International Journal of Economic Development Research and Investment
Volume 11, Number 1; April 2020; **ISSN: 2141-6729**
Published By
International Centre for Integrated Development Research, Nigeria
In collaboration with
Copperstone University, Zambia.

The Relationship between the Gross Domestic Product, Foreign Direct Investment and Non-oil Exports in the Saudi Economy (1970-2019)

Hassan Tawakol A. Fadol

ABSTRACT

This study examines the long-term and short-term balance relationship of Gross Domestic Product (GDP), Foreign Direct Investment (FDI) to the performance of non-oil exports in Kingdom of Saudi Arabia (KSA) within the framework of the export-led growth (ELG) hypothesis: Evidence from Autoregressive Distributed Lag (ARDL), Vector Error Correction Model (VECM) and a smaller evaluation according to Vision 2030. We performed an analysis for the period from 1970 to 2019 by ARDL model and checked the robustness of the results in the VECM. The co-integration and Toda-Yamamoto causality analysis are conducted by using two techniques of Vector Error Correction Model (VECM) and Autoregressive Distributed Lag (ARDL). The main findings indicate that Foreign Direct Investment (FDI) can increase Gross Domestic Products (GDP) growth rates by increasing non-oil exports in the Saudi economy according to the results of the Toda - Yamamoto Causality Test; and the GDP in the Saudi economy are affected by FDI and the rates of non-oil exports, in the long and short term. The reason is the strength of the reserves of the Saudi economy. This study posits that the outcomes found by means of econometric models can be used for predicting and measuring GDP in upcoming years as a guideline to the economic policy makers in Saudi Arabia. The ARDL co-integration results show that GDP, FDI and non-oil exports are co-integrated, indicating the presence of a long-run equilibrium relationship between them. Consequently, the results for the relationship between GDP, FDI and Non-Oil Exports are interesting and indicate that there is no significant from variables and vice-versa using Toda-Yamamoto causality.

Keywords: *Foreign Direct Investment, Gross Domestic Products, Non-oil exports, Stationary, Toda-Yamamoto Test, VECM, ARDL*

INTRODUCTION

In view of the complex socio-economic and environmental factors since the announcement of Saudi's Vision 2030 in April 2016, the Kingdom of Saudi Arabia has witnessed an economic, social and structural transformation as reforms have been implemented towards achieving the Vision's goals (Ministry of Finance,

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KSA 2019). Vision 2030 is supported by 13 approved programs. These programs aim to develop promising economic sectors and increase the productivity of existing pivotal sectors by raising government efficiency and stimulating the prosperity of communities. Vision 2030 aims to achieve comprehensive and diversified economic development, especially in the non-oil sector, to achieve economic growth and fiscal sustainability. Vision 2030 will increase job opportunities and female's participation in the labor market and improve the living standards of citizens (Ministry of Finance, KSA 2019, p13).

Every step made towards production base diversification can be considered a real achievement that we should build on continuously, especially in view of global competition. Every achievement in this area, regardless of how modest it is, also represents a direct safeguard for the future of the Saudi economy in general and the economic potentials that are inherent in this economy and working to diversify it.

The Kingdom's prevailing growth model depends mainly on oil revenues that are redistributed in the economy via government spending on goods, services and employee salaries. Part of this spending relates to citizens' wages and payroll in the public sector and is classified as consumption expenditure, while another part of it relates to capital spending on development projects, infrastructure and social services. This kind of spending goes to the payment of private sector contracts and profits. After four decades of oil exports, this sector's activity is still concentrated in three main areas: construction, services and the importation and marketing of foreign products under Commercial Agency Law (Khalid, 2015).

In applied econometrics, co-integration techniques and Autoregressive Distributed Lag (ARDL) have become the solution to determining the long run relationship between series that are non-stationary, as well as parameterizing them to the Vector Error Correction Model (VECM). With this background, the objective of this study is to examine and measure the short and long-term equilibrium relationship between GDP, FDI and non-oil exports in the Saudi economy through standard modeling (Autoregressive Distributed Lag (ARDL)), (Vector Error Correction Model (VECM)) and Causality for Toda - Yamamoto (1995). The motivation of this study is to address the following inherent problems. First, although the relationship between Gross Domestic Product (GDP), Foreign Direct Investment (FDI) and non-oil exports potentially relates to the incidence of to be linked to an economic growth in a particular economy, the trivariate linkage of GDP, FDI and non-oil exports has not been deliberated yet, especially in the framework of co-integration and Toda-Yamamoto 1995 Causality, Vector Error Correction Model (VECM)) and Autoregressive Distributed Lag (ARDL).

