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THE CAUSALITY BETWEEN AGRICULTURE AND ECONOMIC GROWTH IN THE ARAB WORLD

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Abstract

This paper contributes to the controversy that exists among scholars on the link between agriculture and economic growth. Although there is much literature on the importance of the agricultural sector for economic growth, there is a lack of empirical evidence regarding the Arab World. This paper is one of the very few studies which examine the causality between agriculture and economic growth in a selection of eight Arab countries using time series econometric methods. Time series data from 1980-2018 are employed in this study which is obtained from the official website of the World Bank. However, agriculture is a variable of interest, exports and terms of trade are also included in the estimated models as additional determinants of economic growth. Both the Johansen test and the autoregressive distributed lag bound test are used to study the cointegration between agriculture and economic growth. The results suggest that agriculture could be used as an engine to promote economic growth for some Arab countries since a long-run relationship exists between the variables. Therefore, these countries would be able to enhance the value-added of agriculture through further investment in this sector. However, the direction of the causal relationship between agriculture and economic growth varies across countries. In most Arab countries, the economic growth could be used as a catalyst for growth in the agricultural sector since the direction of causality is from economic growth towards agriculture.

Keywords: Agriculture, Cointegration, Development, Economic Growth

JEL Classifications: O11, O13, O47, Q1

1. Introduction

The primary goal of most developing countries is economic development but sustained economic development cannot be achieved without economic growth. A recent study by Bilgin *et al*. (2019) showed that foreign students highly matter for economic growth as its share significantly supports the economic growth of a country. What is the contribution of the agricultural sector to the economic growth? Is agriculture a prerequisite for the economic growth of developing countries? Economic growth is the result of interactions between agricultural, industrial, and service sectors. The role of the agricultural sector in attaining sustainable economic growth is still debatable. This sector has been the backbone of the economy in most developing countries in their initial stage of development. About 25% of the value-added in poor countries comes from the agricultural sector (Gollin, 2010). Agriculture is also crucial in raising incomes among the poorest compared to other sectors and is accountable for one-third of global gross domestic product in 2014 (World Bank Group, 2019) which means growth in this sector would have a significant aggregate effect. Increasing income caused by agriculture results in an improvement in nutrition and health which leads to increase labor productivity and therefore boosts the overall economic growth. However, the ability of agriculture to generate overall economic growth varies from one country to another (FAO, 2012). To maintain economic growth, developing countries need to consider agricultural growth as a fundamental ingredient toward sustainable economic development.

Gross domestic product (GDP) per capita in the Arab World has been very low over the past two decades. Based on World Bank (2020), GDP per capita grew only at 1.3% from 2000 to 2018. Meanwhile, in the Arab World, a small share of their GDP comes from the agricultural sector where agriculture only accounts for 5.2% of GDP in 2018 with a decline at 0.3% from 2000 to 2018. We can notice from the development experiences of developed countries that the share of agriculture in their GDP declines as their economy grows. This vision contributed to the inclination of undervaluing the role of agriculture in economic growth (Moon and Lee, 2013) and rise a misapprehension that agriculture is unimportant and therefore does not deserve investment during the economic transformation process (Timmer, 1988). However, the agricultural sector remains socially and economically important for its contribution to the achievement of employment and food security. Yao (2000) concluded that agriculture is an important factor for the growth of other sectors despite the fall in the share of agriculture in GDP over time. Timmer (2005) claimed that increasing productivity in the agricultural sector is the necessary condition for all countries that try to transit from poverty. A claim that is similar to the findings of Gulati *et al*. (2005) who demonstrated that China’s growth is extremely impressed by the reforms in the agricultural sector.

Although several studies have outlined the dynamic relationship between agriculture and economic growth, the direction of causality between them rarely examined empirically in Arab countries. Accordingly, more empirical studies are needed. Efforts are made to study the short-run and long-run relationship between agriculture and economic growth, as measured by GDP, in a group of eight Arab developing economies. The main objective of this study is to fill the existing research gap in the Arab World regarding the direction of causality between the agricultural sector and economic growth. Agriculture could be crucial for those countries that have a comparative supremacy in agricultural production and, therefore, it might have a significant impact on the overall economy.

There are numerous empirical studies to demonstrate the relationship and interaction between agriculture and economic growth of both the least developed and developing countries using various methodological approaches. These studies help us understand the potential contribution of agriculture to economic growth. Early studies generally support the agriculture-led growth hypothesis where Johnston and Mellor (1961) revealed that agriculture contributes to economic growth. This claim is rejected by Gardner (2005). Timmer (1995) affirmed the indirect contribution of agriculture to economic growth through its impact on food availability, food price stability, and poverty reduction. Christiaensen *et al*. (2011) presented a similar argument. Matsuyama (1992) rejected the hypothesis that agricultural productivity promotes economic growth suggesting that the openness of an economy is crucial when adopting development strategies. In contrast, Diao *et al*. 2010 and Kaya *et al*. 2012 argued that investment in agricultural productivity is an engine of growth and development.

