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Determinants of the industrial production of the countries of the West African Economic and Monetary Union (WAEMU)

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Abstract

The purpose of this paper is to analyze the determinants of the manufacturing value added (MVA) of the West African Economic and Monetary Union (WAEMU) countries over the period 2006-2020, in a context where industrialization is important in African country development programs. The General Lest Square (GLS) method and System Generalized Method of Moment (SGMM) are used. The results indicate that the sources of manufacturer production are the total public debt, external public debt and the growth rate of the population. Also, they reveal that obstacles are the internal public debt, low control of corruption, private sector credit and trade opening rate. Further, they indicate that the low control of corruption negatively influences the effects of different types of debt on MVA. It therefore implies that these countries reduce the accumulation of internal debt, invest a large part of the external debt and the credit to the private sector in industrialization, adopt better trade policies and apply more rigorous in the control of corruption.

Key Words: *GLS, industrialization, public debt, SGMM, WAEMU.*

Introduction

Industrialization is very often equated with economic development. It is therefore a relevant indicator for measuring economic performance. This is why since independence in the 1960s, the structural transformation of economies through industrialization has been at the heart of the policies of WAEMU countries, like other countries in Sub-Saharan Africa (Boly and Kéré, 2017). Industrialization by import substitution was the most applied strategy in several countries, especially those with agriculture as

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the dominant sector. With the structural adjustment policies (SAP) of the early 1980s and the primacy of short-term macroeconomic balances over development planning processes, the notion of industrialization was gradually perceived as obsolete. But the experience of Britain, North America and Australia in the 19th century, of Japan and East Asia in the early 20th century and of India and China in the second half of the 20th century had already shown that industrialization was important for the economic take-off so sought by developing countries (DCs). This is how industrialization has returned since the mid-2000s as a major theme in all programs aimed at the emergence of African countries established by international institutions such as the African Development Bank (AfDB), the Economic Commission for Africa (ECA), the United Nations Conference on Trade and Development (UNCTAD) and the United Nations Industrial Development Organization (UNIDO) (Jacquemot, 2018). The African Union Agenda 2063 also highlights the importance of industrialization of African countries.

In fact, development economists recognize that the transition from a low-income country to a high-income country is conditioned by a process of industrialization because the latter modifies the economic structure towards modern economic activities. Also, industrialization is a source of positive externalities for other sectors and therefore makes it possible to increase the potential growth of the economy as a whole and therefore facilitates economic development (Goujon and Kafando, 2012). It is even econometrically confirmed that growth in manufacturing production (the main indicator of industrial production) is associated with an acceleration in economic growth (Kaldor, 1967; UN, 1970 and Szirmai and Verspagen, 2015). This is why Sawadogo (2020) affirms that improving the level of industrialization (notably that of manufacturing industries) makes it possible to achieve the structural transformation of the economies of developing countries and facilitates the reduction of poverty and inequalities.

However, African countries, particularly those in WAEMU, have remained relatively isolated from the industrialization process (particularly in the manufacturing sector). Certainly, investment in industry requires enough financing, but the WAEMU countries resorted to external borrowing after independence because of their financing needs which were greater than their internal financing capacity and they are still remained under-industrialized because this financing was not intended for industrialization. Moreover, the massive recourse to external financing, like other developing countries, had led them into an external debt crisis. According to Stiglitz (2017), the SAPs imposed in the 1980s on developing countries (following the external debt crisis) led to the closure of several manufacturing industries one after the other and therefore discouraged industrial development and slowed down growth.

Thus, in the WAEMU region, we see a sharp decline in the share of manufacturing industry value added in GDP between 2000 and 2020 (Figure 1). Figure 1 also indicates that the decline in the share of manufacturing industry value added decreased slightly between 2006 and 2020. Indeed, manufacturing value added fell from 14.64% of GDP in 2000 to 12.82 % of GDP in 2006 (with an average annual decline rate of 1.43%) then to 10.62% of GDP in 2020 (with an average annual decline rate of 1.33% between 2006-2020). This difference in decline is due to the fact that the majority of WAEMU countries had a stationary trend in their manufacturing added value between 2006 and 2020. In addition to this situation of lower industrial performance, the WAEMU area is one of the zones the least industrialized in the world, as shown in Figure 2.

