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The Impact of Industrial Investment on Economic Growth in Algeria 1990-2023

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Abstract. This study analyses the impact of industry on economic growth in Algeria, using annual data for the period (1990-2023). It is based on the Autoregressive Distributed Lag model (ARDL) presented by Pesaran et al (2001). To clarify the real relationship between economic growth and industrial investment, the focus is on investment in the steel, metal, mechanical, electrical. There is also electronic (ISMMEE) sector, imports of capital goods, and investment in agriculture and services. The study found that there is a negative impact of investment in machinery and equipment in the long run, despite the positive impact of both investments in imports of machinery and equipment and investment in ISMMEE on economic growth in the long run.

1. INTRODUCTION

The role of private fixed investment in promoting growth in industrialized countries has been studied in detail; however, there are few of them examining the impact of equipment investment on output growth in developing countries.

Capital accumulation has always been the key factor in GDP growth; however, its role in growth theories has changed over time. The modern growth literature argues that it no longer matters how much a country invests; what is more important is how investments are allocated.

This argument leads to the question:

To what extent the investment are allocated efficiently among the productive sectors?

The new growth theories of the 1990s argue that it is important to explore the link between different forms of investments and GDP growth. This line of thought can be found in the works of (Romer, 1986) and (Mankiw, Romer, & Weil, 1992)which extended the (Solow, 1956) model by including human capital. They pointed out that capital accumulation, with an emphasis on human capital, leads to higher rates of social returns than those explained by the traditional Solow model.

New doctrines of economic growth insist that growth is a continuous process of technological innovation, modernization and industry diversification that allows for the development of different types of infrastructure and institutional arrangements that shape the context of business development and creation. The 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, services and tourism). Hence, it would increase the potential growth of the economy and thus facilitate economic development. Industrial investment can be seen as an essential tool in creating jobs, reducing poverty and promoting regional development policies.

In addition, industrial investment can catalyse technological progress and innovation, which can be seen as productivity gains.

1.1. Problematic

Have investment allocations to the manufacturing sector contributed to increasing the economic growth rate in Algeria?

1.2. Hypotheses

There is a positive impact of investment in equipment on economic growth in Algeria.

There is a positive impact of imported capital goods on economic growth in Algeria.

This study is divided into three parts:

The first axis deals with the role of industrial investment in economic growth, the second axis deals with the contribution of the industrial sector in Algeria to value added, while in the third axis, a benchmark study is used to know the contribution of the industrial sector to economic growth.

2. THE ROLE OF INDUSTRIAL DEVELOPMENT IN ECONOMIC GROWTH

Investment in equipment refers to spending on productive capital goods, usually physical capital such as machinery or factories (Spiegel and Stiegeler, 1982). Investment in equipment can be considered fixed or tangible capital investments, which are those goods that lose relatively little of their value during each production cycle. Examples are factories, machinery and tools. (De Long & Summers, 1991) (De Long & Summers, 1992) (De Long & Summers, 1993) (De Long & Summers, 1994) Prepared a series of papers exploring the relationship between different components of investment and economic growth. They concluded that equipment investments play a more important role in output growth than structural investments. Their main argument was that

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structures cannot be exported and do not produce strong externalities like equipment. With no ability to export and less ability to create external economies, structural investments will have less impact on total factor productivity (TFP). That both equipment investment and human capital (Dulleck & Foster, 2008) affect growth in developing countries is a well-established fact in the empirical growth literature. Few studies have questioned the complementarity between human capital and equipment investment, as human capital affects the ability of developing economies to benefit from investment in capital goods. We examine the impact of equipment investment on the growth of developing countries and the interrelationship between this investment and human capital. We find a complex relationship between equipment investment and human capital. In general, the relationship between equipment investment and growth is lowest, and often negative, for countries with low levels of human capital, highest for countries in the middle range and somewhat in between for countries with the highest level of human capital. Industry is one of the most important achievements of societies. It is an indicator of a society's standard of living, social welfare and progress in various sectors, leading to high levels of employment. Industry also contributes to the development of education and all other economic and social sectors; thus, it measures the progress or failure of a society. According to Moore, “Industry is the total physical production that comes by using machines through different sources of energy” (Addakks, 1999). Investment has been defined as “the use of savings of goods that are not consumed in manufacturing” and has been defined by others as the purchase of capital goods, which are used directly in the production process, such as the purchase of machinery and buildings, or the purchase of additional productive assets from third parties (Raafat, 1985).

(Herrerias, 2010) investigated the causal relationship between investment in equipment and infrastructure on economic growth in China for the period 1964-2004 by applying co-integration analysis and error correction model. The results show that industrial investment has a positive impact on economic growth in the long run. In the short run, there is no relationship between industrial investment and economic growth.

(Kaldor, 1966) is the first scholar who considers investment in the industrial sector as an essential element of economic development. Faster growth rates are almost invariably associated with the rapid growth rate of the secondary sector, especially manufacturing, which is characteristic of the intermediate stage of development.

In the same research,(Chenery, Robinson, & Syrquin, 1986) considers that industrialization is essential for continued growth, and the results concluded based on empirical and theoretical foundations that during the period when the share of industrialization rises is essentially a global period characteristic of structural transformation. Therefore during the industrialization process, some structural transformations must occur such as changes in final demand, changes in intermediate demands and changes in international trade. (Romer, 1986) Also points out that positive technological externalities are the result of the accumulation of physical capital in the industrial sector, which gives the qualification of “knowledge”. (Murphy, Shleifer, & Vishny, 1989) posit that rapid growth is achieved through development in the industrial sector. Almost every country that has experienced rapid growth in productivity and living standards over the past 200 years has done so through industrialization. The countries that have successfully industrialized and shifted to manufacturing production by taking advantage of economies of scale are those that grew rich, Britain in the 18th century, Korea in the 20th century, and Japan. Manufacturing is seen as the most important driver of economic growth. The special characteristics attributed to the manufacturing sector can be explained in several ways: Rapid technological changes, economies of scale, ease of integration into global production networks (Szirmai A. , 2012) and (Szirmai & Lavopa, 2014). In addition, a number of researchers have empirically confirmed that the shift from agriculture to manufacturing, as well as from manufacturing to services is the process of economic development (Clark, 1941); (Kuznets, 1957); (Chenery H. , 1979). Therefore, it has been generally accepted that since the Industrial Revolution, no country has become a major economy without becoming an industrial power (Acharya, 2007). The industrial sector is considered the beating heart of any economy, and for the purpose of knowing the contribution of this sector to economic growth in Algeria. Two models were used, where the first model addresses the extent of the contribution of each economic activity to value added, while the second model addresses the impact of industrial investment for each activity on economic growth.