Self and Grabowski (2007) demonstrated that agricultural modernization has an essential effect on long-run economic growth. Mahmood and Munir (2018) did not find a significant association between agricultural exports and GDP in Pakistan while Loizou *et al*. (2019) highlighted the potential of agriculture as a driver of regional economic growth. Concerning the casual relationship between agriculture and economic growth, Gollin *et al*. (2002) showed that growth in the overall economy of developing countries depends significantly on the agricultural development, while others argued that the impact varies across countries (Apostolidou *et.al*. 2015; Awokuse and Xie, 2015). Tiffin and Irz (2006) concluded that there is a strong relationship between agricultural value-added and economic growth for developing countries, but the direction of causality is unclear. Katircioglu (2006) suggested a bidirectional causality between agricultural growth and economic growth in the long-run period.

The empirical relationship between agriculture and economic growth in the Arab World has been somewhat neglected in the literature. Faycal and Ali (2016) analyzed the impact of agricultural production on the economic growth in Algeria using the Autoregressive Distributed Lag (ARDL) model. The study reveals that the impact of agriculture on the economic growth is negative in the long-run when the governmental support is focused only on the production side of the agricultural sector. Otherwise, when the support is for the agricultural sector as a whole, the impact turns into positive. Chebbi (2010) assessed the relationship between growth in the agricultural sector and growth in other non-agricultural sectors of the Tunisian economy. The results suggest that a long-run relationship exists among different sectors of the Tunisian economy but the impact of the agricultural sector on the growth of other non-agricultural sectors is significant only in the short-run. The first study only examined the existence of the relationship between agriculture and economic growth without focusing on the direction of the relationship between them. The second study investigated the causal flow between agriculture and economic growth without studying the strength of the relationships between them. Therefore, this paper contributed further to the literature by estimating the significance or the strength of the causal relationships between agriculture and economic growth in these countries.

Most of the early works show only the correlation between agriculture and GDP growth without providing information on the direction of causality even though this topic has been neglected somehow in Arab countries. In this study, special attention is paid to examine the direction of the causal relationship between agriculture and economic growth in the Arab countries. The framework is the agriculture-led growth hypothesis where growth in agriculture leads to growth in the overall economy. To this end, the time series econometric methods are used to address this issue. Research on this issue is important to inform policymakers regarding resource allocation in the agricultural sector to achieve economic growth. In the next section, the econometric methodological issues and data sources are described followed by the empirical findings of this study. Finally, concluding remarks are outlined.

2. Methodology

2.1. Model specification

Although the relationship between agriculture and economic growth is of interest, two supplementary variables as additional determinants of growth are also included in the estimated models which are exports and terms of trade. The relationships among variables can be expressed as follow:

$$ln\ G_t = \alpha\ ln\ A_t + \beta\ ln\ E_t + \gamma\ ln\ T_t + \varepsilon_t \qquad (1)$$

where *G* refers net gross domestic product (GDP minus agricultural value-added), *A* indicates agricultural value-added, *E* represents exports, *T* denotes terms of trade, and ε is a randomly distributed error term that captures other variables not included in the model.

2.2. Cointegration tests

Time series are usually non-stationary and are integrated of order one. The Dicky Fuller GLS (DF-GLS) test is used to examine univariate time-series properties. This modified test has the best overall performance in terms of small sample size and power (Elliott *et al*. 1996) against the alternative of an augmented Dickey and Fuller (ADF) test (Dickey and Fuller, 1979). The ADF test which is commonly used in the literature also tends to under-reject the null hypothesis when a series is subject to a deterministic trend, and structural breaks caused by exogenous shocks (Perron, 1989). The DF-GLS procedure tests the null hypothesis of unit root against the alternative hypothesis of stationarity.

After checking the stationarity of the variables included in the system, the long-run relationship among them can be tested. The widely used Johansen and Juselius (1990) maximum likelihood cointegration test is used to examine the existence of long-run relationships among variables. The time series take the following form:

$$\Delta X_t = \mu + \sum_{i=1}^{p-1} \Gamma_i \, \Delta X_{t-i} + \Pi X_{t-1} + \varepsilon_t \tag{2}$$

where X_t indicates an (n × 1) stochastic vector of endogenous variables, μ represents an (n × 1) vector of constant terms representing a linear trend in a system, Γ and Π are coefficient matrices, Δ is a difference operator, k denotes the lag length, and ε is normally distributed error with mean zero and variance Σ.

For this purpose, two likelihood ratio test statistics which are the trace statistic and λ-Max statistic are computed. The null hypothesis of the existence of long-run relationships is rejected when the estimated likelihood ratio test results exceed the asymptotic critical values (MacKinnon *et al*. 1999). The Johansen cointegration approach has a limitation of not providing clear information about the direction of causality. It also requires the series to have the same order of integration. Therefore, as an alternative to Johansen's cointegration test, the autoregressive distributed lag (ARDL) approach and error correction models (ECM) proposed by Pesaran *et al*. (2001) are used as a complementary test for cointegration. The ARDL approach is superior to the traditional Johansen cointegration approach when the sample size is small (Pesaran and Shin, 1999). The ARDL model specification of Equation (1) is expressed as ECM could be expressed as:

$$\Delta G_t = c + \sum_{i=1}^{p} \varphi_i \, \Delta G_{t-i} + \sum_{i=0}^{p} \alpha_i \, \Delta A_{t-i} + \sum_{i=0}^{p} \beta_i \, \Delta E_{t-i} + \sum_{i=0}^{p} \gamma_i \, \Delta T_{t-i} + \delta_1 G_{t-1} + \delta_2 A_{t-1} + \delta_3 E_{t-1} + \delta_4 T_{t-1} + \varepsilon_t \tag{3}$$

where c represents a constant term, and p denotes the lag length and ε is the white noise.

