL*	*LR*	*df*	*P*	*FPE*	*AIC*	*HQIC*	*SBIC*
0	28.0091				0.000059	-1.21996	-1.1743	-1.09457
1	200.534	345.05	9	0	2.00E-08	-9.19677	-9.01414	-8.69524*
2	213.1	25.133	9	0.003	1.70E-08	-9.37075	-9.05115*	-8.49307
3	224.592	22.982*	9	0.006	1.6e-08*	-9.49227*	-9.0357	-8.23844
4	227.146	5.1079	9	0.825	2.20E-08	-9.17783	-8.58428	-7.54785

Note: * denotes the optimal lag

The null hypothesis here is that all the coefficients on the lags of the endogenous variables are zero. For using this sequence of tests an '*' appears next to the statistic indicating the optimal lag. The results in Table 3 demonstrates that the maximum number of lags to include for a VECM is 3, as all the selection criterion such as LR, AIC and HQIC show significant values at lag 3. Only, SBIC lag selection criteria suggest us to take lag 1. Based on the observation, it is better to take lag 3 in Johansen test of cointegration and VECM model as most of the models suggest for it.

JOHANSEN TEST FOR COINTEGRATION

For doing Johansen test of cointegration the pre-condition is that that variables are non-stationary at level but when converted to first difference, they become stationary, meaning integrated of same order. To find out the cointegration across variables Trace Statistics and Max Statistics are required with respective estimated or critical values. Later, the estimated values are compared with critical values to accept/reject the null hypothesis. Here the null hypothesis is that there is no cointegration among the three variables or the variables are not moving together. An inherent test of cointegration is available in STATA executed through the *vecrank* command. The command *vecrank* yields statistics through which the amount of

cointegrating equations in a VECM is decided. This is also referred to as the value of rank. This *vecrank* command gives rank of the model using three methods: Johansen's static method, the maximum eigenvalue statistic method and minimizing an information criterion (Sukati, 2013). All these approaches are established on Johansen's maximum likelihood (ML) estimation of the parameters of a cointegrating VECM. Therefore, the test for cointegration is based on the log likelihood findings in the model. The test starts with rank equal to zero which denotes absence of cointegration between variables when the first null hypothesis is accepted. The result of the *vecrank* command is shown in Table 4 below:

Table 4a
Johansen test of cointegration

Maximum rank	*Parms*	*LL*	*Eigenvalue*	*Trace statistic*	*Critical value*
0	12	210.2592	.	23.0507*	29.68
1	17	216.9474	0.26735	9.6743	15.41
2	20	220.4485	0.15028	2.672	3.76
3	21	221.7845	0.06025		
Maximum rank	Parms	LL	Eigenvalue	Max statistic	Critical value
0	12	210.2592	.	13.3765	20.97
1	17	216.9474	0.26735	7.0023	14.07
2	20	220.4485	0.15028	2.672	3.76
3	21	221.7845	0.06025		

Note: * denotes there is one cointegration model in the system

Table 4 shows the Johansen test of cointegration result. The null hypotheses for all the rank specified in above table are accept/reject based on the estimated and critical values. When the Trace or Max statistics > critical value, it implies that the null hypothesis needs to be rejected, and vice versa. However, the results are considered when both Trace and Max value shows similar results. Null hypothesis and alternate hypothesis are defined below for rank 0 and 1, and similarly it is considered for rank 2 and rank 3.

Rank 0, Null hypothesis: There is no cointegration among the variables

Alternate hypothesis: There is cointegration among the variables

Rank 1, Null hypothesis: There is 1 cointegration model among the variables

Alternate hypothesis: There is more than or equal to 1 cointegration among the variables

Results from Table 4 indicate that for rank 0, Trace statistics < critical value, which means the null hypothesis cannot be rejected rather it is accepted and concludes that there is no cointegration among the variables. The same results are also checked for rank 1, as initially the variables are non-stationary and later when converted into first difference, become stationary. In Johansen cointegration test

result it is found that there is cointegration in all the case of rank, both trace and max statistics are less that the critical value, which shows that the null hypothesis cannot be rejected and conclude that all these variables are cointegrated with each other. This means that the variables are cointegrated among each other or they have long run relationship. After determining that there is indeed a long run cointegration relationship between the variables, the next step is to collect the VECM estimates.