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Moreover, no study linking the role of FDI in the non–oil export – growth relationship in Kingdom of Saudi Arabia (KSA) could be cited from available related literature.

Theories of Growth and Foreign Direct Investment

According to the endogenous growth theory, the main determinants of economic growth include factors such as economies of scale, increasing returns or induced technological changes in the production process. Romer (1990); Grossman and Helpman (1991) developed a growth model explaining the relationship between FDI and economic growth within the endogenous growth theory. In this model, technological advancement is assumed to be the main driving force of economic growth. The creation of technological knowledge, the transfer of this knowledge and innovation are major engines for growth in these theories. New growth theories find bidirectional causality between FDI and growth. Factors that could explain this are as follows: the incorporation of new inputs and foreign technologies in the production function of host country, the increase in host country's existing knowledge through training and development (Borensztein, De Gregorio and Jongwha, 1998 and De Mello, 1999). Nonetheless, Dowling and Hiemenz (1982) contend that inflow of FDI is stimulated when there is rapid economic growth in the host country. This rapid growth creates an enabling environment and self-assurance to foreign investors to invest in the host country.

Additionally, high levels of capital requirements created as a result of sustainable growth coupled with the host country's need for FDI gives birth to a macroeconomic climate that attracts foreign investors. Hence, foreign direct investment and economic growth has a positive and bidirectional causality relationship. Several studies have been conducted to measure the causal relationship between GDP, FDI in KSA (Mohmmed and Tarek 2010, Khalid, 2014; Mounir and Atef 2018). However, most studies do not use the method of combining tests (ARDL, VECM and Toda - Yamamoto) to measure the causal relationship between GDP, FDI in KSA.

This study examines the long-run relationship between Gross Domestic Product (GDP), Foreign Direct Investment (FDI) and Non-Oil Exports, in KSA for the time period 1970 to 2019. In order to assess the long-run relationship, the study uses the tests evidence from VECM and ARDL and evaluation from Toda - Yamamoto (1995) Causality test. This study is a valuable addition to the growing body of empirical literature on relationship between macroeconomic variables, besides being useful to policy makers and investment community.

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MATERIALS AND METHOD

Data were the annual data for gross domestic product (GDP), FDI and non-oil exports from the International Monetary Fund. This study covers the annual sample period from 1970 to 2019. The descriptive statistics show that the standard deviations differ among variables. In addition, at the 5% significance level, we find that all variables are normally distributed (Jarque-Bera, Skewness and Kurtosis statistics) (Table 1). As in time series econometrics, the starting point is to study the time series properties of the variables under consideration to avoid any spurious relationships between them. If the time series properties of the variables are satisfied, then possible long-term relationships or co-integration are likely to exist. The analytical procedure adopted in this study include: the specification of the empirical models, the concept of Toda-Yamamoto causality within Autoregressive Distributed Lag (ARDL) framework and Vector Error-Correction Modeling (VECM). The baseline empirical model is specified to capture the hypothesized relationship among the core variables namely GDP, FDI and non-oil export. In doing this, the endogenous growth theory is a useful guide. This theory emphasizes the role of exports in determining long-run growth via a higher rate of technological innovation and dynamic learning from abroad (Romer, 1986; Lucas, 1988).

Table 1: Descriptive Statistics

Statistics	GDP	FDI	NOE
Mean	6248396260.924869	262681065971.759	120124058821.1863
Median	874450102.521353	155950708152.6145	62431688637.29755
Maximum	39455863929.3334	766350347333.333	399419733333.3329
Minimum	-3732394367.24856	5377333333.33333	2731777777.77778
Std. Deviation	11082189552.44239	242696763626.1531	116249445647.022
Skewness	1.754655550165247	1.0329836795287	1.100208075358777
Kurtosis	5.039691293436434	2.562814741363974	2.883656753798241
Jarque Bera	34.32417702379836	9.290316831373444	10.11534789015713

RESULTS AND DISCUSSION

Figure 1 shows that Saudi GDP is increasing during the study period because the increase in the rates of FDI, non-oil exports and other variables, and both foreign direct investment and Non-Oil Exports increased during the study period. It was found that during the period 1990 and 2019 the increase and change was quick and simple. The researcher finds that the change is consistent for all variables during this period.

