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

Bakari, Sayef

Department of Economics Sciences, LIEI, Faculty of Economic Sciences and Management of Tunis, University of Tunis El Manar, (Tunisia), University of Nice Sophia-Antipolis, (France)

August 2018

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

**Sayef Bakari**[a,b]

[a]Department of Economics Sciences, LIEI, Faculty of Economic Sciences and Management of Tunis, University of Tunis El Manar, (Tunisia)

[b]University of Nice Sophia-Antipolis, (France)

Email: bakari.sayef@yahoo.fr

**Abstract:**

The aim of this paper is to study empirically the impact of agricultural raw materials imports on agricultural growth since it 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 all 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 are 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.

**JEL Classification: F11, F13, F14, F15, L66, O47, O55, Q16, Q17**

**Keywords:** Agricultural Raw Materials Imports, Agricultural Growth, VECM, North Africa.

**Acknowledgments:** The author would like to thank **Professor Albert Marouani**[1] for his invitation to the University of Sofia Antipolis for his support in providing all the necessary conditions to carry out this work.

[1] Former President of the University of Nice Sophia-Antipolis - France (2004 - 2012) and Director of the Higher Institute of Social Work in Nice - France.

## I. Introduction

Generally, developing countries cannot produce the capital goods embodied in the technology they need. 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 cannot function properly, nor will growth be strong {see: Chenery and Bruno (1962), Mckinnon (1964) and Taylor (1991)}.

Amsden (1989) claimed that foreign technology imports are the most factors in explaining the rapid economic growth and 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 and 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 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, reduce production costs and lower 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.

De Janvry 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...,).

Furthermore, such an empirical exercise has never been done before in the context of North Africa and in the context of the impact of agricultural raw materials imports on Agricultural growth. In this research, we aim to span these wide opening by using function production include agricultural raw materials imports, agricultural exports and Gross Domestic Product in the agricultural sector; and which are estimated by applying co-integration analysis and vector error correction model for the period 1965 to 2016.

The rest of the paper is fixed as follows. Section 2 establish on a survey of literature. Section 3 explains the data characterization and methodological structure. Empirical results and analysis are engaged into account in next coming Section 4. Section 5 ends the study along with recommendations.

## II. Literature Survey

The following table presents a set of empirical studies that are collected during our exploitation 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 | M <=> Y : LR |
| | | | | Granger Causality Tests | |
| **2** | Alavinasab (2013) | Iran | 1961 – 2010 | OLS | M => Y: (-) |
| **3** | Ahmed and al (2014) | Pakistan | 1983 – 2013 | Cointegration Analysis | M => Y |
| | | | | Granger Causality Tests | |
| **4** | Albiman and Suleiman (2016) | Malaysia | 1967 – 2010 | Cointegration Analysis | M # Y |
| | | | | VAR | |
| | | | | Granger Causality Tests | |
| **5** | Riyath and Jahfer (2016) | Sri Lanka | 1962 – 2015 | Cointegration Analysis | M # Y : SR |
| | | | | VECM | M => Y: LR |
| **6** | Bakari (2017) | Tunisia | 1965 – 2016 | Cointegration Analysis | M => Y : LR |
| | | | | VECM | M # Y : SR |
| **7** | Bakari and Mabrouki (2017) | Panama | 1980 – 2015 | Cointegration Analysis | M => Y |
| | | | | VAR | |
| | | | | Granger Causality Tests | |
| **8** | Bakari and al (2018) | Nigeria | 1981 – 2015 | Cointegration Analysis | M # Y : LR |
| | | | | VECM | M <=> Y : SR |
| **9** | Ofeh and Muandzevara (2017) | Cameroon | 1980 – 2013 | Correlation Analysis | M => Y: (-) |
| | | | | OLS | M => Y : LR |
| | | | **Imports diversification and economic growth** | | |
| **10** | Zhang and Zou (1995) | 50 Developing Countries | 1965 – 1988 | Pooled OLS | FTM => Y |
| | | | | Fixed Effect Model | |
| | | | | Random Effect Model | |
| **11** | Ghosh (2009) | India | 1970 – 2006 | Cointegration Analysis | OM # Y : LR |
| | | | | ARDL | |
| **12** | Jayaraman and Lau (2011) | 5 countries | 1982 – 2007 | PFMOLS | OM => Y: LR (-) |
| | | | | Panel Cointegration Analysis | |
| | | | | Panel Granger Causality Tests | |
| **13** | Yazdani and Faaltofighi (2012) | 5 countries | 1980 – 2007 | PFMOLS | OM <= Y |
| | | | | 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 | AM => Y |
| | | | | Fixed Effect Model | |
| | | | | Random Effect Model | |
| | | | | Hausman Test | |

