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The Impact of Domestic Investment in the Industrial Sector on Economic Growth with Partial Openness: Evidence from Tunisia

Sayef Bakari
LIEI, University of Tunis El Manar, Tunisia.

Mohamed Mabrouki
Higher Institute of Companies Administration University of Gafsa, Tunisia.

Asma Elmakki
Higher Institute of Companies Administration University of Gafsa, Tunisia.

Abstract

This paper investigates the relationship between industrial domestic investment 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 domestic investment and economic growth in the long run term. Otherwise, and on the basis of the results of the Granger causality test, we noted a unidirectional causal relationship from economic growth to industrial domestic investment in the short term. These results provide evidence that domestic investment in industrial sector, thus, are not seen as the source of economic growth in Tunisia during this large period and suffer a lot of problems and poor economic strategy.

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Contact: Sayef Bakari - bakari.sayef@yahoo.fr, Mohamed Mabrouki - mabroukimed@gmail.com, Asma Elmakki - asmaelmakki@yahoo.com.
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1. Introduction

Kaldor (1966) is considered to be the initiator of exposing that investment in the industrial sector as a fundamental element of economic development. "Faster rates of growth are almost invariably associated with the fast rate of growth of the secondary sector, mainly manufacturing, and this is an attribute of an intermediate stage of development". In the same search line, Chenery et al. (1986) deliberated on the link between the industrial sector and economic growth. "Is industrialization necessary for continued growth? Our models of the transformation suggest that the answer is yes. (...) We conclude that -on both the empirical and theoretical grounds-a period in which the share of manufacturing rises is essentially a universal feature of the structural transformation ". Chenery et al. (1986) advised that along the process of industrialization some structural transformations must take place such as changes in final demand, changes in intermediate demands and changes in international trade. Referring to the work of Arrow (1962), Romer (1986) suggests that positive technological externalities are the result of an accumulation of physical capital in industrial sector, which gives the qualification of "knowledge". Thus, Murphy et al. (1989) assume that rapid growth is achieved by development in the industrial sector. "Virtually every country that experienced rapid growth of productivity and living standards over the last 200 years has done so by industrializing. Countries that successfully industrialize -turned to production of manufacturing taking advantage of scale economies- are the ones that grew rich, are being they 18th-century Britain or 20th-century Korea and Japan". The Neoteric doctrines of economic growth insist that growth is a chronic process of technological innovation, modernization and diversification of the industry that allows the development of the various modes of infrastructure and institutional arrangements that make up the Context of business development and creation that can be briefly described as a mutated chapter and a structural change in the economy. Domestic investment in the industrial sector can change the economic structure of modern economic activities and can be seen as a source of positive externalities for other sectors (agriculture, service and tourism). It would therefore increase the potential growth of the economy and thus facilitate economic development. Industrial investment can be seen as a fundamental instrument in creating jobs, reducing poverty and promoting regional development policies. In addition, industrial investment can motivate technological progress and innovation, which can be seen as productivity gains. Over the last two decades, unemployment and underemployment, notably the exclusion of young graduates from the labor market, is one of the most important problems in Tunisia. The policy of generalization of education has contributed to the increase in the number of young