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Autoregressive Distributed Lag (ARDL) Model

The study draws on the ARDL approach that is proposed by Pesaran Shin and Smith (1996) and subsequently it was modified by Pesaran, Shin and Smith (2001) by introducing the bounds testing approaches. We select this technique for two main reasons: First, it is effective in executing the short-term and long-term relationships between the different variables that do not have the same order of integration - provided that such variables are stationary in level; I (0), and/or they are stationary in the first difference; I (1). Second, the ARDL approach can remove the problems associated with omitted variables and auto correlation. The model used for the application of the ARDL approach:

$$\Delta GDP_t = \alpha + \Sigma \beta_i \Delta GDP_{t-1} + \Sigma \lambda_i \Delta FDI_{t-i} + \varphi GDP_{t-1} + \delta NOE_{t-1} + \eta_t$$

GDP= Gross domestic product

FDI= Foreign Direct Investment

NOE= Non-oil exports

(α, β, λ, φ, δ)= Coefficients of variables

Δ= The first difference for the variables

η= Random error

Although ARDL co-integration technique does not require pre-testing for unit roots, to avoid ARDL model crash in the presence of integrated stochastic trend of I(2), we are of the view that the unit root test should be carried out to know the number of unit roots in the series under consideration.

Vector Error Correction Models (VECM):

The VECM approach provides a systematic way to treat non-stationary variables in a simultaneous equation system, thus addressing the issues of simultaneity and non-stationarity. A brief discussion of these issues is followed by a description of the general form of the VECM, and included variables such as GDP, FDI and Non-Oil Exports of the Saudi economy during the period which is 1970-2019. Causality inferences in the multi-variate framework are made by estimating the parameters of the following VECM equations.

$$\left[\Delta GDP = \alpha + \sum_{i=1}^{m} \beta i \Delta GDP_{t-i} + \sum_{k=1}^{0} \delta \Delta FDI + \sum_{l=1}^{p} \zeta \Delta Non - OilE + \theta Z_{t-1} + \varepsilon_t\right]$$

Where:

GDP	= Gross Domestic Product
FDI	= Foreign Direct Investment
Non-OilE	= the Non-Oil Exports
zt-1	= the error-correction term which is the lagged residual series of the cointegrating vector.

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The error-correction term measures the deviations of the series from the long run equilibrium relation.

Figure 1.1

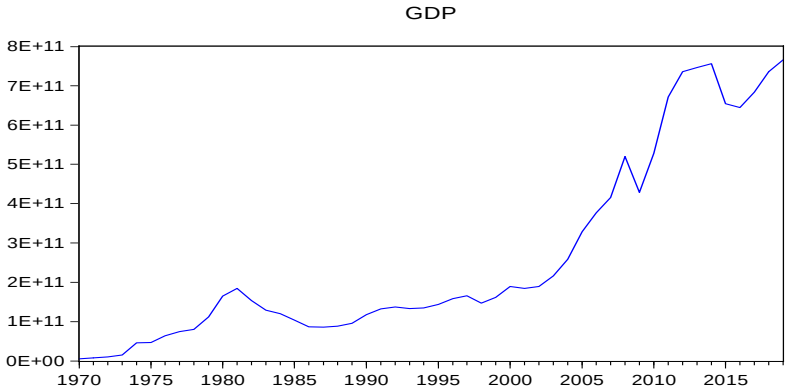


Figure 1.2

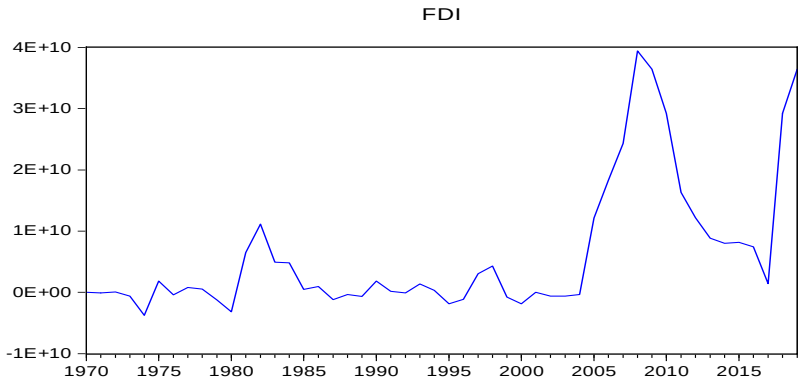
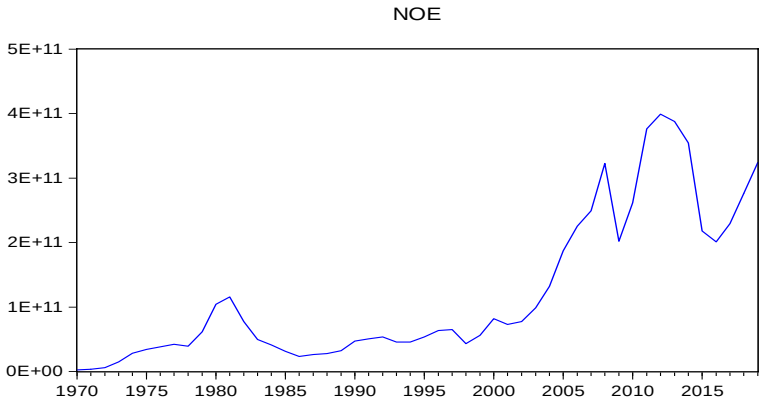


