The Nexus between Industrial Exports and Economic Growth in Tunisia: Empirical Analysis

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Abstract:

This paper investigates the relationship between industrial exports and economic growth in Tunisia. In order to achieve this purpose, annual data for the periods between 1969 and 2015 were tested using the Johansen co-integration analysis of VECM and the Granger-Causality tests. According to the result of the analysis, it was determined that there is a negative relationship between industrial exports and economic growth in the long run term. Otherwise, and on the basis of the results of the Granger causality test, we noted the absence of a causal relationship between industrial exports and economic growth in the short term. These results provide evidence that industrial exports, thus, are not seen as the source of economic growth in Tunisia and suffer a lot of problems and poor economic strategy.

KEYWORDS: Industrial Export, Economic Growth, Tunisia, Cointegration, VECM and Causality.

I. Introduction

Economic growth defined as the measure of a country's economic well-being or performance has been and continues to be at the center of many debates. Indeed, various researchers have undertaken investigations into the determinants of economic growth. In several cases, they have used the neoclassical production function where the variable economic growth is explained by the capital variables as well as labor. Other authors have in addition to the above formulation included factors such as macroeconomic variables (Senhadji, 1999, Guillaumat et al., 1999, etc.) and socio-political variables. Among the variables considered to be essential determinants of growth are the export variable (Krueger, 1978, Schenzler 1982, Balassa 1985, Ram 1987, Fosu 1990, Sengupta 1993, Ghatak 1998, Islam, 1998, etc.). The underlying reason for this taking into account the export variable is that economic growth could be recognized through an expansion of exports. Although it is confirmed that export activities can stimulate (directly or indirectly) economic growth, the idea that the expansion of exports preceding economic growth has been the subject of several debates in the literature on development and economic growth. Industrialization can change the economic structure of modern economic activities and may be seen as a source of positive externalities for other sectors. It will therefore increase the potential increase in the economy and hence assist economic development. Also, industrialization can be seen as an essential technique in creating jobs, reducing poverty and promoting regional development policies. In addition, it can push technological progress and innovation that can be seen as productivity benefits. Indeed, developed countries have discovered the crucial role of industrialization included by the large share of the industrial sector in GDP and supported their industries through targeted policies and appropriate investments in their institutions. Therefore, industrial export plays a very important role in stimulating economic growth. The EU-Tunisia Association Agreement (EU) was introduced on 1 March 1998 and was the first agreement between the EU and the Mediterranean countries. According to the agreement, Tunisia will remove trade barriers with the EU over the next decade. Tunisia is supposed to become a full partner with the European Union in 2008. Industrial in Tunisia has been one of the pillars of the thriving economy of development since independence. Industrial projects were established thanks to important investments based on national and foreign private capital. Today's industrialization policy is aimed at liberalizing the industrial sector in line with the global economy. Tunisia has a diverse economy with important agricultural, manufacturing and tourism sectors. The government has a prominent role in controlling the economy.

Government intervention in the economy is strong, but it began to decline in the 1990s with the trend towards privatization and the simplification of the tax structure. In the 1990s Tunisia achieved real growth of 5.0% and the rate of inflation slowed. The main factor in this economic growth was the increase in tourism and trade revenues. The target of this work, therefore, is to econometrically inquire the linkages between Industrial exports and economic growth of Tunisia, using yearly data for the period 1969-2015. Particularly, this mission antagonizes to empirically find out an answer for the query of whether Industrial exports lead to economic growth. To reach this goal the paper is structured as follows. In section 2, we present the literature review concerning the nexus between exports and economic growth, and between Industrial exports and economic growth. Secondly, we discuss the Methodology Model Specification and data used in this study in Section 3. Thirdly, Section 4 presents the empirical results as well as the analysis of the findings. Finally, Section 5 is dedicated to our conclusion.

II. Literature Survey

Different studies and researches were done by academics and policy makers for exports and economic growth. A variety of studies shows different results about the relationship of these variables. Recently, most of studies have attended to focus on VAR and VEC models and cointegration approach. Our review of literature is limited to studies that focus on the joint impact of export on economic growth and the impact of industrial exports on economic growth.

