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Financial Sector Development and Economic Growth in Saudi Arabia: ARDL Model

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This paper investigates the impact of financial sector development on economic growth in Saudi Arabia over the period 1985-2018; the study utilises the autoregressive distributed lag (ARDL) model to examine the short-run and the long-run relationships between five financial indicators namely: the stock market capitalisation, the total value of stocks traded, the domestic credit to the private sector, the broad money supply, and trade openness on per capita growth rate. The model proves a co-integrating relationship between the variables of the study. The empirical results reveal a positive significant relationship between the per capita growth rate and the total value of stocks traded and trade openness in both the long and short run, while the stock market capitalisation showed a negative significant counter effect. The broad money supply is negative in the short-run and positive in the long-run. The domestic credit to the private sector is found to be statistically insignificant in explaining the per capita growth rate in both the short and the long run. These results are interpreted in terms of the dominance of the oil sector and the high degree of openness characterising the Saudi economy. The development of the Saudi stock market and banking system will enhance the growth of the non-oil sector and the diversification of the economy leading to economic growth.

Key words: *Financial sector, Economic Growth, Per Capita GDP, ARDL Approach.*

JEL: E44; G10; G21; O11; O47

The Saudi Financial Sector: A Review

Numerous empirical studies have demonstrated the positive effect of finance on growth, however, the finance – growth nexus in the short and the long run remains controversial; some researchers argue a positive effect of financial development on economic growth, others advocate a negative impact on economic growth. On the other hand, there was an old debate about whether financial development improves productivity and hence indorses growth or not. The definition that most economists are agreed upon for the term financial development is how financial instruments, financial markets, and financial intermediaries, can lessen the costs of acquiring information and performing contracts and transactions, as a result of efficient means of providing financial functions.

Using broad money, deposit/GDP, and domestic credit to the private sector, Puatwoe & Piabuo (2017) examined the effect of these financial development indicators on economic growth in Cameroon using the ARDL technique; their results reveal a positive short-run relationship between monetary mass (M2), government expenditure and economic growth, and a negative relationship with bank deposits and private investment, while all indicators of financial development showed a positive long-run and significant influence on economic growth. (Puatwoe & Piabuo, 2017)

Abidova (2015) analysed the relation between finance and growth given the present theoretical background, empirical studies, and real-life cases. He argued that the influence of the financial sector on economic growth and the real sector's activity is becoming clearer, particularly after the global financial-economic crisis. (Abidova, 2015)

Pradhan el at (2018) used a panel VEC model to inspect the relations between energy consumption patterns, financial sector development, and economic growth in 35 (FATF) countries for the period 1961-2015. Their results confirmed a significant long-run relationship between energy consumption patterns and financial sector development with economic growth in the FATF countries. (Pradhan, Arvin, Nair, Bennett, & Hall, 2018)

Papi (2015) examined the links between financial development and economic growth in Bangladesh employing the VECM framework using data covering the period 1977-2016. His results revealed significant long-run causality between financial development to economic growth in Bangladesh. His results confirmed the core role of credit circulation to the private sector, in economic activities in Bangladesh. (Papi Halder, 2018)

Jankovic & Gligoric (2017) considered the main indicators of both financial market and banking sectors development for Serbia and their prospective impact on economic growth, the study concluded with the fact that the observed financial market in Serbia is still in the early stages of development and that in the banking sector confronts a substantial level of non-performing loans. (Jankovic & Gligoric, 2017)

The experience 101 developed and developing countries concerning the relationship between financial development, real sector output, and economic growth was investigated by Ductor & Grechyna (2015) using panel data from 1970 to 2010; their results revealed that economic growth depends on the growth of private credit relative to the real output growth. Also, they claimed an optimal level of financial development determined by the characteristics of the economy. (Ductor & Grechyna, 2015)

Ahmed & Ansari (1998) studied the experience of three major South-Asian economies, namely, India, Pakistan, and Sri Lanka concerning the relationship between their financial sector's development and economic growth utilising the standard Granger causality tests and the Cobb-Douglas production function framework. Their causality analysis results showed that financial sector development causes economic growth; they concluded financial sector development has a significant influence on economic growth in these countries.(Ahmed & Ansari, 1998)