The ARDL procedure consists of two estimation steps. In the first step, the bound test is applied to the Equation (3) by Ordinary Least Square (OLS) method to test the null hypothesis of noncointegration of the variables included in the system. Then, an F-test is used to test the joint significance of the estimated coefficients of the lagged level variables of Equation (3). The computed F-statistic is then compared to the two sets of adjusted critical values suggested by Pesaran *et al*. (2001) to check the existence of the cointegration of the variables. When cointegration exists, the second step requires the estimation of the ARDL model which involves the estimation of an ECM that allows for the determination of the direction of causation between GDP and agriculture. The Schwarz Bayesian Criterion (SBC) is used to determine the optimal lag length for the ARDL model.

2.3. Variance decomposition and impulse responses

The individual coefficients from the ECM are difficult to interpret. Therefore, forecast error variance decomposition (FEVD) and impulse response function (IRF) are used to analyze the dynamic relationship among the variables in the system. FEVDs help to determine the proportion of variation of the dependent variable over time explained by each of the independent variables while IRFs represent the reactions of the variables to shocks hitting the system.

2.4. Description of data

Annual observations for a selection of eight Arab countries, Algeria, Comoros, Egypt, Jordan, Mauritania, Morocco, Sudan, and Tunisia. are used in this analysis The sample is restricted to countries that have complete information series, and those countries with missing explanatory variables are dropped from the analysis. The empirical analyses are conducted using data from 1980 to 2018 due to data availability. This study focuses on Arab countries because of the crucial role that agriculture could play in the economic development of these developing countries. Although economies of the Arab countries do not greatly depend on agriculture, Comoros and Sudan are among those countries that their agricultural sector seems to play an important role in their overall economy.

In addition to agriculture, two additional exogenous variables which are exports and terms of trade are also included in the estimated models as additional determinants of economic growth. Each of these variables is expected to have a positive effect on growth (Hwa, 1988; Wunder, 2003; Awokuse and Xie, 2015). Data are obtained from the official website of the World Bank (2020) taking world development indicator data. All variables used in this study are measured in the constant local currency units and transformed in natural logarithms to be interpreted in growth terms after taking the first difference.

3. Results

3.1. Unit root test

The results for unit root tests are shown in Table 1. At the statistic level, the null hypothesis is failed to be rejected meaning that the series have a unit root. To establish the stationarity, the first difference is taken for all variables. The results of the DF-GLS test for each variable, across each of the countries, suggest that all the series are integrated of the same order, i.e. *I*(1), which implies the possibility of a cointegrating relationship for all eight countries.

Table 1. Unit root test results

Levels	Algeria	Comoros	Egypt	Jordan
GDP	0.376	1.921	0.693	-0.442
AGR	-0.926	1.117	0.630	-0.435
EXP	-0.932	3.622	1.276	0.183
TOT	-1.364	2.609	-1.802*	-2.962***
1st Differences				
GDP	-3.703***	-7.612***	-3.219***	-4.234***
AGR	-5.716***	-7.602***	-7.148***	-7.208***
EXP	-4.187***	-4.266***	-4.108***	-3.014***
TOT	-5.520***	-4.830***	-6.393***	-6.990***
Levels	Mauritania	Morocco	Sudan	Tunisia
GDP	1.980	-0.255	-2.626**	-3.084***
AGR	1.249	-0.169	-0.028	-0.251
EXP	-1.253	1.579	-0.477	0.578
TOT	-1.498	-2.185**	0.456	0.544
1st Differences				
GDP	-5.725***	-10.599***	-4.857***	-6.137***
AGR	-7.443***	-11.151***	-5.973***	-7.422***
EXP	-5.593***	-7.358***	-3.873***	-4.140***
TOT	-4.489***	-5.598***	-8.239***	-9.132***

Notes: Trend and intercept are included in the test equation for the variables of GDP, and AGR for Morocco. For the rest, only intercept is included in the test equation. *, **, and *** indicate the rejection of the null hypothesis of nonstationary at 10%, 5% and 1% significant level, respectively.

Source: Author's own calculation

3.2. Johansen test for cointegration

Table 2 reports the results for the Johansen cointegration tests to determine the existence of a long-run relationship between the variables under investigation by testing the null hypothesis that the number of cointegrating vectors is less than or equal to rank. Table 2 reports the results of both the trace statistics and the maximum eigenvalue statistics. The null hypothesis of the noncointegration vector is rejected against the alternative hypothesis of the cointegrated vector for all the countries but Morocco at the 5% significance level. Based on the results of the Trace test, one cointegrating vector is found for Egypt, Jordan, Mauritania, and Tunisia as the null hypothesis of the noncointegration vector is rejected. For Algeria, Comoros, and Sudan, two cointegrating vectors are found implying the existence of a long-run relationship between variables in the system for all the countries. The existence of the noncointegration vector for Morocco suggests that a VECM is not the appropriate model specification. Therefore, the nature of the relationships between agriculture and GDP is inquired through the analyses of estimated parameters from the ECMs.