1) The nexus between exports and economic growth

Table 1: Studies related to the relationship between exports and economic growth

NO	Authors	Countries	Periods	Econometric techniques	Keys Findings
1	Khaled R.M. Elbeydi and al (2010)	Libya	1980 – 2007	Cointegration Analysis VECM Granger Causality Tests	EX => GDP
2	Dilawar Khan and al (2012)	Pakistan	1972 – 2009	Cointegration Analysis VECM Granger Causality Tests	GDP <=> EX
3	Qazi Muhammad Adnan Hye (2012)	China	1978 - 2009	Cointegration Analysis Granger Causality Tests	GDP <=> EX
4	Velnampy.T and Achchuthan. S (2013)	Sri Lanka	1970 – 2010	Cointegration Analysis OLS	EX => GDP
5	Güngör Turan and all (2014)	Albania	1984-2012	OLS	EX => GDP
6	Auro Kumar Sahoo and all (2014)	India	1981 – 2010	Cointegration Analysis VECM Granger Causality Tests	GDP => EX
7	Ajmi and all (2015)	South Africa	1911 – 2011	Granger Causality Tests	GDP ≠ EX
8	Sachin N. Mehta (2015)	India	1976 – 2014	Cointegration Analysis VECM Granger Causality Tests	GDP => EX
9	Gaber H. Abugamea (2015)	Palestine	1968 - 2012	Cointegration Analysis VECM Granger Causality Tests	GDP ≠ EX
10	Masoud Albiman Md and all (2016)	Malaysia	1967 – 2010	Cointegration Analysis VAR Granger Causality Tests	EX => GDP
11	Hatem H. A. A and al (2016)	Saudi Arabia	1980 -2014	Cointegration Analysis VECM	EX => GDP
12	Nhung (2017)	Vietnam	1986-2015	ARDL ECM	GDP ≠ EX
13	Yaya KEHO (2017)	Cote D'Ivoire	1965-2014	ARDL Cointegration analysis Granger Causality tests	EX => GDP
14	Bakari, S. and Krit, M. (2017)	Mauritania	1960 - 2015	cointegration analysis VECM Granger Causality tests	GDP <=> EX
15	Bakari, S. and Mabrouki, M. (2017)	Panama	1980 - 2015	Cointegration analysis VAR Granger Causality tests	EX => GDP

2) The nexus between Industrial exports and economic growth

3) Table 2: Studies related to the relationship between Industrial Exports and Economic Growth

NO	Authors	Countries	Periods	Econometric Techniques	Keys Findings
1	Zhenhui Xu(2000)	74 countries	1965 -1992	Cointegration Analysis Granger Causality Tests	Industrial Exports => Economic Growth
2	Cuaresma and Wörz (2005)	45 Developed and Developing Countries	1981-1997	GLS SLS	Industrial Exports => Economic Growth
3	Parida and Sahoo (2007)	4 South Asian Countries	1980 - 2002	Cointegration Analysis OLS	Industrial Exports => Economic Growth
4	Neveen M. Torayeh (2011)	Egypte	1980-2008	Cointegration Analysis VECM Granger Causality Tests	Industrial Exports <=> Economic Growth
5	Adeniyi Jimmy Adedokun (2012)	Nigeria	1975 - 2009	ECM	Industrial Exports => Economic Growth
6	Bahram Shakouri and al (2012)	Iran	1959 - 2008	Cointegration Analysis Granger Causality Tests	Industrial Exports => Economic Growth
7	Javad N. A and al (2014)	Iran	2002-2010	Cointegration Analysis Granger Causality Tests	Industrial Exports => Economic Growth
8	Seyed M. P.H. and al (2014)	Iran	1970-2008	Cointegration Analysis Granger Causality Tests	Industrial Exports ≠ Economic Growth
9	Shah Mehmood WAGAN(2015)	Pakistan	2012-2014	Cointegration Analysis	Industrial Exports => Economic Growth
10	Adel Shakeeb Mohsen(2015)	Syria	1975-2010	Cointegration Analysis Granger Causality Tests	Industrial Exports ≠ Economic Growth

III. Data and Methodology

1) Data

This research employs four variables: Gross domestic Product (GDP), Fixed Formation Capital, Industrial Exports and Imports to examine the short run and long run impacts of Industrial Exports on economic growth. The secondary data for period 1969-2015 is collected from Central Bank of Tunisia and converted into logarithm denoted by l in each variable to make the model linear and to avoid heteroskedasticity problem.