graduates of Tunisian universities. At the same time, the lack of job creation has increased unemployment (14 per cent in 2010), especially for graduates (23.3 per cent in 2010), compared with 8 per cent in 1999. Over the period 1999-2010, the unemployment rate of tertiary graduates more than doubled, demonstrating the sharp increase in demand for graduate work in the Tunisian market. The concentration of investment and public services, as well as economic activities in coastal areas, has accentuated poverty (both in terms of the number of poor and inequality) and unemployment in other regions, including youth and women. The collapse of the economic situation in the country after the revolution of 14 January 2011, because the economy of Tunisia is based mainly on investment, especially external, and on export, and then on the services sector, and these sectors vital to the economy of the country, which are sensitive sectors and rely mainly on the environment and business climate. This deteriorating situation has pushed the Tunisian state to the brink of bankruptcy. The Tunisian state has resorted to financing its expenditures by resorting to external debt through external borrowing. Tunisia's external debt reached about 50 percent of GDP, compared to 39 percent in 2010, a rate that jumped by 11 percent Three years. Thence the importance and the ability of investment assure a robust economic growth. The industry is one of the basic components of any country, and whatever the industry is small, contributes to the development of the country and increases its national output, economy and growth. The industrial sector in Tunisia contributes 30% of the national GDP and 32.5% of the active population in 2014. For André Wilmots (2003), Tunisia "is one of a handful of nations in the developing world that has taken advantage of the wave of redeployment of North-South activities; by positioning itself in time, by creating the necessary infrastructure and establishing its reputation in terms of time and quality[1]". Indeed, in the 1950s, the industrial fabric was almost non-existent and products coming from France paying a low or even non-existent tariff prevents the local production from developing. According to the statistics of the national institute of Tunisian statistics and the financial statistics of the Tunisian central bank, the industrial sector which includes non-manufacturing industries (mining, energy, electricity and construction) and especially manufacturing (Agri-food, textiles and leather, building materials, glass, plastic, mechanical products, electrical, Electronic and chemical, wood, etc.), produces manufactured goods representing 79% of total exports in 2014. For years, the Tunisian industrial sector has made enormous efforts to increase its growth, despite the crisis

[1] André Wilmots (2003), De Bourguiba à Ben Ali. L'étonnant parcours économique de la Tunisie (1960-2000), éd. L'Harmattan, Paris, 2003, p. 32

of four years of social and economic crisis of Tunisia. In this research, we wanted to know the impact of industrial investment on economic growth in Tunisia by eliminating a set of indicators related to openness and the international economy such as foreign direct investment and external debt. It is well known that the majority of foreign investment in Tunisia is aimed at extracting and exploiting its natural resources such as oil, gas, phosphates and iron, as these foreign investments are in fact a long-term ruin for Tunisia. As the contracts passed by foreign companies have several disadvantages, and Tunisia has seen most of them such as pollution of the sea water affecting the marine and tourist products. The air pollution caused by the plants caused a decline in agricultural production, desertification of forests, high mortality and a significant shortage of water stocks. In addition, it is not prudent to exploit and spend the natural resources of the country, especially by foreign companies, but must be saved for the future and to seek other ways to achieve economic growth and sustainable development. Moreover, the corruption witnessed by the Tunisian country led to the holding of investment contracts with foreign companies at cheap prices and without value to satisfy their personal ambitions (see Ben-Taher and Gianluigi (2009); Bredoux and Magnaudeix (2012); Ben Gharbia (2013); Haddaoui (2014); Ismail, M and Hassan (2017)). The issue of foreign indebtedness of developing countries has been of great importance not only at the domestic level of Third World countries, but also at the international level and the United Nations. Because of the aggravation of debt and turn it into a crisis that is rife with the economies of developing countries and is accompanied by social calamities and economic devastation. Foreign indebtedness emerged as one of the most complex economic problems of the present age, threatening more risks to developing economies in the Third World. Due to the gap between the modest domestic saving rate and the investment rate, developing countries resorted to external borrowing to avoid this gap. Third World indebtedness has been a dilemma for developing countries since the early 1980s as a result of their adoption of strategies to rely on external financing. Although most debtor countries have failed to meet their financial obligations, advanced industrial countries have continued to soften and flood developing countries with loans to embroil these countries with heavy indebtedness and trap them in debt, which they see as an outlet for third world intrudes into borrowers' affairs. For this reason we will base the phenomenon of cointegration of the variety of the macroeconomic variables to explore that if, when we rely on domestic investment in the industrial sector with a partial trade openness that our exports since these are essential for the economy, Entered currencies and imports since Tunisia needs to import the machines and cars in its state to refine and react its investments. To achieve this objective the paper is structured

as follows. In section 2, we present the review literature concerning the nexus between domestic investment and economic growth, and the nexus between domestic investment in industrial sector 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.