Mazur & Alexander (2001) studied the case of New Zealand, which witnessed considerable economic reforms in the financial sector. Their outcomes showed long-run relationships between indicators of banking and stock market development and private savings, but relatively varied results when considering either real GDP per capita or its growth rate. (Mazur & Alexander, 2001)

Using four indicators for financial development, Ageli & Zaidan (2012) examined the relationship between financial sector development and economic growth in the Saudi economy during the period 1970-2012, employing unit root tests, co-integration test, the Granger Causality Test, and the Vector Error Correction Model (VECM). Their results reveal a positive relationship between financial sector development and economic growth in Saudi Arabia. (Ageli & Zaidan, 2013)

Masih, Mansur Al-Elg, Ali (2009) adopted the supply-leading and demand-following hypothesis to examine expected directions of connection between financial development and economic growth in Saudi Arabia; their results suggested that the direction of the causal relation is supply-leading rather than demand–following. To them, this conclusion is justifiable for all countries in their early stages of development and hence it is acceptable in an open developing economy like Saudi Arabia.(Masih, Al-Elg, & Madani, 2009)

Samargandi, Nahla and Fidrmuc, (2014) examined the effects of financial development on Saudi oil and non-oil sectors using the ARDL Bounds test technique; their results reveal a positive impact of financial developments on the non-oil sector growth, while the impact on the oil-sector growth is either negative or insignificant. (Samargandi, Fidrmuc, & Ghosh, 2014)

Several researches in the same area were conducted such as Levine (1999)(Levine, 1999), Gregorio (1995)(De Gregorio & Guidotti, 1995), Ang and McKibbin (2007) (Ang & McKibbin, 2007), Jung (1986)(Jung, 1986), Osman(2019) (Osman et al., 2019), Al-Yousif(2002) (Al-Yousif, 2002)

Data and methodology:

The Data:

The study utilises time-series data covering the period 1985-2018 for a set of the variables that constitute the indicators of the financial sector; the sources are different issues of the annual report of Saudi Arabian Monetary Authority (SAMA), the General Authority of for Statistics KSA, statistical yearbook, and the Saudi Stock Market (Tadawul).

Model Specification:

To assess the impact of financial sector development on economic growth in the Saudi economy, the study addressed the most important determinants that affect the main segments of the financial sector which are:

1. Stock market (market-base): The development of this market is evaluated by its basic traditional characteristics, namely:

    a. The market size, measured by stock market capitalisation (SMC), the market size assures the ability to mobilise capital and diversify risk.

    b. Market liquidity (VST) measured by the total value of stocks traded. This variable reflects how easily investors buy and sell securities and hence enhances the prospects of long-term economic growth.

2. Banking sector: The degree of financial deepening is usually evaluated in terms of the intermediaries' capability to reduce the cost of information and transaction, mobilise savings, manage risks, and facilitate transactions. Two measures are used to reflect financial deepening:

    a. The ratio of domestic credit to the private sector to GDP denoted by DCP.

    b. Broad money supply as a ratio of the GDP denoted by M3SH.

3. The Macroeconomic financial environment variables influence economic growth measured by trade openness (TOP).

The study adopted the Autoregressive Distributed Lag (ARDL) model to examine the existence of the short and long-run relationships between financial sector development measured by the stock market capitalisation (SMC), the total value of stocks traded (VST), the domestic credit to the private sector (DCP), liquid liabilities of the banking system (M3SH), and trade openness (TOP) constituting the model explanatory variables and the economic growth in Saudi economy measured by per capita growth (PCG) as a dependent, using a time-series data for the period 1980 - 2018.

