Journal of Economics, Finance and Management Studies

ISSN(print): 2644-0490, ISSN(online): 2644-0504

Volume 02 Issue 03 December 2019

Page No.- 35-47

Relationship between Export Diversification and Economic Growth, Case of Tunisia (1987-2015)

ALOUANI Ahmed[1], Ismahène ABID[2]

[1]PH.D. of Economics 2007, CEMAFI, University of Nice-Sophia Antipolis, Nice, France
And Assistant Professor at the Higher Institute of Business Administration, Gafsa, TUNISIA

[2]holder of a master's degree in economics and future doctoral student. Gafsa, TUNISIA

Abstract : If in the empirical literature, the postive relationship between divisification of exports and growth has been detected. However, this relationship does not always come out. As an indication and as we have argued, Michaely (1977), for example, has found a significant positive link between exports and economic growth only in the most developed countries. This was not the case in the least developed countries. In our study concerning Tunisia, we concluded that this relationship, indeed, exists. In this study we chose as period: 1987-2015. On the econometric side, we used the co-integration method. According to the results of the analysis, we found that exports, especially agricultural exports, have a positive effect on long-term growth. Hence, investments in the production of exportable agricultural goods must be encouraged.

Key Words : Growth, diversification, exports, agricultural exports, Tunisia, positive relationship, co-integration

INTRODUCTION

Economic theory usually supports the hypothesis of a positive link between foreign trade and economic growth. Classical and neoclassical approaches explain this effect by comparative advantages or factor endowments or by the difference in technology. Endogenous growth models highlight the dissemination of know-how, foreign trade, the increase in the size of the market favorable to the achievement of economies of scale.

This article is devoted to the development and estimation of an econometric model to assess the effects of the diversification of Tunisia's exports on economic growth. To achieve this objective, the document is structured as follows. In the 1st section, we will present the review of the empirical literature concerning the link between export diversification and economic growth. In the second, we will discuss the characteristics and the econometric system. In the third, we will study the specification of the econometric study of the relationship: export diversification-economic growth, as well as the analysis of the results

1- empirical work on the relationship between export diversification and economic growth

1.1 1-1- Literature paper :

Economic policies favoring export growth and trade liberalization have been at the heart of the strategies recommended for developing countries. The origins of the theoretical foundations of the positive link between trade openness and growth are twofold. On the one hand, the classical approach explains the gains drawn from trade liberalization by comparative advantages, whether these are in the form of endowments in natural resources (Hecksher-Ohlin model) or technological differences (Ricardian model). On the other hand, the literature on endogenous growth assumes that trade opening positively affects per capita income and growth through economies of scale and technological diffusion between countries. Theoretical and empirical studies have attempted to analyze the impact of openness to the outside world and integration into the world economy for the target countries.

Smith and Ricardo define the advantages that countries can derive from liberalizing their trade. Smith says that all countries can gain from trade because, for him, the objective of trade does not lie in the trade balance but in the fact of being able to obtain products cheaply only if one produced them oneself . This is the basis of the theory of absolute advantage that leads to international specialization and the establishment of an international division of labor. For Adam Smith, trade is not necessary for development because production is determined by capital.

Likewise, Ricardo demonstrates that foreign trade, whatever its extension, cannot suddenly increase national values. It is advantageous for the countries which practice it because it assesses the number and variety of objects for which one can use one's income, i.e. the level of well-being or real income. Krugman (1995) uses the notion of "diversification effect" to describe this situation. This diversification effect benefits not only consumers but also producers who will have an additional choice in production goods.

For Johnson (1972), the development of exports is essential insofar as the growth brought about by the development of investments comes up against more or less long term the deficit of the trade balance caused by the increase in imports of intermediate goods and consumer goods. Exports can thus contribute to maintaining the balance of the trade balance in the long term and to a high growth rate while restoring a solvent demand (Diaz, 1989)

Michaely (1977) considered the correlation between an export growth variable and an income growth variable. The objective of this type of study was to show the superiority in terms of growth of an export promotion policy over an import substitution policy. Thus, from a sample of 41 developing countries for the period (1950-1973), Michaely (1977) finds a Spearman correlation coefficient of 0.38 significant at 1% between the growth rate of the share of exports in gross national product (GNP) and the growth rate of GNP per capita.

Michaely, Heller and Porter (1978) find that the correct correlation to be tested concerns the growth rate of exports and the growth rate of the non-exported component of production. The Spearman correlation coefficient obtained is 0.57 for the richest countries and 0.09 for the others. This confirms Michaely's results. If the correlation tests make it possible to establish a link between two variables, it gives no information as to the nature of this link. One way to understand this link more precisely is to estimate an equation integrating other variables.

The study by Feder (1982) establishes an example of this type of analysis with multiple linear regressions. Its objective is to estimate the theoretical equation linking the GDP growth rate to the investment rate, the population growth rate, the real export rate and the real export growth rate multiplied by the share of exports. in GDP. This last variable is of particular interest since it makes it possible to detect the presence of gains brought about by the transfer of factor of production from a sector with low productivity to a sector with high real productivity (Feder 1982). The study concerns a group of 50 developing countries for the period (1964-1973) and tests the hypothesis that on the one hand, marginal productivity in the export sector is higher and that on the other hand this export sector generates positive externalities. The regression effectively gives significant coefficients equal to 0.75 and 0.13 respectively, which confirms the hypothesis of a beneficial effect of openness via competition and technological diffusion on growth.