2.1. The Impact of Investment In Various Industrial Activities on Value Added

2.1.1. Evolution of Value Added by Activity 1989-2023

The industrial sector also contributes to the country's GDP According to 2004-2005, the contribution of the industrial sector to GDP is 18.3 per cent. In this way, this sector increases the national GDP. Developing the industrial sector means more investment, labour and production. Increased production will increase national income. If we study the history of economic development, we find that the growth in national income and per capita income has been accompanied by a relative decrease in their dependence on agriculture. At present, the industrial sector's share of GDP is 6.8 per cent. Between 1980 and 2001, the share of machinery and transport equipment in MVA increased somewhat, from 22 per cent to 32 per cent (World Bank, 2006). The share of textiles and clothing declined, and while the sector produced 18 per cent of MVA in 1980, it produced 12 per cent in 2001. While light industry exports such as textiles are large and growing (Figure 2), their relative importance has declined somewhat and the importance of more skill-demanding manufacturers has increased.

Overall, the volume of Algerian exports expanded significantly during the 1990s, and the share of manufactures in total merchandise exports also increased, exceeding 90 per cent in 2004. The industrial sector is the second largest single sector in the economy, accounting for 24 per cent of GDP. Activity in the manufacturing sector consists of large, medium and small scale. The growth rate of industrial production during 2005 remained at 6%. The growth rate of large-scale manufacturing is 19.9%. Most of Algeria's current economic distresses are ultimately related to the slow pace of industrial development. Rapid industrialization is the sovereign remedy to put our economy on a sound footing.

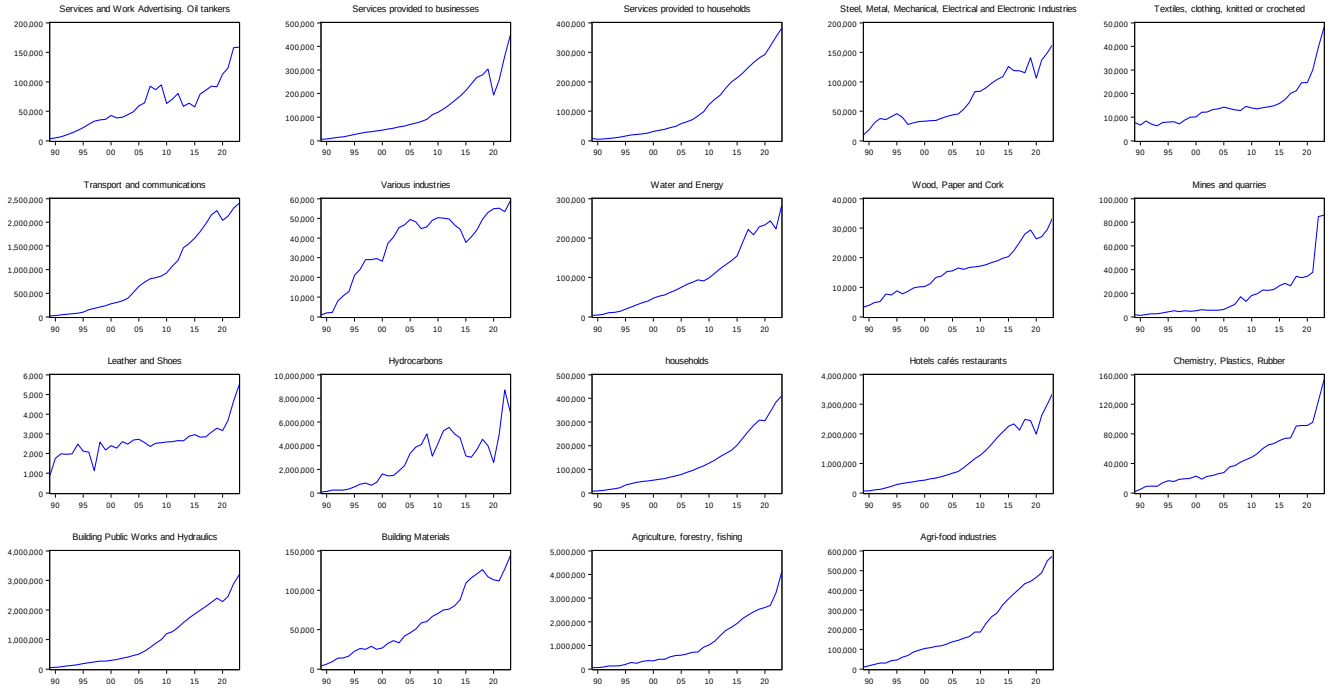

Figure 1. Evolution of value added by activity 1989-2023.
Source: Prepared by the researchers using the statistical program EViews10

2.2. Evolution of Industrial Production

With regard to industrial production volumes, the results for the period 1996-1998, by branch of activity, confirm the poor performance of this strategic sector, whose status has always given it a privileged place in the reforms. Overall, industrial production in 1996 declined by 6.2 per cent compared to 1995. Excluding hydrocarbons, this rate is 9.8%. In 1997, the negative development of production significantly affected the mining and steel industry (-4.1%), mechanics, electronics and electricity (-38.3%) and textiles and leather (-10.9%).

