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Causality between the Construction Sector and Economic Growth: The Case of Saudi Arabia

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This study empirically investigates the relationship between construction flow and economic growth for Saudi Arabia during the 1970–2011 period. Integration and cointegration techniques are applied to investigate the relationship between the construction sector and economic growth. Given the fact that Saudi Arabia is an oil-rich country, oil revenue has also been included in the model as a conditioning variable. The findings reveal that there is strong causality that runs from economic growth and oil revenues to the construction industry with feedback effects that only run from construction to economic growth (i.e. bi-directional relationship). However, the construction industry does not Granger-cause oil revenues in the long-run (i.e. uni-directional relationship). The findings also reveal that there exists no causal relationship between economic growth and oil revenues in the long-run. Economic growth and oil revenue are "independent" effects on construction growths in the long-run. However, oil revenues have significant effects on economic growth just in the short-run. Therefore, oil revenues play a critical role in economic growth in the short-run and therefore, the growth of the construction industry in the long-run. The accuracy of the estimated results is validated by performing several diagnostic tests.

Keywords

Construction Sector, Economic Growth, Oil Revenues, Granger Causality, Saudi Arabia

1. Introduction

Worldwide, the construction sector is considered a prime source of employment generation, which offers job opportunities to millions of unskilled, semi-skilled, and skilled workers. The sector is also considered to play a key role in generating income in both the formal and the informal sectors of a national economy. Development organizations, researchers, and policy makers maintain that the construction sector is an essential component of national economic growth and development because of its strong linkages to other economic sectors (Hirschman 1958; World Bank 1984; Bon and Pietroforte 1990; ILO 2001; Ewing and Wang 2005; Khan 2008; Jackman, 2010). According to Hillebrandt (2000), the most significant factor that affects construction demand is the general economic situation and expectations about how it will change. In a buoyant economy with a high and growing gross domestic product (GDP), a satisfactory balance of payments, and a reasonable level of employment—and with expectations that this situation will continue—generally, standards of living rise, consumer expenditures increase, and the government is able to spend to improve services to the community. In a depressed situation, the entire position is reversed and less demand for construction will be created.

Given a buoyant economy, the construction sector in Saudi Arabia is the largest and fastest growing market in the Gulf region. As of 2010, ongoing construction projects in the Gulf were valued at $1.9 trillion, and one-quarter of the developments were located in Saudi Arabia (US-SABC 2011). The Saudi construction sector has great potential for growth. Demand for housing project construction is sharply rising, given the 3.5 percent annual growth in the Saudi population. Demand is also increasing from the massive industrial expansion through the National Industrial Cluster Development Program and from the completion of the six Economic Cities. Demand for commercial and institutional construction projects is also growing. All of these factors play a critical role in reviving growth in the construction sector in the short- and long-run. The Saudi government has committed itself to spending more than $400 billion on different construction projects during the next five years to boost the national economy and provide more job opportunities for its citizens (9^{th} NDP 2007).

In light of these growing development factors, a critical investigation into the effect of the construction sector on economic growth in Saudi Arabia is needed, and hence, whether a construction promotion strategy is a relevant growth factor for the Saudi economy needs to be examined. Specifically, this study attempts to answer the following main question:

> Is there a relationship between the construction sector and economic growth in Saudi Arabia? And if a relationship exists, what is the direction of causality between these two variables?

Given the fact that Saudi Arabia is an oil-rich country, oil revenues could be the cause and the consequence of both growth in the national economy and construction industry. To validate this assumption, oil revenue will be included in the analysis as a conditioning variable along with the construction and economic growth variables. To the best of the author's knowledge, no study of this nature has been conducted on Saudi Arabia or any area in the Gulf region. Furthermore, studies on the construction sector and its effect on economic growth have been largely restricted to developed countries. Hence, by focusing on Saudi Arabia as a developing country, this study adds to the rather sparse body of knowledge on the effect of the construction sector on developing countries in general and on the Gulf-states in particular.

The remainder of this paper is organized as follows. Section 2 presents a review of the literature. Section 3 presents the data, methodology, and results. Section 4 concludes the study.