Other tests have shown an impact of exports on growth. However, when one is interested in determining the direction of causality between export growth and income growth, this consensus in favor of an export promotion policy tends to disappear. Jung and Marshall (1985) tested the direction of causality between these two variables using a Granger test based on time series for a sample of 37 developing countries. They show that the usual prediction of a significantly positive effect of exports on growth is only empirically validated in only four cases. Conversely, based on a Sims test, Chow (1987) highlights a strong two-way causal relationship between export growth and industrial development in eight (08) new "open" industrialized countries (among which are find South Korea, Singapore, Hong Kong and Taiwan) and concludes that the two variables mutually benefit from each other.

Love (1994) used an improved Granger test on 20 low- and middle-income developing countries, and can only weakly corroborate the export-led growth hypothesis. Along these lines, Nurkse (1961) in his study advanced the thesis that exports were the engine of growth in the developing countries of the time in the 19th century, a thesis which he illustrated by analyzing the growth in seven (07) countries: Argentina, Uruguay, South Africa, New Zealand, Australia, the United States and Canada.

Kindleberger (1961) also emphasized the essential role that exports have played in the development of the British economy in XIX^{ième} century, in that of Sweden and Denmark at the end of the same century and of Canada and the Netherlands at the beginning of the XIX^{ième} century.

French-Davis (1990), in a study in Chile, notes that this country has fully benefited from the advantages of free trade described by theories of international trade after it has opted for openness to the outside notably through a reform of its export sector in the seventies. Growth has been maintained there since 1984, consumption levels have greatly increased, companies freed from protectionist and state constraints have rationalized and modernized their equipment, increased productivity by reducing stocks

and computerizing management. More dynamic entrepreneurs have appeared and have taken advantage of the opportunities of the international market both for export and import.

Whereas, Lourimi Malek (2000), in his doctoral thesis entitled "liberalization of foreign trade, growth, wages and employment in Tunisia", analyzed the relationship that may exist between the liberalization of foreign trade and economic growth in countries in development. The study and criticism of the different growth models having dealt with the question of export correlation, as an indicator of openness to trade and economic growth, enabled him to specify the elements to be taken into account in the study of Tunisian case. Thus, the results of these econometric tests showed that the outward trade orientation had positive effects on macroeconomic performance and that these positive effects were more present during the period after the application of the Program d 'structural adjustment.

Félix Fofana N'Zué (2005), in a study which aims to analyze the causal relationship in the Granger sense between the expansion of exports and economic growth in Côte d'Ivoire and to determine its implications in terms of of job creation and which was done on the basis of tests of stationarity, cointegration and causality à la Granger, concludes that despite the lack of cointegration between exports and economic growth, there is a circular relationship between they. In addition, there is no cointegration between the labor factor, exports, public spending and economic growth.

Still in the interest of emphasizing the importance of exports in the growth process, Honoré Lezona (2005) conducted a study to analyze the impact of exports on economic growth over the 1972-2002 period in the Congo. This study takes into account the main economic and sectoral reforms undertaken in Congo Brazzaville. He was thus brought to highlight the favorable factors of economic growth, through exports, and in particular, to identify the obstacles which slow down this growth. With regard to the method of analysis used, it consists in estimating a growth model which uses both the theory of international trade and a production function. Six variables (GDP per capita, gross fixed capital formation, terms of trade, oil exports, non-oil exports and political instability) were used in this econometric model (error correction model) which also takes into account well, the short term and long term effects.

It is often argued that it is not only the level of exports that drives economic growth, but also the degree of diversification of these exports or the export base has an effect on economic development. Advocates of this view have highlighted the strong impact diversification has on growth.

Romer (1990) considered that the diversification of exports is presented as a factor of production while Acemoglu and Zilibotti (1997) affirmed that diversification could increase incomes by spreading the risks linked to investment on a portfolio wider.

Other studies have shown that an expansion in exports has a positive, significant impact on economic growth, such as Michaely, (1977); Balassa, (1978, 1989 and 1995); Tyler, (1981); Grossman and Helpman, (1989); Fosu, (1990); Tybout (1991 and 1992); Rahman (1993); Savvides, (1995); Asmah, (1998); Sachs and Warner (1997); Edward, (1998); Frankel and Romer, (1999); Ram, (1987). On the other hand, others have concluded that the positive relationship between exports and economic growth did not exist during certain periods in certain countries: Tyler (1981), Helleiner (1986), Ahmad and Kwan (1991), Buffie (1992), Onafowora and Owoye, (1998). In recent decades, and for international economists, trade policies of developing countries have been a central focus, with a desire for rapid economic growth in developing countries raising many questions about the relationship between trade and economic growth.

At the same time, analysts have studied the theoretical and empirical immanence of the justifications given for the abandonment of rational models of resource allocation. In addition, some developing countries have significantly revised their trade policies, often with dramatic results. These reversals and the resulting changes in economic structure have also stimulated analysis of the link between trade policies and development.

Next, the empirical analysis will focus on Tunisia, a country for which little work has been done such as Bouoiyour Jamal (2001), Afaf Abdull J. Saaed and Majeed Ali Hussain (2015), Khalifa H. Ghali (2000)… and in which a debate has been engaged in recent years (since the fall of the Ben Ali regime in 2011) on the most appropriate development model.