Thus, faced with the persistent poor performance of the manufacturing industry in the WAEMU countries, the desire to industrialize makes the following question legitimate: What are the determining factors of the manufacturing production in the WAEMU countries?

We choose manufacturing value added as the industrial production variable because it is found in recent research that increasing manufacturing value added has a particularly higher poverty reduction effect, and more particularly compared to the mining/oil sector which occupies a preponderant place in many African economies (Cadot et al. 2015). Also, it makes it possible to understand the industrial production capacity of economies by including the capacity to satisfy internal demand and offers the greatest opportunities in terms of sustainable growth and jobs.

In the review of previous work, several determining factors of industrial production were identified. The source factors for the development of the manufacturing industry are local competition, trade openness rate (TO), foreign direct investment (FDI), human capital, total factor productivity, population size, long-term agricultural sector, currency appreciation, good governance, secondary education, cultivable land, domestic credit to the private sector, infrastructure/technology, consumption of public sector goods and services, financial development, the size of the domestic market, the real effective exchange rate, aggregate domestic consumption expenditure, Gross Fixed Capital Formation (GFCF) and technological innovation (Gao, 2004; Ilias et al., 2010; Diarra , 2014; Mijiyawa, 2017; Anyanwu, 2017; Diop et al., 2018; Guillaumont Jeanneney and Hua, 2018; Ahmad et al., 2020; Ouinsou and Chabossou, 2021; Effiom and Uche, 2022; Kingué Moudoute et al., 2023). As for the obstacles to industrial production, they are the level of investments, arable land, the share of mining production, dependence on age (old or young), the effective exchange rate, labor market conditions , private investment, infrastructure, long-term currency appreciation, short-term export, imports (especially manufactured goods), TO, real bilateral exchange rate of SSA/China countries, quality regulation, rule of law, control of short and long term corruption and rainfall (Ilias et al., 2010; Dabla-Norris et al., 2013; Sammouel and Aram, 2016; Ongo Nkoa, 2016; Kutu and Ngalawa, 2016; Guillaumont Jeanneney and Hua, 2018; Effiom and Uche, 2022; Naute and Tregenna, 2023).

We can therefore see that the effects of the exchange rate and trade openness on the manufacturing industry are ambiguous. Then, to our knowledge, very few studies have taken into account the role of public debt in industrialization even though it could have effects on industrial production. Indeed, within the framework of the debt conversion program in Nigeria which aimed to reduce the weight of the external debt by reducing the service of the external debt, the results of the study by Ngereboa (2012) indicate that this program has contributed to industrializing Nigeria, even more than the credit of the banking system allocated to industrialization. Also, Ventura and Voth (2015) demonstrated through statistical analyzes and a calibration model that external financing contributed somewhat to the British industrial revolution of the 18th century, which accelerated structural change by making of the United Kingdom, which is rapidly becoming the most industrialized. Then recently, the study by Fogang and Tchitchoua (2020) on a sample of 10 African countries in the franc zone (including the WAEMU

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countries except Senegal and Togo) over the period 1996-2017 initially reveals that at a level of external debt below a threshold of 58.91% of GDP, its impact on industrialization is not significant but beyond this threshold, the impact becomes negative. Secondly, the results show that by dividing the period into two (1996-2006 and 2007-2017), we find that before 2006, external debt was an asset for industrialization but afterward, it gave way to domestic credit. Therefore, external debt has become obsolete after reaching the completion point of the Initiative for Heavily Indebted Poor Countries (HIPC), and would be a danger for the industrialization of the franc zone in the event of excess.

Thus, the objective of this article is to analyze the determining factors of the industrial production of the manufacturing sector of WAEMU countries over the period of 2006-2020. Unlike the work already carried out, we take into account the external and internal public debt of the WAEMU. This study period is chosen because of the evolution of certain variables. Indeed, deindustrialization has slowed since 2006, then after having benefited from the relief of their external debts within the framework of the HIPC and the MDRI, the majority of WAEMU countries have been getting back into debt since 2006. Also, the choice of this period makes it possible to take into account the control of transparency, responsibility and corruption, the data of which have been calculated by the World Bank since 2005.