2. Literature Review

A number of researchers have addressed the contributions from the construction sector to a country's aggregate economy, and valuable literature is available on the linkage between the construction sector and other sectors of an economy. Several researchers conclude that the construction sector has strong forward and backward linkages with other sectors of a national economy. Hillebrandt (1985) defines construction as a complex sector of the national economy that involves a broad range of stakeholders and linkages with other economic activities. Park (1989) argues that the construction industry generates one of the highest multiplier effects through its extensive backward and forward linkages with other sectors of the economy. The World Bank (1984) states that the importance of the construction industry stems from its strong linkages with other sectors of the economy.

Many studies on construction economics (Turin 1969; Wells 1986; Field and Ofori 1988; Bon and Pietroforte 1990; Bon 1992; Green 1997; Hillebrandt 2000; Lean 2001; Rameezdeen 2007; Myers 2008; Dlamini 2011) emphasize the important role of the construction sector in national economic growth. They all argue that construction makes a noticeable contribution to the economic output of a country. Construction generates employment and income for the people; therefore, the effects of changes in the construction industry on the economy occur at all levels and in virtually all aspects of life. These studies also emphasize that construction has a strong linkage with many economic activities, and that whatever happens to the industry directly and indirectly influences other industries and, ultimately, the wealth of a country. Hence, the construction industry is regarded as an essential and highly visible contributor to the growth process (Khan 2008, p. 282). However, many of these studies are largely restricted to developed nations. Little consensus seems to exist on the relationship between the construction sector and economic growth in developing nations.

Authors such as Wang and Zhou (2000), Hassan (2002), Tan (2002), Kim (2004), and Dlamini (2011) all argue that the construction sector and its related activities are not drivers of economic growth, but followers of fluctuations in the national economy. In contrast, researchers such as Bon et al. (1999), Hongyu et al. (2002), Abdullah (2004), Khan (2008), and Jackman (2010) find that bi-directional causality exists between the construction sector and economic growth. Hence, no clear-cut evidence exists on the issue as it relates to developing countries, possibly suggesting that the ability of the construction sector to boost economic growth depends on the economy at hand. These results indicate that, to promote construction strategies to boost the national economy, the government and policy makers in developing countries should carefully make their decisions based on empirical analysis. In other words, the extent to which a construction promotion strategy is relevant to national economic growth needs to be carefully investigated; otherwise, construction and related activities are believed to have extremely high capital-output ratios compared with other types of investments and are deemed to be "resource absorbers," which negatively affects the national economy and its socio-economic development plans in the long run.

3. Data Methodology and Results

The main objective of this study is to investigate the causal relationship between the construction sector and economic growth in Saudi Arabia. The dataset employed consists of annual data on construction output and GDP from 1970 to 2011. Data on construction flows, real GDP and oil revenues in local currency were directly obtained from the Saudi Arabian Monetary Agency (SAMA) database. All variables are expressed in natural logarithms, thus allowing the estimated coefficients to be considered as the elasticity of the relevant variables.

The maximum likelihood estimation technique of Johansen and Juselius (1990) is employed to determine the existence of a cointegration equation. This cointegration technique determines only the existence of a relationship between variables and not the direction of causality. Hence, Granger causality and the vector error correction model (VECM) are employed to determine the direction of causality in both the short run and the long run. A basic estimation model is mathematically presented as follows:

$$Ln(GDP_t) = \beta_0 + \beta_1 Ln(Const_t) + \varepsilon_t \quad (1)$$

$$Ln(Const_t) = \alpha_0 + \alpha_1 Ln(GDP_t) + v_t \quad (2)$$

where coefficient $(\beta_1; \alpha_1)$ is expected to positively determine construction $(LnConst)$ and economic growth $(LnGDP)$ in both the long run and the short run.

The Johansen and Juselius (1990) maximum likelihood test of cointegration requires the same order of integration I(1) of all of the variables. The augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests are employed to determine the unit root. The ADF test checks for serial correlation by adding lagged values of explanatory variables and is represented as:

$$\Delta y_t = \beta_1 + \beta_{2t} + \delta y_{t-1} + \alpha_i \sum_{i=1}^{n} \Delta y_{t-i} + \varepsilon_t \quad (3)$$

where ε_t represents the white noise error term, $\Delta y = y_t - y_{t-1}$, and *t* represents the time trend. The PP unit root test uses a non-parametric method to take care of serial correlation in the error term without adding a lagged difference term. The PP test estimates the modified t-value associated with the estimated coefficient so that serial correlation does not affect the asymptotic *t* distribution.