Table 4b
Johansen test of cointegration (continued)

Case 1: GDP to Govt and Private	*Coefficient*	*Std. Err.*	*Z statistics*	*Cointegrating* equation (ce1)
Ln_GDP	1			*Chi2=151.09and*
Ln_Govtsector	-.4194	0.2863	1.46	*P>Chi2=0.00*
Ln_Privatesector	-.2295	0.2092	1.10	*then Cannot*
Constant	-6.035094			*reject Ho*

The long run relationship can be stated:

Ln_GDP = 6.035094 + 0.4194 Ln_Govtsector + 0.2295 Ln_Privatesector

It denotes that 1% increase in the government sector would lead to around 41% increase in GDP and 1% percent increase in private sector would lead to around 22% increase in GDP. Unfortunately, the results are not significant. This could be due to misspecification of the model or missing an important variable. Like, the oil sector which has an important contribution to the GDP of Saudi Arabia has not been included in the model. In fact the oil sector has been deliberately not included in the model as the idea was to see the relative contribution of government sector and private sector to GDP over the years. Another probable cause could be the problem of autocorrelation. This will be taken up later in diagnostic checking of the model.

VECTOR ERROR CORRECTION MODEL

For estimating the VECM in STATA, the *vec* command is used where the software performs a VAR of the cointegrated variables using maximum likelihood method of Johansen's (1995). The output from STATA *vec* command is depicted in Table 5 below.

In Table 5, dependent variable is ln GDP and the model is specified with two independent variables – government sector and private sector. Where LD, L2D and L3D for each independent variables represents the first, second and third lagged variable of the variables. The coefficients ce1 represents the error correction term or the speed of adjustment towards equilibrium. In the VECM results, the target results are presented for GDP with respect to other variables. The long run

Table 5
VECM results

	Coefficient	*Std. Err.*	*Z statistics*
Ce1 (Error correction term)	-0.3462	0.15098	-2.29**
Ln (GDP in million riyals)			
LD.	0.2712	0.16932	1.6
L2D.	0.47884	0.19065	2.51**
L3D.	0.07213	0.22245	0.32
Ln (Government sector in million riyals)			
LD.	-0.8983	0.5503	-1.63
L2D.	-0.1848	0.54647	-0.34
L3D.	0.45625	0.44192	1.03
Ln (Private sector in million riyals)			
LD.	0.02072	0.33488	0.06
L2D.	0.55951	0.3229	1.73*
L3D.	-0.0757	0.32327	-0.23
Constant	0.01253	0.02124	0.59

Note: *** and ** denotes significance at 1 and 5 percent level

causality, happens only when the Ce1 (error correction term) is negative in sign and significant. Then it can be said that there is a long run causality running from the two variables to GDP. Based on the above results, it is found that the error correction term is negative and significant. And 34% of disequilibrium is corrected in a year. Therefore, it confirms that long run causality runs from independent variables to dependent variable. For the short run causality, it is needed to check whether the other lagged variables independently cause GDP or not.

In Table 6, test results to check the short run causality running from independent variables to the variable of interest that is, GDP is presented. While doing test, the lagged variables of each independent variable are considered. To test the short run causality of the independent variables with the GDP the null hypothesis is defined below:

Null hypothesis: There is no short run causality running from Govt/private sector to GDP.

Alternative hypothesis: There is short run causality running from Govt/private sector to GDP.

Table 6 presents the test result to check for short run causality. Two separate tests are done with all the variables with their lagged values on GDP. The condition to accept/reject the null hypothesis depends on the probability value of the test. If the probability value of the test is greater than 5 percent, the null hypothesis cannot be rejected. For the causality running from government sector to GDP, the probability value of test statistics is greater than 5 percent, and hence the null

Table 6
Test for short run causality

Case 1: GDP and Govt. sector test ([D_ln_GDP]: LD.ln_Govtsector L2D.ln_Govtsector L3D.ln_Govtsector)		
(1) [D_ln_GDP]LD.ln_Govtsector = 0 (2) [D_ln_GDP]L2D.ln_Govtsector = 0 (3) [D_ln_GDP]L3D.ln_Govtsector = 0	chi2(3) = 3.82	Prob > chi2 = 0.2810
Case 2: GDP and Private sector test ([D_ln_GDP]: LD.ln_Privatesector L2D.ln_Privatesector L3D.ln_Privatesector)		
(1) [D_ln_GDP]LD.ln_Privatesector = 0 (2) [D_ln_GDP]L2D.ln_Privatesector = 0 (3) [D_ln_GDP]L3D.ln_Privatesector = 0	chi2(3) = 3.28	Prob > chi2 = 0.3498

Note: LD, L2D and L3D for each independent variables represents the first, second and third lagged variable of the variables.

hypothesis cannot be rejected and it can be concluded that there is no short run causality running from government sector to GDP. Similar conclusion is also drawn for the private sector as the probability value is greater than 5 percent. To conclude the test results, it is clear that there is no short run causality running from government sector and private sector to GDP.