2. Literature Survey

Domestic investment is considered one of the most important economic changes for any country, especially if it has the necessary capabilities that make it play an important role in economic growth through increasing the knowledge of work and face the problem of unemployment, which in turn leads to increased levels of income and many of these projects also raise awareness The spread of education and the achievement of a level of luxury and a decent life. Also, domestic investment leads to increased opportunities and investment rates when governments make the area under the area attractive to investment by attracting technical capital and modern management then, there is no doubt that public investment projects contribute directly and not to achieve the desired strategies. As well as increasing competitiveness and high level of progress in civilization, and encourages domestic investment to demand the sectors to each other. Obtainable literature, including recent extensions of the neo-classical growth model as well as the theories of endogenous growth has emphasized the role of domestic investment in economic growth. Among these studies we can cite Romer (1986); Lucas (1988); Grier and Tullock (1989); Barro (1991); Levine and Renelt (1991); Rebelo (1991); Mankiw, Romer, and Weil (1992); Fischer (1993) and Barro and Sala-iMartin (1999). Other studies prove that domestic investment may not necessarily have a favorable impact on economic growth Khan (1996); Devarajan (1996) and among others. Pegkas and Tsamadias (2016) looked into the influence of foreign investment, domestic investment, exports and human capital for Greece's economic growth over the period 1970 – 2012. It employed time series dissection and estimates the impact of these determinants on economic growth, by stratifying a modification of Mankiw, Romer and Weil (1992) model. Empirical results show that in the long run and the short run domestic investment has positive effect on economic growth. Adams et al (2017) examined the effects of capital flows on economic growth in Senegal using autoregressive distributed lag (ARDL) over the period 1970 – 2014. The results show that domestic investment has positive effect on economic growth in the long run. Bakari (2017a) investigated the long run and short run

impacts of exports on economic growth in Gabon for the period 1980 – 2015 by implementing cointegration analysis and error correction model. The empirical results show that in the long run domestic investment affect negatively on economic growth. However, in the short run domestic investment produce economic growth. Bakari (2017b) investigated the appraisal of trade potency on economic growth in Sudan for the period between 1976 and 2015, by using cointegration analysis of vector error correction model and the Granger Causality test. The results show that in the long run there is no relationship between trade, domestic investment and economic growth. On the other hand, it defined that in the short run only economic growth cause domestic investment. Mbulawa (2017) explored the impact of economic infrastructure on long term economic growth in Botswana by using Vector Error Correction Model and Ordinary Least Squares during the period of 1985 – 2015. Empirical results show that domestic investment influence positively economic growth. Siddique et al (2017) looked for the nexus between external debt and economic growth in Pakistan for the period of 1975-2015 by utilizing the autoregressive lag distributed bound testing for co-integration method empirical investigation prove that external debt has negative effect on economic growth. However, there is no relationship between domestic investment and economic growth.

Another group of researchers studied the impact of domestic investment in different sectors of agriculture, industry or services. De Long and Summer (1991) researched the nexus between manufactured investment and economic growth in 61 countries over the period 1960 – 1985. By using ordinary least square regression, they have found that machinery and equipment investment has strong association with growth. Auerbach et al. (1994) examined the impact of equipment investment on economic growth by using the same data and the same technique used by De Long and Summuer (1991) for the period 1960 - 1985. They have found that equipment investment has not any effect on economic growth. Herrerias (2010) researched the causal relationship between equipment investment and infrastructure on economic growth in China for the period 1964 - 2004 by applying cointegration analysis and error correction model. Results show that industrial investment has positive effect on economic growth in the long run. In the short run there is no relationship between industrial investment and economic growth. Reungsri (2010) investigated the effects of public infrastructure investment on economic growth in Thailand during 1993 to 2006 by using quarterly times series data. Empirical results indicate that investments in public infrastructure have positive and negative effects on economic growth. Babatunde and al (2012) looked into the nexus between infrastructure investment and economic growth in Nigeria during 1970 - 2010. They found that investment in infrastructure has a positive effect on economic growth with a bi-

directional causal link. Younis (2014) examined the relationship among infrastructure investment and economic growth in Pakistan. By applying the vector error correction model (VECM), empirical results show that there is a negative effect between infrastructure investment and economic growth in the long run. However, in the short run, empirical results show that there is no effect between the two variables.