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \varepsilon_t \quad (4)$$

Table 1 presents the results of the ADF and PP unit root tests, which imply that both variables are stationary at their first difference level - *I*(1). The unit root result is encouraging for further econometric estimations when using the Johansen and Juselius (1990) technique for long-run relationships. If two non-stationary time series regressions result in stationary residuals, then both variables are said to be cointegrated or have a long-run association.

Table 1 Results of Unit Root Test

Variables	ADF		PP		Decision
	Level	1st difference	Level	1st difference	
LnGDP	-2.777 (0.070)	-4.901 (0.000)	-3.021 (0.041)	-4.944 (0.000)	I(1)
LnConst	-0.486 (0.881)	-4.186 (0.002)	-3.865 (0.004)	-4.959 (0.000)	I(1)

Notes: Figures in the parenthesis are the probability value.
Source: Author estimation by using EViews8.

The lag length for a vector autoregressive (VAR) system is selected based on the minimum Akaike Information Criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) – *see Appendix (I)*. The estimation of cointegration by using this method involves an estimation for following an unrestricted VAR model:

$$Y_t = A_0 + \sum_{i=1}^{n} Ai\, Y_{t-1} + \varepsilon_t \quad (5)$$

where Y_t is a n × 1 vector of non-stationary I(1) variables and, in this study, *Y*= GDP and construction; hence, A_0 is a 3 × 1 constant vector. n is the number of lags, A_i is a 3 × 3 matrix of the estimated parameters, and ε_t is a 3 × 1 independent error term. To determine the existence of the cointegration of Y_t, the unrestricted VAR is converted into a vector error correction model (VECM):

$$\Delta Y_t = A_0 + \sum_{i=1}^{n-1} \varphi i \, \Delta Y_{t-1} + \beta Y_{t-1} + \varepsilon_t \tag{6}$$

where

$$\varphi i = - \sum_{i=1}^{n-1} Ai \ and \ \beta = \sum_{i=1}^{n} Ai - I. \tag{7}$$

where *I* is the identity matrix (n × n) and *Δ* is the difference operator.

Johansen and Juselius (1990) derive two cointegration tests: a trace test and the maximum eigenvalue test. The null hypothesis of no cointegration between construction and economic growth is tested against the alternative hypothesis of the existence of cointegration. Table 2 presents the result of the cointegration between construction and economic growth. The result shows that the trace statistic is higher than the 5% critical value; hence, it rejects the null hypothesis of no cointegration in favor of one cointegrating vector. Similarly, the maximum eigenvalue test statistic is also higher than the 5% critical value, which indicates rejection of the null hypothesis of no cointegration. Thus, this result suggests that there exists a long-run stable relationship between the GDP and the construction sector.

Table 2 Results of Johansen-Juselius Cointegration

Hypothesis		Trace Test			Maximum Eigenvalue		
Null	Alternative	Statistic	5% Critical Value	*P*-Value	Statistic	5% Critical Value	*P*-Value
r = 0	r = 1	28.6678	15.4947	0.0003	28.6677	14.2646	0.0002
r ≤ 1	r = 2	0.0001	3.8414	0.9930	0.0001	3.8414	0.9930

Note: See Appendix II – for more information
Source: Author estimation by using EViews8.

As previously mentioned, the Johansen and Juselius cointegration technique only determines the existence of cointegration between variables, but not the direction of causality. The Granger causality test is employed to determine the direction of causation. If a variable Y is found to Granger-cause U, this means that past values of Y are useful in forecasting values of U without considering past values of U. Similarly, for a variable Y that is found to Granger-cause U, this means that past values of U are useful in forecasting values of Y without considering past values of Y. The Granger causality test consists of estimating the following equations:

$$\Delta LnGDP_t = \beta_0 + \sum_{t=1}^{n} \beta_{1i} LnGDP_{t-1} + \sum_{t=1}^{n} \beta_{2i} LnConst_{t-i} + U_t \quad (8)$$