Figure 1.3



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Toda – Yamamoto (1995) Causality:

The Toda and Yamamoto (1995) method of Granger causality test is relatively more efficient in small sample data sizes and is particularly appropriate for time series for which the order of integration is not known or may not be necessarily the same, or the order of integration is more than two. Another advantage of this procedure is that it does not require the pretesting of the time series for cointegration properties so long as the order of integration of the process does not exceed the true lag length of the model. Toda and Yamamoto (1995) methodology of Granger causality test by directly performing the test on the coefficients of the levels VAR, minimises the risk associated with possibly wrongly identifying the orders of integration of the series and the presence of cointegration relationship (Galies, 1997; Mavrotas and Kelly, 2001).

Modified Wald test (MWALD) for the causality test is used as proposed by Toda and Yamamoto (1995) which avoids the problems associated with the ordinary Granger causality test by ignoring any possible non-stationary or co-integration between series when testing for causality. The Toda and Yamamoto (1995) approach fits a vector autoregressive model in the levels of the variables thereby minimizing the risks associated with the possibility of faulty identifying the order of integration of the series (Mavrotas and Kelly, 2001).

Unit Root and Co-integration Tests:

Before we proceed with the ARDL bounds test, we tested for the stationarity status of all variables to determine their order of integration. This is to ensure that the variables are not I(2) stationary so as to avoid spurious results. According to Ouattara (2004), in the presence of I(2) variables, the computed F-statistics provided by Pesaran Shin and Smith (2001) are not valid because bounds test is based on the assumption that the variables are I(0) or I(1). Therefore, the implementation of unit root tests in the ARDL procedure might still be necessary in order to ensure that none of the variable is integrated of order 2 or beyond. We employed ADF Dickey-Fuller test to obtain the order of integration of each variable as results shown in Table 2. Relying on the results of the conducted unit root tests, we conclude that the studied time series are of same order of integration. According to the results of the ADF test, we have variables (GDP, FDI and Non-Oil Exports) stationary in the first difference I (0).

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Table 2: Results of Unit-Root Test (ADF):

Variables	Level ADF test statistics	Lags	**First Difference ADF test statistics**	Lags
GDP	0.849850	1	**-5.531369***	1
FDI	-1.085793	1	**-5.579721***	1
NOE	-0.736134	1	**-5.702097***	1

*,** Denotes rejection at 5% and 1% levels, respectively.

Results of ADF unit root tests shown in Table 1, indicate that the hypothesis that the time series LGDP, LFDI and LNon-Oil Exports are stationary in the first difference can be accepted. Relying on the results of the conducted unit root tests, we conclude that the studied time series are of same order of integration. According to the results of the ADF, tests, we have all variables (GDP, FDI and Non-Oil Exports) stationary in the first difference I (0). has the order of integration I (1) based on the results of the ADF tests.

ARDL Bound Test Critical Values:

Maximum 4 lag is used to find out the cointegration relationship between the variables. Minimum Akaike Information Criteria (AIC) and Schwarz Bayesian Information Criteria (SBC) are used to determine optimal lag length. ARDL (1,0,4) is the optimal model for the cointegration analysis, and there is no autocorrelation problem in this estimated model. Besides, the calculated F-statistic of the model is founded as 30.85176.

Table 3: ARDL Bound Test Critical Values

k	***F-statistic***	***10% Significance Level***		***5% Significance Level***		***2.5% Significance Level***		***1% Significance Level***	
2	**30.85**	**I(0)**	**I(1)**	**I(0)**	**I(1)**	**I(0)**	**I(1)**	**I(0)**	**I(1)**
		4.19	5.06	4.87	5.85	5.79	6.59	6.34	7.52

Note: k denotes the independent variables in the model (FDI, Non-Oil Exports).