3. Data and Methodology

The analysis used in this study cover annual time series of 1969 to 2015 or 47 observations which should be sufficient to capture the relation between domestic investment in industry and economic growth in Tunisia. The data set consists of observation for GDP, exports of goods and services, imports of goods and services, Fixed Formation Capital in industry and the total of Fixed Formation Capital for the other investment sector. All data set are taken from The Central Bank of Tunisia. We will use the most appropriate method which consists firstly of determining the degree of integration of each variable. If the variables are all integrated in level, we apply an estimate based on a linear regression. On the other hand, if the variables are all integrated into the first difference, our estimates are based on an estimate of the VAR model. When the variables are integrated in the first difference we will examine and determine the cointegration between the variables, if the cointegration test indicates the absence of cointegration relation, we will use the model VAR. If the cointegration test indicates the presence of a cointegration relation between the different variables studied, the model VECM will be used.

The augmented production function including domestic investment, exports and imports is expressed as:

$$\mathbf{Y = AK^{\alpha 1} X^{\alpha 2} M^{\alpha 3}} \quad \mathbf{(1)}$$

In Equation (1), Y is GDP (measured in constant US $), K is domestic investment (Fixed Capital Formation measured in constant US $), X is Export (measured in constant US $), M is Import (measured in constant US $), while A shows the level of technology (assumed to be constant) utilized in the country. The returns to scale are associated with domestic investment, export and import which are shown by α_1, α_2 and α_3 respectively. All the series are switched into logarithms in order to make linear the nonlinear form of Cobb–Douglas production. The Cobb–Douglas production function is sculptured in linear functional form as follows:

$$\mathbf{Log\,(Y_t) = Log\,(A) + \alpha_1\,Log\,(K)_t + \alpha_2\,Log\,(X)_t + \alpha_3\,Log\,(M)_t + \varepsilon_t} \quad \mathbf{(2)}$$

The overhead empirical will explore the influence of domestic investment, export and import on economic growth by keeping technology constant. The linear model rendering the impact of domestic investment, export and economic growth on economic growth after keeping technology constant can be written as follows:

$$\mathbf{Log\ (Y_t) = \alpha_0 + \alpha_1\ Log\ (K)_t + \alpha_2\ Log\ (X)_t + \alpha_3\ Log\ (M)_t + \varepsilon_t} \quad \mathbf{(3)}$$

The domestic investment in Tunisia comprises 3 sectors which are the agriculture, the service and the industry. We will focus on domestic investment in the industrial sector. In this case we will be talking domestic investment in two sectors; the first sector represents domestic investment in the industrial sector and the second sector represents the remaining share of domestic investment in the other sectors.

$$\mathbf{K = IK + OK} \quad \mathbf{(4)}$$

Equation (4) presents our domestic investment division (k) of which (IK) presents the industrial investment and (OK) presents the domestic investment in the other investment. In equation (5), (IK) and (OK) are relocated into logarithms in order to carry out linear the nonlinear form of Cobb–Douglas production.

$$\mathbf{Log\ (K)_t = Log\ (IK)_t + Log\ (OK)_t} \quad \mathbf{(5)}$$

When we merge equation 3 and 5, we obtain the following equation which presents our final model for our estimation.

$$\mathbf{Log\ (Y_t) = \alpha_0 + \alpha_1\ Log\ (IK)_t + \alpha_2\ Log\ (X)_t + \alpha_3\ Log\ (M)_t + \alpha_4\ Log\ (OK)_t + \varepsilon_t} \quad \mathbf{(6)}$$

In equation (6); $\{Y, IK, X, M\ and\ OK\}$ present respectively economic growth, domestic investment in industrial sector, export, import and domestic investment on other sector. The returns to scale are associated with industrial investment, export, import and other domestic investment which are shown byα_1, α_2, α_3 and α_4 respectively.

4. Empirical Analysis

4.1 Correlation Test

To establish how forceful the nexus is between two variables, we can use the Pearson correlation coefficient value.

- If the coefficient value is in the negative range, then that indicates the relationship between the variables is negatively correlated, or as one value increases, the other decreases.