Table 2. Johansen's cointegration test results

	Algeria		Comoros		Egypt		Critical Values	
Cointegration Rank	Trace	λ-max	Trace	λ-max	Trace	λ-max	Trace	λ-max
r = 0	**142.233**	**59.572**	**172.458**	**89.205**	**123.287**	**80.078**	88.803	38.331
r ≤ 1	**82.661**	**41.009**	**83.252**	**51.599**	43.209	20.506	63.876	32.118
r ≤ 2	41.652	17.689	31.653	19.0	22.702	10.369	42.915	25.823
r ≤ 3	23.962	15.025	12.653	10.182	12.333	8.546	25.872	19.387
r ≤ 4	8.936	8.936	2.47	2.47	3.786	3.786	12.517	12.517
	Jordan		Mauritania		Morocco		Critical Values	
	Trace	λ-max	Trace	λ-max	Trace	λ-max	Trace	λ-max
r = 0	**88.835**	**42.789**	**102.546**	**44.033**	86.22	28.707	88.803	38.331
r ≤ 1	46.045	23.297	58.513	27.61	57.513	25.342	63.876	32.118
r ≤ 2	22.747	11.70	30.902	16.382	32.17	20.204	42.915	25.823
r ≤ 3	11.047	6.897	14.52	12.388	11.965	7.882	25.872	19.387
r ≤ 4	4.149	4.149	2.131	2.131	4.083	4.083	12.517	12.517
	Sudan		Tunisia				Critical Values	
	Trace	λ-max	Trace	λ-max			Trace	λ-max
r = 0	**93.836**	28.384	**95.922**	**47.098**			88.803	38.331
r ≤ 1	**65.451**	25.759	48.823	25.79			63.876	32.118
r ≤ 2	39.692	17.115	23.033	11.616			42.915	25.823
r ≤ 3	22.577	13.491	11.417	9.111			25.872	19.387
r ≤ 4	9.086	9.086	2.305	2.305			12.517	12.517

Notes: Figures in bold denote rejection of the null hypothesis of cointegration rank at the 5% significance level. The cointegrating rank is determined at the first failure to reject the null hypothesis. The deterministic trend assumption of the test is to allow for linear deterministic trend with intercept and trend in cointegration equation. The optimal lag lengths are selected using SBC.

Source: Author's own calculation

3.3. ARDL bounds test for cointegration

For the ARDL analysis, the bounds *F*-test for cointegration are used. The ARDL approach has the best performance with small samples. For Algeria, Comoros, Sudan, and Tunisia, the appropriate ARDL model specification is the case with intercept and trend. In contrast, the case with no intercept no trend is used for both Jordan and Mauritania while the case of with trend only is preferred for both Egypt and Morocco. The computed *F*-statistics are above the upper bound of the adjusted critical value suggested by Pesaran *et al*. (2001) for all countries as shown in Table 3. The results suggest rejection of the null hypothesis of noncointegration implying the existence of long-run relationships between agriculture and GDP for all eight countries.

Table 3. Autoregressive distributed lag cointegration test results

	Algeria	Comoros	Egypt	Jordan
F-statistics	10.063***	10.5***	5.085***	8.007***
	Mauritania	Morocco	Sudan	Tunisia
F-statistics	7.146***	3.899**	4.677**	7.597***

Notes: The optimal lag lengths are selected using SBC. *F*-test is obtained by joint zero restrictions on estimated coefficients. ** and *** denote rejection of the null hypothesis of no cointegration at the 5% and 10% significance level, respectively.

Source: Author's own calculation

3.4. Variance decomposition and impulse responses results

An ECM specification of Equation (3) is used to examine the economic significance or the strength of the causal relationships between agriculture and GDP using both FEVDs and IRFs. The results for the FEVDs for each of the eight countries are summarized in Table 4.

Estimates provide both short-run and long-run causal flow from GDP to agriculture suggesting that growth in the aggregate economy could serve as an engine for growth in the agricultural sector for all eight countries. In the first year, growth in GDP explains 37.1% and 78.4% of FEVD for agriculture in Algeria and Morocco, respectively. Meanwhile in the long-run, growth in agriculture explains 27.8% and 17.5% of FEVD for GDP in Algeria and Morocco respectively. This means the bidirectional dynamic linkages exist between agriculture and GDP growth in these two countries. Although, GDP growth explains 95.2%, 49.6%, and 43.6%, of FEVD for agriculture in Comoros, Tunisia, and Sudan respectively, the proportion of variation in GDP explained by agriculture is low. This means only the causal flow from GDP to agriculture exists in these countries. The bidirectional linkages also exist in Egypt while the causal flow from GDP to agriculture is noticed in Jordan and Mauritania. These findings are consistent with the study conducted by Chebbi (2010) who also found a long-run relationship between agriculture and economic growth in Algeria. The GDP lead agriculture result of this study is also consistent with the study conducted by Faycal and Ali (2016) who found only a short-run relationship between agriculture and some other non-agricultural sector in Tunisia.

An IRF represents the mechanism through which a shock to agriculture affects GDP over time, and vice versa. Figure 1 represents impulse responses for each of the eight countries over 10 years. The response of GDP to shock in other variables is presented in the first column while the response of agriculture to shock in the other variables is presented in the second column. The results indicate a positive response for GDP due to one standard deviation shock in agriculture in Algeria, Comoros, and Egypt. Meanwhile, a significantly positive response in agriculture is observed as a result of a shock in GDP in these countries. This result assures the bidirectional dynamic linkages between agriculture and GDP growth in Algeria, Comoros, and Egypt. In Jordan, the result from IRF is also consistent with the result from FEVD in support of the causal flow from GDP to agriculture where a shock in GDP results in a positive response in agriculture up to seven years. A similar situation is also noticed in Mauritania and Sudan where a response in agriculture is positive only in the short run. IRF results related to Morocco do not support the bidirectional dynamic linkages between agriculture and GDP. In Morocco, a positive response in agriculture is observed for up to five years due to a shock in GDP. Finally, in Tunisia, a GDP lead agriculture scenario is noticed which is consistent with the results from FEVD.