Fisher (1993) looked at the effects of macroeconomic instability on growth. Using panel data, he linked the GDP growth rate to certain key macroeconomic variables. Thus the inflation rate, the budget deficit and the terms of trade are recognized as having a significant impact on growth. For him, macroeconomic instability favors poor economic performance.

For Johnson (1972), the development of exports is necessary insofar as the growth brought about by the development of investments comes up against more or less long term the deficit of the trade balance caused by the increase in imports of intermediate goods and consumer goods. Exports can thus contribute to maintaining the balance of the trade balance in the long term and to a high growth rate while restoring a solvent demand (Diaz, 1989).

From all of the above we can retain that exports constitute an important source of economic growth. The question we are asking is how these different models can be applied to Tunisia: a weakly industrialized country, predominantly agricultural where the informal sector still plays an important role.

1.2 1-2- Studies on the relationship between exports and economic growth

Authors	Country	Periods	Models	Results
1 -Joseph O.E et al.(2014)	Nigéria	1980 -2012	Analyse Co intégration VECM	EX => PIB
2-Khaled R.M. Elbeydi al (2010)	Libye	1980 – 2007	Analyse Co intégration VECM Causalité Granger	EX => PIB
3-ZULFIQAR BASHIR(2003)	Pakistan	1980-1995	VECM Analyse co integration	EX => PIB
4-Adama, J.A.et Ohwofasa, B.O.(2015)	Nigeria	1980-2011	VAR Analyse de co integration	EX => PIB
5-Nahanga Verter1, Věra Bečvařova1(2016)	Nigeria	1962-2013	Tests de causalité de Granger OLS	PIB=> EX
6-AZU BENEDICT(2009)	Nigeria	1970-2006	Analyse Co intégration OLS VECM	PIB<=> EX
7-P. J. Dawson(2005)	PMA	1974-1995.	analyse de régression	PIB<=> EX
8-V.O. Okoruwa, et al.(2003)	Nigeria	1960 – 1997	VECM Tests de causalité de Granger	EX => PIB
9-Oyetade P. O., Shri DewiApplanaidu (2016)	Nigeria	1981 – 2014	VAR Analyse de co –intégration Analyse de Granger OLS	EX => PIB
10-Abolagba E.O et al.(2010)	Nigeria	1962-2004		EX => PIB

11-Muhammd Abrar ul haq ,et al.(2015	Pakistan	1972-2008	Analyse de co integration	EX ≠PIB
12-TIGIST YIFRU(2015)	Ethiopie	1973-2013	VAR Analyse de co integration Test Granger	PIB <=> EX
13-Efthimia Tsakiridou(2010)	MENA	1998-2010	Analyse de test Granger	EX => PIB
14-Anderson K. and Valenzuela E.,(2009)	Amérique latine	1965-2004	Probit	PIB <=> EX
15-Victor Ushahemba Ijirshar,(2015)	Nigeria	1970 -2012	ADF Test de co- integration VECM	EX => PIB
16-Muhammad Zahir Faridi(2012)	Pakistan	1972-2008	Test de co-integration	PIB <=> EX
17-Megbowon Ebenezer Toyin(2016)	Afrique du Sud	1975-2012	ADF Test de Granger Analyse de co-integration	EX ≠PIB

2- Characteristics and Econometric System

2-1- Methodology

The empirical methodology used in this study takes place in three stages and consists in determining the degree of integration of each of the variables. In the econometric literature, several statistical tests are used to determine the degree of integration of a variable. The tests that will be used in this study are the Augmented Dickey-Fuller tests (ADF), the cointegration test of Johansen (1988), the ADF test which takes into account only the presence of autocorrelations in the series. The null hypothesis of the ADF test is that of stationarity. So for the series to be considered stationary, the next step will be to examine the possible presence of cointegration relationships which may exist in the long term between the variables. This analysis will be done according to the cointegration test procedure of Johansen (1988) more effective than the two-step strategy of Engle and Granger (1987) when the sample is small and the number of variables high. The third step deals with the causality tests between the variables of the model. The so-called Granger sequential test procedure will be applied.

2-2- the variables of the model:

The data used to estimate the equation are annual. They mainly come from the databases of the Tunisian national institute and the central bank of Tunisia. The period covered goes from 1987 to 2015. GDP is the real gross domestic product, labor represents the total population, capital is gross capital formation, exports are represented by all agricultural and industrial exports. All these variables are in Tunisian Dinars.

As the theoretical model suggests, we use the following variables: Gross Domestic Product (GDP), investment (I), labor factor (l), agricultural exports (AX) and industrial exports (IX). variables are converted to natural logarithms

2-3- model specification: basic model

This study sets out to determine the influence of export diversification on economic growth and then to analyze the contribution of GDP and other sectors of the economy to growth. The traditional methodological approach used to measure the impact of export diversification on economic growth considers sectors as exogenous and other sectors of the economy as

endogenous. But there are possibilities for two-way interactions between sectors of the economy, and in addition the exogenous nature of exports.

We will be interested in examining the causal impact, focusing on the interdependence between the deferent variables and their integration.

To examine this impact we go through a number of basic tests, namely:

- The first is the linear correlation test: in fact, we will determine the increase in correlations in the periods.

-The second is the linear regression test: We will estimate the linear models of gross domestic product and economic growth on the EVIEWS software

-We also go through the cointegration test and the error correlation model: SIMS (1980) favors the models (VAR / VECM / SVAR)

-Another test is the Granger causality test from which we seek to highlight the different relationships existing between export diversification and Tunisian economic growth.