$$\Delta LnConst_t = \alpha_0 + \sum_{t=1}^{n} \alpha_{1i} LnConst_{t-1} + \sum_{t=1}^{n} \alpha_{2i} LnGDP_{t-i} + V_t \quad (9)$$

where U_t and $V_t$are uncorrelated and white noise error term series. Causality may be determined by estimating Equations (1) and (2) and testing the null hypothesis that $(\beta_{2i}; \alpha_{2i} = 0)$ against the alternative hypothesis that $(\beta_{2i}; \alpha_{2i} \neq 0)$ for Equation (8) or (9) respectively. If the coefficients of β_{2i} are statistically significant, but those of α_{2i} are not statistically significant, then economic growth (GDP) is said to have been caused by construction growth (uni-directional causality relationship). The reverse causality holds, if the coefficients of α_{2i} are statistically significant while those of β_{2i} are not. However, if both β_{2i} and α_{2i} are statistically significant, then causality runs both ways (bi-directional causality relationship). The results of the Granger causality test are presented in Table 3.

Table 3 Granger Causality Test

Causality	Lag Length	*F*-Statistic	*P*-Value
Economic Growth ↛ Construction	1	6.195	0.017
Construction ↛ Economic Growth	1	3.183	0.082
Economic Growth ↛ Construction	2 **	6.923	0.002
Construction ↛ Economic Growth	2 **	2.520	0.094
Economic Growth ↛ Construction	3	3.398	0.029
Construction ↛ Economic Growth	3	2.448	0.081

Notes: 1. The notation Economic Growth ↛ Construction represents the null hypothesis: Economic growth (GDP) does not Granger-cause Construction sector. A similar interpretation follows for the reverse test.
2. Denotes optimal leg length based on (AIC), (SC) and (HQ) test.

Source: Author estimation by using EViews8.

The results indicate that economic growth does Granger cause construction sector in the first-differences of the data. The *F* statistics is significant at the 1% level, which means that in the case of Saudi Arabian economic growth, GDP does greatly affect the construction industry. The results also indicate that there is a causal effect that runs from the construction sector to economic growth, and the null hypothesis is rejected (i.e. the construction sector does not Granger cause economic growth) at a 10% significance level. Therefore, the Granger causality test indicates that there is a bi-directional relationship between the construction sector and economic growth in Saudi Arabia.

Engle and Granger (1987) suggest that if cointegration exists between two variables, then proper statistical inference is obtained only by analyzing causality based on an error correction model (ECM). The VECM is employed to determine the short-run and long-run causalities between construction and economic growth. The VECM estimation is performed by using the following VAR framework:

$$\Delta LnGDP_t = \beta_0 + \sum_{t=1}^{n} \beta_{1i} LnGDP_{t-1} + \sum_{t=1}^{n} \beta_{2i} LnConst_{t-i} + \lambda 1 Ect_{t-1} + U_t \quad (10)$$

$$\Delta LnConst_t = \alpha_0 + \sum_{t=1}^{n} \alpha_{1i} LnConst_{t-1} + \sum_{t=1}^{n} \alpha_{2i} LnGDP_{t-i} + \lambda 2 Ect_{t-1} + V_t \quad (11)$$

where $\beta_{1i}, \beta_{2i}, \alpha_{1i} \& \alpha_{2i}$ are the short-run coefficients, $1Ect_{t-1} \& 2Ect_{t-1}$ are the error correction terms, and U_t & V_t are the residuals. The error correction terms Ect_{t-1} are derived from a long-run cointegration relationship and measure the magnitude of past disequilibrium. The coefficient λ of the error term represents deviations in the dependent variable from the long-run equilibrium. Table 4 presents the results of the VECM test. The error correction term for both $\Delta LnGDP_t$ and $\Delta LnConst_t$ is correctly signed and significant at 5% and 1% respectively. These results support the result obtained from the Granger causality test, which can be concluded that there is a long-run (two ways) causality relationship between economic growth and the construction industry in Saudi Arabia for the period of 1970-2011.

Table 4 Results of VECM Test

Dependent variable	Source of Causation (Independent variable)			
	Long-run		Short-run	
	Ect_{t-1}	*T*-statistic	$\Delta LnGDP_t$	$\Delta LnConst_t$
			χ^2-*Statistic*	
$\Delta LnGDP_t$	-0.213	-2.158 (0.038)	2.750 (0.252)	—
$\Delta LnConst_t$	-1.194	-5.551 (0.000)	—	3.002 (0.222)

Note: Figures in the parenthesis are the probability value (see Appendix III).
Source: Author estimation by using EViews8.

