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The Impact of Non-Oil Exports, FDI, and Services on Economic Growth in Saudi Arabia: An Empirical Analysis

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Abstract

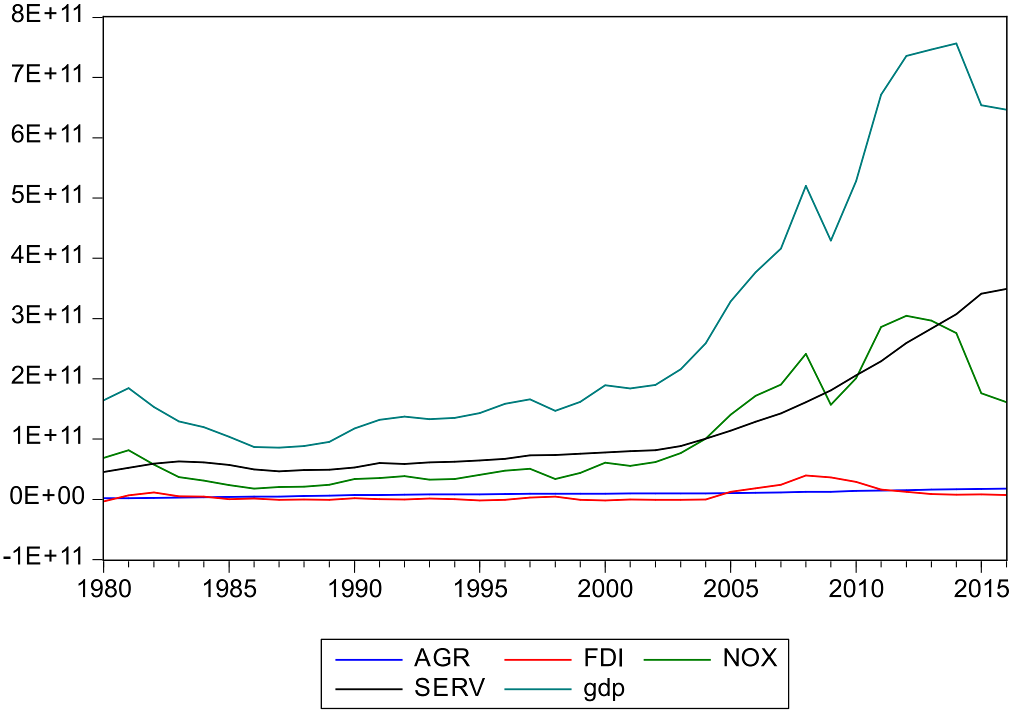
This study was designed to reveal the transformation of the Kingdom of Saudi Arabia's (hereafter referred to as the KSA) economy from an oil-driven one to one not driven solely by oil. Its focus is therefore on investigating the role of non-oil sectors (non-oil exports, foreign direct investment, and services) on economic growth during the 1980–2016 period. As part of the empirical analysis, cointegration, a vector error correction model, variance decomposition, impulse response, and CUSUM analysis were undertaken. The result of the variance decomposition analysis supports an earlier result obtained through the causality analysis, which revealed a unidirectional causality running from FDI to growth, as well as from non-oil exports to services. In the responses of the four variables to one standard deviation, innovations were, on average, found to be inactive in the early stages of the sample forecast period, but all variables demonstrated more pronounced responses after about seven years into the forecast period. Finally, the CUSUM test indicated the stability of the model.

Keywords: Economic Growth, Non-Oil, FDI, Cointegration, Error Correction, Impulse Response
JEL Classification: C33, C32, F43, F21

1. Introduction

Recent studies show that the KSA has enjoyed substantial economic growth in recent years. Explanations for this perceived trend have been attempted in different academic papers (Elimam, 2017; Nasir et al., 2017; Choudhury and Al-Sahlawi, 2008). The performance of non-oil exports has also improved considerably over the 1980–2016 period. Several factors appear to have contributed to this phenomenon, such as a rapid move toward trade liberalization, determined efforts to expand the economy's productive base, and a significant increase in foreign direct investment (FDI) flowing into the country.

Figure 1: GDP and the non-oil sectors over time



In developing countries, FDI is one of the most effective strategies for accelerating economic growth and development. It can serve as an instrument for growth and development in these countries by integrating them more into global financial and capital flows, increasing employment and the export base, building technological proficiency, and having spillover effects on domestic firms. These investment arrangements therefore improve the host countries' prospects for economic growth. Figure 1 shows the historical progress of the dependent variable (GDP growth) together with the explanatory variables considered in this paper (agriculture, foreign direct investment, and non-oil exports).

The role of exports in the economic performance of developing countries has become an intensively studied topic in recent years. The major motivation for such studies is the export-led growth (ELG) hypothesis, which attempts to provide a prevailing explanation in this context. The ELG hypothesis posits that a growth in exports has a positive influence on economic growth. However, the empirical evidence for the causal relationship between exports and growth is somewhat mixed. More specifically, the available time series studies have failed to deliver unwavering support for the ELG hypothesis, while most cross-sectional studies offer empirical evidence in support of the hypothesis. The opening up of trade in developing countries has increased not just trade but also FDI flows.