2-4- Steps :

The study period is: 1987-2015

The SIMS model (1980) considers the following steps:

i) Study of stationarity (ADF (Dickey-Fuller Augmanté), PP (Phillips-Peron test)).

ii) Study of number of delays: Akaike information criterion, (AIC), SCHWARZ (SC), ..

iii) Co-integration of the variables (John test): which approximates the proposition

The first, if there is co-integration, we use VECM long or short term, the second favors the absence of co-integration, we use the VAR model by Granger causality

3- Econometric study of the relationship: diversification of exports-economic growth

In this part, it will be a question of empirically testing the model of analysis of trade given in the preceding chapter then moving on to the interpretation of the results. In fact we first present the results of our estimates before moving on to interpretations.

3-1-Study of stationarity:

3-1-1- Presentation and definition of the stationarity test

The empirical software used is Eviews. With: log (GDP) denotes the logarithm of gross domestic product, Log (INV) denotes the logarithm of investment, Log (AG) denotes the logarithm of agricultural exports, Log (IND) denotes the logarithm of industrial exports), Log (L) denotes the working logarithm.

We estimated the linear models of the gross domestic product and the diversification of exports by the Error Correction Models (ERM) by an EVIEWS software, the tests on the temporal data were carried out. These include the recent stationarity and co-integration tests. Non-stationarity manifests itself through two components: the presence of a deterministic trend and / or the stochastic trend. In this regard, the test proposed by Dickey-Fuller Augmanté takes order level (0), primary difference and secondary difference. Consequently, reading the test results is done in two steps:

* the significance or not of the trend: it is assessed from the calculated statistic or the probability attached to this statistic (this is compared to 5%)

* the presence or absence of a unit root: for this purpose, we test the null hypothesis H0 against the alternative hypothesis H1. The assumptions are:

H0: series in level is not stationary

H1: series in stationary level

In this study, we are looking for co-integration and causal relationships between the different sectors of activity in Tunisia, using Johansen's trace tests, used co-integration and the estimation of a error correction vector model (VECM) to assess the impact of export diversification on growth in Tunisia based on the Gross Domestic Product (GDP).

The model used in this document is based on a classic production function whose general form is:

Our starting point is the following Gobb-Douglass production function:

$$Yt = F(Kt, Lt) \quad \textbf{(1)}$$

Where Yt denotes global output, kt capital, Lt labor and t, time:

We designate that exports (X) as an evolution index, the equation is:

$$Y(t)=F(K,L,X) \quad \textbf{(2)}$$

$$Y = A\ k^{\alpha 1} L^{\alpha 2}\ X^{\alpha 3} \quad \textbf{(3)}$$

$$\text{Donc : } \log(Y) = \log(A) + \alpha_1\ \log(K) + \alpha_2\ \log(L) + \alpha_3 \log(X) \quad \textbf{(4)}$$

$$\log(Y) = \alpha_0 + \alpha_1 \log(K) + \alpha_2 \log(L) + \alpha_3 \log(X) \quad \textbf{(5)}$$

On a, X =XI+XA **(6)**

Avec XI : Exportations industrielles, XA : Exportations agricoles

$$\log(X) = \log(XI) + \log(XA) \quad \textbf{(7)}$$

On a combinais l'équation **(5)** et **(7)** pour obtenir l'équation **(8)** :

$$\log(Y) = \alpha_0 + \alpha_1 \log(K) + \alpha_2 \log(L) + \alpha_3 \log(IX) + \alpha_3 \log(XA)$$

***** Definition of the Dickey test fuller Increased

The Dickey _fuller _Augmenté (1979) test is a test which aims to detect the non-stationarity of a time series. By considering a time series noted y (t), based on the residual correlation hypothesis and on the estimation by the ordinary least squares (OLS) method, the ADF test estimates three models:

- Model 1 : without constant and without trend (in level):

$$\Delta_{Xt} = \rho\, X_{t-1} \sum_{j=1}^{p} \varphi j\, X_{t-1} + \varepsilon_t$$

- Model 2: with constant and without trend (first difference)

$$\Delta_{Xt} = \mathrm{C} + \rho x_{\tau-1} + \sum_{j=1}^{\rho} \varphi j \;\; X_{\tau-1} + \varepsilon_\tau$$

- modèl 3 : with constant and with trend (secondary difference)) :

$$\Delta_{Xt} = C + \; b_t p_{xt-1} + \sum_{j=1}^{p} \varphi j \;\; X_{t-j} + \varepsilon_t$$

We start with the study of the third model: the trend is not significant, we move on to the second model. In the second, we see if the constant is significant otherwise we go to the first model. We also consider in this test, the following two hypotheses:

H0: Unit root (not stationary)

H1: No unit root (stationary)

3-1-2- stationarity test:

To determine the degree of stationarity (order of integration) of the variables in the model, we used the augmented Dickey-Fuller test and the cointegration test of Engel and Granger.

In our work, we will verify using the Dickey-Fuller augmented test that this series is not stationary.

Thus if the statistic of the ADF test (ADF Test Statistic) is greater than the critical value (Critical value), we reject hypothesis H1, the series is therefore non-stationary, and vice versa, or the probability is greater than the threshold of 5%.