The following equation describes the model:

$$PCG = \alpha 0 + \beta_1 SMC + \beta_2 VST + \beta_3 DCP + \beta_5 M3SH + \beta_6 TOP + Ut \quad (1)$$

With:

$$\frac{\partial PCG}{\partial SMC} > 0, \frac{\partial PCG}{\partial VST} > 0, \frac{\partial PCG}{\partial DCP} > 0, \frac{\partial PCG}{\partial M3SH} > 0, \frac{\partial PCG}{\partial TOP} > 0$$

Where:

PCG = per capita growth.
SMC = the stock market capitalisation as a ratio of GDP.
VST = total value of stocks traded as a ratio of GDP.
DCP = the domestic credit to the private sector as a ratio of GDP.
M3SH = liquid liabilities of the banking system as a ratio of GDP.
TOP = trade openness.
α and β = unknown parameters to be estimated.
Ut = the error term.

The model is transformed to a linear form by taking natural logarithm values of the variables as the nature of the relation between the macroeconomic explanatory variables of the model is likely to be not stationary; by doing so, the model variables become in the growth rate form and the parameters turn out to be elasticities. The econometric logarithm format model is:

$$Ln\text{PCG} = \alpha 0 + \beta_1 Ln\text{SMC} + \beta_2 Ln\text{VST} + \beta_3 Ln\text{DCP} + \beta_4 Ln\text{M3SH} + \beta_5 Ln\text{TOP} + Ut \quad (2)$$

ARDL Bound Test:

The method of estimation adopted in the study is the Autoregressive Distributive Lag (ARDL) developed by Pesaran et al. (2001) (Pesaran, Shin, & Smith, 2001). Compared to other techniques of cointegration, the ARDL model, irrespective of the order of integration, works with time series under both the level I (0) and/or variables that are stationary after the first differentiation I (1).

The general ARDL (*p*, *q*) functional form model of X_t as explanatory and Y_t as a dependent is expressed by:

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\alpha_0} + \boldsymbol{C_0 t} + \sum_{i=1}^{p} \beta_i \, \Delta \boldsymbol{Y_{t-i}} \sum_{j=0}^{q} \gamma_j \, \Delta \boldsymbol{X_{t-j}} + \boldsymbol{\delta_1 Y_{t-1}} + \boldsymbol{\delta_2 X_{t-1}} + \boldsymbol{\epsilon_t} \qquad (3)$$

Where:

ΔY_t and ΔX_t are the differences of $Y_t$and X_t

p and q are the respective lags: i=1, 2, …, p; q=1, 2, …, q

t indicates the periods t=1, 2, …, T

α_0, C_0 are the drift and trend coefficients respectively

ϵ_t is the error term.

and γ_j coefficients for all j correspond to the short-run relationship while the δ_j corresponds to the long-run relationship.

Based on the above ARDL general functional, the study-specific functional form model is defined as follows:

$$\Delta LnPCG_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \alpha_{2i} \, \Delta LnPCG_{t-i} + \sum_{i=1}^{q1} \alpha_{3i} LnSMC_{t-i} + \sum_{i=1}^{q2} \alpha_{4i} \, \Delta LnVST_{t-i} + \sum_{i=1}^{q3} \alpha_{5i} \, \Delta LnDCP_{t-i} + \sum_{i=1}^{q4} \alpha_{6i} \Delta LnM3SH_{t-i} + \sum_{i=1}^{q5} \alpha_{7i} \, \Delta LnTOP_{t-i} + \alpha_{10} LnPCG_{t-1} + \alpha_{11} LnSMC_{t-1} + \alpha_{12} LnVST_{t-1} + \alpha_{13} LnDCP_{t-1} + \alpha_{14} LnM3SH_{t-1} + \alpha_{15} LnTOP_{t-1} + \epsilon_t \qquad (4)$$

Where:

$\Delta LnPCG_t$, denotes the dependent variable, $\Delta Ln\ SMC_{t-i}$, $\Delta Ln\ VST_{t-i}$, $\Delta Ln\ DCP_{t-i}$, $Ln\ M3SH_{t-i}$ *and*, $\Delta Ln\ TOP_{t-i}$, denote independent variables respective difference values; α_2, α_3, α_4, α_5, α_6, and α_7 represent the short-run dynamic relationships; α_{10}, α_{11}, α_{12}, α_{13}, α_{14}, and α_{15} represent long-run dynamic relationships; *P* denotes the lag period of the dependent variable; q_1, q_2, q_3, q_4, and q_5 specify the lag period of the explanatory variables, respectively; and ϵ_t is the error term.