In this research work, the added value of production in the manufacturing industry is chosen as an indicator of industrial production. The importance of this indicator is that it makes it possible to understand the industrial production capacity of economies by including the capacity to be able to satisfy internal demand. Industrialization can be defined as the multiplication of industrial activities and the transformation of production processes through the use of machines (Bikoué, 2010) or quite simply the development of industrial activities in an economy. However, Kingué Moudouté et al. (2023) consider industrialization like the process of manufactured products using techniques allowing high labor productivity while grouping workers in constant infrastructures with fixed schedules and strict regulations.

The interest of this research work is that it will contribute to theoretical debates and enrich the empirical literature on the industrialization of developing countries by proposing economic policies for industrialization to WAEMU countries in particular. Above all, it will make it possible to assess the impact of external and internal public debt in the current context of strong growth in public debt.

The article is organized as follows: A first section presents some stylized facts on the industrial production of WAEMU countries. A second section summarizes theoretical and empirical studies that deal with the determinants of industrial production. In a third section, the study method is developed. In this section, we first define the study variables, then we define the models and finally, we develop the estimation method which is the generalized least squares (GLS) method and the generalized method of moments in system (SGMM) for the sake of robustness. Finally, in a fourth and final section, the results are discussed and economic implications are formulated.

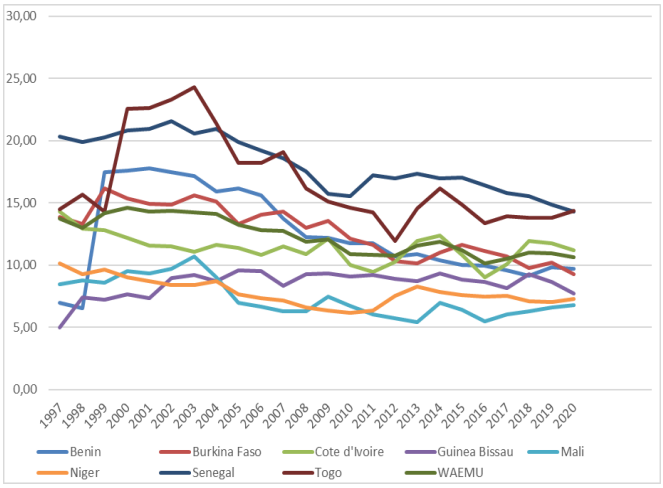
1. Stylized facts on industrial production in the WAEMU area

Following independence in 1960, the precarious conditions of the economies led African countries to move towards promoting industrialization through aid flows. Indeed, according to these countries, the change in their conditions necessarily had to go through the development of industry (particularly manufacturing) following the example of the countries which have benefited and continue to benefit from an industrial boom and are becoming increasingly developed countries today. These are South Korea, Singapore, Hong Kong, Taiwan, China, India, Malaysia and many others. To achieve this goal, most African countries have adopted import substitution as a model to protect local businesses from foreign competition. Unlike other countries which have strong economic growth and a high level of development, the WAEMU countries, like other African countries, have never achieved a significant level of growth. In fact, the growth of African countries depends largely on exports of raw materials while the growth of other countries has been driven by a structural transformation based on a solid industrialization program (Kriaa et al. 2017).

After the failure of the import substitution policy, monetary institutions such as the World Bank and the International Monetary Fund (IMF) recommended SAPs to developing countries (DCs) in the 1980s. The main objective of SAPs being to make budgetary balances sustainable, one of the methods used was to reduce the role of the State in the industrialization process in favor of markets to create an environment favorable to the development of the private sector. However, the results turned out to be negative and this led to the closure of several manufacturing industries (Stiglitz, 2017), thus leading to a drop in manufacturing added value in developing countries in general and in the WAEMU region in particular. Which proves that the withdrawal of state support was done without taking into account the capacities of local businesses; they were therefore exposed to foreign competition at a time when they were not ready.

The following figure describes the evolution of the added value of the manufacturing industry between 1997 and 2020.