ADF test results and interpretation

Model 1: the stationarity test at level:

Table 1 : Results of level stationarity tests

Variables	Had level					
	With constant and without trend			With constant and trend		
	Statistical test ADF	Critical test at 5% threshold	Probability	Statistical test ADF	Critical test at 5% threshold	Probability
Ln (PIB)	0.102999	2.96776	0.9604	2.934449	3.57424	0.1670
Ln(FBCF)	0.157838	2.96776	0.9648	3.590623	2.68773	0.2486
Ln(XA)	2.546642	2.99806	0.9999	4.444665	3.57424	0.0073
Ln(XI)	1.005018	2.96776	0.7380	3.768477	3.58062	0.0339
Ln(L)	1.293420	2.99806	0.6146	2.662233	3.24307	0.2590

Source: author's calculation

The result shows that, the probability of (log GDP = 0.9604) is greater than the 5% threshold, this analysis shows that the variables are non-stationary in level (test with constant and constant test and trend), for that, we pass to the second model.

Model 2: the stationarity test in prime deferences:

Table 2: Results of the stationarity tests in primary differences

Variables	In first differences					
	With constant and without trend			With constant and trend		
	Statistical test ADF	Critical test at 5% threshold	Probability	Statistical test ADF	Critical test at 5% threshold	Probability
Ln (PIB)	5.0705876	2.971853	0.001	5.605765	3.580623	0.0005
Ln(FBCF)	4.754718	2.971853	0.007	4.661186	3.580623	0.0046
Ln(XA)	8.702371	2.971853	0.000	4.430078	3.622033	0.0097
Ln(XI)	4.057747	2.971853	0.0041	3.977093	3.580623	0.0217
Ln(L)	1.130101	2.998064	0.6859	1.156706	3.622033	0.8959

Source: author's calculation

This analysis shows that the variables are non-stationary in level but they are rather stationary in prime differential, which leads us to suppose a cointegration relation. The results obtained for the level variables indicate that the log (GDP), Log (Total Population), Log (Gross capital formation), Log (Agricultural Exports) and Log (Industrial Exports) series are not stationary at the threshold of 5 %. Indeed for these series, the ADF test statistics have probabilities greater than 5% and therefore authorize not to reject the null hypothesis of unit root (non stationarity). The test carried out on the series in first differences makes it possible to reject the null hypothesis of nonstationarity for all the series at the threshold of 5%. We must accept the stationarity hypothesis of this series as raw differences.

3-2- Study of the delay choice:

To determine the number of delays, we used AKAIKE (AIC) and SCHWARZ (SC) criteria. In our case, we will use the AIC criterion since it is used several times in several empirical works. We can therefore choose the highest AIC.

3-2-1-Definition of the Akaike Information Criterion

The Akaike information criterion (AIC) is a measure of the quality of a statistical model proposed by Hirotigu Akaike in 1973. When we estimate a statistical model, it is possible to increase the likelihood of the model by adding a parameter. The information criterion of Akaike makes it possible to penalize the models according to the number of parameters in order to satisfy the criterion of parsimony.

3-2-2-Result and interpretation of the choice of the number of delays

Table 3: the result of the choice of the number of delays

Lag	LogL	LR	FPE	AIC	SC	HQ
0	213.4477	NA	7.48e-14	-16.03444	-15.79250*	-15.96477
1	243.3184	45.95481	5.37e-14	-16.40911	-14.95746	-15.99108
2	276.2561	38.00507*	3.71e-14*	-17.01970*	-14.35834	-16.25333*

Source: Author's calculation

The AIC criterion indicates that the number of delays existing in the sets of our variables used concerning our estimation is equal to 2. We therefore go to the next step which assimilates to apply the co-integration test to determine the number of relations of co-integration between the different variables.

3-3- Co-integration analysis test

3-3-1-Definition

To dull and identify the subsistence of a co-integration relationship, one generally applies a set of tests like the Granger-Engel algorithm (1987); Johansen's approaches (1988, 1991); The Stock test - Watson (1988), The Phillips-Ouliaris test (1990). In our analysis, we will use Johanson's test. The popular approach for estimating co-integration is Johansen (1988) and Johansen and Juselius (1990). After determining the order of integration, two statistics called trace statistics ($\lambda Trace$) and maximum eigenvalue (λMax) are used to determine the number of co-integration vectors.

In trace statistics:

$$\Delta yt = r1\Delta yt\text{-}1 + r2\Delta yt\text{-}2 + f_0 \ldots\ldots\ldots .. rP\Delta yt\text{-}p + 1$$

On the other hand, in maximum eigenvalue, we will be estimated:

$$yt = r1\Delta yt\text{-}1 + r2\Delta yt\text{-}2 + f_0 \ldots\ldots\ldots .. rP\Delta yt\text{-}p + 1$$

Where yt the vector of the variables involved in the model and p is the order of autoregression.

3-3-2- Johanson co-integration test result

3-3-2-1-Johanson co-integration test results

Tableau 4: ohanson's test

Number of cointegration relationship	Own values	Trace Statistics	Critical values at 5%	Probability
None *	0.923499	132.2734	69.81889	0.0000
At most 1 *	0.727043	68.01206	47.85613	0.0002
At most 2 *	0.655792	35.55101	29.79707	0.0097
At most 3	0.261131	8.888301	15.49471	0.3758
At most 4	0.051522	1.322420	3.841466	0.2502

Source: Author's calculation

3-3-2-2- Interpretations of Johanson's test

The results of Johanson's test show us the presence of the relation of three cointegrations between the 3 variables. Since the cointegration analysis announces the existence of a cointegration relation between the 3 variables, we can say that the model with error correction will be retained. In our case, we have (r = 0)

The trace statistic (= 132.2734) is greater than the critical values (= 69.81889) and probability (= 0.0000) less than 5%. So this hypothesis is rejected, we can affirm the existence of a co-integration relation.