This negative trend, which particularly affects the mining sector, ISMMEE, as well as the textile and wood industries, i.e. the mainstay of Algerian industry, proves that the industrial production system as a whole remains in deep recession. In its 1997 economic report, the National Economic and Social Council (NESC) sounded the alarm on this stagnant state of the Algerian economy, stating: “The national economy has already reached a serious level of material loss in the form of hidden transfers, in the form of neglect of productive sectors (loss of knowledge). This situation reveals a contradiction in the implementation of structural adjustment, which aims to downsize the economy by reducing productive capacities.

There are many reasons for the low growth rate of industrial sector output during the period of structural adjustment plan.

1. Lower rates of capacity utilization, especially in general industry. In general, this rate changed as follows: 51.2% in 1993; 48.5% in 1994; 46.7% in 1995 and below 45% in 1997.

The decline in capacity utilization rates is explained by supply constraints for raw materials and spare parts (-13% in 1997 compared to 1996) and by high outage rates due to the ageing of facilities.

2. The sudden devaluation of the dinar in April 1994 (a 33% drop followed by another 10% drop for two years). In fact, by devaluing the currency, public institutions were faced with situations for which they were totally unprepared. The resulting overdrafts, inflated by bank charges, rose from 10 billion dinars at the end of 1994 to 92,109 billion at the end of 1995.

3. The dissolution of a large number of companies. More than 800 public economic enterprises have been dissolved since 1994, of which 54% for the industrial sector, followed by the BTPH sector with 30%; the rest, 16%, relate to other sectors.

4. Low level of investments in the industrial sector. According to a 1998 (NESC) report, from 1993 to 1998, agency of promotion and investment support(APSI) registered 30,072 investment. The implementation rate is very low and does not exceed 15%. A large part of the projects is blocked for panel stories, banks, energy, telecoms, transport, etc.

5. Finally, the opening of the domestic market and foreign competition have hampered an entire sector of the industrial sector, especially textiles and leather, which are suffering from shrinking demand and imports. Industrial food processing, textiles, chemicals, metals and minerals, and building materials are the main activities of the manufacturing sector.

Traditionally, Algeria imports the pharmaceutical products it needs. In recent years, these imports have decreased while local production has increased sharply, with the current coverage rate reaching more than 45%. Agriculture contributes about 11% of GDP and employs 9% of the labour force. Wheat, barley, oats, citrus fruits, viticulture, olives, tobacco and tobacco are the main crops. The tertiary sector contributes 44% of GDP and employs 60% of the labour force. The automotive market is the second largest in Africa, experiencing strong growth with the establishment of several foreign manufacturers. Algeria has launched 2,500 new tourism projects, given that the sector is highly underdeveloped, and aims to attract nearly 24 million visitors in 2025. The country is seeking international partnerships in hotel vocational training (Ambassade-de-suisse-a-Alger, 2017, p. 1)

During the period 2002-2008, industry remained the first recipient of investment with 45% of the total amount and 28% of employment created by investment.

Decree 06-08 of 15 July 2006 establishes a new legal framework that grants additional tax exemptions to investors, creates the National Agency for the Development of Investment (NADI), reduces the time for procedures and establishes the possibility of recourse for companies against the failure of administrations.

This new framework offers hope for positive effects on industrial investment. NSI should take advantage of the contributions of the new legislation and therefore projects in the sectors targeted by NSI will automatically benefit from the maximum duration (10 years) envisaged by the convention regime and will benefit from additional advantages.

Excluding hydrocarbons, industry's share of GDP was 7.2% in 2001 compared with 7.0% in 2000. The sector's growth, which was low in 2001, was 0.9% compared to 2000, the private sector grew by 4.5%, while the public sector declined by 0.7%. After a period of decline, reflecting the structural issues of the manufacturing industry. Thanks to the private sector, the non-hydrocarbon construction sector grew by 3.2% in 2004 and contributed 0.2% to overall growth. The non-hydrocarbon industry closed 2005 with increased growth: 2.5%, versus 1.9% in 2004. The public sector saw a growth rate of 3.4% versus 1.7% for the private sector.

Manufacturing activity continued to stagnate with growth of 0.2% in 2005. In this sector, the private sector's growth performance (2.3%) was greater than that of the public sector, whose activity declined (-4.5%). In 2006, the value added of industry in GDP represented only 5.3%, excluding hydrocarbons. The sector accounted for 5.8% of the total GDP in 2007. The hydrocarbon sector is thus the largest supplier of wealth in the country. It has the largest share in development (25%) while other sectors - industry and agriculture - develop tangentially. Economic growth outside the oil and gas sector remains dependent on energy production and prices. A significant portion of energy sector revenues is used to finance public investments in non-energy projects. It is noted that during all periods of economic recovery programs (2001-2014), this sector accounted for about 60.5% of GDP on average, and the average real growth rate of this sector was about 95.1%. This reflects the weak contribution of the industrial sector to GDP, due to the low growth rates of factory industries, given the requirements of the local market. Not to mention the weak competitiveness of national enterprises. It can also be concluded that this sector has not benefited as hoped from the economic recovery programs, which ensures the building of a strong national industrial sector with competitive capabilities capable of meeting the needs of the local market.

In the second quarter of 2016, the industry recorded a slowdown in its quarterly growth rate with an increase of 3.4% instead of 4.2% during the same period of the previous year. The industry's sub-sectors are experiencing the following developments:

- Water and Energy: Value added increased by 5% compared to 7.3%.
- Mines and quarries: A slight increase of 0.1% compared to a decrease of 6.6%.
- ISMME: 3.3% compared to 10.7%.
- Building Materials: Strong increase of 7.2% vs. 0.2%.
- Chemicals, plastics and rubber: 3.2% vs. 2.5%.
- Agri-food industry: 3.5% vs. 6.5%.
- Textiles and apparel: 1.6% instead of 3.6%.
- Leather and footwear: 3% growth vs. 5.5% decline.
- Wood, paper, cork: 8.5% vs. 2.6%.
- Other industries: 13.6% decline instead of a 20.4% decline.