Empirical Analysis:

Unit root test:

We start with checking for the stationarity of the study variables using Augmented Dickey-Fuller (ADF); as shown in Table (1) below:

Table 1: Unit root tests results:

The Null hypothesis: variable is non- stationary

Variable	ADF Test statistic	t- statistic	Prob.	Test critical values		Decision
LOGPCG	level (Intercept)	-5.1364*	0.001	1% level 5% level 10% level	-4.3098 -3.5742 -3.2217	I(0)
LOGSMC	1st Difference (Intercept)	-6.5341*	0.000	1% level 5% level 10% level	-3.7695 -3.0048 -2.6422	I(1)
LOGDCP	Level (Trend and intercept)	-4.4091*	0.007	1% level 5% level 10% level	-4.2845 -3.5628 -3.2152	I(0)
LOGVST	1st Difference (Intercept)	-3.4918**	0.014	1% level 5% level 10% level	-3.6537 -2.9571 -2.6174	I(1)
LOGM3SH	1st Difference (Intercept)	-6.1631*	0.000	1% level 5% level 10% level	-3.6537 -2.9571 -2.6174	I(1)
LOGTOP	1st Difference (Intercept	-4.7523*	0.000	1% level 5% level 10% level	-3.6537 -2.9571 -2.6174	I(1)

Source: Author Calculations

Note: * denotes the rejection of the unit root hypothesis at the 1% level of significance, ** denotes the rejection of the unit root hypothesis at the 5% level of significance level.

From the results of Table (1) above, LOGPCG and LOGDCP are stationary and integrated at the level, whereas LOGSMC, LOGVST, LOGM3SH, and LOGTOP are stationary at the first difference implying that they are integrated at I(1). Thus, the null hypothesis of the non-stationary is rejected.

As stated by Pesaran, Shin & Smith, (2001) (ARDL) is the appropriate methodology for long-run analysis as far as the variables series of the model are of first difference and/or at the level.(Pesaran et al., 2001)

The model optimal lag order is determined employing the standard VAR model below:

The Standard VAR model for Lag order determination:

Table 2: The Results of Standard VAR Model:

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-10.1400	NA	0.129752	0.795717	0.843296	0.810262
1	3.721947	25.74369*	0.051786	-0.12299	-0.02783*	-0.09390

Source: Own calculation

According to Table (2), using the Schwarz Information Criterion (SIC), the study's model optimal lag order is 1.

ARDL Bound Test:

Table 3 below shows the value of the ARDL bounds test which indicates 1% significance with 19.55691 F-statistic value; this implies the confirmation of the long-run cointegration at 1% and the rejection of the null hypothesis

Table: 3 ARDL Bounds Test

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	19.55691	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: Author Calculations.

Based on the results of table 3, the study variables exhibited cointegrating relationships; therefore, the model is viable for examining both long-run relationships and short-run error correction dynamics.

Estimated Long-run Effects:

The ARDL (1, 1, 1, 1, 2, 2) bound test is used to examine the long-run cointegration relationship between the LOGPCG and the independent, shown in Table(4) below:

Table: 4 ARDL long-run effects:
Dependent Variable: LOGPCG
Selected Model: ARDL (1, 1, 1, 1, 2, 2)
Sample: 1985 - 2018
Included observations: 22

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGSMC	-0.51072	0.099945	-5.110035	0.0009
LOGVST	0.306301	0.067377	4.546087	0.0019
LOGDCP	-0.119458	0.529819	-0.225469	0.8273
LOGM3SH	1.020976	0.696621	1.465612	0.1809
LOGTOP	0.840919	0.292661	2.873354	0.0207
C	-3.427805	2.093495	-1.637360	0.1402

Source: Author Calculations.