It therefore seems apparent that FDI has become another vital link in the export-growth association. It is notable, however, that despite the perceived acceleration of FDI inflow, there has not been any satisfactory effort to measure its contribution to the KSA's economic growth. This calls for an empirical investigation, and the questions here are: What vital role do non-oil sectors (non-oil exports, FDI, and services) play in economic growth? Are there any causal relationships? In this study, we explore an econometric analysis of these issues using appropriate techniques.

The rest of this paper is divided into sections as follows: Section two presents a brief survey of related literature and addresses the theoretical and empirical issues. Section three is devoted to the empirical analysis, while section four gives the summary and conclusions.

2. Literature Review

Two major economic theories, namely the Solow–Swan model and the New Growth Theory of Romer and Lucas, have acted as the basis for most studies into economic growth. The Solow-Swan model is one of the most imperative contributors to contemporary economic theory. It aims to detect and assess basic aspects that affect economic growth. The Solow–Swan model began with a normal production function that was contingent upon labor, capital and technical advances (Solow, 1962). It was subsequently extended in order to a) include other variables (e.g., savings, population growth, investment, and technical progress) and b) investigate how these in turn affect living standards and economic growth. Romer (1986) and Lucas (1988), meanwhile, established a theory of endogenous growth that focuses on the stock of human capital, technological advances, trade, and government policies. The crucial distinction with this model is that it links technical progress, rather than labor and capital, directly to productivity and economic growth.

Nonetheless, most studies for both developed and developing countries rely upon the expanded Solow–Swan model (Anaman 2004). In their study to establish the most appropriate model for developing countries, Rao and Cooray (2012) found that the expanded Solow–Swan model to be unsurpassed in the case of less developed countries.

Adding to these theoretical deliberations, empirical studies have endeavored to identify the significant factors for economic growth. However, such analyses encounter two major challenges: 1) the large number of diverse variables that affect economic growth and 2) that fact that each country has its own particular circumstances (Piazolo, 1995). Building on these empirical studies and considering these challenges, the factors that influence economic growth in Saudi Arabia were selected by focusing mainly on the key determinants of economic growth in non-oil sectors (non-oil exports, FDI and services).

Many empirical studies have found exports to be a main factor for growth in both oil and non-oil sectors (Tyler, 1981; Chow, 1987; Asseery and Al-Sheikh, 2004; Harvie and Pahlavani, 2006; Kogid et al., 2010; Tiwari, 2011).

Numerous analysts have proven that the relationship between exports and economic growth is mostly contingent on the export-led growth (ELG) hypothesis (Al-Yousif, 1997; Awokuse, 2007). They therefore use this hypothesis to measure the impact of exports on economic growth. Previous empirical studies have revealed that exports contribute positively to growth on several fronts, such as through the delivery of foreign exchange, technological transfer and the dispersion of knowledge, and improved efficiency by enhancing workers' skills.

Studies addressing the determinants of economic growth in oil-producing countries have been inclined to emphasize the exports variable (Anaman, 2004; Asseery and Al-Sheikh, 2004; Konya, 2004; Tuwaijri, 2001). They examine the causal relationship between economic growth and exports in the Kingdom of Saudi Arabia for the 1969–1996 period. Government spending was included in the analysis, and there was evidence that increased oil exports led to increased government spending, which in turn positively and significantly influenced economic growth. The study revealed the presence of bilateral causality between economic growth and exports, though the impact of exports on growth was stronger than the impact of growth on exports. In addition, the inclusion of the variable for government spending significantly amplified the strength of the causal relationship between growth and exports.

Although the ELG hypothesis remains relatively popular, the related empirical evidence from time series studies is mixed. Surprisingly, most literature based on cross-section studies support a positive link between exports and growth. However, such results from cross-country studies must be treated with caution, because they are subject to substantial limitations. These limitations are clearly outlined by Giles and Williams (2000) and include the implicit assumption of a common economic structure and similar production technology across different countries, which is clearly an over-simplification of the real situation.

Again, cross-country differences in technology presumably affect the international pattern of specialization and trade, as well as the rate of technological progress and growth. Secondly, the economic growth of a country is influenced by a host of domestic policies—such as monetary, fiscal, and external policies—that are not taken into account. Thirdly, cross-country regressions take positive associations as evidence of causation and provide little insight into the way that exports affect growth. To address these identified potential limitations in cross-sectional studies, a number of time-series studies have been undertaken.