2) Methodology

First, we will determinate the degree of integration of each variable. If the variables are all integrated in level, we apply an estimate based on a linear regression. However, if the variables are integrated in

the first difference we will look into the cointegration between the variables. In this step, if the cointegration test denotes the absence of cointegration relation, we will involve the model VAR. But, if the cointegration test elects the presence of a cointegration relation between the different variables studied, the model VECM will be applied.

3) Model specification

We will utilize the augmented production function, including domestic investment (Fixed Formation Capital), Industrial Exports and Imports are uttered as:

$$\boldsymbol{GDP_t = f(Investment, Industrial\ Exports, Imports)} \quad \textbf{(1)}$$

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

$$\boldsymbol{\log(GDP)_t = \beta_0 + \beta_1 \log(Investment)_t + \beta_2 \log(Industrial\ Exports)_t + \beta_3 \log(Imports)_t + \varepsilon_t} \quad \textbf{(2)}$$

Where:

- β_0 : The constant term.
- β_1: coefficient of variable (Investment)
- β_2: coefficient of variables (Industrial Exports)
- β_3: coefficient of variable (Imports)
- t: The time trend.
- ε: The random error term assumed to be normally, identically and independently distributed.

IV. Empirical Analysis

1) Test for unit roots: ADF

Generally, to check and to determine the integration order of each variable, a set of stationary tests is used. In our case, we will use the ADF Test.

Table 3: Tests for Unit Root

Variable	ADF		Order of Integration
	Test Statistic	Probability	
Log(GDP)	-6.904913	0.0000	I(1)
Log(Investment)	6.911939	0.0000	I(1)
Log(Imports)	-7.119584	0.0000	I(1)
Log(Industrial Exports)	7.536583	0.0000	I(1)

It is found that for all variables {Log (GDP), Log (Investment), Log (Imports) and Log (Industrial Exports)}, the ADF statistics are less than the critical statistics of the different thresholds, that after a first differentiation, they are therefore integrated in one. Then we can conclude that there may be a cointegration relation.

2) Cointegration Analysis

a- VAR Lag Order Selection Criteria

In the estimation of a model VAR (p), it is very important to determine the size of the model by the choice of the number of the delay, by calculating the functions AIC (p) and SC (p).

Table 4: VAR Lag Order Selection Criteria

Lag Order Selection =1	
Akaike information criterion	-6.389968
Schwarz criterion	-5.587007

The results of the table above show that the number of delays is equal to one since both criteria (AIC) and (SC) select that the number of delays is equal to one.

b- Johanson Test

The sequence of the Johanson test involves discovering the number of cointegration relations.

Table 5: Johanson Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability **
None *	0.648954	110.6308	47.85613	0.0000
At most 1 *	0.554988	64.56993	29.79707	0.0000
At most 2 *	0.316949	28.94515	15.49471	0.0003
At most 3 *	0.241687	12.17300	3.841466	0.0005
Trace test indicates 4 cointegrating eqn(s) at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability **
None *	0.648954	46.06091	27.58434	0.0001
At most 1 *	0.554988	35.62478	21.13162	0.0003
At most 2 *	0.316949	16.77215	14.26460	0.0197
At most 3 *	0.241687	12.17300	3.841466	0.0005
Max-Eigen value test indicates 4 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The results of the Johanson test indicate that there are four co-integration relationships between economic growth and industrial exports. That is to say, industrial exports and economic growth have evolved over time, over the study period considered here, so the model of the error correction will be retained.