- If the coefficient value is in the positive range, then that indicates the relationship between the variables is positively correlated, or both values increase or decrease together

Table 1: Correlation Test

	(1)	(2)	(3)	(4)	(5)
(1) Y	**1**	0.97	0.99	0.99	0.99
(2) IK	0.97	**1**	0.97	0.97	0.97
(3) OK	0.99	0.97	**1**	0.98	0.98
(4) X	0.99	0.97	0.98	**1**	0.99
(5) M	0.99	0.97	0.98	0.99	**1**

The results of the correlation test give us that all the variables studied are positively correlated, that is meant an increase in investment industry, other investments, exports, and imports directly lead to an increase in the gross domestic product and the reverse when Is a decrease.

4.2 Tests For unit root

Consistent with the appearance of the curves [Log (Y), Log (IK), Log (OK), Log (X) and Log (M)], we observe according to their general directions at the same time and the same movement, which place their stationary in level. For this reason, we are obliged to test the stationary of the variables used in our model, in order to check whether or not the stature of a unit root is the same, using the augmented Dickey Fuller test (ADF) and the Phillipps-Perrons (PP).

The general form of ADF test is estimated by the following regression:

$$\mathbf{\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{i=0}^{n} \beta_i \Delta Y_i + \varepsilon_t} \quad \mathbf{(7)}$$

The general form of PP test is estimated by the following regression

$$\mathbf{\Delta y_t = \alpha + \beta \Delta y_{t-1} + \varepsilon_t} \quad \mathbf{(8)}$$

Where Δ is the first difference operator, Y is a time series, t is a linear time trend, α is a constant, n is the optimum number of lags in the dependent variable and ε is the random error term.

Table 2: Tests for Unit Root

Variable	ADF		PP		Order of Integration
	Test Statistic	*Probability*	*Test Statistic*	*Probability*	
Log(Y)	-6.904913	0.0000	-6.985056	0.0000	**I(1)**
Log(IK)	-6.623469	0.0000	-6.623469	0.0000	**I(1)**
log(OK)	-7.153984	0.0000	-7.264817	0.0000	**I(1)**
Log(M)	-7.119584	0.0000	-7.115935	0.0000	**I(1)**
Log(X)	-7.571080	0.0000	-7.559320	0.0000	**I(1)**

From Table 2, it can be seen that for all variables the statistics of the ADF test and the PP test are lower than the criterion statistics of the different thresholds than after a prior differentiation, so they are integrated with orders I(1), then we can conclude that there may be a cointegration relation.

4.3 Cointegration Analysis

To check the cointegration between the variables studied, it is necessary to pass through two stages. First of all, it is necessary to specify the number of optimal delay which must be suitable for our model. Then we will use the Johanson Test to specify the number of cointegration relationships between variables.

The results of VAR Lag order Selection Criteria show us that the number of lags has been equal to 2 since the criteria, AIC and SC select that the number of lags is equal to 2.

To blunt and to identify the subsistence of a cointegration relation, one generally applies a set of tests like Granger-Engel's algorithm (1987); the approaches of Johansen (1988, 1991); The Stock - Watson test (1988); The Phillips-Ouliaris test (1990). In our analysis, we will use the Johanson test. The popular approach to estimate the cointegration is Johansen test given by Johansen (1988) and Johansen and Juselius (1990) which is a vector auto-regression (VAR) based test.

After determining the order of integration, two statistics named trace statistics ($\boldsymbol{\lambda}_{Trace}$) and maximum Eigenvalue ($\boldsymbol{\lambda}_{Max}$) are used to determine the number of cointegrating vectors. In trace statistics, the following VAR is estimated.

$$\Delta \boldsymbol{y_t} = \boldsymbol{r_1}\Delta \boldsymbol{y_{t-1}} + \boldsymbol{r_2}\Delta \boldsymbol{y_{t-2}} + \ldots\ldots\ldots\ldots \boldsymbol{r_P}\Delta \boldsymbol{y_{t-p+1}} \quad \textbf{(9)}$$

On the other hand, in maximum Eigenvalue, the following VAR is estimated:

$$y_t = r_1 \Delta y_{t-1} + r_2 \Delta y_{t-2} + \ldots\ldots\ldots r_P \Delta y_{t-p+1} \quad (10)$$

Where y_t the vector of the variables involved in the model and p is is the order of auto-regression. In Johansen's cointegration test, the null hypothesis states there is no cointegrating vector ($r = 0$) and the alternate hypothesis makes an indication of one or more cointegrating vectors ($r > 1$).