The generation of productivity spillovers is one possible means through which FDI can affect growth. Some earlier studies found evidence that FDI leads to significant positive spillover effects for the labor productivity of domestic firms and the growth rate of domestic productivity in Mexico (Blömstrom and Persson, 1983); Blömstrom, 1986; Blomström and Wolf, 1994). However, Kokko, Tansini and Zejan (1996) caution that in the case of Mexico and Uruguay, the spillover effects are difficult to identify in industries where foreign affiliates have much higher productivity levels than local firms. De Gregorio (2003) contributes to the debate on the importance of FDI by noting that FDI may allow a country to bring in technology and knowledge that are not readily available to domestic investors. This in turn increases productivity growth throughout the economy. Dolan and Tomlin (1980), meanwhile, found that FDI flows were positively associated with a growth in per capita income, but that the FDI stock had a negative effect on growth. This result is further supported by Saltz (1992), who confirms a negative stock effect for a sample of 75 developing countries for the 1970–1980 period. Balasubramanyam, Salisu, and Sapsford (1996), meanwhile, analyzed how FDI affects economic growth in developing economies. Using cross-sectional data and OLS regressions, they found that FDI has a positive effect on economic growth in host countries with an export promoting strategy but not in countries using an import substitution strategy.

3. Empirical Analysis

3.1 The Empirical Model

We now proceed by specifying the baseline empirical model that captures the hypothesized relationships among the core variables under investigation. In doing this, the endogenous growth theory can be considered a very useful guide. This theory emphasizes the role of exports on driving long-term growth through a higher rate of technological innovation and dynamic learning from abroad (Lucas, 1988; Romer, 1986). The specified model is provided in equation (1) below.

$$Growth = f(NOX, FDI, \mathrm{SRV}) \qquad (1)$$

Where *Growth* is the economic growth as measured by the growth rate of the real Gross Domestic Product (GDP), *NOX* is the non-oil exports, *FDI* is Foreign Direct Investment inflow, and *SRV* is the contribution of the service sector to GDP. Data for these variables from 1980 to 2016 were obtained from the IMF and World Bank. Equation (1) may only be estimated in its econometric form, which is stated in equation (2).

$$Growth_t = \alpha_0 + \beta_1 NOX_t + \beta_2 FDI_t + \beta_3 SRV_t + + \epsilon_t \qquad (2)$$

Where α_0 denotes the intercept term, β_i are slope coefficients representing the parameters to be estimated, ϵ_t is the disturbance term and assumed to be purely random, and the subscripts t are for the dating of variables over the time period. On a priori grounds, the theoretical expectations are that α_0, β_1, β_2 *and* $\beta_3 > 0$. The empirical results obtained from this study are presented and discussed below.

3.2 Testing the Series for Stationarity

To investigate whether the time series are stationary or not, we apply two sets of unit root tests for stationarity, namely the Augmented Dickey-Fuller (ADF) and the Philips-Perron (PP) tests (Dickey and Fuller, 1979; Phillips and Perron, 1988). The results are presented in table 1 below.

Table 1: Unit Root Test for Stationarity

ADF UNIT ROOT TEST					
Variable		ADF value (constant included)		ADF value (constant and linear trend included)	
		Level	First differenced	Level	First differenced
Growth		-4.897800*	-6.123532*	-5.239983*	-6.065041*
NOX		-0.964993	-4.944531*	-2.040441	-4.884256*
FDI		-2.154046	-4.107410*	-2.775671	-4.017284**
SRV		-0.577475	-0.746443	-1.186604	-2.642024
Critical values	1%	-3.626784	-3.639407	-4.234972	-4.252879
	5%	-2.945842	-2.951125	-3.540328	-3.548490
	10%	-2.611531	-2.614300	-3.202445	-3.207094
PP UNIT ROOT TEST					
Variable		PP value (constant included)		PP value (constant and linear trend included)	
		Level	First differenced	Level	First differenced
Growth		-4.976185*	-16.72452*	-5.297399*	-16.21466*
NOX		-1.057331	-4.944531*	-2.040441	-4.884256*
FDI		-1.967710	-4.107410*	-2.042286	-4.017284**
SRV		5.274221*	-1.673253	1.738780	-3.023535
Critical values	1%	-3.626784	-3.632900	-4.243644	-4.243644
	5%	-2.945842	-2.948404	-3.544284	-3.544284
	10%	-2.611531	-2.612874	-3.204699	-3.204699

Notes: * indicates significance at one percent or a rejection of the null of no unit root at the one percent level
** indicates significance at five percent or a rejection of the null of no unit root at the five percent level
*** indicates significance at ten percent or a rejection of the null of no unit root at the ten percent level
Optimal lags based on Schwartz information criterion are in curly brackets and the optimal Newey-West bandwidths are in square brackets
The critical values come from Osterwald-Lenum (1992)

The results of the unit root tests for stationarity of the individual time series are reported in table 1 above. The PP tests are non-parametric unit root tests that are modified so that serial correlation does not affect their asymptotic distribution. The PP tests reveal that all variables are integrated of order one, both with and without linear trends and with and without intercept terms. A review of the results reveals that each series is first difference stationary at the one percent level using the PP test. What this means is that we cannot reject the presence of a unit root for any of the variables under the PP tests. However, the ADF test results are not so clear cut, because only the growth variable passed the differenced stationarity test at the one percent level. We therefore rely on the PP test results as the basis for a cointegration test among all stationary series of the same order.