DIAGNOSTIC TEST OF THE MODEL

Autocorrelation

In this section, an attempt was made to check for autocorrelation of the variables. The result in Table 7 presents the langrage multiplier test to detect autocorrelation based on the following hypothesis:

Null hypothesis: No autocorrelation at lag order

Alternate hypothesis: Autocorrelation at lag order

Table 7
Lagrange multiplier test for autocorrelation

Lag	*chi2*	*df*	*Prob > chi2*
1	47.1888	9	0.00000
2	21.2083	9	0.01176

In the above table, test for autocorrelation has been shown using Lagrange multiplier test. Here the results confirm that the estimated probability value is less than 5 percent in both the case of lag order, therefore the null hypothesis is rejected. This implies that that VECM mode has autocorrelation as a whole and that is not

desirable. This could be a possible explanation for the parameters being not significant in the long run. However, autocorrelation is corrected by including lagged versions of the response variable as explanatory variables. Therefore the estimated results can be treated as robust as lagged variable of independent variables is included in the model. A final test for normality to check whether the residuals are normally distributed is to be done.

JARQUE-BERA TEST FOR NORMALITY

The assumption that the errors are independently, identically and normally distributed with zero mean and finite variance is important as it allows for the derivation of the likelihood function (Sukati, 2013). It may be that the residuals are not normally distributed. For this, the Jarque-Bera statistics to check normality is applied using *vecnorm* command to test the null hypothesis that the errors are normally distributed. The results are shown in table below. Here the null and alternate hypotheses are:

Null Hypothesis: Residuals are normally distributed

Alternate Hypothesis: Residuals are not normally distributed

Table 8
Test for normality using Jarque-Bera test

Equation	*chi2*	*df.*	*Prob > chi2*
D_ln_GDP	0.256	2	0.88007
D_ln_Govtsector	3.443	2	0.17884
D_ln_Privatesector	0.595	2	0.74252
ALL	4.293	6	0.63703

The test for normality of residuals is presented in table 11. The procedure to accept/reject of hypothesis is based on the estimated probability value. If the value is greater than 5 percent, it indicates that the null hypothesis cannot be rejected, rather it is accepted. The good thing here is that in case of all the variables including the overall test for normality is insignificant. This is because the probability value is greater than 5 percent and hence one cannot reject the null hypothesis. Therefore, it is concluded that all the residuals are normally distributed.

CONCLUSION

There is a significant positive correlation of government sector and private sector with GDP. For probing further, a more robust econometric technique of cointegration is applied. All the three variables are non-stationary at level but are stationary at first difference. An optimal lag of three is selected, where its tests whether GDP, government sector and private sector are cointegrated or not. Using

Johansen test the study found that all the three variables are cointegrated. Moreover, the error correction term is negative and significant implying that there is a long run causality running from both the government and the private sector to GDP. And, if there is any disequilibrium from the long run equilibrium, 34% of it is corrected in a year. However, results indicate that there is no short run causality running either from the government sector or from the private sector to GDP.

A point of view which emerges from all the analysis is that the private sector needs contribute more. This in a sense signifies that the benefits of the private sector are not going to the general population. This supports the view of Callen (et.al, 2014) in whose opinion the corporate sector enjoys huge profits and only 25% goes to labour. Another study by Hertog (2014) also reported that the total amount of salary provided by the government was double the amount of all the salaries given by the private sector and further comments that regardless of enormous private employment in private sector, it created very less of autonomous demand. Moreover, there is a nominal 20% corporate tax for foreign companies and only 2.5% tax as Zakat on local companies. This issue of low taxation has been voiced by Hertog (2014) and Callen (et.al, 2014) and Al Kibsi (et.al. 2015) in their reports. They commented that the Kingdom received income in the form of dividends only and not as taxes and recommended a "modern system of taxation" as one of the tools for transforming the economy. Hence this study, as a policy recommendation asks for increased taxation of the private sector and a hike in the salaries in the private sector, though this has not been directly analysed in this study.

However, this does not at all undermine the importance of the private sector. Things like efficiency, innovation and competition that are the hallmarks of any economy are best provided by the private sector. In fact, diversification of an economy can be provided only through a vibrant and flourishing private sector. The factors that can facilitate the private sector are beyond the scope of this study. To an extent, the limitations of the study can be nullified based on the past studies. Hegazy (2015) was of the opinion that Saudi Arabia should improve business climate, education, labour market reforms, infrastructure and SMEs as "challenges remain in contract enforcement, resolution of company insolvencies and trade integration despite export incentives". Alodadi and Behin (2015) suggested reforms in infrastructure development, privatisation process and facilitating visa process. Callen (et.al, 2014) suggested that the private sector should generate "high productivity jobs in high value added sectors to attract nationals". There is further scope to study these factors and their impacts.

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