This method is profitable because it makes it possible to give the number of co-integration relationships that remain between our long-term variables. The sequence of the Johanson test involves discovering the number of cointegration relations. For this purpose, the maximum likelihood method is used and the results are explained in Table 4.

Table 4: Johanson Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability
None *	0.713550	121.8184	69.81889	0.0000
At most 1 *	0.488261	68.06021	47.85613	0.0002
At most 2 *	0.399364	39.25280	29.79707	0.0031
At most 3 *	0.237220	17.33284	15.49471	0.0261
At most 4 *	0.123925	5.689059	3.841466	0.0171
Trace test indicates 5 cointegrating eqn(s) at the 0.05 level				

To specify the number of cointegration relations, we must examine the following hypothesis:

- If the statistic of the trace is greater than the value criticized then one rejects H0 therefore there exists at least one cointegration relation.
- If the trace statistic is less than the critiqued value, then H0 is accepted so there is no cointegration relationship.

There are 2 cointegration relationships, so the error-correction model can be retained.

4.4 Estimation of VECM

The target to perform 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 the long term. As, GDP, industrial investment, exports, imports and other investment are cointegrated**,** ECM (error correction model) representation would have the following form:

$$\mathbf{\Delta Y_t = \sum_{i-1}^{k} \alpha_0 \Delta Y_{t-i} + \sum_{i-1}^{k} \alpha_1 \Delta IK_{t-i} + \sum_{i=1}^{n} \alpha_2 \Delta X_{t-i} + \sum_{i-1}^{k} \alpha_3 \Delta M_{t-i} + \sum_{i-1}^{k} \alpha_4 \Delta OK_{t-i} + Z_1 EC1_{t-1} + \varepsilon_{1t}} \quad (11)$$

Where Δ is the difference operator, k is the number of lags, $\alpha_0, \alpha_1, \alpha_2, \alpha_3 and\ \alpha_4$ are the short run coefficients to be estimated, $EC1_{t-1}$ 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 serially uncorrelated error terms in equation

4.4.1 Long run equation

The results of the estimation by the maximum likelihood method denote the following cointegration relation. The long-term equilibrium relation is presented as follows:

$$\mathbf{Log\ (Y) = 0.004 - 0.53\ Log(IK) - \ 0.24\ log(X) + \ 1.5\ log(M) - 0.01\ Log(OK)} \quad \mathbf{(12)}$$

The equation of the long-run relationship shows that industrial investment {Log (IK)} has a negative effect on the dependent variable {Log (GDP)}; that is, a 1% increase in industrial investment leads to a 53% decrease in gross domestic product. To justify the robustness of the last result and to prove and affirm that this long-term relationship is fair or not, we must test the significance of these variables. For this reason, we will apply the Error Correction Model (ECM). 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:

$$\mathbf{D(DLOG(Y)) = C(1) * (DLOG(Y(-1)) + 0.5 * DLOG(IK(-1)) + 0.2 * DLOG(X(-1)) - 1.5 * DLOG(M(-1)) + 0.01 * DLOG(OK(-1)) - 0.004) + C(2) * D(DLOG(Y(-1))) + C(3) * D(DLOG(Y(-2))) + C(4) * D(DLOG(IK(-1))) + C(5) * D(DLOG(IK(-2))) + C(6) * D(DLOG(X(-1))) + C(7) * D(DLOG(X(-2))) + C(8) * D(DLOG(M(-1))) + C(9) * D(DLOG(M(-2))) + C(10) * D(DLOG(OK(-1))) + C(11) * D(DLOG(OK(-2))) + C(12)} \quad \mathbf{(13)}$$

The following table shows the results of estimating the equation. If the coefficient of the variable C (1) 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: Estimation of VECM

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1.189198	0.665464	-1.787021	0.0837
C(2)	1.074311	0.972841	1.104303	0.2780
C(3)	0.021466	0.741883	0.028934	0.9771
C(4)	0.022400	0.254692	0.087948	0.9305
C(5)	0.206025	0.228192	0.902857	0.3736
C(6)	-0.208255	0.362699	-0.574180	0.5700
C(7)	-0.712421	0.350170	-2.034501	0.0505
C(8)	-0.907718	0.810274	-1.120261	0.2712
C(9)	0.289493	0.587574	0.492693	0.6257
C(10)	-0.289088	0.515299	-0.561010	0.5788
C(11)	0.037397	0.474556	0.078804	0.9377
C(12)	-0.007968	0.032319	-0.246548	0.8069

In our case, the correction error term is significant and has a negative coefficient. These prove that in the long run, 1% increase in industry investment leads to a decrease of 0.53% of GDP.