3.3 Testing for Cointegration (the Johansen approach)

Here we investigate the existence of any unique equilibrium relationship(s) among stationary variables of the same order of integration. The Johansen methodology is a VAR-based approach, and results based on VARs are generally sensitive to the lag length used. This compelled us to devote considerable time to selecting the lag structure. Variables' lag lengths were chosen by minimizing the Akaike information criterion. The selected lag length(s) were therefore those that reduced autocorrelation in the model. The results are presented in table 2 below.

Table 2: Results of the Co-integration (Johansen Technique) for Growth, NOX, FDI, and SERV

Panel A: The Results of the Trace & Maximum Eigenvalue Tests

TRACE TEST				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	Prob.
None*	0.658136	75.76059	47.85613	0.0000
At most 1*	0.436681	38.19366	29.79707	0.0043
At most 2*	0.402742	18.10687	15.49471	0.0198
At most 3	0.001931	0.067640	3.841466	0.7948
Trace test indicates 3 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values				

Panel B: Estimate of Co-integrating Vectors

Cointegrating Eq:	CointEq1
GROWTH(-1)	1.000000
NOX (-1)	**0.000211** **(8.3E-05)** **[2.54361]**
FDI(-1)	**2.48E-09** **(7.5E-10)** **[3.31772]**
SERV	**-3.24E-10** **(2.7E-10)*** **[-1.18492]****
C	83.38450

*Standard errors
**t-statistics

The eigenvalues are presented in the second column, while the third column (Likelihood Ratio) gives the LR test statistics. Q_r is the so-called trace statistic and is the test of $H_{1(r)}$ against $H_{1(k)}$:

$$Q_r = -T\sum_{i=r+1}^{k}\log(1-\lambda_i)$$

for r = 0, 1,…, k-1, where λ_i is the i^{th} largest eigenvalue.

To determine the number of co-integrating relations *r*, subject to the assumptions made about the trends in the series, we can proceed sequentially from *r* = 0 to *r* = *k*-1 until we fail to reject. The first row in table (2) tests the hypothesis of no co-integration, while the second row tests the hypothesis of one co-integrating relation. The third row then tests the hypothesis of two co-integrating relations, and this continues until the alternative hypothesis of full rank, which means that all series in the VAR are stationary.

As can be seen, the null of no co-integration, as well as the null of at most one or two co-integrating vectors are rejected because the values of the trace statistics are greater than the critical value. However, the null of at most three co-integrating vectors cannot be rejected, thus favoring *r* = 3. There are therefore three vectors among the variables of the growth function.

The results from the growth equation indicate in a temporal sense, as the existence of cointegration clearly suggests, the existence of a causal relationship in at least one direction between or among the cointegrating variables. Fortunately, the information on causation is embodied in the vector error correction model (VECM), so we proceed by examining this.

3.4 The Vector Error Correction Model

All variables in the cointegrating equation are assumed to be endogenous in a VAR structure. The VECM builds on this by making use of differenced data and lagged differenced data for the chosen variables in a VAR structure. An essential element of the VECM is the error correction term or factor. The coefficient of the error-correction term is theoretically expected to be negatively signed and have a value between zero and one. This ensures that equilibrium error correction within the system over time will be at least meaningful.

Cointegration presupposes causality in at least one direction, and this may be further determined by employing a vector error correction model (VECM). We begin with a simple VAR model with *k* lags, as shown in equation (3) below:

$$y_t=\beta_1 y_{t-1}+\beta_2 y_{t-2}+\ldots+\beta_k y_{t-k}+u_t \qquad (^3)$$

A typical VECM in its simplest form will appear as shown in equation (4):

$$\Delta Growth_t = a_0 + \Sigma_{i=1}^{n} b_i \Delta Growth_{t-i} + \Sigma_{i=1}^{n} c_i \Delta NOX_{t-i} + \Sigma_{i=1}^{n} d_i \Delta FDI_{t-i} + \Sigma_{i=1}^{n} e_i \Delta Serv_{t-i} + \lambda EC_{t-i} + \varepsilon_t \qquad (4)$$

where EC_{t-i} is the lagged error-correction term, based on the estimates from Table 2 - Panel B .
The OLS estimates of the error-correction model in equation (4) are presented in Table 3 below.