The Wald test is also employed to check the short-run causality between construction and economic growth. The estimated results show that construction does not Granger-cause economic growth and economic growth also does not Granger cause construction in the short-run in Saudi Arabia. Both variables have a positive but insignificant effect on each other in the short run. The above results are consistent with several previous studies, such as: Bon and Pietroforte (1990); Tan (2002); Fadhlin (2004); Khan (2008) and Jackman (2010). The ECM also passes a range of diagnostic tests (Table 5). The accuracy of the ECM estimated results is validated by performing several diagnostic tests, such as the tests of normality, serial correlation (LM), and heteroskedasticity. These tests imply that the model is well-behaved (i.e. the errors appear to be normal; free of autocorrelation and non-heteroskedasticity).

Table 5 Diagnostic Tests

Test	Test Statistic	*P*-Value
VAR Residual Normality Test (JarqueBera)	χ^2 = 4.530	0.338
VAR Residual Serial Correlation LM Test (Lags 1 to 12)	LM = 6.392 LM = 7.941 LM = 2.408 LM = 6.406 LM = 2.557 LM = 0.139 LM = 2.395 LM = 0.988 LM = 0.230 LM = 5.591 LM = 2.225 LM = 1.615	0.171 0.095 0.661 0.170 0.634 0.997 0.663 0.911 0.993 0.231 0.694 0.806
Heteroskedasticity Test (ARCH)	χ^2 = 2.374	0.305

Source: Author estimation by using EViews8.

As previously mentioned, given the fact that Saudi Arabia is an oil-rich country, oil revenues could be the cause and the consequence of both growth in the construction sector and the national economy. Movements in construction activities and economic growth may be driven by underlying factors such as oil revenues. To validate this assumption, oil revenues ($LnOilr$) have been included in the VECM model as a conditioning variable along with the construction ($LnConst$) and economic growth ($LnGDP$) variables *(see Appendix IV*). The results reveal the following points:

- There is strong causality that runs from economic growth and oil revenues to the construction industry with feedback effects that run from construction to economic growth only (i.e. bi-directional relationship). The construction industry does not Granger-cause oil revenues in the long-run (i.e. uni-directional relationship).

- There exists no causal relationship between economic growth and oil revenues in the long-run. These two variables are "independent" effects on construction growths in the long-run. However, oil revenues have significant effects on economic growth just in the short-run.

The above results validate the assumption that oil revenues do, indeed, play a critical role in economic growth in the short-run, and therefore, the growth of the construction industry in the long-run.

4. Conclusion and Policy Implications

The purpose of this study is to test for Granger causality between the construction sector and economic growth for Saudi Arabia over the period of 1970-2011. The empirical results suggest that historically, bidirectional causality had existed between construction and economic growth. The estimated results of the Wald test show that neither construction nor economic growth has a short-run causal effect on each other. These results suggest two important factors:

1. Historically, causality had existed from the construction sector to the aggregate economy, thereby justifying the Saudi government's intention to intervene in construction-driven activities.
2. The Granger causality test also lends support to the growth-driven construction hypothesis; in other words, the construction sector is largely influenced by the general national economic situation. During expansionary periods, the Saudi government appeared to spend more on construction projects, whereas recessionary periods are associated with a reduction in construction activities.
3. Saudi Arabia as a rich-oil-resource country needs to stabilize a new institutional mechanism in order to cushion shocks from oil revenue instability and related boom-bust economic cycles.