Figure 1 : Evolution of manufacturing added value by country



Source: Authors based on CBWAS data

The figure 1 indicates that over the entire period 1997-2020, the added value of the manufacturing industry remained very low in the area (less than 25% of GDP), thus reflecting a situation of under-industrialization. In addition, the countries have a downward trend in their manufacturing added value except Guinea-Bissau. This means that overall, the total manufacturing value added of the WAEMU has a downward trend, thus reflecting deindustrialization. Comparatively, between 2006 and 2020, the least industrialized countries are Mali, Niger and Guinea-Bissau

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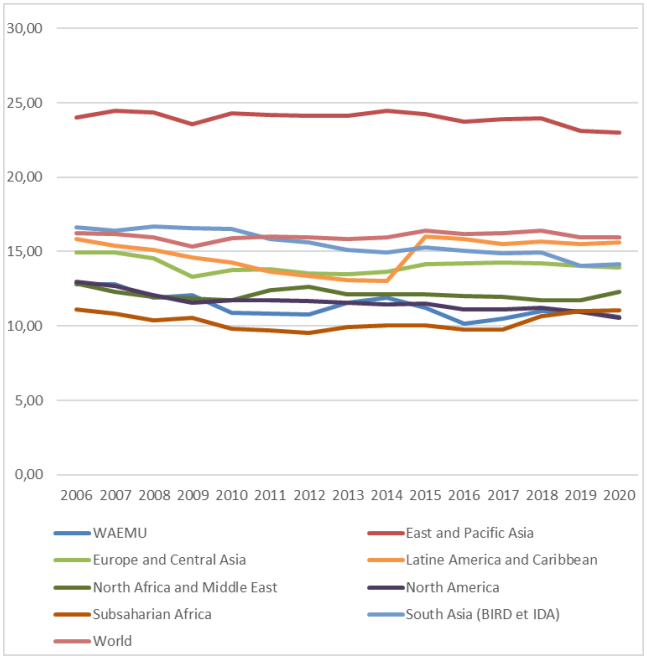
(with a manufacturing added value less than 10% of GDP) and the most industrialized are Senegal and Togo (with a manufacturing value added of between 12 and 19% of GDP). We can therefore say that the WAEMU countries, even though they are under-industrialized, are in the process of de-industrializing in recent years. This could be partly explained by the long-term effects of the structural adjustment programs of the 1980s; since the countries of the zone have seen several of their manufacturing industries close.

Within the framework of the SAPs, primacy was given to short-term macroeconomic balances over development planning processes, and this had caused the objective of development through industrialization to be abandoned. But from the 2000s, the WAEMU countries, like other African countries, have once again committed to industrialization, which represents the key to sustained growth. Indeed, industrialization has since become a major theme in all programs aimed at the emergence of African countries established by international institutions such as the African Development Bank (AfDB), the Economic Commission for Africa (ECA), the United Nations Conference on Trade and Development (UNCTAD) and the United Nations Industrial Development Organization (UNIDO) (Jacquemot, 2018). Also, the industrialization of African countries is at the heart of Agenda 2063 of the African Union.

However, WAEMU countries are still very far from other countries in terms of industrialization. Consider the following figure:

Figure 2 : Evolution of WAEMU manufacturing value added compared to other zones



Source: Authors based on data from CBWAS and WDI, 2023

The figure 2 tells us that the WAEMU area as well as all of Sub-Saharan Africa are among the least industrialized areas in the world between 2006 and 2020. Compared to the world average, a lot of effort needs to be made because the gap is very high. It also appears that the most industrialized area in the world is East and Pacific Asia.

2. Literature review

In previous work, it has been demonstrated since pioneering studies that industrialization in general and manufacturing value added (MVA) in particular play a more important role in economic growth compared to other sectors (Kaldor, 1967; UN , 1970 and Szirmai and Verspagen, 2015). For developing countries in particular, MVA constitutes a source of externality for other sectors by making it possible to achieve the structural transformation of these economies and facilitates the reduction of poverty and inequalities (Goujon and Kafando, 2012 and Sawadogo, 2020). Promoting industrialization is therefore interesting for these countries. Thus, in this section, we provide a brief summary of recent theoretical and empirical work that has dealt with the determining factors of industrialization (particularly MVA).

2.1. Theoretical determinants of industrial production

Theoretically, several factors can explain industrial production (notably VAM). Among these factors, we distinguish innovation, the exchange rate, foreign direct investment (FDI), trade openness, human capital and public debt.

Innovation and industrialization: Regarding innovation, it is considered an important factor in the structural transformation of economies (Schumpeter, 1939 and Lewis, 1954). It is in this vein that Nelson and Winter (1982) argue that companies possess a creative capacity which allows them to take initiatives to introduce changes in their environment. In this sense, the specific capacity of companies to have research departments or services for practicing research activities that lead to innovations can lead to industrial development. Also, companies have the ability to imitate other practices external to them to improve their situation.