Table 3: Estimates of the Error-Correction Model, where the Dependent Variable is $\Delta Growth_t$

Regressors	Coefficient	t-Ratio
$\Delta Growth_{t-1}$	-0.518313	-2.94397
$\Delta Growth_{t-2}$	-0.004084	-0.02562
ΔNOX_{t-1}	-3.27E-06	-0.30018
ΔNOX_{t-2}	2.53E-05	1.95863
ΔFDI_{t-1}	-6.37E-10	-2.23844
ΔFDI_{t-2}	7.21E-10	1.85137
$\Delta Serv_{t-1}$	-6.76E-11	-0.20732
$\Delta Serv_{t-2}$	-5.97E-10	-1.35936
Constant	5.965102	3.28391
EC (-1)	-0.092273	-1.48797
R-squared	0.601280	
F-statistic	4.021398	
AIC	128.5628	

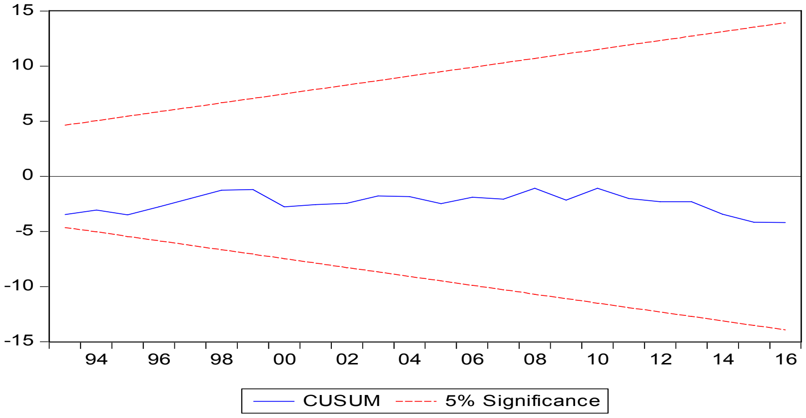
NOTE: EC is the error-correction term determined from the corresponding cointegration reported in Table 2 - Panel B.

First, the fact that the EC_{t-i} carries a significantly negative coefficient supports cointegration, thus showing a long-run relation among the variables of the money demand function. Second, since the estimated coefficient of the EC_{t-i} is rather small (-0.092273), the adjustment in the KSA growth model is very slow, indicating some inefficiency.

However, are the short-run coefficient estimates taken together with the long-run estimates reported in table 3 stable over time?

To answer this question, we rely upon the CUSUM test proposed by Brown, Durbin and Evans (1975). The CUSUM test is based on the cumulative sum of recursive residuals using the first set of *r* observations. The CUSUM statistic is updated recursively and plotted against the break points. If the plot of the CUSUM statistic stays within a 5% significance level, as portrayed by two straight lines given by the equations of Brown et al. (1975, section 2.3), then the coefficient estimates are said to be stable. A graphical representation of the CUSUM test is given in Figure 2 below.

Figure 2: Plot of CUSUM Statistics



As can be seen in Figure 2, the CUSUM plot does not cross the critical bounds, indicating stability in the model.

In addition, the VECM contains vital information on causal relationships and the dynamic interactions among the cointegrating variables. This vital information can be clarified through variance decomposition and impulse response analysis. Variance decompositions, in their truest sense, may be regarded as out-of-sample causality tests (Bessler and Kling, 1985). The results are reported in Table 4 below.

Table 4: VAR Granger Causality
Sample: 1980 2016

Dependent variable: Growth

Excluded	Chi-sq	df	Prob.
NOX	2.421661	2	0.2979
FDI	4.449704	2	0.1081
SERV	2.620999	2	0.2697
All	9.539536	6	0.1454

Dependent variable: NOX

Excluded	Chi-sq	df	Prob.
Growth	1.240131	2	0.5379
FDI	11.17753	2	0.0037
SERV	3.913045	2	0.1413
All	17.79879	6	0.0068

Dependent variable: FDI

Excluded	Chi-sq	df	Prob.
Growth	0.488974	2	0.7831
NOX	2.884979	2	0.2363
SERV	0.959460	2	0.6190
All	5.048313	6	0.5376

Dependent variable: SERV

Excluded	Chi-sq	df	Prob.
Growth	3.379155	2	0.1846
NOX	17.94371	2	0.0001
FDI	2.565615	2	0.2773
All	33.46318	6	0.0000

The results of the temporal causality test based on VECM are also reported in Table 4. These clearly indicate the presence of unidirectional short-run causalities from FDI to non-oil exports (Chi-sq=11.1775 and Prob.=0.0037) and from non-oil exports to services (Chi-sq=17.9437 and Prob. =0.0001). There was no evidence of short-run causal relationships in any direction for any of the other combinations. The error correction term, as reported in table 3 (EC=-0.092273 with a t-statistic=-1.48797), is highly significant, even at the five percent level. This indicates the existence of a long-run causality from non-oil exports, FDI, and services to GDP (Economic Growth) in the KSA.