Table 4. Results of forecast error variance decompositions

Algeria

	Variance Decomposition of GDP					Variance Decomposition of Agriculture				
Period	S.E.	GDP	AGR	EXP	TOT	S.E.	GDP	AGR	EXP	TOT
1	0.01	100.00	0.00	0.00	0.00	0.05	37.10	62.90	0.00	0.00
2	0.02	90.38	1.65	0.34	7.63	0.06	32.09	42.84	16.49	8.58
3	0.02	89.34	4.80	0.32	5.54	0.07	24.50	37.94	30.63	6.93
10	0.04	46.27	27.80	21.03	4.92	0.09	21.88	34.06	36.48	7.59

Comoros

	Variance Decomposition of GDP					Variance Decomposition of Agriculture				
Period	S.E.	GDP	AGR	EXP	TOT	S.E.	GDP	AGR	EXP	TOT
1	0.03	100.00	0.00	0.00	0.00	0.03	95.29	4.71	0.00	0.00
2	0.04	99.74	0.07	0.17	0.01	0.04	96.28	3.05	0.56	0.11
3	0.05	99.34	0.18	0.47	0.01	0.05	96.50	2.15	1.19	0.16
10	0.10	94.27	0.58	5.13	0.01	0.09	97.40	0.80	1.72	0.08

Egypt

	Variance Decomposition of GDP					Variance Decomposition of Agriculture				
Period	S.E.	GDP	AGR	EXP	TOT	S.E.	GDP	AGR	EXP	TOT
1	0.02	100.00	0.00	0.00	0.00	0.01	0.76	99.24	0.00	0.00
2	0.02	96.67	1.16	2.08	0.10	0.01	2.20	95.76	2.03	0.02
3	0.02	91.41	3.53	4.72	0.34	0.01	4.49	90.60	4.83	0.08
10	0.04	66.47	25.05	6.50	1.98	0.02	26.34	65.27	7.90	0.49

Jordan

	Variance Decomposition of GDP					Variance Decomposition of Agriculture				
Period	S.E.	GDP	AGR	EXP	TOT	S.E.	GDP	AGR	EXP	TOT
1	0.04	100.00	0.00	0.00	0.00	0.14	28.66	71.34	0.00	0.00
2	0.06	92.60	6.31	0.01	1.08	0.16	23.97	74.74	0.53	0.76
3	0.08	83.80	10.28	2.99	2.92	0.17	20.13	73.14	2.53	4.20
10	0.19	40.94	9.30	45.51	4.25	0.21	21.18	58.52	14.24	6.07

Mauritania

	Variance Decomposition of GDP					Variance Decomposition of Agriculture				
Period	S.E.	GDP	AGR	EXP	TOT	S.E.	GDP	AGR	EXP	TOT
1	0.04	100.00	0.00	0.00	0.00	0.08	30.20	69.80	0.00	0.00
2	0.05	90.42	5.17	2.82	1.59	0.08	29.67	69.35	0.39	0.59
3	0.07	83.57	7.70	5.39	3.34	0.08	32.49	65.11	1.77	0.63
10	0.13	51.26	3.91	41.92	2.92	0.10	41.91	45.79	10.28	2.02

Morocco

	Variance Decomposition of GDP					Variance Decomposition of Agriculture				
Period	S.E.	GDP	AGR	EXP	TOT	S.E.	GDP	AGR	EXP	TOT
1	0.03	100.00	0.00	0.00	0.00	0.16	78.47	21.53	0.00	0.00
2	0.03	92.49	6.01	0.75	0.75	0.17	74.61	20.98	0.20	4.21
3	0.04	91.11	7.24	1.04	0.62	0.17	75.85	19.93	0.19	4.03
10	0.05	71.95	17.49	6.14	4.41	0.18	73.95	19.51	0.67	5.87

Sudan

	Variance Decomposition of GDP					Variance Decomposition of Agriculture				
Period	S.E.	GDP	AGR	EXP	TOT	S.E.	GDP	AGR	EXP	TOT
1	0.05	100.00	0.00	0.00	0.00	0.10	43.64	56.36	0.00	0.00
2	0.07	98.87	0.99	0.04	0.11	0.12	43.89	54.99	0.67	0.44
3	0.09	97.34	1.42	0.44	0.80	0.13	47.12	49.52	2.05	1.31
10	0.20	89.36	1.65	1.78	7.22	0.17	57.66	31.49	8.28	2.58

Tunisia

	Variance Decomposition of GDP					Variance Decomposition of Agriculture				
Period	S.E.	GDP	AGR	EXP	TOT	S.E.	GDP	AGR	EXP	TOT
1	0.02	100.00	0.00	0.00	0.00	0.10	49.59	50.41	0.00	0.00
2	0.03	88.01	0.31	2.12	9.56	0.12	40.43	39.12	8.97	11.48
3	0.04	85.45	0.63	3.92	10.00	0.12	39.22	37.95	9.18	13.65
10	0.06	83.39	1.06	2.87	12.68	0.13	36.70	33.54	15.92	13.83