Value added rose 3.9% in the first quarter of 2017 versus 5.1% in 2016 (ONS, 1er trimestre 2017). ISMMEE recorded a decrease of 8.2 percentage points compared to 2017, which also saw a smaller decrease of -6.3 percentage points .Capacity utilization lost 4.8. points between 2017 and 2018.

2.3. The State of Algeria's Industrial Sector

Public sector industrial production increased by 4.1% in the third quarter of 2017 compared to the corresponding quarter of 2016, with the growth rate reaching more than 2.1% in the first nine months of 2017, APS has learned from the National Statistics Office (ONS). This increase was mainly driven by the sectors of, respectively, textile, leather and footwear, food industry, building materials, wood and paper industries, while poor performance was recorded in the iron and steel, metals, mechanical, electrical and electronics sector. Industries (ISMMEE) as well as chemical industries

ISMMEE still struggling to take off ISMMEE continues to post poor results with a 12.4% decline in Q3 2017. This trend is explained by the lower level of output of some activities, notably the manufacturing of metal, mechanical and electrical intermediate goods (-3.2%), the iron, steel and iron transformation industry (-49.7%) and the manufacturing of consumer electrical goods (-39.6%). The only sectors that escaped the gloom in this sector are mainly industrial vehicle manufacturing with a growth of 48.3%, electrical (+52%) and metal (+21.1%) goods manufacturing.).

The chemical industry recorded a decline of 7.2% in the third quarter of 2017. This trend can be observed in fertilizers and pesticides (-15.8%), paint manufacturing (-16.8%) and basic organic chemistry (-58.6%). However, in the same industrial sector, pharmaceutical products saw their output increase by 6.7% and the manufacturing of other plastic goods recovered by almost 6%.

2.3.1. The Results Analysis of the Industrial Production Index and the Capacity Utilization Rate:

2.3.1.1. The Failure of the Economic Reforms of the 1990s

The economic reforms were intended to breathe new life after the failure of the organic and financial structure of the public enterprises in operation in the 1980s, which continues to this day. There is no positive impact on the productive system, and the poor results of investment expenditures in Algeria (Banque.Mondiale, 2005, p. 52) are strongly linked to inefficiencies in the management of public expenditures. Recent estimates of international experience have shown that poor GDP outcomes are a severe impediment to the realization of public investment objectives in many countries (Lindsay & Krugman, 2003), and Algeria is no exception to this rule.

The observed ineffectiveness is due to the poor implementation of investment programs and, before that, the formulation of investment plans, the exaggerated estimation of expenditures and the significant delays in the implementation of projects:

1. There is a disparity between financial planning and sectorial priorities.
2. The absence of effective intervention resulting from the budgetary division resulting from the separation between investment allocations and the management budget.
3. Significant discrepancies between the approved investment budget and the investments actually materialized.
4. Significant delays and additional costs during project implementation.

2.3.1.2. Massive Investment Has Not Translated into Production

Huge investments do not translate into production Industrial development during this period is characterized by massive investment in heavy industries located at the top of the industrial process. The investment rate during the period fluctuates

between 45 and 50% of GDP, or $1,260 per capita in 1980, making it one of the highest in the world. Hydrocarbons get 50% of industrial investments or 25-30% of total investments to ensure increased production.

As we can see from the table, the rate of utilization of productive capacity did not improve, but on the contrary, it deteriorated, with the exception of the hydrocarbon sector and the building materials sector, where the rate of utilization of productive capacities was maintained.

To summarize the above, we can say that the Algerian industry today is characterized by:

- Huge production capacities that are not fully utilized, either because of the tight market, or because of the wear and tear of equipment and machinery in the absence of investment to renew them.
- Weak and often negative factor productivity.
- Inefficient and ineffective management and business management techniques.
- Low productivity and very low growth rates.
- Production that is not in line with the rules of competitiveness.
- High dependence on the hydrocarbon sector.
- Lack of diversification in exports.
- Weak technological structure of the national economy