3.5 Variance Decompositions Based on the VECM Results

Variance decomposition is very sensitive to the ordering of variables. Thus, two orderings were applied that were the exact opposite of each other. At each stage, the sensitivity of the result is considered. We employed a ten-year forecasting (out-of-sample forecast) horizon and observed the relevance of the variable ordering over time.

Table 5: Decomposition of Variance
ORDER I: GROWTH, NOX, FDI, SERV

Forecast Year	Relative Variance In:	Percentage of Forecast Variance Explained by Innovations in :			
		GROWTH	NOX	FDI	SRV
1	Growth	100.0000	0.000000	0.000000	0.000000
3		82.35923	13.64253	2.023528	1.974708
7		62.26170	22.57869	11.87322	3.286393
10		52.59471	19.36828	22.87779	5.159228
1	NOX	4.560808	95.43919	0.000000	0.000000
3		15.83128	71.15075	3.377237	9.640734
7		32.57344	44.80748	18.86767	3.751414
10		35.15321	40.62926	21.69358	2.523952
1	FDI	10.36224	14.25936	75.37840	0.000000
3		14.21366	31.25911	54.43832	0.088918
7		26.78963	41.22992	31.33652	0.643929
10		27.71211	34.20548	36.93217	1.150240
1	SRV	4.971899	0.692110	0.216438	94.11955
3		21.14674	29.26646	0.783403	48.80340
7		38.83846	39.47959	3.666453	18.01550
10		42.01892	38.61033	9.634564	9.736191

ORDER II: GROWTH, NOX, FDI, SERV

Forecast Year	Relative Variance In:	Percentage of Forecast Variance Explained by Innovations in			
		NOX	SERV	FDI	GROWTH
1	NOX	100.0000	0.000000	0.000000	0.000000
3		73.92656	24.40656	1.134242	0.532647
7		70.06295	18.64629	10.16049	1.130268
10		70.58781	14.14346	13.99955	1.269187
1	SERV	2.458606	97.54139	0.000000	0.000000
3		32.75017	64.74838	2.194620	0.306824
7		41.97535	56.31520	1.191201	0.518253
10		46.77408	52.03913	0.543837	0.642956
1	FDI	17.28965	5.067980	77.64237	0.000000
3		33.66759	11.79598	54.41839	0.118042
7		36.05293	12.26225	51.50717	0.177654
10		30.98467	16.54260	52.31641	0.156319
1	GROWTH	2.341160	0.037874	1.119720	96.50125
3		4.026314	2.105318	12.51056	81.35781
7		4.189634	5.393122	11.80502	78.61223
10		6.978403	5.267267	14.71646	73.03788

As emphasized earlier, the ordering of variables is of immense importance in the decomposition of variance. The relevance of the ordering can clearly be seen in the values under orderings I and II over the same forecasting horizon, as reported in table 5 above. There are various notable features among the results. For example, shocks to the *growth* variable in forecast year 1 accounted for 100% and 96.50% of the variations in *growth* under orderings I and II, respectively. During the same forecasting period, shocks to *NOX* and *FDI* both accounted for 0% of the variations in *growth* using ordering I, yet they accounted for 2.341% and 14.716%, respectively, of the variations in *growth* under ordering II. Similar explanations hold for the variations in *growth* in the other forecast periods.

Furthermore, shocks to *growth* accounted for 4.565% and 0.00% of the variations in *NOX* using orderings I and II, respectively, during forecast year one. Shocks to *NOX* accounted for 95.439% and 100% of the variations in *NOX* using orderings I and II, respectively, during forecast year one. After the first three years, *FDI* explains about 18.86% of the variations in *NOX*, with 75.37% being due to its own shocks. This result further supports the fact that a unidirectional causality runs from *FDI* to *NOX*.