Cointeq = LOGPCG - (-0.5107* LOGSMC + 0.3063* LOGVST -0.1195* LOGDCP + 1.0210* LOGM3SH - 0.8409* LOGTOP -3.4278) (5)

According to outcomes of the long- run ARDL (1, 1, 1, 1, 2, 2) model, the coefficients of LOGSMC is negative and statistically significant at 1% reflecting a strong counter effect on LOGPCG, while LOGTOP and LOGVST are positive and statistically significant at 1% indicating a positive strong impact on LOGPCG. The estimated coefficients of LOGDCP and LOGM3SH are statistically insignificant.

The Error Correction model (ECM):

According to Banerjee et al. (1998) (Banerjee, Dolado, & Mestre, 1998), the error correction term (ECT) should be negative and statistically significant. The estimated ECT of the study model is -1.426981 and significant at 1%. The value of the estimated ECM implies that instead of monotonically converging to the equilibrium path directly, it fluctuates around the long-run value in a dampening manner.(Narayan & Smyth, 2006)

The short-run coefficient estimates from the ECM of the ARDL model is given in Table 5 below:

Table: 5 Short-run Error Correction Model (ECM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGSMC)	-0.31925	0.089307	-3.57478	0.0072
D(LOGVST)	0.138095	0.051856	2.663039	0.0287
D(LOGDCP)	0.431923	0.552550	0.781690	0.4569
D(LOGM3SH)	-1.27464	0.530200	-2.40407	0.0429
D(LOGM3SH (-1))	-1.27172	0.273074	-4.65708	0.0016
D(LOGTOP)	1.53547	0.579376	2.65022	0.0292
D(LOGTOP (-1))	0.546198	0.420924	1.297617	0.2306
ECM	-1.42698	0.158446	-9.00608	0.0000

R^2	0.94	F-statistic	10.52844
D.W stat	1.681	Prob.(F-statistic)	0.001191

Source: Author calculations.

The short-run model suggests that D(LOGSMC) and D(LOGM3SH (-1)) have the greatest negative influence on LOGPCG at a 1% level of significance.

D(LOGVST) and D(LOGTOP) showed a positive significant impact on LOGPCG at a 5% level of significance while D (LOGM3SH (-1)) exhibit a negative influence on LOGPCG at a 5% level of significance. D(LOGDCP) and D(LOGTOP (-1)) seem insignificant and do not influence LOGPCG.

Diagnostic Tests:

In the following part, three diagnostic tests will be performed, namely serial correlation, heteroscedasticity, and stability:

Breusch-Godfrey Serial Correlation LM Test:
The Null Hypothesis: No serial correlations exist.

Table: 6 Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.252719	Prob. F(1,21)	0.6306
Obs*R-squared	0.766583	Prob. Chi-Square(1)	0.3813

From the values of table 6, we accept the null hypothesis, i.e. no serial correlations exist and residuals are normally distributed.

Breusch-Pagan-Godfrey Heteroskedasticity Test:
The Null Hypothesis: No autocorrelations exist.

Table: 7 Breusch-Pagan-Godfrey Heteroskedasticity Test:

F-statistic	1.898028	Prob. F(9,22)	0.1835
Obs*R-squared	16.61351	Prob. Chi-Square(9)	0.2176
Scaled explained SS	1.638517	Prob. Chi-Square(9)	0.9999

Based on the values of table 7, we accept the null hypothesis, i.e. no autocorrelations exist, and the residuals are Heteroskedastic.

CUSUM Recursive Estimates Test for stability:

The CUSUM and CUSUM Square tests confirm the stability of the estimated coefficients parameter of the ARDL model as depicted in Fig.1 and Fig.2.

Fig.1: The cumulative sum (CUSUM Test):