3) The Results of Estimation VECM

a- Long run relation

As soon as the variables are stationary in order 1 and there is a 4 cointegration relation, the econometric ruler guides us to use the error correction model. The estimation of the error-correction model is delineated in two steps; the first step is to study the impact of industrial exports and long-term economic growth, and the second step is to study the relationship between industrial exports and short-term economic growth.

To estimate the coefficients of the long-term relationship, the method used is that of the ARMA maximum likelihood due to the presence of an autoregressive term.

The long-run equilibrium relation is as follows:

Log (GDP) = 2.1026 Log (Imports) – 1.1004 Log (Investment) – 0.3869 Log (Industrial Exports)

After estimating the long-run equilibrium relationship, we estimate the equation in the following form as an error correction model. The results of the estimate give the following relation:

D(DLOG(GDP)) = C(1)*(DLOG(GDP(-1)) + 1.10046930995*DLOG(Investment(-1)) - 2.10263065548*DLOG(Imports (-1)) + 0.386930453213*DLOG(Industrial Exports(-1)) - 0.00926213531843) + C(2)*D(DLOG(GDP(-1))) + C(3)*D(DLOG(Investment(-1))) + C(4)*D(DLOG(Imports(-1))) + C(5)*D(DLOG(Industrial Exports(-1))) + C(6)

Table 6: Least Squares (Gauss-Newton / Marquardt steps)

Dependent Variable: D(DLOG(PIB))				
Method: Least Squares (Gauss-Newton / Marquardt steps)				
	Coefficient	Std. Error	t-Statistic	Probability
C(1)	-1.024074	0.310277	-3.300515	0.0021
C(2)	1.042163	0.520366	2.002750	0.0524
C(3)	-0.095537	0.397877	-0.240117	0.8115
C(4)	-1.390760	0.492796	-2.822182	0.0075
C(5)	0.187710	0.222828	0.842398	0.4048
C(6)	-0.002236	0.033565	-0.066623	0.9472

The coefficient of variable C (1) is negative and has a probability of less than 5%. Then we can affirm the credibility of the long-term equation. So, we can say that an increase in industrial exports of 1% leads to a reduction of economic growth of 0.3869% in the long term.

b- Short-term relationship

To verify the existence of a short-term relationship between industrial exports and economic growth, we will use the Granger causality test.

Table 7: VEC Granger Causality/Block Exogeneity Wald Tests

VEC Granger Causality/Block Exogeneity Wald Tests			
Dependent variable: D(DLOG(GDP))			
Excluded	Chi-sq	df	Probability
D(DLOG(Investment))	0.057656	1	0.8102
D(DLOG(Imports))	7.964710	1	0.0048
D(DLOG(Industrial Exports))	0.709635	1	0.3996
All	11.68353	3	0.0085
Dependent variable: D(DLOG(Investment))			
Excluded	Chi-sq	df	Probability
D(DLOG(GDP))	8.976688	1	0.0027
D(DLOG(Imports))	11.74381	1	0.0006
D(DLOG(Industrial Exports))	1.552790	1	0.2127
All	15.38028	3	0.0015
Dependent variable: D(DLOG(Imports))			
Excluded	Chi-sq	df	Probability
D(DLOG(GDP))	4.222570	1	0.0399
D(DLOG(Investment))	0.586860	1	0.4436
D(DLOG(Industrial Exports))	0.502782	1	0.4783
All	4.869124	3	0.1816
Dependent variable: D(DLOG(Industrial Exports))			
Excluded	Chi-sq	df	Probability
D(DLOG(GDP))	2.187598	1	0.1391
D(DLOG(Investment))	2.256944	1	0.1330
D(DLOG(Imports))	0.093580	1	0.7597
All	3.098154	3	0.3767

According to the results of the Granger causality test, we note the absence of a causal relationship between industrial exports and economic growth.

4) Checking the quality of our estimation

a- Residual Diagnostics Tests

To verify the quality of our estimated model and the robustness of our estimation, we use a set of tests called diagnostic tests.