**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.

## III. Data, methodology and model specification

### 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 1

**Table 1: 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 |

### 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 delays 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) Model specification

The augmented production function including Agricultural Gross Domestic Product, agricultural exports and Agricultural raw materials imports is expressed as:

$$\mathbf{AY} = \mathbf{F}(\mathbf{AX}, \mathbf{AMM})$$

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:

$$\mathbf{Log}(\mathbf{AY}) = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\,\mathbf{Log}(\mathbf{AX})_t + \boldsymbol{\beta_2}\,\mathbf{Log}(\mathbf{AMM})_t + \boldsymbol{\varepsilon_t}$$

Where:

- $\boldsymbol{\beta_0}$ is the constant term
- $\boldsymbol{\beta_1}$ is the coefficient of variable ‘agricultural export’
- $\boldsymbol{\beta_2}$ is the coefficient of variable ‘agricultural raw materials imports)
- $\mathbf{t}$ is the time rend (by year)
- $\boldsymbol{\varepsilon}$ is the random error term assumed to be normally, identically and independently distributed

## IV. 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.

**Table 2: Augmented Dickey Fuller Test**

| Variables | Egypt | | Morocco | | Tunisia | |
|---|---|---|---|---|---|---|
| | Constant | Constant, Linear Trend | Constant | Constant, Linear Trend | Constant | Constant, Linear Trend |
| **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]*** |

*****;** and * denote significances at 1% ; 5% and 10% levels respectively**

**( ) denotes stationarity in level**

**[ ] denotes stationarity in first difference**

The results of the ADF test are described in Table 1. 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 Johanson 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 3: Johanson 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 |
| **Trace test indicates 3 co-integrating equations at the 0.05 level** | | | | |
| ***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 |
| **Trace test indicates 3 co-integrating equations at the 0.05 level** | | | | |
| ***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 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 three long-term equilibrium relations in each country are presented as follows:

- ✓ **Egypt :**

  $Log\ (AY) = 0.0276 + 0.0223\ Log\ (AX) + 0.0433\ Log\ (AMM)$ **(1)**

- ✓ **Morocco :**

  $Log\ (AY) = 0.0016 + 0.7642\ Log\ (AX) + 0.4078\ Log\ (AMM)$ **(2)**

- ✓ **Tunisia :**

  $Log\ (AY) = 0.0074 + 0.2827\ Log\ (AX) + 0.8669\ Log\ (AMM)$ **(3)**

Equations (1), (2) and (3) indicate that agricultural machinery imports and agricultural exports have a positive effect on long-term agricultural GDP in the three countries. To verify the credibility of its results we must test the significance of equations of long-term equilibrium.

**Table 4: 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] |

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

**a- In the long run :**

The results of the VECM model show that imports of agricultural machinery and agricultural exports have a positive effect on agricultural GDP in all countries. Otherwise, the VECM model shows that the agricultural GDP has no effect on agricultural imports and agricultural exports. Even agricultural imports have no effect on agricultural exports.

**b- In the short run :**

The following table summarizes the causal links between the different variables in each country in the short term.

**Table 5: Causality links in the short run**

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

## V. 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.

**References:**


Acheampong, K. (2013). "Crude oil price and economic growth: The case of Ghana." *International Journal of Management Research and Technology*, 1(3) , 140-167.

Ahmed M, Hunjra A I, Iqbal M K and Khalil, J. (2014). Impact of Foreign Direct Investment, Imports, Exports of Goods and Services on Economic Growth of Pakistan. *Bulletin of Business and Economics*, 3(3), 155-165.

Alavinasab S M (2013). Foreign Trade and Economic Growth in Iran: An Empirical Study. *International Journal of Academic Research in Business and Social Sciences*. November 2013, Vol. 3, No. 11.

Albiman M, Suleiman NN (2016). The Relationship among Export, Import, Capital Formation and Economic Growth in Malaysia. *Journal of Global Economy* 4: 186. doi:10.4172/2375-4389.1000186.