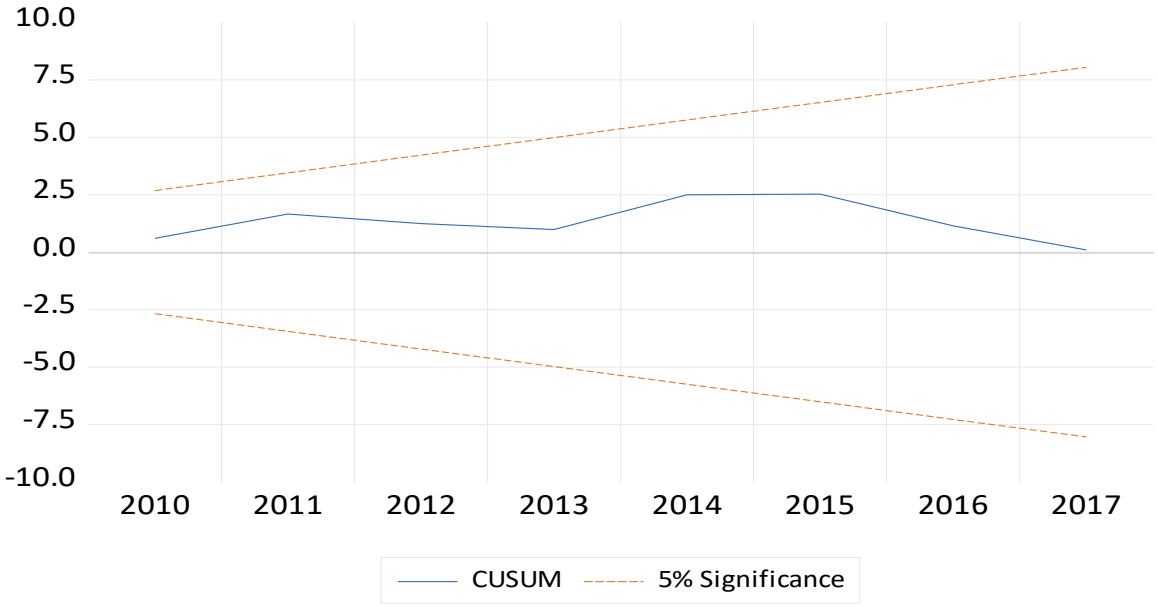
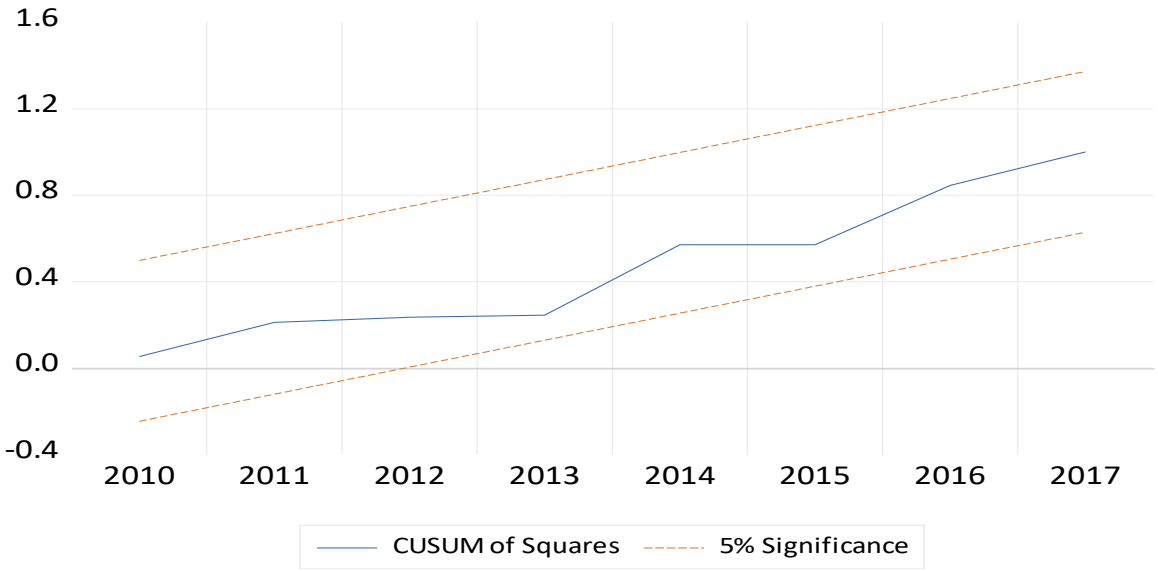


Fig.2: Cusum of Squares Test:



Variance Decomposition (VD):