Source: Author's own calculation

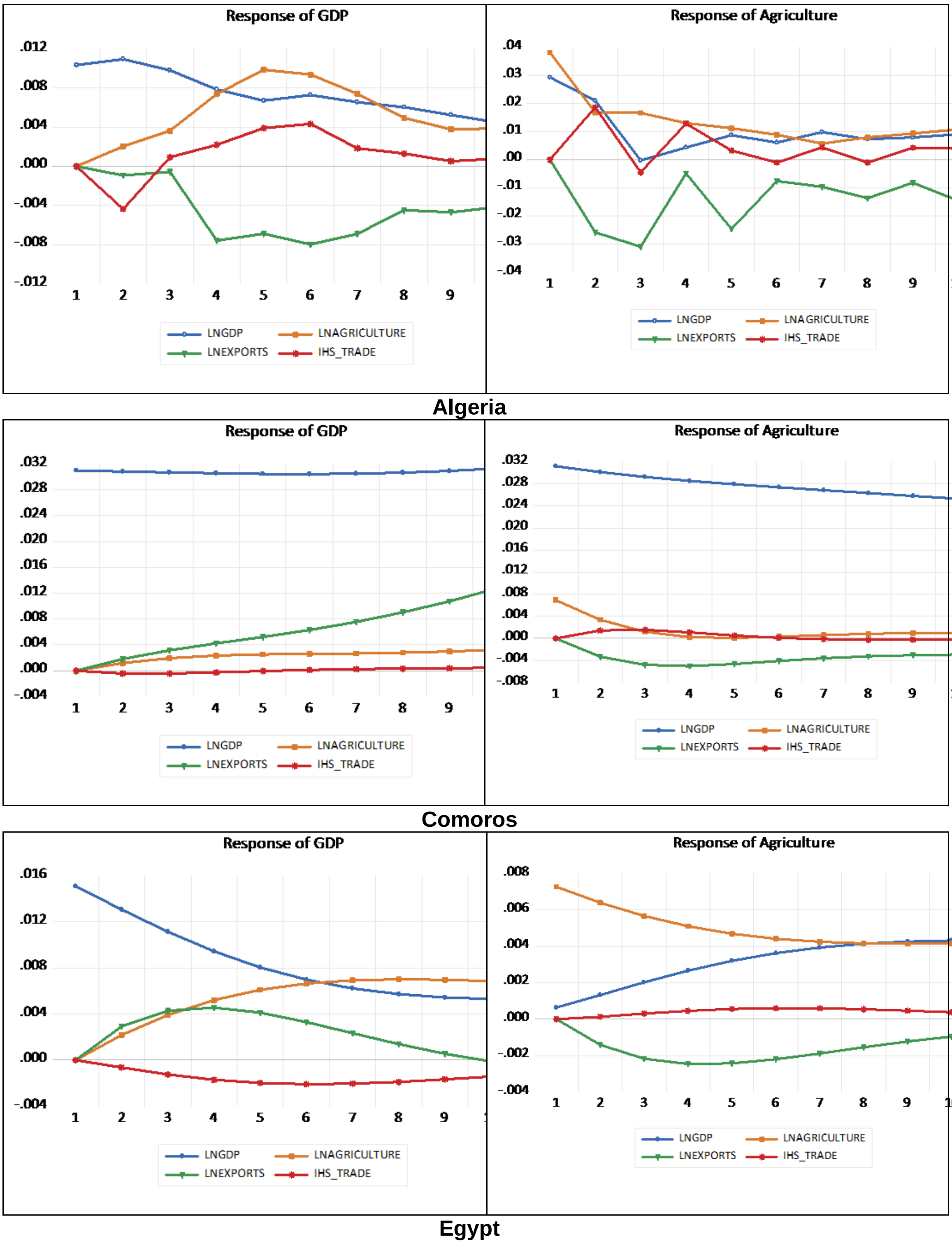
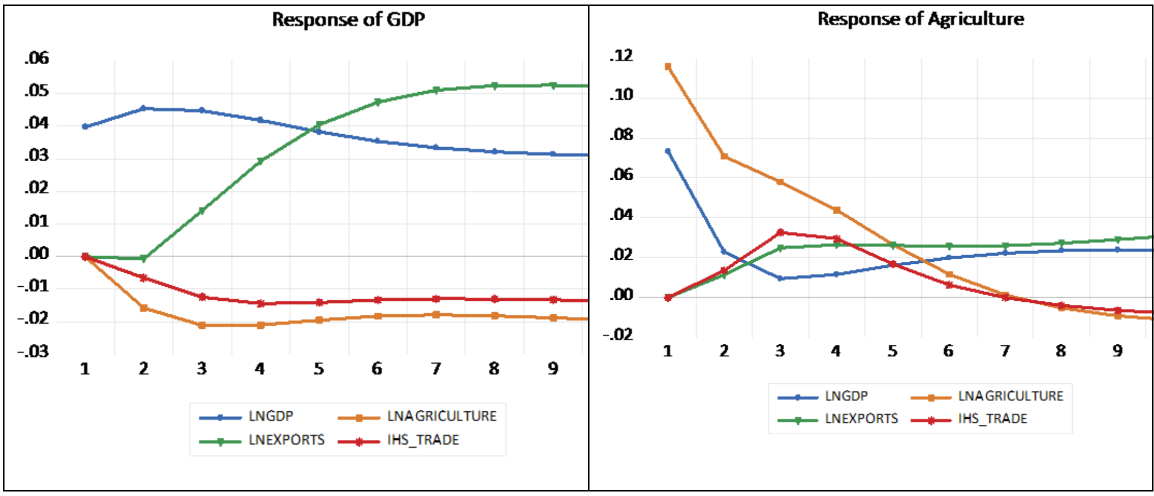
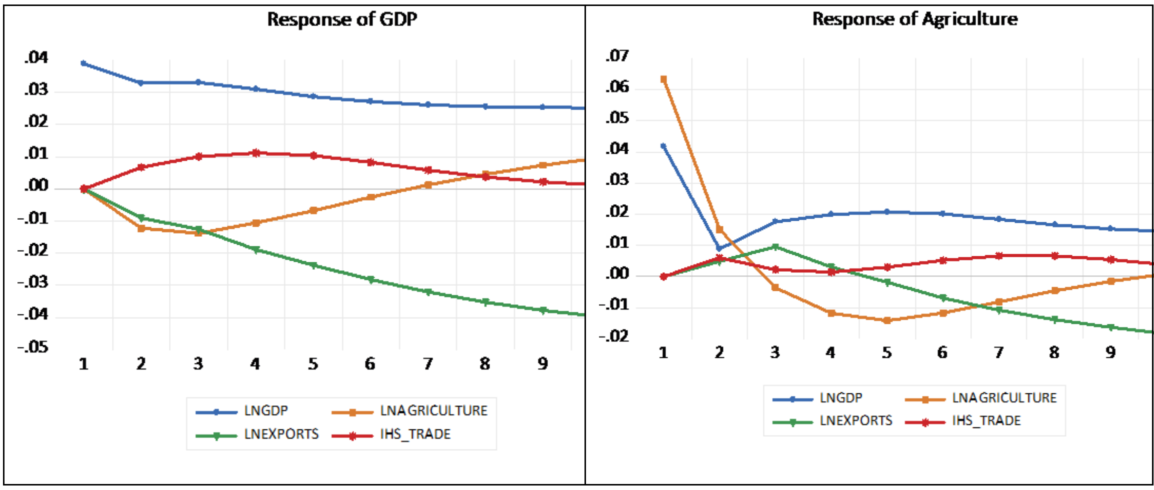