Amsden, A. (1989). "Asia's Next Giant: South Korea and Late Industrialization." *Oxford University Press.*

Anderson, M. (1989). "International Technology Transfer in Agriculture". *Agriculture Information Bulletin, Number 571 August 1989.*

Bakari, S (2017). " The Three-Way Linkages Between Export, Import, and Economic Growth: New Evidence From Tunisia," *Journal of Smart Economic Growth*. Volume 2, Number 3, Year 2017.

Bakari, S and Mabrouki, M (2017). "Impact Of Exports And Imports On Economic Growth: New Evidence From Panama," *Journal of Smart Economic Growth*, , vol. 2(1), pages 67-79, March.

Bakari, S and Mabrouki, M (2018). "The Impact of Agricultural Trade on Economic Growth in North Africa: Econometric Analysis by Static Gravity Model." *MPRA Paper 85116,* University Library of Munich, Germany.

Bakari, S., Mabrouki, M and Othmani A (2018). "The Six Linkages between Foreign Direct Investment, Domestic Investment, Exports, Imports, Labor Force and Economic Growth: New Empirical and Policy Analysis from Nigeria". *Journal of Smart Economic Growth*, Volume 3, Number 1, Year 2018.

Barro, R.J., Sala-i-Martin, X., (1997). "Technological diffusion, convergence, and growth". *Journal of Economic Growth* 2, 1-26.

Belhaj Hassine, N. (2008). "Trade, Human Capital and Technology Diffusion in the Mediterranean Agricultural Sector." *Economie Internationale* 113: 115-142.

Benhabib, J and Spiegel, M., (2002). "Human capital and technology diffusion", *Federal Reserve Bank of San Francisco* Working Paper 03-02.

Cameron, G., Proudman, J., and Redding, S., (2005). "Technological convergence, R&D, Trade and productivity growth," *European Economic Review* 49, 775-807.

Chenery, H and Bruno, M. (1962). "Development Alternative in an Open Economy: the Case of Israel," *Economic Journal*. Vol. 57, March 1962, 79-103.

De Janvry, A., and Sadoulet, E. (2001). "World poverty and the role of agricultural technology: Direct and indirect effects." *Journal of Development Studies*, 38(4), 1–26.

Ghosh, S. (2009). "Import Demand of Crude Oil and Economic Growth: Evidence from India," *Energy Policy*., 37, 699 –702.

Griffith, R., Redding, S., and Reenen, J.V., (2004). "Mapping the two faces of R&D: Productivity growth in a panel of OECD industries," *Review of Economics and Statistics* 86, 883-895.

Grossman, G.M., and Helpman, E. (1991). "Innovation and Growth in the Global Economy". *Cambridge, MA: MIT Press.*

Hye, M.A.Q., (2012). Exports, imports and economic growth in China: an ARDL analysis. *Journal of Chinese Economic and Foreign Trade Studies*. 5, 42–55

Jayaraman, T., and Lau, E. (2011). "Oil price and economic growth in small Pacific Island countries." *Modern Economy*, 1(2) , 152-161.

McKinnon, R. (1964). "Foreign Exchange Constraints in Economic Development and Efficient Aid Allocation," *Economic Journal*, Vol. 74, p. 388-409.

Ofeh M A and Muandzevara A T (2017). "Investigating the Effects of Migrant Remittances on the Economic Growth of Cameroon." *International Journal of Economics and Finance.* Vol. 9, No. 2; 2017.

Riyath M I M and Jahfer A (2016). "Exports, Imports and Economic Growth in Sri Lanka: Evidence from Causality and Co-Integration Analysis." *5th Annual International Research Conference- 2016.* Faculty of Management and Commerce-SEUSL.

Sims, C. A. (1980), "Macroeconomics and Reality," *Econometrica*, 48, 1-48.

Taylor, L. (1991). "Income Distribution, Inflation, and Growth." *Cambridge, MA: MIT Press.*

Yazdani, M and Faaltofighi, M. (2013). "Study the causal relationship between economic growth and energy consumption in energy (oil) exporting and importing counrties." *Australian Journal of Basic and Applied Sciences*, 74(4) , 500-504

Zhong, Z., and Zou, H. (1995). "Foreign Technology Imports and Economic Growth in Developing Countries," *WPS 1412 Washington*, DC World Bank.