The long-run co-integration relationship between GDP, FDI and Non-Oil Exports exists. So, the long-run coefficients of the model should be estimated. ARDL (1,0,4) is the optimal lag length for the long run model, and its estimation results are showed in Table 4. There is no autocorrelation, heteroskedasticity and normality problem in the long-run estimation. The GDP, FDI and Non-Oil Exports is calculated as 1.00, and it is statistically significant at 10%. According to long-run estimation results, FDI and Non-Oil Exports affect GDP positively.

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Table 4: Long-Run Estimation Results

Independent Variables	Coefficients	Probability	
GDP(-1)	-0.989097**	0.0247	
NOE(-1)	0.483089*	0.0000	
C	-1.462408	0.9531	
Descriptive Statistics			
R2	0.98	Heteroskedasticity Breusch-Pagan-Godfrey	1.21 [0.31]
Adjusted R2	0.97	Normality (Jarque-Bera)	1.71 [0.45]
Autocorrelation (LM)	4.92 [0.42]	Durbin-Watson stat	1.68

Note: ** and * denote statistical significance at the 1% and 5% levels, respectively.
Figures in the square brackets are p-values.

VECM Short Run Coefficients:

After estimating the long-run model, a VECM should be estimated. ARDL (1,0,4) is the optimal lag lengths for the VECM, and its short-run estimation results are displayed in Table 5. This model also passes all the diagnostic tests such as autocorrelation, heteroskedasticity, and normality. According to the results, GDP and Non-Oil Exports affect FDI in the current year positively as expected. However, its effects are negative in 3rd and 5th lags. The coefficient of $VECM_t$ is estimated as -0.18, it is negative and statistically significant as expected. This result indicates that 18% of disequilibrium is corrected in one year.

Table 5: VECM Short Run Coefficients:

Variables	Coefficients	Standard error	t ststistic
D(GDP(-1))	-0.750005	0.06998	-1.04946
D(GDP(-2))	1.376716	0.71466	1.91474
D(FDI(-1))	-1.802702*	0.71901	-5.82876
D(FDI(-2))	2.354218	0.98575	1.48301
D(NOE(-1))	1.117361**	1.58745	6.48761
D(NOE(-2))	-1.433752	1.48301	-1.99168
C	9.35E+09	1.7E+09	1.21108

R^2=0.62.
R^{-2} 0.59
Durbin Watson stat = 1.68
Lagrange multiplier (Lag 1)=(0.2214), (Lag 2)=(0.3515), (Lag 3)=(0.7718)
Heteroskedasticity Breusch-Pagan-Godfrey = 0.31
Breusch-Pagan-Godfrey test=(0.4032)

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Normality Jarque-Bera test=(0.3421).
*Indicates significant at 1%;
**Indicates significant at 5%;
VECM: Vector error correction model

The results show that GDP has long run relationship with FDI and Non-oil exports. Further, FDI and Non-oil exports positively and significantly affect GDP in the short run as well as in the long run.

Toda – Yamamoto (1995) Causality Test:

After establishing that a co-integrated relationship between GDP, FDI and Non-oil exports exists, the study proceeded to also test for Toda - Yamamoto causality as introduced by Toda - Yamamoto (1995). Modified Wald test (MWALD) for the causality test is used as proposed by Toda and Yamamoto (1995) which avoids the problems associated with the ordinary Granger causality test by ignoring any possible non-stationary or co-integration between series when testing for causality. The Toda and Yamamoto (1995) approach fits a vector autoregressive model in the levels of the variables thereby minimizing the risks associated with the possibility of faulty identifying the order of integration of the series (Mavrotas and Kelly, 2001). So, in this final stage of our empirical analysis, we test for the causal relationship among the variables of interest according to Toda - Yamamoto (1995) causality test (Dritsaki, 2017).