3.6 Impulse Response Analysis

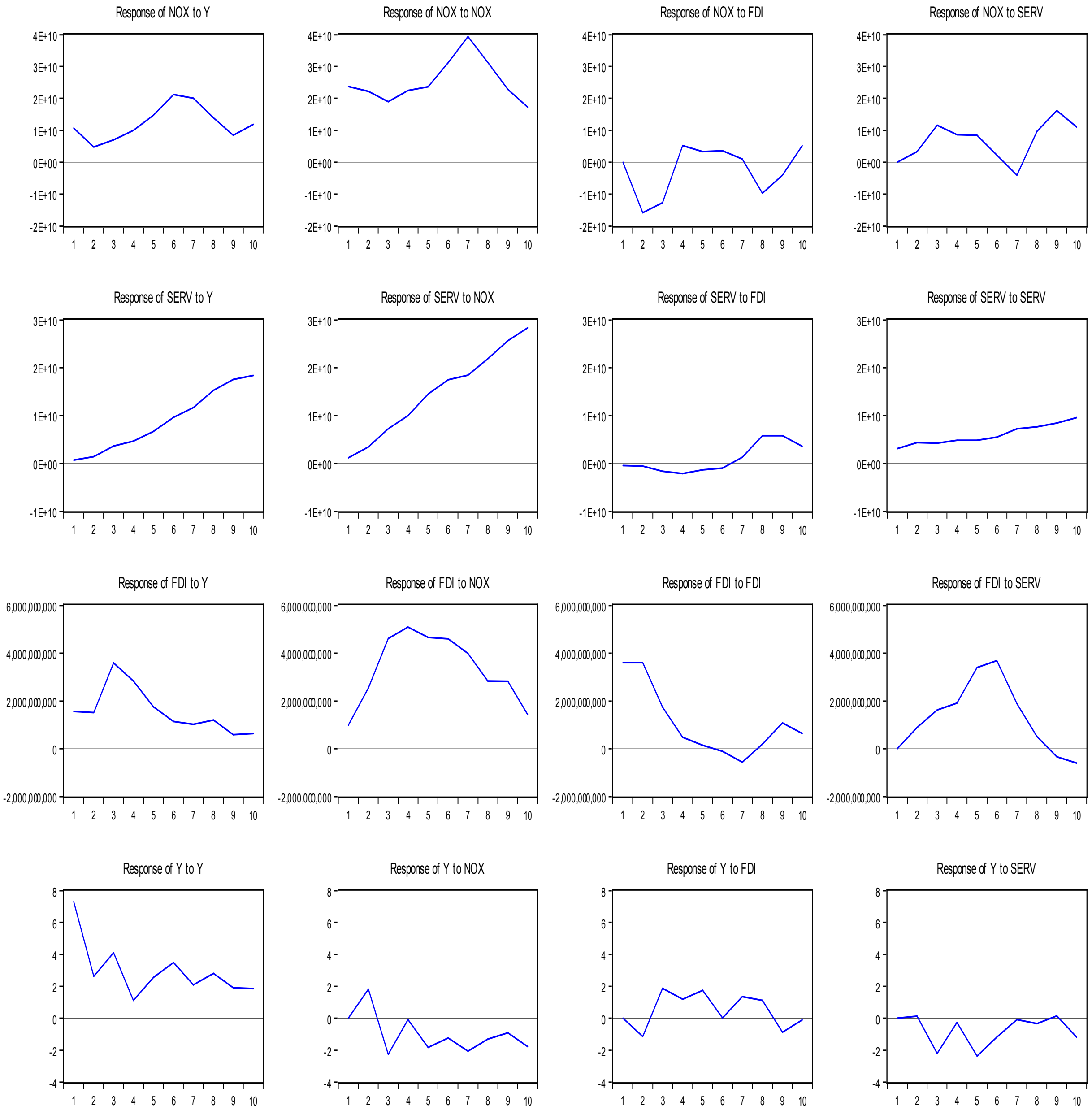
We again recall that the ordering of variables has an effect on impulse response functions. In the absence of any theory compelling a certain ordering for the series, the logical course of action is to undertake some sensitivity analysis. In what follows, we therefore present the impulse response functions in the figures below.

We apply one positive standard deviation shock to each error term to establish how the variables react to each other. The ordering of the variables is a very important consideration in the calculation of impulse responses and variance decompositions. In practice, the error terms are likely to be correlated across VAR equations to some extent, and a failure to assume this would lead to a misrepresentation of the system dynamics. The usual approach in this case involves generating orthogonalized impulse responses while considering the sensitivity of the results at every stage.

The results of the impulse response analysis are reported in Figures 3 and 4 below.