In Table 6 below, a 10 years forecast horizon is used to clarify the focus error variance in economic growth in Saudi Arabia (PCG) as defined by the stock market capitalisation (SMC), the total value of stocks traded (VST), the domestic credit to the private sector (DCP), liquid liabilities of the banking system (M3SH), and trade openness (TOP). At period 10 which specifies a long run, the total value of stocks traded (LOGVST) explains the focus error variance in the (LOGPCG) significantly with 44.6%, while 25.6% is explained by LOGPCG itself, the LOGSMC and LOGPCG clarify 13.1% and 12.5% of focus error variance respectively. On the other hand, period 2 indicates the short-run focus error variance in LOGPCG, which shows 52.2% of focus error variance in the LOGPCG; this is explained by LOGPCG itself. The total value of stocks traded (LOGVST) shows a strong influence in predicting LOGPCG by 40.6%, while the rest of the variables contribute only by 7.2%, reflecting insignificant effect in predicting LOGPCG.

Table 6: Variance Decomposition

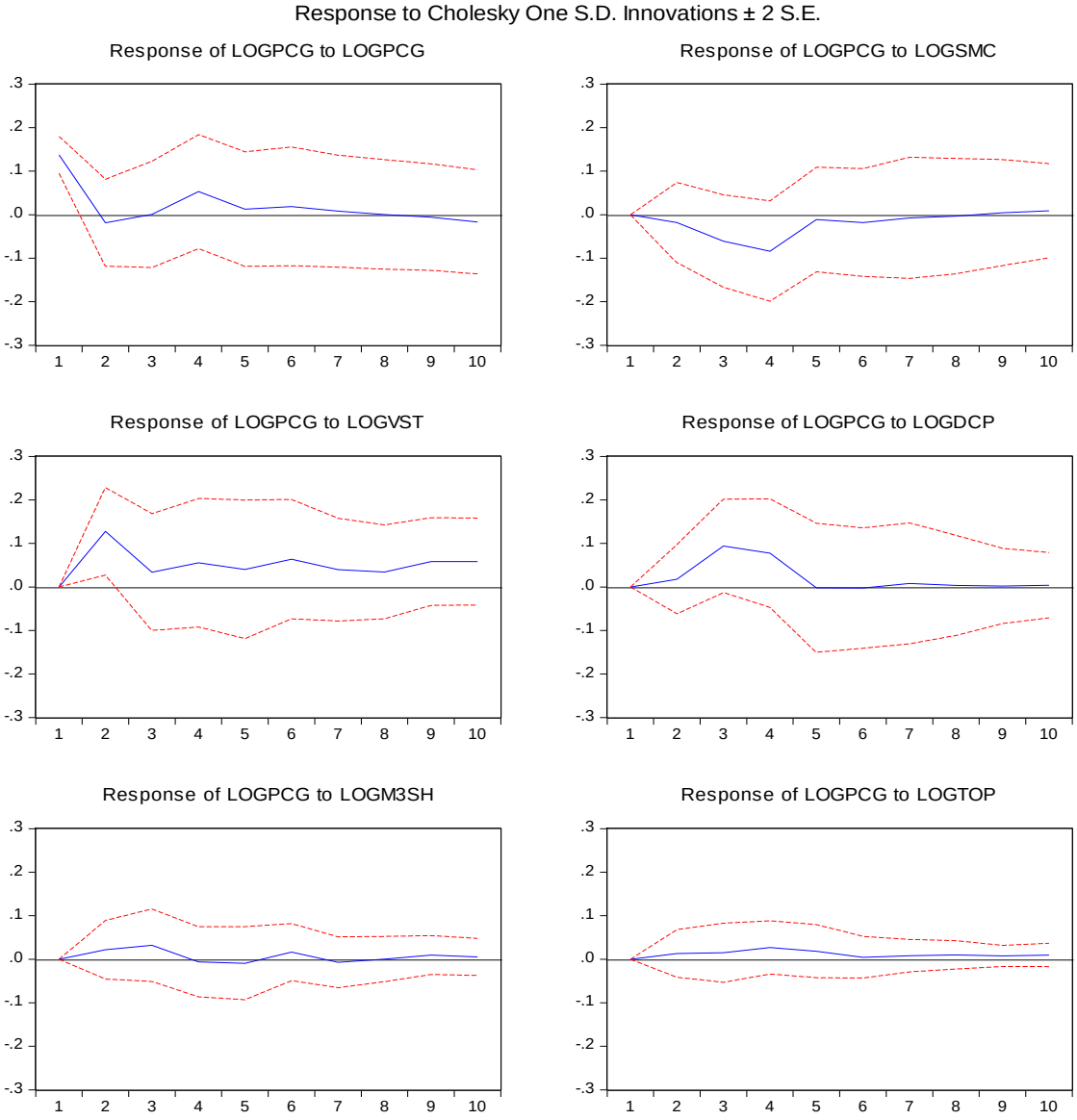
Period	S.E	LOGPCG	LOGSMC	LOGDCP	LOGVST	LOGM3SH	LOGTOP
1	0.137244	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.191762	52.17555	0.894987	4.555388	40.62610	1.287654	0.460322
3	0.227522	37.06385	7.861537	12.48913	38.96414	2.872080	0.749261
4	0.267353	30.77459	15.54174	11.87829	38.10669	2.133238	1.565450
5	0.271699	30.01380	15.22117	12.03050	38.58455	2.180441	1.969538
6	0.280782	28.55394	14.66988	12.45758	40.07580	2.374342	1.868458
7	0.284094	27.96812	14.39830	12.30365	41.03492	2.386367	1.908655
8	0.286380	27.52344	14.18409	12.28780	41.66053	2.348422	1.995717
9	0.292588	26.40710	13.61238	12.44404	43.20271	2.356736	1.977033
10	0.299157	25.57073	13.11131	12.46386	44.57571	2.283351	1.995054