Table 5: The long-term co-integration relationship: Normalized co-integration coefficients

DLOG(Y)	DLOG(I)	D(DLOG(L))	DLOG(AX)	DLOG(IX)
1.000000	-0.251592	25.92741	-0.363290	-0.233351
	(0.05889)	(2.20820)	(0.03771)	(0.07756)

Source: Author's calculation

According to this table, a 0.25% increase in investment leads to a 1% increase in GDP, similarly an increase in agricultural exports of 0.36% leads to an increase of 1% of GDP. Otherwise, the five variables are cointegrated, which forces us to use the VECM model to test the significance of this model.

3-4- VECM estimation

The target for making an estimate based on the error correction model is to extract the effect of the explanatory variables on the variable to be explained in the short term and in the long term.

Like GDP, exports and imports are co-integrated.

3-4-1-VECM equation

The representation of VECM (vector error correction model) would have the modeling of the VECM model gives us the following function:

D(DLOG(Y)) = C(1)*(DLOG(Y(-1)) - 0.251592416378*DLOG(I(-1)) + 25.9274109831*D(DLOG(L(-1))) - 0.363289930236*DLOG(AX(-1)) - 0.233350828989*DLOG(IX(-1)) + 0.0215003932814) + C(2)*D(DLOG(Y(-1))) + C(3)*D(DLOG(Y(-2))) + C(4)*D(DLOG(I(-1))) + C(5)*D(DLOG(I(-2))) + C(6)*D(DLOG(L(-1)),2) + C(7)*D(DLOG(L(-2)),2) + C(8)*D(DLOG(AX(-1))) + C(9)*D(DLOG(AX(-2))) + C(10)*D(DLOG(IX(-1))) + C(11)*D(DLOG(IX(-2))) + C(12)

3-4-2-Presentation and Interpretation of the estimation of the coefficients of the long-term equation

3-4-2-1-Presentation of the estimate

Table 6: result of the VECM estimate

variables	Coefficient	Std. Error	t-Statistic	Probabilité
C(1)	-1.210601	0.442953	-2.733023	0.0171
C(2)	-1.299516	0.386349	-3.363580	0.0051
C(3)	-0.508611	0.324582	-1.566973	0.1411
C(4)	0.465388	0.193621	2.403602	0.0319
C(5)	0.068780	0.146753	0.468679	0.6471
C(6)	16.53589	7.643265	2.163459	0.0497
C(7)	5.936968	3.406303	1.742936	0.1049
C(8)	-0.358641	0.130068	-2.757343	0.0163
C(9)	-0.134738	0.067432	-1.998128	0.0671
C(10)	0.396922	0.234167	1.695034	0.1139
C(11)	-0.437784	0.224849	-1.947014	0.0735
C(12)	0.013992	0.011367	1.230909	0.2402

Source: Author's calculation

3-4-2-2-Interpretation of the estimate:

According to the estimate, C (1) must be significant, and the coefficient of C (1) should be significantly negative for the VECM model to be significant.

C (1) = -1.210601 = correction error term or probability = (0.017), in our case we find a significant correction error term and has a negative coefficient. This proves that the explanatory variables have an effect on the variable to be explained in the long term (The existence of a long-term relationship).

3-5- Verification of the quality of the model

At the end of each empirical investigation, we must apply a set of analyzes to verify the robustness and the credibility of our work, our model and the results of our estimation. In this regard, we will try to apply a broad analysis to achieve this verification objective, including the use of heteroskedasticity tests, diagnostic tests and the stability of the VECM model.

3-5-1-diagnostic tests and test interpretations

3-5-1-1-Test results

Table 7: Results of diagnostic tests

Diagnostic tests	Probabilité
R^2	0.837454
Probability (statistic F)	0.001536
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.571965
	0.0188
Heteroskedasticity Test: Harvey	0.1724
Heteroscedasticity test Test: Glejser	0.9601
Heteroscedasticity test: ARCH	0.7774
Breusch-Godfrey Serial Correlation LM Test	0.090621
Jarque-Bera	

Source: Author's calculation

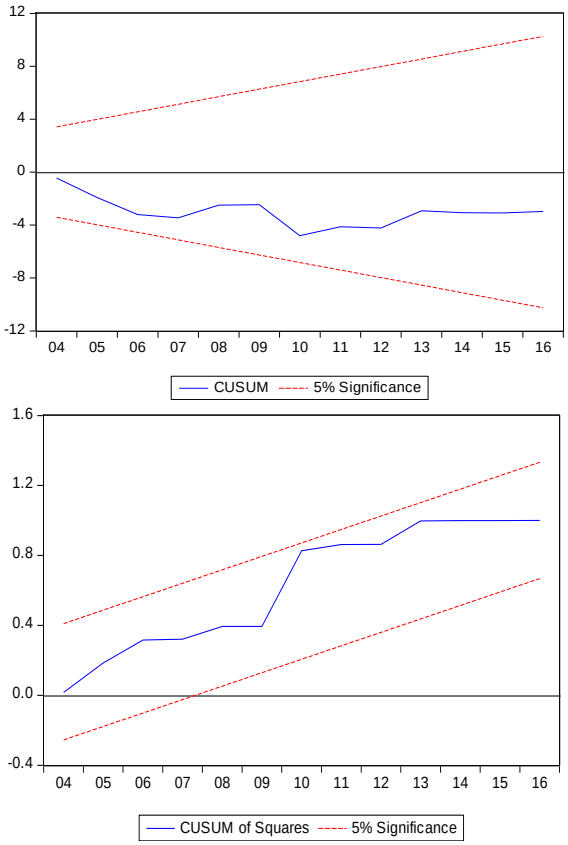
3-5-1-2-Interpretation of results:

Diagnostic tests indicate that the specification adopted is generally satisfactory. The Jarque-Bera test does not reject the assumption of error normality. The tests carried out to detect the presence of Breusch-Pagan-Godfrey in the estimated equation do not highlight any problem of heteroskedasticity at the 5% threshold.