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Appendices

Appendix I VAR Lag Order Selection Criteria

Endogenous variables: LOGCST LOGGDP
Exogenous variables: C
Date: 09/29/13 Time: 01:10
Sample: 1970 2012
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-52.97174	NA	0.053550	2.748587	2.833031	2.779119
1	47.64148	186.1345	0.000428	-2.082074	-1.828742	-1.990477
2	81.15322	58.64554*	9.80e-05*	-3.557661*	-3.135441*	-3.405000*
3	82.48227	2.192925	0.000112	-3.424113	-2.833005	-3.210387

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix II Johanson-Juselis Cointegration Test

Sample (adjusted): 1973 2012
Included observations: 40 after adjustments
Trend assumption: Linear deterministic trend
Series: LOGCST LOGGDP
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.511636	28.66787	15.49471	0.0003
At most 1	2.66E-06	0.000107	3.841466	0.9930

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.511636	28.66776	14.26460	0.0002
At most 1	2.66E-06	0.000107	3.841466	0.9930

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I)

LOGCST	LOGGDP
-3.406348	1.872387
3.461189	-3.990911

Unrestricted Adjustment Coefficients (alpha)

D(LOGCST)	0.057032	-3.59E-05
D(LOGGDP)	0.062653	-0.000258

1 Cointegrating Equation(s): Log likelihood 82.48221

Normalized cointegrating coefficients (standard error in parentheses)

LOGCST	LOGGDP
1.000000	-0.549676
	(0.07205)

Adjustment coefficients (standard error in parentheses)

D(LOGCST)	-0.194269
	(0.03500)
D(LOGGDP)	-0.213417
	(0.09889)

Appendix III Vector Error Correction Estimates

Date: 09/27/13 Time: 18:01
Sample (adjusted): 1973 2012
Included observations: 40 after adjustments
Standard errors in ( ) & t-statistics in [ ]

CointegratingEq	CointEq1	
LOGCST(-1)	1.000000	
LOGGDP(-1)	-0.549676	
	(0.07205)	
	[-7.62860]	
C	-3.147306	
Error Correction	D(LOGCST)	D(LOGGDP)
CointEq1	-0.194269	-0.213417
	(0.03500)	(0.09889)
	[-5.55126]	[-2.15817]
D(LOGCST(-1))	0.707129	0.744089
	(0.20744)	(0.58617)
	[3.40886]	[1.26942]
D(LOGCST(-2))	-0.122387	-0.203101
	(0.13120)	(0.37075)
	[-0.93280]	[-0.54782]
D(LOGGDP(-1))	0.071940	-0.357191
	(0.07968)	(0.22515)
	[0.90287]	[-1.58645]
D(LOGGDP(-2))	-0.070590	-0.300427
	(0.08108)	(0.22911)
	[-0.87061]	[-1.31126]
C	0.039604	0.110281
	(0.01319)	(0.03728)
	[3.00163]	[2.95797]
R-squared	0.921934	0.374720
Adj. R-squared	0.910454	0.282767
Sum sq. resids	0.143544	1.146166
S.E. equation	0.064976	0.183605
F-statistic	80.30579	4.075122
Log likelihood	55.84225	14.29161
Akaike AIC	-2.492113	-0.414580
Schwarz SC	-2.238781	-0.161248
Mean dependent	0.106862	0.101736
S.D. dependent	0.217135	0.216797
Determinant resid covariance (d of adj.)		7.68E-05
Determinant resid covariance		5.55E-05
Log likelihood		82.48221
Akaike information criterion		-3.424111
Schwarz criterion		-2.833003

Appendix IV Causality Test &VEC Estimates – Including Oil Revenues

Causality Test

Causality	Lag Length	F-Statistic	P-Value
Economic Growth ↛ Construction	2	6.923	0.002
Construction ↛ Economic Growth		2.520	0.094
Oil Revenues ↛ Construction		3.539	0.039
Construction ↛ Oil Revenues		0.540	0.587
Oil Revenues ↛Economic Growth		2.427	0.102
Economic Growth ↛ Oil Revenues		0.815	0.450

VEC Estimates

Dependent variable	Source of Causation (Independent variable)				
	Long-run		Short-run		
	Ect_{t-1}	T-statistic	$\Delta LnGDP_t$	$\Delta LnConst_t$	$\Delta LnOilr_t$
			χ^2-*Statistic*		
$\Delta LnGDP_t$	-0.196	-1.824 (0.077)	—	5.207 (0.074)	5.192 (0.074)
$\Delta LnConst_t$	-0.204	-4.904 (0.000)	1.524 (0.466)	—	0.176 (0.915)
$\Delta LnOilr_t$	-0.561	-2.072 (0.046)	0.215 (0.897)	0.004 (0.995)	—