More recently, Osakwe and Moussa (2017) consider that whatever the sources of innovations (the countries' own technological capacity or imitation), the importance of their role in the industrialization process of economies is undeniable. Indeed, not only do innovations improve the productivity of existing businesses, but they also promote the creation of new businesses.

Exchange rate and industrialization: For this point, it should be noted that exchange rate management would be considered as an instrument of structural change in economies. However, points of view differ. Indeed, some argue that the undervaluation of the currency leads to an increase in investment and savings and facilitates exports through the accumulation of capital in the tradable goods sector, including the manufacturing sector (Bhaduri and Marglin, 1990; Gala, 2008; Gala and Libanio, 2010). Furthermore, according to Schumpeter's "creative destruction", a real appreciation of the currency leads business leaders to close their least productive factories while, conversely, real depreciation is a means of allowing poorly performing production units to survive. Since a depreciation makes the prices of domestic goods (especially manufacturing production) lower compared to the prices of imported goods and thus making local companies more competitive. Thus, the undervaluation of the currency would make it possible to stimulate growth in the manufacturing sector by compensating for market failures and institutional failures to which this sector is particularly sensitive (Rodrik, 2008; McMillan and Rodrik, 2011). For Ibrahim and Amin (2005), the effects of exchange rate shocks on manufacturing production would be greater than on total production.

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However, others consider that currency overvaluation can, in certain circumstances, promote economic growth because it forces firms in the tradable goods sectors to innovate and increase their productivity by adopting more capital-intensive production (Porter, 1993; Harris, 2001). Also, Guillaumont Jeanneney and Hua (2011) argue that an appreciation of the currency is likely to increase the productivity of workers and business managers and reduce the cost of imported capital goods. Conversely, in countries or sectors where a large part of capital goods are imported (as is certainly the case in the manufacturing sectors in WAEMU), the depreciation of the currency could lead to a reduction in investment and capital accumulation (Elbadawi et al., 2011).

Foreign direct investment (FDI) and industrialization: After Bouoiyour and Toufik (2003) asserted that foreign companies are more productive and pay high wages, Shujie et al. (2006) concluded that FDI is a driver of production efficiency. This is therefore a source of economic growth for a newly industrialized economy to catch up with the most advanced countries (Kriaa et al., 2017). Indeed, less industrialized countries can benefit from skills development, technology transfer, management experience and integration into the value chains that accompany them. Particularly in Africa, the AfDB (2011) notes that the presence of Chinese FDI appears to play a catalytic role in growth as an industrial policy feature of the region.

Human capital and industrialization: At this level, the work of Lucas (1988) highlights the importance of human capital in increasing the productivity of work or labor. Recently, Buera and Kaboski (2012a,b) developed a model to show that the role of human capital growth or intensive service skills has a complementary mechanism with the importance of technology in explaining the 'industrialization. Indeed, through a qualified workforce adapted to technology, human capital allows manufacturing industries to move up the value chain of high-quality products and increase their productivity.

Commercial openness and industrialization: Since the old theories of international trade (notably the theory of absolute advantages of Smith (1776), the theory of comparative advantages of Ricardo (1817) and the theory of factor endowments known as Heckscher-Ohlin-Samuelson), trade openness is seen as an important factor for production. More recently, Matsuyama (2008) has argued that trade openness plays an important role in structural transformation.

Public debt and industrialization: The Chenery models maintain that when external debt is well managed, it provides external currencies which make it possible to import sufficient industrial inputs through an inflow of external capital; and thereby accelerating the pace of transition of recipient economies towards the targeted self-sustaining growth (Chenery and Bruno, 1962; Adelman and Chenery, 1966; Chenery and Strout, 1966 and Chenery and Eckstein, 1970). The import of industrial inputs therefore makes it possible to boost the industrial sector.

Beyond these theories, several empirical works have been carried out to analyze the determining factors of industrial production.

2.2. Empirical work

A large number of studies identify several determining factors of industrial production. The source factors for the development of the manufacturing industry include local competition, trade openness rate (TO), FDI, human capital, total factor productivity, population size, long-term agricultural sector, appreciation of currency, good governance, secondary education, cultivable land, domestic credit to the private sector, infrastructure/technology, consumption of public sector goods and services, financial development, size of the domestic market, real effective exchange rates, aggregate domestic consumption expenditure, GFCF and technological innovation (Gao, 2004; Ilias et al., 2010; Diarra, 2014; Mijiyawa, 2017; Anyanwu, 2017; Diop et al., 2018 ; Guillaumont Jeanneney and Hua, 2018; Ahmad et al., 2020; Ouinsou and Chabossou, 2021; Effiom and Uche, 2022; Kingue Moudoute et al., 2023).