4.4.2 VEC Granger Causality/Block Exogeneity Wald Tests

The objective of the WALD test is to determine that if there is a short-term relationship between the variables used.

Table 6: Short run Granger Causality/ Wald Test

	(1)	(2)	(3)	(4)	(5)
(1) Log(Y)	-	0.0288	0.0741	0.5614	0.4826
(2) Log(IK)	0.6240	-	0.6364	0.3043	0.0792
(3) Log(OK)	0.7261	0.7556	-	0.9816	0.8987
(4) Log(M)	0.0699	0.0012	0.0289	-	0.1802
(5) Log(X)	0.0658	0.0324	0.0402	0.0051	-

4.5 Checking the Quality of Estimation

4.5.1 Diagnostics Test

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

Table 7: Diagnostics Tests

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.702854	**Prob. F(20,22)**	0.0129
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.305618	**Prob. F(2,29)**	0.7390
F-statistic	3.740378		
Prob(F-statistic)	0.001828		
Durbin-Watson stat	1.918390		
R-squared	0.570305		

Diagnostic tests indicate that the overall specification adopted is satisfactory. The tests performed to detect the presence of Breusch-Pagan-Godfrey in the estimated equation did not reveal any problem of heteroskedasticity at the 5% threshold. The Durbin Watson is acceptable, because, it is between 1, 6 and 2, 4 (1.918390). Otherwise the probability of Fisher is less than 5%, which indicates that our model is well treated.

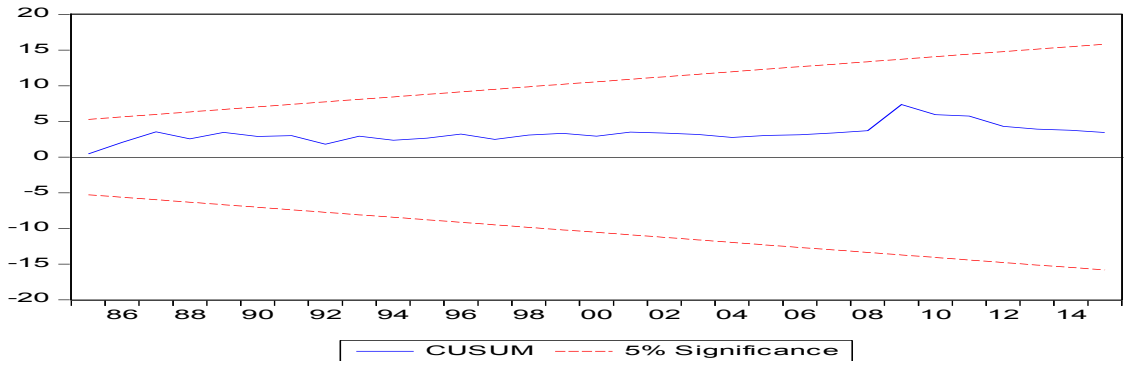
4.5.2 VAR Stability

Finally we will apply to use the test CUSUM, this test makes it possible to study the stability of the model estimated over time. There are two versions of this test: the CUSUM **"S_t"** based on the cumulative sum of the recursive residues.

$$S_t = (T - k)\frac{\sum_{j=K+1}^{t} \varepsilon_j}{\sum_{j=K+1}^{t} \varepsilon^2_j} \quad t = k + 1, \ldots, T \quad (14)$$

While **"k"** is the number of parameters to be estimated from the model and **"ε_j"** is the residue normalized by its standard deviation.

Graph 1: Stability VAR (CUSUM Test)



The test result of the stability VAR (CUSUM 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.