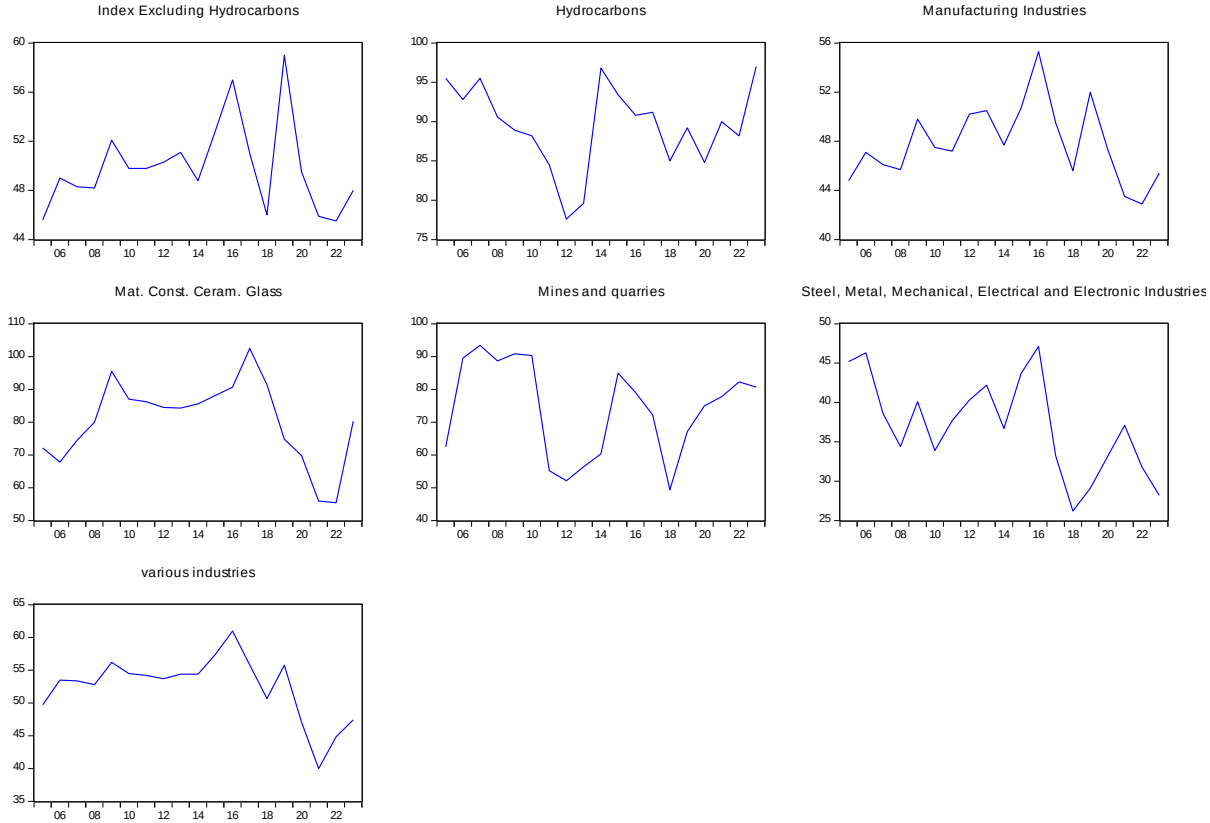

Figure 2. Annual rate of capacity utilization (2005-2023).

Source: Prepared by the researchers using the statistical program EViews10

Activity According to business leaders' surveyed, industrial activity in the third quarter of 2016 continued its downward trend for the public sector and was characterized by a positive development for the private sector. Nearly 46% of public sector respondents utilized their production capacity at less than 75%.

The level of supply of raw materials is lower than the expressed demand for almost 27% of public sector respondents and about 13% in the private sector, resulting in out-of-stocks for more than 29% of the former and nearly 5% of seconds. This shortage caused work stoppages of up to 29 days for most public sector workers and less than 10 days for more than 70% of private sector workers. More than 28% of public sector respondents and about 15% of private sector respondents experienced power outages, resulting in work stoppages, for up to 12 days for 44% of the former and about 47% of the latter. In addition, water supply was adequate according to the majority of respondents.

Due mainly to obsolescence by public sector respondents and overuse of equipment by private sector respondents, more than 70% of the former and more than 31% of the latter experienced breakdowns, causing work stoppages, ranging from 13 days for the majority of private sector workers and up to 30 days for nearly 27% of public sector workers. Nearly 81% of business leaders in the public sector have restarted their devices and more than 79% of private sector workers have carried out extensions. Almost 79% of the former and more than 86% of the latter say they can produce more by revamping their equipment and without hiring additional staff. Moreover, the rest say they can produce more only by reorganizing the production process without renovation or extension. ISMMEE activity continued its downward trend in the third quarter of 2016. More than 53% of the production capacities surveyed utilized their production capacity at less than 75%. The degree of satisfaction with raw material orders remains below the needs expressed by more than 28% of respondents, leading to inventory shortages for nearly 34%, causing work stoppages of up to 29 days for more than 63% of them. More than 18% of respondents experienced downtime due to power outages, lasting up to 12 days for more than half. Water supply was adequate by public opinion. With rising sales prices, demand for manufactured products saw a decline in the third quarter of 2016. More than 68% of business leaders surveyed have fulfilled all incoming orders and there is still inventory of manufactured products for 73% of them, a situation considered abnormal. More than 27% of business leaders surveyed declared that they experienced transportation issues during this quarter. **(ONS, 2016)**

2.4. The Empirical Analysis of The Impact of Investment in Various Economic Sectors on Economic Growth

2.4.1. Data Sources and Measurement

This study adopts different approaches to investment theory in order to test the relationship between industrial investment and economic growth; in this regard, using secondary investment time series data from 1990 to 2023. The time frame was chosen based on data availability and the desire to identify the period of economic translation from regulation to deregulation.

The data was obtained from the publications of the Algerian National Bureau of Statistics.

The analysis used in this study covered the annual time series from 1990 to 2023 or 47 observations; which should be sufficient to capture the relationship between domestic investment in industry and economic growth in Algeria. The dataset consists of GDP, exports of 7 goods and services, imports of goods and services, fixed formation capital in industry and total fixed formation capital for the other investment sector.

All data are taken from the National Bureau of Statistics. We will use the most appropriate method which first consists of determining the degree of integration of each variable. If all variables are integrated at the level, we apply an estimate based on linear regression.

On the other hand, if all variables are integrated in the first difference, our estimates are based on the estimation of a VAR model. When the variables are combined in the first difference, we will examine and determine the co-integration between the variables, and if the co-integration test indicates that there is no co-integrating relationship, we will use a VAR model.

If the co-integration test indicates a co-integrating relationship between the various variables studied, the VECM (model is used).

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

Through the theoretical study that dealt with the determinants of foreign investment as well as the relationship of foreign investment with economic growth, we propose a number of variables for the purpose of analysis, study and testing the hypotheses of this research. For this reason, the selection of these variables on the basis of the theoretical aspect of this research and previous similar studies that are related to the subject of the research, and we also refer to the availability of data for the research, and on this basis we propose the following variables:

2.4.2. The Study Variables

GDP : Gross domestic product.
MAEQUI:The raw accumulation of fixed capital for machinery and equipment.
IMPEQU: The value of imports of machinery and equipment.
ISMMEE: Raw accumulation of fixed capital. Of Steel, Metal, Mechanical, Electrical and Electronic Industries
SER: The raw accumulation of fixed capital for services.
AG: The raw accumulation of fixed capital for agriculture.
TPP: The raw accumulation of fixed capital for hydrocarbon public works.
Deflator GDP
Model Specification:

This consists of the empirical method used to examine the relationship between investment in the industrial sector and economic growth in Algeria from 1990 to 2023, and will produce data on investment in the industrial sector and industrial GDP.