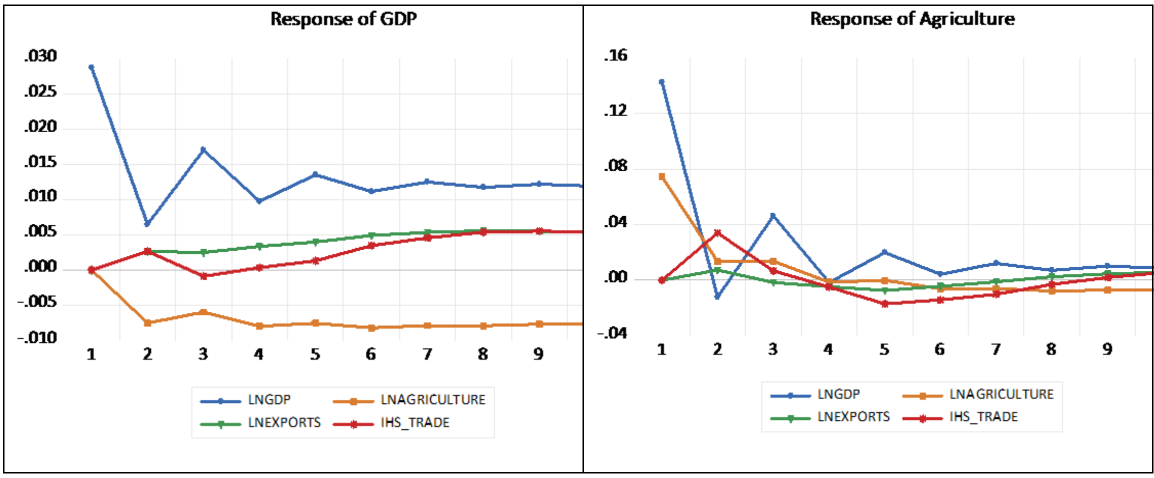
Figure 1. Results of impulse responses
Source: Author's own calculation