The coefficient of determination R^2 is greater than 80%, which confirms that our estimate is acceptable. Otherwise the Fisher probability (0.001536) is less than 5% which indicates that our model is well treated.

3-5-2-VECM stability

Finally we will apply the CUSUM Squares test, this test allows to study the stability of the estimated model over time.



The results of the VECM stability tests (CUSUM of Square Test) show that the modulus of all the roots is less than unity and is found in the circle of unity. Consequently, we can conclude that our estimated VECM model is stationary.

CONCLUSION

The purpose of this study was to test the relationship between agricultural exports and the economic growth of Tunisia's GDP during the period 1987-2015. The co-integration test, the error correction model and the Causation tests in the sense of Granger are applied to study the relationship between agricultural exports, investments, industrial exports and GDP. The unity of the fundamental properties of the data was examined using the Dickey Fuller test (ADF), after that the cointegration and causality tests were conducted. Error correction models were also estimated to examine the long-term relationship between export diversification and economic growth. The conclusion is that agricultural exports, investment, total population, industrial exports and GDP are stationary at the first difference. Then, the variables were found to be integrated of order 2 and the number of delays also equal to 2. The co-integration test confirmed that agricultural exports, investments, total population, non-agricultural exports and the GDP are co-integrated, indicating the existence of a long-term equilibrium relationship between all the study variables confirmed by the results of Johansen's co-integration tests. Testing of error correction models confirmed the existence of the long-term equilibrium relationship between agricultural exports and GDP.

The causality test in the sense of Granger finally confirmed the presence of the unidirectional causal relationship between GDP and exports. Investment manifests itself as a link between agricultural exports and economic growth. Similarly, industrial exports present a link between economic growth and agricultural exports. Agricultural exports have beneficial effects on economic growth in Tunisia. We can therefore draw several lessons from these estimation results and make proposals for orientation of Tunisian economic policies. Policies to encourage agricultural investment and mainly the production of exportable agricultural products must be implemented to support growth and improved well-being.

REFERENCES

1) **Adama, J.A.et Ohwofasa, B.O.,**(2015),” Determinants of Agricultural Export Earnings in Nigeria, 1980-2011*”, International Journal Of Innovative Research& Development*, Vol .4 Issue 8