Table 6: Toda – Yamamoto (1995) Causality Test:

Null Hypothesis:	**Wald test statistic**	**P-value**
D(GDP) does not Cause **D(FDI)**	2.083446	0.3528
D(FDI) does not Cause **D(GDP)**	2.772820	0.2500
D(NOE) does not Cause **D(FDI)**	3.986331	0.1363
D(FDI) does not Cause **D(NOE)**	5.343433	0.0491*
D(GDP) does not Cause **D(NOE)**	7.140083	0.0282*
D(NOE) does not Cause **D(GDP)**	18.03599	0.0001**

From table 6, we observe that for GDP and inflows of foreign direct investment, there is an independent causal relationship between them. Thus, neither is there a causal effect flowing from GDP to inflow of FDI nor is there a causal effect moving from inflow of FDI to GDP at 5% level of significance. And there is a one-way causal relationship between foreign direct investment and non-oil exports. Finally, there is a bidirectional causal effect between Non-Oil Exports and GDP in KSA. Thus, at 5% level of significance, Non-Oil Exports has a causal effect on GDP.

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CUSUM and CUSUMSQ (ARDL 1,0,4):

Figure 2.1 CUSUM

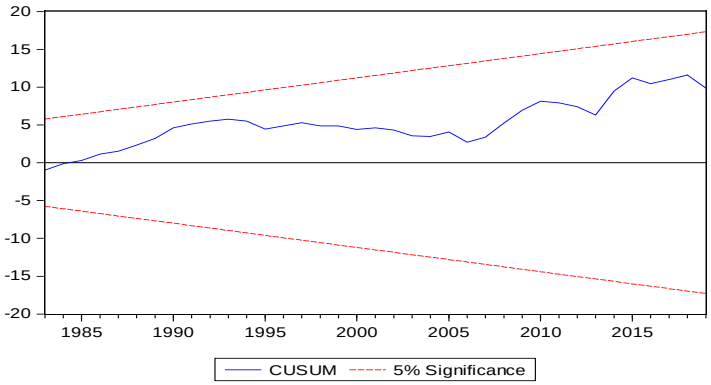
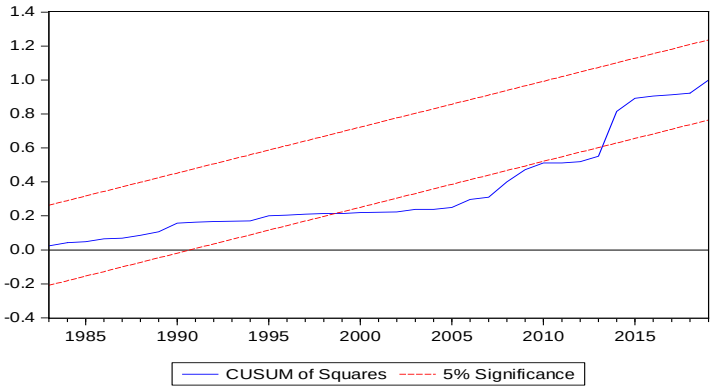


Figure 2.2 CUSUMSQ



The stability of the long run parameters were tested using the cumulative sum of recursive residuals (CUSUM) and CUSUM of recursive squares (CUSUMSQ). The results are illustrated in Figures 2.1 and 2.2. The results fail to reject the null hypothesis at 5% level of significance because the plot of the tests falls within the critical limits. Therefore, it can be realised that our selected ARDL (1, 0, 4) model is stable.

CONCLUSION

The paper discusses and measures the relationship between GDP, FDI and non-oil exports in Kingdom of Saudi Arabia (KSA) during the period (1970-2019).

The long-run relationships between these variables are intriguing and are of acute interest to policy makers. Using the ARDL bounds-testing approach of co-integration, suggested by Pesaran, Shin and Smith (2001), together with the VECM method, and Toda - Yamamoto 1995 Causality, the study reaches the conclusion that the ARDL co-integration results showed that GDP, FDI and non-oil exports are co-integrated, indicating the presence of a long-run equilibrium relationship between them. The Toda - Yamamoto (1995), VECM results also showed the presence of bidirectional causality between GDP, non-oil exports and a unidirectional causality from FDI and non-oil exports direct investment. A policy implication of this study is that non-oil exports can be considered to be the best policy variable to predict both foreign direct investment and economic growth in KSA. If policy-makers want to maintain sustainable economic growth and high foreign direct investment, they must focus on building non-oil exports in the economy in the longer term. Such a policy could be supported by infrastructure policy restructuring, especially in the non-oil exports sector, in line with the suggestions of Pradhan and Bagchi (2013).

Acknowledgment:
We would like to thank the anonymous reviewers for their valuable comments and suggestions on the earlier draft of this research. We would also like to thank Dr. Abdalla Elmolhim for knowledge-sharing and Dr. Tarig Elrasheed for sharing his E-views9 programming codes. Any remaining errors or omissions are the responsibility of the authors.

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