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Do Agricultural Raw Materials Imports Cause Agricultural Growth? Empirical Analysis from North Africa

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ABSTRACT

The aim of this paper is to study empirically the impact of agricultural raw materials imports on agricultural growth since it is never done before. We have made this study in the context of three Countries from North Africa (Tunisia, Morocco and Egypt) for the period 1965 – 2016. By using cointegration analysis and vector error correction model, empirical analysis proves that agricultural raw materials imports produce a positive effect on agricultural growth in the long run for the three Countries and cause agricultural growth in the short run in the case of Tunisia and Egypt. It is seen that agricultural raw materials imports is a source of economic growth in the agricultural sector. For this reason, countries of North Africa should adopt to integrate foreign technology imports and not technological innovation to stimulate agricultural sector.

Anahtar Kelimeler
Agricultural Raw Materials Imports, Agricultural Growth, VECM, North Africa.

JEL Kodu
F11, F13, F14, F15, L66, O47, O55, Q16, Q17

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1. Introduction

Generally, for developing countries, imports of capital goods and intermediate goods are essential inputs because these types of countries cannot produce these goods and because they are incorporated in the technology they need. And if there is not enough foreign exchange to finance imports of capital goods and intermediate goods, the economy neither functions properly nor will economic growth be strong[1]. Amsden (1989) claimed that foreign technology imports are an important factor in explaining the rapid economic growth. He suggested that a growth model suitable should integrate not technological innovation but foreign technology imports. Grossman and helpman (1991), Barro and sala-I-Martin (1997), Benhabib and sepiegel (2002) and Griffith et al (2004) declare that the spreading of new technologies from developing economies to developing ones is considered as an essential driver of productivity growth for developing countries.Benhabib and Sepiegel (2002), Griffith et al (2004), Cameron et al (2005) propose that countries which are overdue behind the technological frontier will experience faster productivity growth than the leading country and thus benefit from technological catch-up.Bel Haj Hassine (2008) explored the role of human capital and trade openness in the process of technological diffusion and productivity growth in the Mediterranean agricultural sector. She found that human capital and trade openness facilitates technology diffusion and stimulates agricultural growth.Margot Anderson (1989) argues that technology transfer helps to increase agricultural productivity, reduces production costs and lowers consumer prices. Indicating that benefits depend on the way technology is transferred, the speed of transfer and the degree of influence of government policy on technology transfers.DeJanvry and Sadoulet (2001) have shown that technology in the agricultural sector can contribute to reducing poverty through direct effects (gain for adopters) and indirect effects (lower food prices, job creation, effects related to agricultural investment and agricultural growth...,).Such an empirical exercise has never been done before in the context of North Africa and in the context of the impactof agricultural raw materials imports on Agricultural growth. In this research, we try to bridge these gaps by looking into the impact of agricultural raw materials imports on agricultural growth for the period 1965 to 2016. The rest of the paper is fixed as follows. Section 2 establishes on a survey of literature. Section 3 explains the data characterization and methodological structure.

[1]see: Chenery and Bruno (1962), Mckinnon (1964) and Taylor (1991)

Empirical results and analysis are engaged into account in next coming Section 4. Section 5 ends the study along with recommendations.

2. Literature Survey

The following table presents a set of empirical studies that are collected during our exploration of this research theme to inspire the realization of our empirical analysis.

Table 1

Studies Related to the Nexus Between Imports / Economic Growth and Between Imports Diversification and Economic Growth

No	Authors	Countries	Periods	Econometric Techniques	Keys Findings
			Imports and Economic Growth		
1	Hye (2012)	China	1978 - 2009	ARDL Granger Causality Tests	M <=>Y : LR
2	Alavinasab (2013)	Iran	1961 - 2010	OLS	M => Y: (-)
3	Ahmed and al (2014)	Pakistan	1983 - 2013	Cointegration Analysis Granger Causality Tests	M => Y
4	Albiman and Suleiman (2016)	Malaysia	1967 - 2010	Cointegration Analysis VAR Granger Causality Tests	M # Y