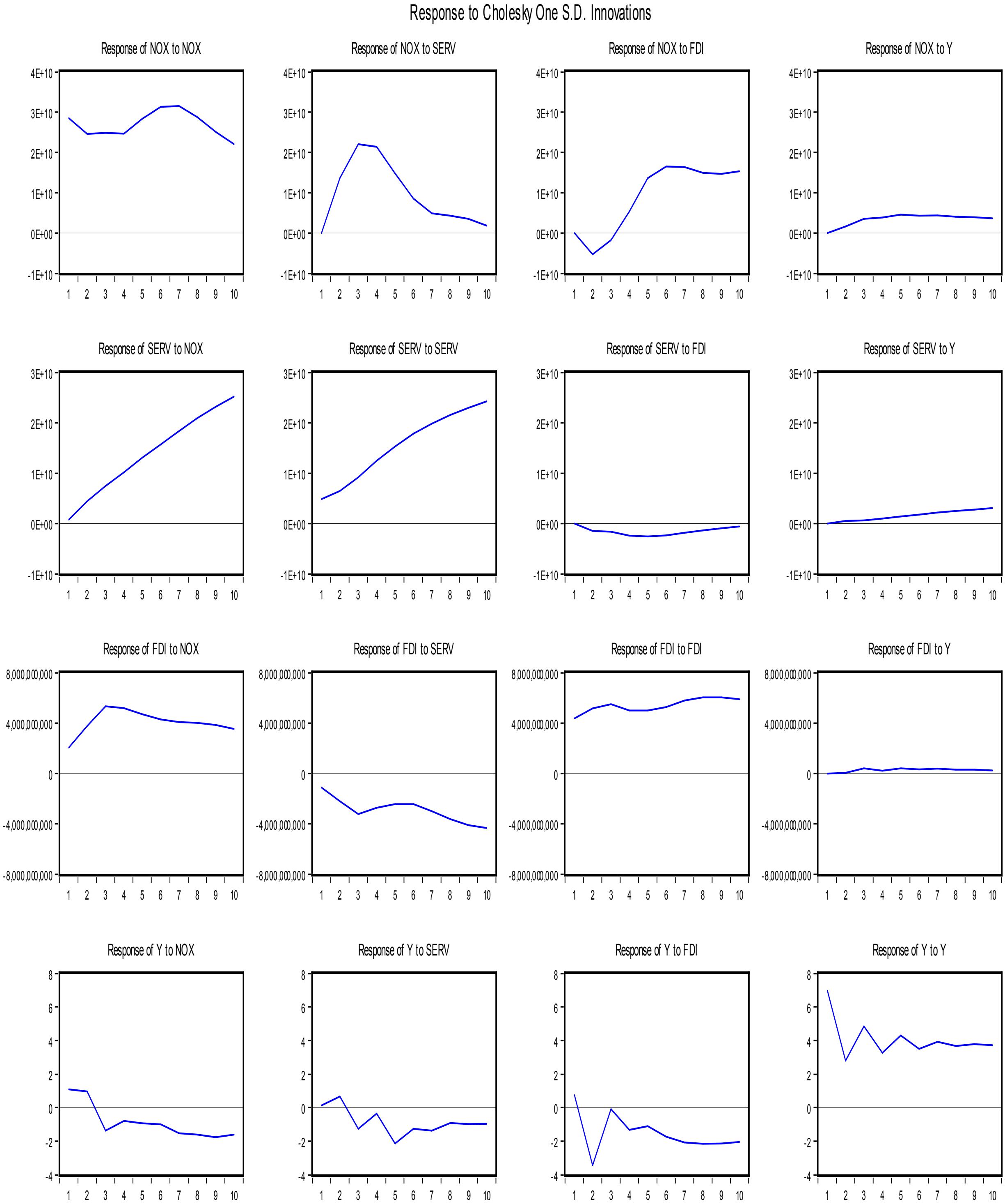
Figure 3: Impulse Response Function (Ordering I - GROWTH, NOX, FDI, SERV).

Response to Cholesky One S.D. Innovations



Response of NOX to Y
Response of NOX to NOX
Response of NOX to FDI
Response of NOX to SERV
Response of SERV to Y
Response of SERV to NOX
Response of SERV to FDI
Response of SERV to SERV
Response of FDI to Y
Response of FDI to NOX
Response of FDI to FDI
Response of FDI to SERV
Response of Y to Y
Response of Y to NOX
Response of Y to FDI
Response of Y to SERV

Figure 4: Impulse Response Function (Ordering II - NOX, SERV, FDI, GROWTH)



Figures 3 and 4 reveal the effects of a one standard deviation shock on each of the variables over time. The impulse responses do not appear to be very sensitive to the ordering of variables. What is more, it is striking that in both orderings, the shocks appear to die down during the early stages, only to become very pronounced later on. A total of 16 impulse responses could be calculated, because there are four variables in the system.

In figures 3 and 4, considering the signs of the responses, innovations to unexpected movements in *FDI* produced little or no response in the other four variables under consideration up to the seventh forecast year. Beyond this period, a one standard deviation shock to *FDI* triggered a significant negative response in *NOX* and *FDI* itself. The response in growth was positive during the same forecast period, however. Similar explanations can be applied to the other variables in both figures.

4. Conclusion

This study has examined the impact of non-oil exports, FDI, and services on economic growth using data for the KSA. A causality analysis of the relevant variables was undertaken in order to verify both the short- and long-term impacts of the non-oil sectors on the growth of the KSA's economy. Based on the available data, empirical evidence reveals the significant impact of FDI on driving economic growth.

In addition, the dynamic interaction among non-oil exports, FDI, services, and economic growth was also investigated using the concepts of variance decomposition and impulse response analysis.

The findings from the variance decomposition support an earlier finding from the causality analysis, which revealed unidirectional causalities running from FDI to non-oil exports and from non-oil exports to services. The responses of the four variables to one standard deviation innovations were, on average, found to be unpronounced in the early stages of the out-of-sample forecast period. However, all variables demonstrated distinct responses after about seven years into the forecast period.

It is therefore important to note here that policy shocks to FDI, non-oil exports, and economic growth in the KSA do not show immediate responses in the desired direction.

We suggest that policy makers need to consider placing more emphasis on attracting foreign direct investment (FDI), combined with establishing new regulations and modifying existing laws to help achieve this important objective.

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