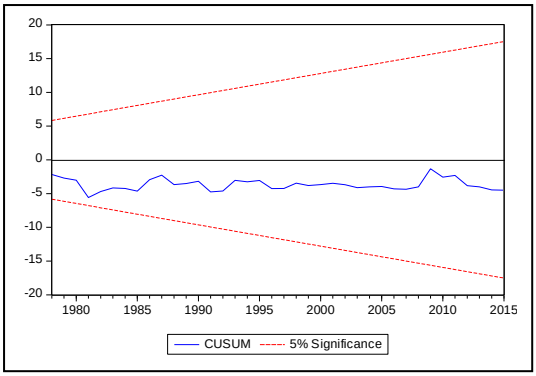
Table 8: Residual Diagnostics Tests

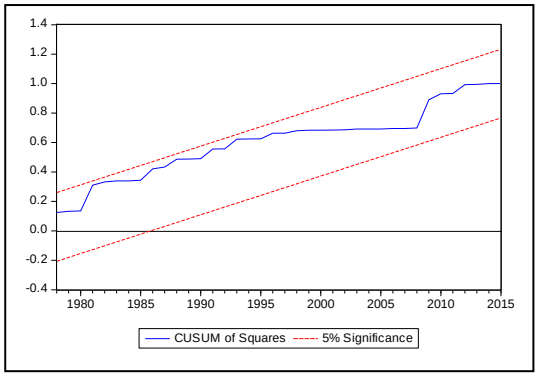
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.675319	Probability F(12,31)	0.7613
Heteroskedasticity Test: Harvey			
F-statistic	1.910522	Probability F(12,31)	0.0727
Heteroskedasticity Test: Glejser			
F-statistic	1.096269	Probability F(12,31)	0.3969
Heteroskedasticity Test: ARCH			
F-statistic	0.021987	Probability F(1,41)	0.8828
Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.836525	Probability F(1,37)	0.1006
R-squared	0.430643	Adjusted R-squared	0.355728
F-statistic	5.748397	Probability (F-statistic)	0.000480
Jarque-Bera	37.81655	Probability	0.000000

Diagnostic tests indicate that the overall specification adopted is satisfactory.

b- VAR Stability

Finally we will apply to use the test CUSUM and the test CUSUM of SQUARES, this test makes it possible to study the stability of the model estimated over time.





The tests results of the stability VAR (CUSUM Test and CUSUM of Square Test) show that the Modulus of all roots is less than unity and lie within the unit circle. Accordingly we can conclude that our model the estimated VAR is stable or stationary.

V. Conclusion

The aim of this study was to determine the relationship between Industrial exports and economic growth of Tunisia in the period 1969 – 2015. The cointegration analysis, VECM model and the Granger Causality Tests are used here to look into the relationship between Industrial exports and economic growth in the long run term and in the short run term. According to our empirical analyzes, we find a negative relationship between industrial exports and economic growth in the long run term, of which a 1% increase in industrial exports has directly led to a 0.38% economic growth. Otherwise, and on the basis of the results of the Granger causality test, we noted the absence of a causal relationship between industrial exports and economic growth in the short term. These two results highlight the inability of industrial exports to stimulate and promote economic growth. This may explain for several reasons, of which we can cite the weakness and the visible absence of companies and advertising services to publish and let foreign countries know the industrial products Tunisian. On the other hand, Tunisia's trade agreements with the European Union adversely affect the Tunisian economy, since Tunisia sees itself as a very weak and non-modern country compared to the European country and strong competition In the trade of industrial products in the European market, which sometimes obliges Tunisian companies to sell their industrial products with lower prices and sometimes these prices are lower than their production cost. Finally, we can add that Tunisia's industrial exports are not of good quality and are not innovated and their production takes more time and more expensive with the lack of innovative and fast machines including their production. This highlights Tunisia to make a change in their economic strategies and better refine international trade policies and encourage investment in an environment of pure imperfect competition so that companies and investors will be very enthusiastic to refine and to elutriate their industrial products.

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