5	Riyath and Jahfer (2016)	Sri Lanka	1962 - 2015	Cointegration Analysis
				VECM
					M # Y : SR
					M => Y: LR

6	Bakari (2017)	Tunisia	1965 - 2016	Cointegration Analysis VECM	M =>Y : LR M # Y : SR
7	Bakari and Mabrouki (2017)	Panama	1980 - 2015	Cointegration Analysis VAR Granger Causality Tests	M => Y
8	Bakari and al (2018)	Nigeria	1981 - 2015	Cointegration Analysis VECM	M # Y : LR M <=>Y : SR
9	Ofeh and Muandzevara (2017)	Cameroon	1980 - 2013	Correlation Analysis OLS	M => Y: (-) M =>Y : LR
			Imports diversification and economic growth		
10	Zhang and Zou (1995)	50 Developing Countries	1965 – 1988	Pooled OLS Fixed Effect Model Random Effect Model	FTM => Y
11	Ghosh (2009)	India	1970 – 2006	Cointegration Analysis ARDL	OM # Y : LR
12	Jayaraman and Lau (2011)	Fiji, Samoa, Solomon Islands, Tonga and Vanuatu	1982 – 2007	PFMOLS Panel Cointegration Analysis Panel Granger Causality Tests	OM => Y: LR (-)
13			1980 – 2007	PFMOLS	OM <= Y

	Yazdani and Faaltofighi (2012)	Turkey, South Korea, Malaysia, India and Pakistan		PVECM	
14	Acheampong (2013)	Ghana	1967 – 2011	Cointegration Analysis	OM => Y: LR (-)
				ARDL	OM => Y: SR (-)
15	Bakari and Mabrouki (2018)	North Africa	1982 – 2016	Correlation Analysis Fixed Effect Model Random Effect Model Hausman Test	AM => Y

Note. Y means Economic Growth, M means Imports, AM means Agricultural Imports, OM means Oil Imports, FTM means Foreign Technology Imports, LR means Long Run, SR means Short Run, (-) means Negative Effect

3. Data, Methodology and Model Specification

3.1. Data

To perambulate the impact of Agricultural raw materials imports on Agricultural GDP in North Africa, we will utilize a time series database that will spread the period 1965 - 2016 and taken from annual statistical reports of the World Bank. The short illustration of variables is specific as below in Table 2.

Table 2

Description of Variables

No	Variables	Description/Definition	Source
1	AY	Agricultural Gross Domestic Product (constant US $): agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3 or 4.	The World Bank
2	AX	Agricultural Export (Constant US $): comprises the commodities in SITC sections 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels), (constant US $)	The World Bank
3	AMM	Agricultural raw materials imports (constant US $): comprise SITC section 2 (crude materials except fuels) excluding divisions 22, 27 (crude fertilizers and minerals excluding coal, petroleum, and precious stones), and 28 (metalliferous ores and scrap).	The World Bank

3.2. Methodology

Methodologically, an estimate based on the development of VAR models introduced by Sims (1980) will be used to identify the nature of the temporal link between the main macroeconomic aggregates.The first step includes determining the order of integration of each variable (If the variables are all stationary we can apply the model of Sims, and if not, we cannot apply it).The second step is to determine the number of optimal lags included in our model to know the time needed (per year) for the independent variables to cause an effect (whether positive / negative) on the dependent variables.The third step is to check the existence or the absence of a cointegration relation between the variables (if there is a cointegration relation we will apply the VECM Model, if there is not a cointegration relation we will apply the VAR Model).

3.3. Model Specification

To inspect empirically the impact of agricultural raw materials imports on agricultural growthis expressed as[2]:

$$AY = F(AX, AMM) \quad (1)$$

Where AY, AX and AMM depict respectively: gross domestic product in agricultural sector (Constant US $), agricultural export (Constant US $) and agricultural raw materials imports (Constant US $).

The Function can also be represented in log-linear econometric format thus:

$$Log(AY) = \beta_0 + \beta_1 Log(AX)_t + \beta_2 Log(AMM)_t + \varepsilon_t \quad (2)$$

Where:

- $\boldsymbol{\beta_0}$ is the constant term

[2] This modality of production function is very dynamic and very transparent to substantiate the nexus between trade and economic growth, largely in the developing countries and predominately, in the countries of Africa as the case of Egypt, Morocco and Tunisia, since these countries take holding of various natural resources and rare goods such as oil, gas, phosphate, gold, copper, iron, phosphorus for export, and generally require high-level imports to extract these resources (such as; Imports of manufactured goods, Imports of ICT goods, Imports of ores and metals). In addition, the share of investment and labor force are not of considerable effectiveness simply because of the emergence of percentages of unemployment, poverty and Corruption in these countries {See Central Bank of Tunisia (1965 - 2016), World Bank indicators and Transparency International}. In addition, there are independent researchers in this field who have applied only the two variables export and import in the function of production to extract their relations with economic growth, such as Hussain (2014); Turan and Karamanaj (2014); Mohsen (2015); Yüksel and Zengin (2016), Bakari (2017), Bakari and Mabrouki (2017), Bakari (2018).