2) **Afaf Abdull J. Saaed and Majeed A. H.,** (2015). The causality relationship between exports, imports and economic growth in Jordan: 1977-2012. *EPRA International Journal of Economic and Business Review. Vol - 3, Issue- 7, July 2015.*
3) **Afaf Abdull J. Saaed and Majeed A .H.,** *(2015).* Impact of exports and imports on economic growth: Evidence from Tunisia*. Journal of Emerging Trends in Economics and Management Sciences. 6(1):13-21, (ISSN: 2141-7016).*
4) ***Aleksandra P. and Massimo T****. ,(2013).* Product diversification, relative specialization and economic development: Import-export analysis*. Journal of Macroeconomics. 38, (2013), 121–135.*
5) **Abolagba E.O.**,(2010), **"** Determinants of Agricultural Export**s",** *J Hum Ecol, 29(3*), pp.181-184
6) **Anderson K. and Valenzuela E.,**(2009),**"** Agricultural and trade policy reforms in Latin America: impacts on markets and welfare",
7) **Ahmed J., Somchai H** .,(1995) , "Unit roots and cointegration in estimating causality between Exports and economic growth :Empirical evidence from the ASEAN contries ,*Economic Letters 49*,pp.329-334
8) **Akhand Akhtar H**. ,(2009), " Structural change in the export demand function for Indonesia: Estimation, analysis and policy implications", *Journal of Policy Modeling 31*, pp.260–271
9) **Augusta Pelinski Raiher, Alex Sander Souza do Carmo, Alysson Luiz,(2017**)« The effect of technological intensity of exports on the economicgrowth of Brazilian microregions: A spatial analysis with panel data », *Economia*
10) **Andres Z.**, (2007), " Decomposing world export growth and the relevance of new destinations *", MPRA Paper*, n 30295
11) **Alessandrini M., Enowbi Batuo M.**,(2008), « The Trade Specialization of SANE: Evidence from Manufacturing Industries », *MPRA Paper* ,n°. 13216
12) **Arthur J.W, McCord G.C.**,(2017), " Fertilizing growth: Agricultural inputs and their effects in economic development *", Journal of Development Economics* ,127, pp.133–152
13) **Adama, J.A.et Ohwofasa, B.O**.,(2015)," Determinants of Agricultural Export Earnings in Nigeria, 1980-2011*", International Journal Of Innovative Research& Development*, Vol. 4 Issue 8
14) **BENEDICT A**.,(2009), *"the* impact of agricultural export commodity prices on nigeria's economic growth ", economics , university of Nigeria , nsukka
15) **Belloumi M.**,(2013), " The relationship between trade, FDI and economic growth in Tunisia: An application of the autoregressive distributed lag model ", *ECOSYS*, p. 461
16) **Chebbi H. , Lachaal L**.,(2007)," Agricultural sector and economic growth in Tunisia: Evidence from co-integration and error correction mechanism", *MPRA Paper*, No. 9101
17) **Chun-Ping Chang , Aziz N. Berdiev , Chien-Chiang Lee**,(2013) , " Energy exports, globalization and economic growth :The case of South Caucasus *", Economic Modelling 33* ,pp. 333–346
18) **Constantine Michalopoulos ,***(1998), "*TRADE POLICY AND MARKET ACCESS ISSUES FOR DEVELOPING COUNTRIES " , *POLICY RESEARCH WORKING PAPER ,2214*
19) **Cadot O., Carrere C., Strauss-KhanV.**,(2011), " Export Diversification: What's behind the Hump? *" ,CERDI, Etudes et Documents*, E 2009.34
20) **Dilawar K. and al.,** (2012)," Exports, imports and economic growth nexus: Time series evidence from Pakistan", *World Applied Sciences Journal,*18 (4) , pp. 538-542
21) **Dingjiang C. , Minpeng H., Jiahui W.et al**.,(2016), " Factors controlling phosphorus export from agricultural/forest and residential systems to rivers in eastern China (1980–2011) ", Journal of Hydrology 533 ,pp. 53–61
22) **David Kanter R. ,Musumba M. , Sylvia Wood L.R. et al.,**(2016)," Evaluating agricultural trade-offs in the age of sustainable development", *Agricultural Systems*
23) **David Lansing M.,** (2013), " Understanding linkages between ecosystem service payments, forest plantations, and export agriculture", *Geoforum 47*,pp.103–112
24) **Dokić A ., Jović S**.,(2017)," Evaluation of agriculture and industry effect on economic health by ANFIS approach", *Physica A 479*,pp.396–399
25) **Dawson P. J. ,** (2005), " Agricultural exports and economic growth in less developed countries*", Agricultural Economics 33* ,pp.145–152
26) **Encarnación Moral-Pajares , Adoración Mozas-Moral ,Enrique Bernal-Jurado , Miguel Jesús Medina-Viruel**,(2015), "Efficiency and exports: Evidence from Southern European companies " , *Journal of Business Research 68*, pp. 1506–1511

27) **Gnangnon, Sèna K. , Roberts M.,** (2015) , " Aid for trade, foreign direct investment and export upgrading in recipient countries ", *WTO Staff Working Paper*, n°.ERSD-2015-10
28) **Hiroyuki K. , Beverly L.**, (2013), " Productivity and the decision to import and export: Theory and evidence ", *Journal of International Economics 89* ,pp. 297–316
29) **Haichao F. , Yao Amber L. ,Stephen R. Yeaple**,(2014), **"** Trade Liberalization, Quality, and Export Prices", *HKUST IEMS Working Paper* , n°. 2015-01
30) **IBRAHIM, Abbas M.**,(2012) , " MERCHANDISE EXPORT DEMAND FUNCTION FOR EGYPT: A PANEL DATA ANALYSIS **",** *Applied Econometrics and International Development ,* Vol. 12-1
31) **Joseph O.E et al.,** (2014), " AGRICULTURAL EXPORT AND ECONOMIC GROWTH IN NIGERIA:A MULTIVARIATE JOHANSEN COINTEGRATION ANALYSIS**"** , *International Journal of Arts and Commerce ,Vol. 3 No. 3*
32) **Joao P. A.** ,(2015), " Evidence of growth complementarity between agricultureand industry in developing countries", Structural Change and Economic Dynamics 34, pp. 1–18
33) **Johansen, S. (**1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control*, 12(2), pp.231-254.
34) **Johansen S.** (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. Econometrica: *Journal of the Econometric Society*, pp.1551-1580.
35) **Johansen S.** (1995). Likelihood based inference in cointegrated vector autoregressive models. *OUP catalogue*.
36) **Johannes R. , Sebastian Baeza A. , Jonathan Barton R**. ,(2014), "Chile's resource-based export boom and its outcomes: Regional specialization, export stability and economic growth", *Geoforum 56* , pp. 35–45
37) **Kónya L.,** (2006), " Exports and growth: Granger causality analysis on OECD countries with a panel data approach", *Economic Modelling 23* ,pp. 978–992
38) **Karel J.**,(2014), "Czech Export Credit Agencies and their Market Power ", *MPRA Paper* ,n°. 54097
39) **Khaled R.M. Elbeydi and al.,** (2010) , " The Relationship between Export and Economic Growth in Libya Arab Jamahiriya" ,*Theoretical and Applied Economics*
40) **Laxmi Pandey V., Suganthi**, D., (2015) , " Fueling agricultural growth in India: Some reflections ", *Land Use Policy 42*, pp.227–232
41) **Muhammd Abrar ul haq et al.** ,(2015), " Agricultural Export and Economic Growth: A Case Study of Pakistan", *Public Policy and Administration Research,* Vol.5, No.8
42) **Moghaddas R ., Anoushe A.(**2016)," Energy consumption and total factor productivity growth in Iranian agriculture*", Energy Reports 2* ,pp.218–220