In specifying this sectorial model, we can assume a linear relationship between the share of industrial GDP and the explanatory variables. Industrial sector investment is the independent/explanatory variable also known as regressors, while industrial growth or INDGDP is the explanatory/dependent variable or the regression explains the overall economic capacity of industrial investment as it responds to the performance of industrial sector growth.

Thus, the formulation of the model is: The general model (i.e., the mathematical form) can be stated as follows:

This study adopts the Cob-Douglass production function structure which states that Yt = ALαKβ.e

This can be written in a variable way as Yt = LogA + α Log L + β Log K + Et:

In this study, the cointegration test method using ARDL is adopted to estimate the impact of industrial investment on economic growth for the period 1984-2016, for which the following equation will be estimated:

$$GDP_t = \alpha + \beta_1(\text{MAEQUI}) + \beta_2(\text{IMPEQU}) + \beta_3(\text{ISMMEE}) + \beta_4(\text{SER}) + \beta_5(\text{AG}) + \beta_6(\text{TPP}) + \beta_7\ \text{DEFGDP} + \varepsilon_t$$

t=1,2,3 ……. T

To estimate the long-short relationship, the following relationship estimation is used:

$$\ln(GDP) = \beta_0 + \sum_{i=1}^{p} \beta_i\, ln(\text{MAEQUI})_{t-i} + \sum_{i=0}^{q} \beta_i\, ln(\text{IMPEQU})_{t-i} + \sum_{i=0}^{m} \beta_i\, ln(\text{ISMMEE})_{t-i} + \sum_{i=0}^{n} \beta_i\, ln(\text{SER})_{t-i} + \sum_{i=0}^{n} \beta_i\, ln(\text{AG})_{t-i} + \sum_{i=0}^{m} \beta_i\, ln(\text{TPP})_{t-i} + \sum_{i=0}^{m} \beta_i\, ln\text{DEFGDP}_{t-i} + \lambda_1 GDP_{t-1} + \lambda_2 \text{MAEQUI}_{t-1} + \lambda_3 \text{IMPEQU}_{t-1} + \lambda_4 \text{ISMMEE}_{t-1} + \lambda_5 ser_{t-1} + \lambda_6 \text{TPP}_{t-1} + \lambda_7 \text{DEFGDP}_{t-1} + \varepsilon_t$$

2.5. Grading Results and Discussion

2.5.1. Unit Root Test

This test is important because it determines whether the time series variables used in this study are stationary in the long run; the results obtained from the ADF tests have a 5% significance level by comparing the observed values with the critical values (in absolute value).

The result revealed that all variables became stationary at the first difference, i.e., they are integrated from the same I (1). With the exception of the variables GDP, hydrocarbon public works, and imports of fixtures and fittings, they are integrated of order I(0).

Table 1. Augmented dickey fuller unit root test.

	ADF at level				ADF at first difference				Order of
Variables	**Fixed**		**Constant and direction**		**Fixed**		**Constant and direction**		**integration**
LOG(GDP)	-4.4163	[0.001]	-2.3946	[0.374]	-4.5942	[0.001]	-5.5533	[0.000]	I=(0)
LOG(AG)	-0.7682	[0.812]	-2.6019	[0.282]	-7.7236	[0.000]	-7.5173	[0.000]	I=(1)
LOG(SER)	-1.7396	[0.401]	-3.4542	[0.063]	-6.6816	[0.000]	-6.5433	[0.000]	I=(1)
LOG(TPP)	-3.8215	[0.008]	-1.5713	[0.778]	-5.9112	[0.000]	-4.555	[0.000]	I=(0)
LOG(IMPEQU)	-3.9786	[0.006]	-0.7557	[0.955]	-4.8403	[0.000]	-7.2928	[0.000]	I=(0)
LOG(MAEQUI)	-1.9373	[0.311]	-1.8124	[0.672]	-5.7061	[0.000]	-5.7708	[0.000]	I=(1)
LOG(ISMMEE)	-2.3278	[0.170]	-1.9115	[0.622]	-4.3295	[0.002]	-4.6162	[0.005]	I=(1)
DEFGDP	-0.2067	[0.926]	-2.3375	[0.402]	-4.7635	[0.000]	-4.6769	[0.004]	I=(1)

Source: Prepared by the researchers using the statistical program (EViews10)

2.5.2. Test Steps and Results' Analysis

Choosing the optimal deceleration period.

Table 2. Results of the criteria for selecting the deceleration period.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	45.67266	NA*	0.004036	-2.690904	-2.310274	-2.574542
1	47.55078	2.548876	0.003819*	-2.753627*	-2.325419*	-2.622719*
2	47.89089	0.437281	0.004040	-2.706492	-2.230705	-2.561039

Note: * indicates the slowdown period chosen by the benchmark.
Source: Prepared by the researchers using the statistical program EViews10.

Most of the benchmarks emphasized that the optimal deceleration period is:

After several iterations, we decided to choose this lag period because it fits the quality of the model we are studying. Using the eviews10 program, the optimal degree of lag is 1.

Testing for co-integration Using a Bounds Approach:

Testing the ARDL model involves first testing the existence of a long-run equilibrium relationship between the model variables, if we confirm the existence of this relationship, we proceed to estimate the long-run and short-run parameters, and for this we calculate the F statistic through the Wald test, where the null hypothesis that there is co-integration between the model variables is tested.

Table 2 In the appendix, the F-stat is greater than the upper limits of the critical value at all degrees of significance of the upper limits of significance, thus we reject the null hypothesis and accept the alternative hypothesis that there is a long-run equilibrium relationship between the dependent variable Log(PIB) and the independent variables.

Table 3. Bounds F-test for cointegration Pesaran et al. (2001).