- $\boldsymbol{\beta_1}$ is the coefficient of variable 'agricultural export'
- $\boldsymbol{\beta_2}$ is the coefficient of variable 'agricultural raw materials imports)
- **t** is the time rend (by year)
- $\boldsymbol{\varepsilon}$ is the random error term assumed to be normally, identically and independently distributed

Equation (2) can be written in Error Correction Model form as:

$$\Delta AY_{(t)} = \sum_{(i-1)}^{k} \beta_0 \, \Delta AY_{t-i} + \sum_{(i-1)}^{k} \beta_{(1)} \Delta AX_{(t-i)} + \sum_{(i-1)}^{k} \beta_{(2)} \Delta AMM_{(t-i)} + Z_{(1)} ECT_{(t-1)} + \varepsilon_{(t)} \qquad (3)$$

WhereΔ is the difference operator; k is the number of lags, $\beta_0, \beta_1 \, and \, \beta_2$ are the short run coefficients to be estimate; $EC1_{t-1}$ is the error correction term derived from the long-run co integration relationship; Z_1 is the error correction coefficients of$EC1_{t-1}$and ε_{1t} is the error terms in equation.

4. Empirical Analysis

As usual, the first step in performing estimation based on VAR model modeling is stationary analysis. There are several tests that determine the order of integration of each variable such as ADF, PP and KPSS. In our case, we will use the most adopted test which is the ADF test[3].

Table 3

Augmented Dickey Fuller Test

Variables	Egypt		Morocco		Tunisia	
	C	CT	C	CT	C	CT
AY	(1.463859)	(1.752586)	(0.791663)	(3.113750)	(1.102977)	(3.832720)**
	[8.315827]***	[8.545897]***	[14.51686]***	[14.35747]***	[5.082067]****	[5.527687]***
AX	(0.351095)	(1.479282)	(0.146829)	(2.781120)	(0.037970)	(2.014369)
	[6.767956]***	[6.919399]***	[7.428073]***	[7.418593]***	[9.768890]***	[9.907908]***
AMM	(2.170230)	(4.768593)***	(2.950329)	(2.773951)	(1.122097)	(3.832289)**
	[7.881689]***	[7.799699]***	[7.738695]***	[8.053752]***	[8.403844]***	[8.357375]***

Note. ***;** and * denote significances at 1% ; 5% and 10% levels respectively
( ) denotes stationarity in level
[ ] denotes stationarity in first difference

[3] Augmented Dickey Fuller test, See: Dickey and Fuller (1979, 1981)

The results of the ADF test are described in Table 3. All the variables are stationary and especially they are stationary in first difference. The second step in our empirical analysis is the cointegration analysis. In this case, we will apply the Johansen test which is most appropriate in checking the existence or absence of a cointegration relationship between the variables. It should be noted that the results of the Lag Order Selection VAR indicate that the number of optimal delays is equal to 4 in the case of Egypt and 2 in the case of Tunisia and Morocco.

Table 4

Johansen Test

Unrestricted Cointegration Rank Test (Trace)				
Egypt				
Hypothesized No. of CE(s)	***Eigen Value***	***Trace Statistic***	***0.05 Critical Value***	***Prob.*****
None *	0.383183	47.42711	29.79707	0.0002
At most 1 *	0.319348	24.71754	15.49471	0.0016
At most 2 *	0.131686	6.636465	3.841466	0.0100
Morocco				
Hypothesized No. of CE(s)	***Eigen Value***	***Trace Statistic***	***0.05 Critical Value***	***Prob.*****
None *	0.453713	57.56817	29.79707	0.0000
At most 1 *	0.317091	28.54688	15.49471	0.0003
At most 2 *	0.192113	10.23997	3.841466	0.0014
Tunisia				
Hypothesized No. of CE(s)	***Eigen Value***	***Trace Statistic***	***0.05 Critical Value***	***Prob.*****
None *	0.460966	63.14962	29.79707	0.0000
At most 1 *	0.301816	33.48673	15.49471	0.0000
At most 2 *	0.287067	16.24162	3.841466	0.0001

Trace test indicates 3 co-integrating equations at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Johansen's test[4] results indicate the existence of 3 cointegration relationships between the 3 variables in the 3 countries. Since all the variables are co integrated in the 3 countries, the vector error correction model will be retained. Among the virtues of applying an estimation based on the VECM model is the determination of the relationship between all variables in the long-term and the short-term.