Source: Author Calculations.

Impulse Response Analysis:

The impulse response functions indicate economic growth in Saudi Arabia (PCG) and responds to one standard deviation shock caused by the stock market capitalisation (SMC), the total value of stocks traded (VST), the domestic credit to the private sector (DCP), liquid liabilities of the banking system (M3SH), and trade openness (TOP).

The following figures show the response to Cholesky One S.D Innovations ± 2 S.E:



Conclusions:

The study aims to assess the short and the long-run impact of financial sector development on economic growth in Saudi Arabia over the period 1985-2018; for this purpose the study developed an autoregressive distributed lag (ARDL) model to examine the short run and the long-run relationships between the per capita growth (PCG) standing for Saudi economic growth and the financial sector developments which are decomposed in its three components, namely, the Stock market, banking system, and the macroeconomic financial environment. A set of indicators are used to measure the developments in these components, which are the stock market capitalisation (SMC) and the total value of stocks traded (VST) for the stock market, the domestic credit to the private sector (DCP), and Broad money supply to indicate

liquid liabilities of the banking system (M3SH) for the banking sector, and trade openness (TOP) to assess the effect of the macroeconomic financial environment.

The model proves a co-integrating relationship between the variables of the study. The estimated ECT is -1.426981, which is negative and significant at 1%. According to outcomes of the long- run ARDL (1, 1, 1, 1, 2, 2) model, the results revealed a positive significant impact of the total value of stocks traded (VST) trade openness (TOP) on per capita growth (PCG), while the coefficients of the stock market capitalisation (SMC) showed a negative significant counter effect on the per capita growth (PCG). The estimated coefficients of LOGDCP and liquid liabilities LOGM3SH are statistically insignificant. The short-run results suggest that the stock market capitalisation (SMC) and M3SH (-1) have the greatest positive influence on PCG at a 1% level of significance, whereas VST, M3SH, and TOP were significant at 5%. DCP and TOP (-1) are insignificant and do not influence per capita growth (PCG).

These results can be interpreted in terms of the high degree of openness characterising the Saudi economy and the dominance of the oil sector. The study recommends the development of the Saudi stock market and the banking system to enhance the growth of the non-oil sector which will lead to diversification of the economy and facilitate economic growth.

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