Calculated Fischer	**Tabular F value according to estimates (pss)**		**Morale level**		
F-statistic			**1%**	***%5***	***%10***
17.271107	*I(0)*		*3.976*	*2.794*	*2.334*
		I(1)	5.691	4.14	3.515

Source: Prepared by the researchers using the statistical program EViews10

2.5.3. ARDL Model Estimation for Error Correction with Short-Term Dynamics

Table 4. Short-term estimates according to the error correction model (ECM).

Optimal model ARDL(1, 1, 1, 1, 0, 1, 1, 1)			
Variables	**Coefficients**	**t-Statistic**	**Probability**
C	4.021833	15.13811	0.0000
@TREND	-0.023494	-19.33329	0.0000
DLOG(MAEQUI)	-0.356382	-6.644747	0.0000
DLOG(IMPEQU)	0.141954	4.672171	0.0004
DLOG(ISMMEE)	0.330751	6.792432	0.0000
DLOG(AG)	-0.013842	-8.953572	0.0000
DLOG(TPP)	0.032056	2.596487	0.0222
D(DEFPIB)	0.011642	21.74933	0.0000
CointEq(-1)*	-0.558941	-14.57968	0.0000

Source: Prepared by the researchers using EViews10 statistical program.

2.5.4. ARDL Model for Long-Run Error Correction:

From the table below we conclude the following:

As for the long-run parameters, each of the variables of investment in machinery and equipment, imports of machinery and equipment, investment in SMMEE industries, public works for hydrocarbons and inflation are statistically significant at 1% at most, while the rest of the variables are weakly statistically significant and did not show any positive role in the long run, From the economic aspect, the sign of the inflation parameter is positive, which means that an increase in inflation leads to an increase in economic growth rates in Algeria. This is not acceptable from the economic point of view, and for the variables of investment in machinery and equipment and services and agricultural field have an inverse effect on the economic growth rate.

Table 5. Estimation of long-run parameters according to the ARDL model.

Optimal model ARDL(1, 0, 0, 1, 1, 1, 0, 1, 1, 1)			
Variable	**Coefficient**	**t-Statistic**	**Prob.**
LOG(MAEQUI)	-0.857730	-5.257726	0.0002
LOG(IMPEQU)	0.631140	7.430477	0.0000
LOG(ISMMEE)	0.804782	4.151490	0.0011
LOG(SER)	-0.084259	-3.259875	0.0062
LOG(AG)	-0.049356	-4.862200	0.0003
LOG(TPP)	0.180074	4.712249	0.0004
DEFPIB	0.012729	7.627242	0.0000

Source: Prepared by the researchers using the statistical program (EViews10)

2.5.5. Diagnostic tests for the ARDL model

Table 6. Testing the fit and quality of the model used.

Diagnostic test	**Statistical**	**Value**	**Probability**
Breusch-godfrey serial correlation tsest	F-statistic	0.889017	0.3643
	Chi-Square(2)	2.000269	0.1573
normality test	Jarque-Bera	2.004	0.3670
Variance instability	F-statistic	0.666867	0.7754
	Chi-Square(2)	12.61084	0.6323
Testing the appropriateness of the model characterization	F-statistic	0.831496	0.4207
	Chi-Square(2)	0.691386	0.4207

Source: Prepared by the researchers using the statistical program (EViews10)

To ensure that the model used in the analysis is good and free of measurement issues, several tests were performed as follows:

Autocorrelation test Breusch-Godfrey test, the LM Test, as shown briefly in Table 5. It is noted from the table that the value of the F-statistic Chi-Square is not significant at the 5% significance level, which means that there is no null hypothesis and therefore through this test it was found that there is no serial autocorrelation of errors in the residuals of the regression equation.

Heteroskedasticity Test: with the aim of ensuring that the assumption of stability of the variance of the random term, which represents one of the basic assumptions on which the least squares method (OLS) is based, is achieved through the White Test, as shown briefly in Table 5, and it is noted from this table that the value of the F-statistic Chi-Square, is not significant, which means that the null hypothesis is not rejected, and therefore, the model does not suffer from the existence of the variance instability issue.

Normality Test: in order to ensure that the model takes the form of a normal distribution, and therefore, consistent with the assumptions of the least squares method (OLS) that was used, through the Jarque-Bera (JB) test. The value of the parameters of this test (JB) is insignificant at the 5% level, which means that the null hypothesis is not rejected, and the distribution takes the form of a moderate normal distribution. Therefore, the model can be accepted statistically.

Ramsey Reset test: for model specification appropriateness by testing for model misspecification and functional form validity, through the corresponding probability of the test statistic, which was 0.42, which is not significant at the 5% level, thus confirming the absence of model misspecification.

2.6. Structural Stability Test for Short-Term and Long-Term Coefficients

(Pesaran & Pesaran, 1997) is used to test whether the data used in this study are free of any structural changes over time.

To achieve this, two tests are used: The cumulative sum of residuals test (cumulative sum of squares of residuals test). The structural stability of the coefficients estimated by the UECM formula of the ARDL model is achieved if the graph of the CUSUM and CUSUMSQ statistics falls within the critical limits at the 5% significance level, and then these coefficients are unstable if the graph of the statistics of the two mentioned tests moves outside the limits at this level.