The VECM estimate for each country gives us three long-run equilibrium equations, which are presented as follows:

[4] Johansen test, See: Johansen (1988, 1991); Johansen and Juselius (1990)

Egypt:

$$Log\ (AY) = 0.0276 + 0.0223\ Log\ (AX) + 0.0433\ Log\ (AMM) \quad (4)$$

Morocco:

$$Log\ (AY) = 0.0016 + 0.7642\ Log\ (AX) + 0.4078\ Log\ (AMM) \quad (5)$$

Tunisia:

$$Log\ (AY) = 0.0074 + 0.2827\ Log\ (AX) + 0.8669\ Log\ (AMM) \quad (6)$$

Equations (4), (5) and (6) indicate that agricultural machinery imports and agricultural exports have a positive effect on long-term agricultural GDP in the three countries. It manifests that:

- ✓ In Egypt, agricultural raw material imports and agricultural exports have a positive effect on economic growth, a 1 % increase in Log (AMM) and in Log (AX) leads respectively to an increase of 0.0433 % and 0.0223% of Log(Y).
- ✓ In Morocco, agricultural raw material imports and agricultural exports have a positive effect on economic growth, a 1 % increase in Log (AMM) and in Log (AX) leads respectively to an increase of 0.4078 % and 0.7642% of Log(Y).
- ✓ In Tunisia, agricultural raw material imports and agricultural exports have a positive effect on economic growth, a 1 % increase in Log (AMM) and in Log (AX) leads respectively to an increase of 0.8669 % and 0.2827 % of Log(Y).

To verify the credibility of its results we must test the significance of equations of long-term equilibrium by using the Least Squares of Gauss Newton.If the coefficient of the error correction term (Lagged ECT) is negative and possesses a significant probability. This means that all variables in the long-term relationship are significant in explaining the dependent variables.

Table 5

VECM Estimation

Independent Variables	**AY**	**Dependent Variables**	
		AX	**AMM**
Egypt			
AY	-	9.441692 (0.0510)**	6.312555 (0.1770)
AX	12.12238 (0.0165)***	-	2.829385 (0.5868)
AMM	8.462452 (0.0760)*	18.77716 (0.0009)***	-
Lagged ECT	**[-0.660036]****	[19.60309]	[16.47573]
Morocco			
AY	-	8.711686 (0.0128)***	1.165515 (0.5584)
AX	4.040152 (0.1326)	-	25.61590 (0.0000)***
AMM	1.044576 (0.5932)	1.254831 (0.5340)	-
Lagged ECT	**[-0.980779]*****	[1.168880]	[0.442794]
Tunisia			
AY	-	0.051700 (0.9745)	11.81685 (0.0027)***
AX	11.62245 (0.0030)***	-	3.132892 (0.2088)
AMM	9.336255 (0.0094)***	5.322587 (0.0699)*	-
Lagged ECT	**[-0.823725]*****	[1.356063]	[0.582888]

Note. Values in brackets are estimated t-statistics for each cointegration equation. All other values are asymptotic Granger causality F tests (WALD Test), values in parentheses are p-values.
* ** ; ** and * denote significances at 1% , 5% and 10% levels respectively

Table 5 reports that the coefficient of error correction term (ECT) is significant and has a negative coefficient in the three cases. This means that that imports of agricultural machinery and agricultural exports have a positive effect on agricultural GDP in all countries in the longrun.

In the short run we use WALD test to determine the causal links between the different variables in each country. Table 6 summarizes the results of the WALD test included in Table 5. Table 6 reports that agricultural material imports have a positive effect on economic growth in the short run in the three countries.

Table 6

Causality links in the short run/ WALD Test

Egypt	Morocco	Tunisia
AX <=> AY	AY => AX	AX => AY
AMM => AY	AX => AMM	AMM <=> AY
AMM => AX		AMM => AX

5. Conclusion

In this article, we examined the effect of agricultural material imports on economic growth in the agricultural sector in Tunisia, Morocco and Egypt. In use three time series databases that cover the period 1965 - 2016 and that have been estimated by the Co-integration analysis and the error correction vector model.Empirical results show agricultural exports, imports of materials are co-integrated with economic growth positively in the long run. In all three countries, imports of agricultural materials have a positive influence on economic growth, and in its cointegration link, agricultural exports also have a positive effect on agricultural growth.This is explained by the transfer of technology included in imported agricultural materials that contribute to increase agricultural productivity, reduce production costs, and ensure food security and satisfaction with the level of consumption which leads indirectly, an increase in agricultural exports. All of these effects, whether direct or indirect, emphasize that imports of agricultural materials contribute to agricultural growth in the long run.On the other hand, the labor force in the agricultural sector in the three countries has a level of human capital that allows them to learn the use of imported materials technology and to use it in an efficient and more productive way. Which explains the positive effect of imports of agricultural materials on long-term agricultural growth in the case of Tunisia, Morocco and Egypt, and which also explains the positive effect of agricultural imports on agricultural growth in the case of Tunisia and Egypt.So the countries of North Africa must continue to pursue a growth model that adapts to integrate foreign technology imports and not technological innovation to have agricultural investments characterized by huge productivity and rapid growth in the agricultural sector.

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