Jordan

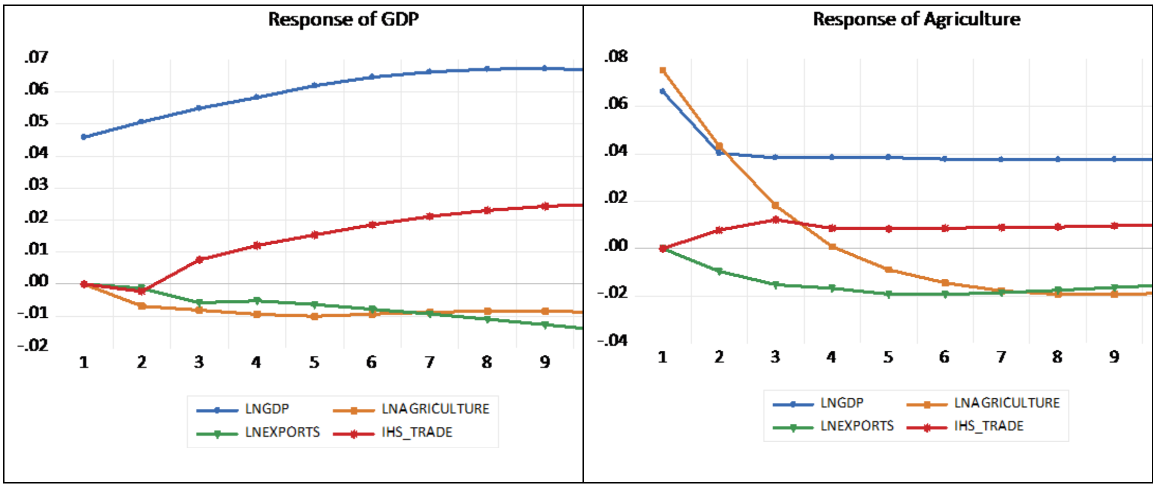


Mauritania

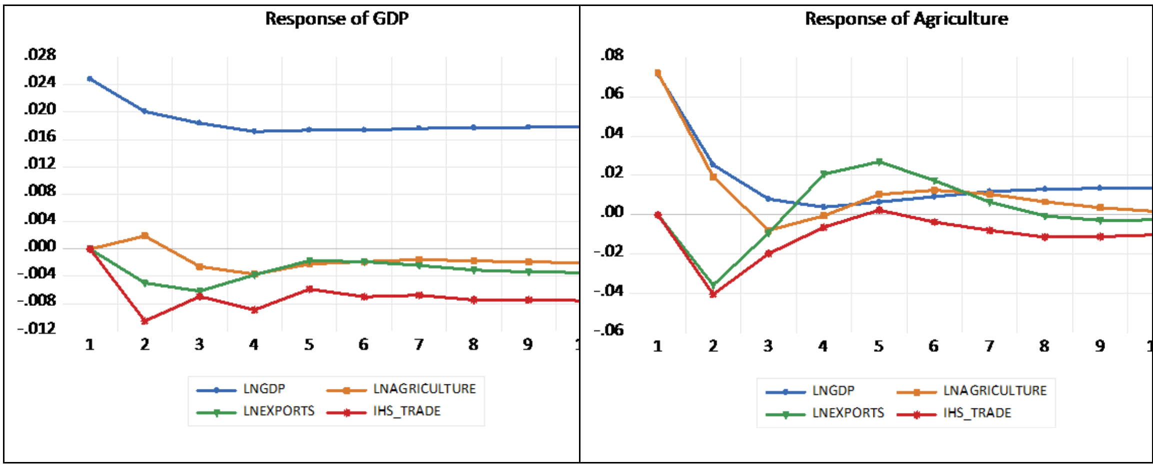


Morocco

Figure 1. Continued
Source: Author's own calculation.



Sudan



Tunisia

Figure 1. Continued

Source: Author's own calculation

4. Conclusion

The role of agriculture as an engine of economic growth has long been a focus in the development literature. This paper investigated the nature of the causal relationship between agriculture and economic growth. Despite the quantitative analyses of the contribution of agriculture to economic growth in developing countries, very few empirical studies on this issue exist in the Arab World. Therefore, this study uses the time-series techniques to investigate the causal flow between agriculture and economic growth in a selection of eight Arab countries.

In general, it is established that agriculture is positively related to economic growth in the studied countries and the relationship is significant both in the short-run and in the long-run but the direction of the causal relationship between agriculture and economic growth varies across countries. For a few countries, more investment in the agricultural sector is desirable since agriculture is shown to be significantly contributed to economic growth in these countries. In contrast, most Arab countries could use the economic growth as a catalyst for growth in the agricultural sector. This result suggests that the agricultural sector so depends on other non-agricultural sectors like the industrial sector on providing modern inputs and technology. In addition to agriculture, both exports and terms of trade also have contributed to economic growth.

Although results from VECM and ARDL approaches show that a long-run relationship exists between agriculture and economic growth, empirical results from FEVDs and IRFs indicate that this type of relationship might only exist in the short-run for some countries. Generally, the findings support the idea that the agricultural sector plays a key role in the economy of Algeria, Comoros, and Egypt as this sector contributed to economic growth in these countries. From a policy perspective, this finding is important for underlying the fact that agriculture could be used as the backbone of economy and it cannot be ignored while studying economic growth in these countries. The cointegration between agriculture and economic growth suggests that agriculture continues to foster better growth and development by providing inputs to other sectors like providing raw materials to manufacturing industry sector, for example. However, the big size of the agricultural sector does not mean it must be a primary sector for economic growth in these countries because agriculture suffers from low productivity compared to other sectors of the economy. Therefore, policymakers in these countries should pay more attention to this problem and work towards enhancing the agricultural value-added. It is recommended that these countries take constructive steps to encourage farmers to produce by implying the reliable insurance programs. They also should help farmers to have access to agricultural inputs by subsidizing the producers of the agricultural primary goods. Data availability limits the number of Arab countries included in this study and future research on this issue could expand the number of Arab countries to investigate the role of agriculture in promoting economic growth in the Arab World.

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