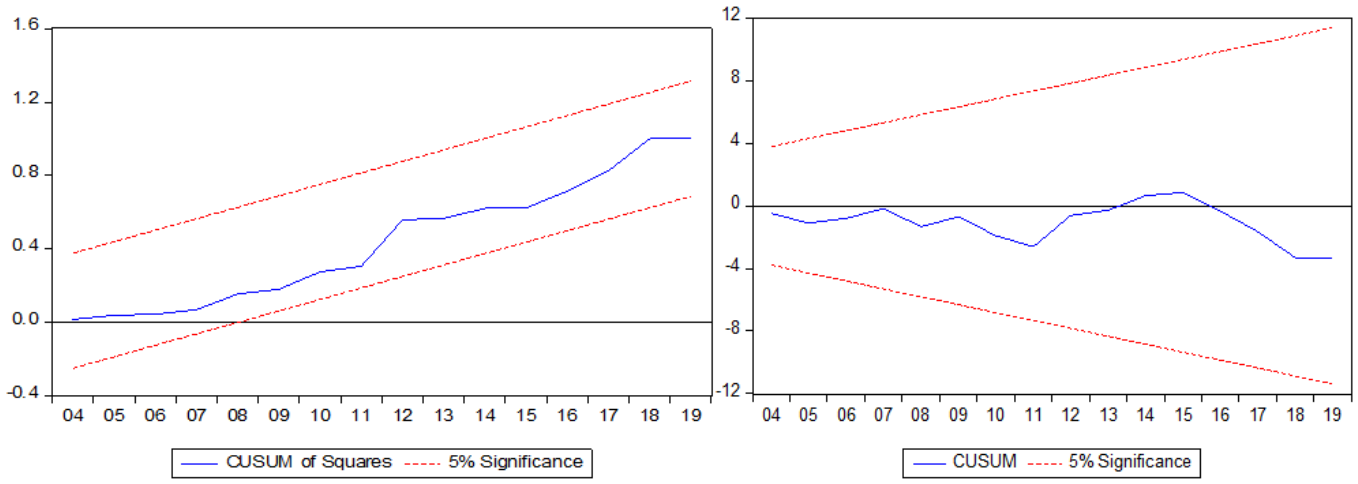

Figure 3. Structural Stability test for the model.

Source: Prepared by the researchers using the statistical program (EViews10).

What is observed through the graph of the CUSUM and CUSUMSQ statistic is within the critical limits at a significance level of 5%, so these coefficients are stable, which means that the data used in this study are free of any structural changes in them over time.

It is clear from these figures that the estimated coefficients of the ARDL model used are structurally stable over the period under study, which confirms the existence of stability between the study variables and harmony in the model between the results of error correction in the short and long term, as the graph of the statistics of the two tests mentioned for these models fell within the critical limits at a significance level of 55%.

3. FINDINGS

The results of the static test showed that the variables private and public investment and internal conflict are stationary at their levels, while the variables GDP growth, foreign direct investment and the level of corruption are not stationary at their levels but are stationary at first differences and integrated of degree I= (1).

The ARDL test found that there is a long-run relationship for the model under study and the analysis of the study found the following:

A positive correlation between capital goods imports and economic growth, where a 1% increase in equipment imports leads to an increase in economic growth by 0.63% in the long run and 0.14% in the short run

There is a positive correlation between investment in the iron, metal, mechanical, electrical and electronic industries and economic growth, where a 1% increase in ISMME leads to an increase in economic growth by 0.80% in the long run and 0.33% in the short run.

The public sector parameter is insignificant and has a negative impact on economic growth.

There is an inverse relationship between investment in plant and equipment and economic growth, where a 1% increase in plant and equipment leads to a decrease in economic growth by 0.85% in the long run and 0.35% in the short run.

A positive effect of investment in hydrocarbon public works, where a 1% increase in investment in this area leads to an increase in economic growth by 0.18% in the long run and 0.03% in the short run.

Negative impact of investment in agriculture and services on economic growth. Industrial development is necessary to modernize agriculture. In Algeria, agriculture is traditional and underdeveloped. The cost of production is high and productivity is low. We need tractors, threshers, pump sets and combines to modernize agriculture. To increase productivity, we need chemical fertilizers, pesticides, herbicides and so on, these are all industrial products. Without industrial development, these goods cannot be produced. So industrial development is necessary to modernize agriculture.

Inflation has a positive effect on economic growth, which contradicts the economic theory that inflation decreases economic growth.

4. CONCLUSION

This paper examined the impact of industrial investment on economic growth in Algeria for the period 1990-2023. The impact of the long- and short-run dynamics of investment in fixtures and fittings, agriculture, public works, hydrocarbons, services and inflation on economic growth was studied. A unit root test was performed using the ADF test to check the level of stationarity of the variables. The co-integration approach was used to test the existence of a long-run relationship between the variables. The ARDL approach was used to determine both the long-run as well as the short-run dynamic effect of investment for different sectors on economic growth.

The unit root results proved that some variables were non-stationary at the level but stationary at first differencing. Also, the co-integration results show that the variables were cointegrated together. Hence, this result guarantees the possibility of a long-run relationship among the variables involved in the model specified in this study. The results of the study showed a significant positive long-run effect of imports of fixtures and fittings on economic growth. While investment in fixtures and fittings has a negative long-run significant effect on economic growth.

Moreover, the results of the economic growth model show that there is room for a return to equilibrium, which expresses the percentage of short-run errors in order to correct the long-run equilibrium position is estimated at 55%, i.e. errors are corrected and integrated into the long-run relationship. This study also found that investment realized from capital goods imports has a significant positive long-run impact on economic growth in Algeria.

Gross fixed capital formation, and more specifically, its main component, industrial investment, has never reached levels considered adequate. There is no lack of references to accuse its relative lack, be it in the level of employment, income growth, and, above all, our ability to face international competition, or more clearly today, the recovery of the internal market.

The general conclusion is that investment in manufacturing, as well as other components of investments are essential for Algeria's growth process. Therefore, the government should increase budgetary allocations for equipment production sectors and increase foreign exchange allocations for fixed asset imports.

It is important for policymakers in developing countries to assess how capital accumulation responds to growth, in order to design short-term development policies and implement short-term stabilization programs. The relationship between investment in domestic equipment and economic growth is critical in assessing the impact of macroeconomic demand variables on the real sector. Thus, one of the goals of macroeconomic policy is to stimulate investment and growth in the short and medium term.

From these results, we recommend paying more attention to industrial investment as a real driver of economic growth.

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