5. Conclusion

This research examines the impact of industrial domestic investment on economic growth in Tunisia with partial openness. 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 domestic investment and economic growth in the long run term. Otherwise, and on the basis of the results of the Granger causality test, we noted a unidirectional causal relationship from economic growth to industrial domestic investment in the short term. These results provide evidence that domestic investment in industrial sector, thus, are not seen as the source of economic growth in Tunisia during this large period and suffer a lot of problems and poor economic strategy. This outcome is one of our new contributions in this research. Environmental pollution has become one of the most serious pests in Tunisia. The risks are increasing and its effects have spread throughout Tunisia. Environmental degradation is reflected in high levels of pollution, which has exacerbated global warming. Water pollution has become a widespread phenomenon in the world as a result of the growing economic development of basic materials that are transported overseas, and most industries are located on the coasts. This results in significant shortages and a complete lack of marine fishing products in many areas such as Gabes, Sfax, Bizerte and Tunis. The increase in the use of pesticides and fertilizers has a negative impact on the productivity of the land, especially nitrogen fertilizers, which lead to soil contamination of chemicals and deterioration of biological capacity, and the increase in industrial activity has led to the increase of solid waste, which may be received on the ground or buried in the interior, which adversely affects the human, animal and plant in many areas in Tunisia such as Sfax, Gafsa, Gabes, Sidi-Bouzid, Kairouan and Medenine. Noise has become a serious environmental problem because of the psychological and health risks. Audio pollution is associated with urban and industrial areas where the use of modern equipment, vehicles and technological devices is increasing. Audio pollution is a mixture of heterogeneous and unwanted information and sounds of energy that affect the ability of consciousness to distinguish information and sounds and to harm the health of audio devices and affect the functions of the nervous system. For these reasons, we can conclude that noise causes human

stress, as well as pressure on workers' intellectual activity, which reduces their productivity. Otherwise the main reason for the negative effect of industrial investment on economic growth is the low rate of utilization of productive capacity. Since industrial investment and especially in the public sector bought more expensive production machinery. But these machines are all at rest and they are not used in production and what but also on the mismanagement of human and material resources. The Tunisian industry has grown at the pace of modernization and upgrading with differing trends in different regions, sectors and industries. However, the industrial sector that continues to play a fundamental role in our economic development has not yet explored all present and future opportunities. Other tracks remain to be explored and possibilities of extension exist. It is about making the right choices, selecting the best niches, resolutely engaging in research and innovation, further improving the competitiveness of industrial products, opening up strongly to external markets, diversifying our industrial fabric, to position it on the sectors that have established comparative advantages, to adapt constantly to the ever-changing and unpredictable international situation. These are some areas on which any industrial strategy should be tackled. The Industry Promotion Agency (IPA) studies in 2000 on the national industrial strategy by 2016 and the annual reports of the Ministry of Industry are interesting and always informative. They give us the opportunity to address this fundamental issue and make some remarks and suggestions. These studies and reports seem to us to be crude, incomplete, and insufficient and without precise and dated quantification. A strategy devised by a consulting firm and some senior civil servants could not achieve its objectives without a real consultation with the industrialists who are the first to be involved, as well as researchers and academics. It is not therefore a question of having technocratic foresight, but of developing a strategic vision of the future of domestic investment in the industrial sector, where all actors must work together. This strategy must take account of the internal changes under way while correcting the difficulties and the thinning noted; Identify challenges and challenges, and adapt to global changes and the crisis that predicts global disruption and strategic repositioning of different industrial sectors in most countries. The international markets for manufactured products are increasingly competitive and subjecting the Tunisian manufacturing sector to growing difficulties. All industrial sectors are targeted by this competitive frenzy. It all depends on the degree of adaptability and competitiveness of our industry. Tunisian manufacturing companies are not internationally important because they are more oriented towards the internal market, they are not sufficiently concerned about their exports, they are poorly managed for the most part, do little to innovate or research development and because their

volume of production is too low to achieve economies of scale to lower their average production costs. In sum, Tunisia must adopt economic strategies and policies that are responsible for: (i) Developing competitiveness clusters, (ii) inspired by successful foreign experiences, (iii) adopting a new economic model: The green economy.

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