As obstacles to industrial production, we distinguish in empirical work factors such as the level of investments (particularly private investment), arable land, the share of mining production, dependence on age (old or young), effective exchange rate, labor market conditions, infrastructure, long-term currency appreciation, short-term exports, imports (especially manufactured goods), TO, bilateral exchange rate reality of SSA/China countries, quality regulation, rule of law, control of corruption in the short and long term and rainfall (Ilias et al., 2010; Dabla-Norris et al., 2013; Sammouel and Aram, 2016; Ongo Nkoa, 2016; Kutu and Ngalawa, 2016; Guillaumont Jeanneney and Hua, 2018; Effiom and Uche, 2022; Naute and Tregenna, 2023).

For the work which took into account the WAEMU countries, the factors favorable to industrial development are TO, FDI, population size, agricultural sector in the long term, human capital, consumption of goods and services of the public sector, financial development, the size of the domestic market, the real effective exchange rate and the GFCF (Dabla-Norris et al., 2013; Diarra, 2014; Sammouel and Aram, 2016; Ongo Nkoa, 2016; Diop et al. al., 2018; Guillaumont Jeanneney and Hua 2018; Effiom and Uche, 2022). As for the obstacles to industrial production, we distinguish among others arable land, the share of mining production, dependence on age (old or young), the effective exchange rate, labor market conditions, investment private sector, infrastructure, imports (particularly of manufactured goods), the real bilateral exchange rate of SSA/China countries, TO, quality regulation, the rule of law, control of short-term and long-term corruption long term and rainfall (Dabla-Norris et al., 2013; Sammouel and Aram, 2016; Ongo Nkoa, 2016; Guillaumont Jeanneney and Hua, 2018; Ouinsou and Chabossou, 2021; Effiom and Uche, 2022 and Naute and Tregenna, 2023).

We therefore see a contradiction on the role of the TO and the exchange rate. Above all, we note that most empirical work which has dealt with the determining factors of industrial production has ignored the role of public debt. To our knowledge, very few have taken public debt into account even though it seems to have an influence on industrialization. To this end, Ngereboa (2012) conducted research within the framework of the debt conversion program in Nigeria which aimed to reduce the burden of external debt by reducing external debt service. The results, through Ordinary Lest Squares (OLS) regression, show that over the period 1988-2003, this external debt reduction program contributed to industrializing Nigeria and this more than the credit of the banking system allocated to industrialization. Also, Ventura and Voth (2015) demonstrate through statistical analyzes and a calibration model that external financing contributed somewhat to the British industrial revolution of the 18th century. This therefore accelerated structural change by making the United Kingdom rapidly the most industrialized. Then recently, Fogang and Tchitchoua (2020), looked at a sample of 10 African countries in the franc zone (including the WAEMU countries except Senegal and Togo) over

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the period 1996-2017. The first results over the entire period through a PSTR (Panel Smooth Threshold Regression) model show a non-linear impact of external debt on industrialization. Thus, for a level of external debt below a threshold of 58.91% of GDP, the impact is insignificant but beyond this threshold, the impact becomes negative. The second results show that by dividing the period in two (1996-2006 and 2007-2017) and using the methods of Generalized Least Squares (GLS) and SUR (Seemingly Unrelated Regressions) we find that before 2006, the external debt was an asset for industrialization but afterwards, it gave way to domestic credit. Thus, external debt became obsolete after reaching the HIPC completion point, and would be a danger for the industrialization of the franc zone in the event of excess.

Table 4 in Appendix presents a non-exhaustive summary of the empirical work. We therefore see that in the search for the determining factors of industrialization, most empirical studies have tended to ignore the role of public debt. Therefore, through our empirical analysis, we will attempt to overcome this weakness by taking into account public debt.

3. Methodology

The objective of this research is to analyze the determining factors of the manufacturing industry of WAEMU countries. In this section, we first present the variables and the data, then we define the models and finally, we present the estimation methods used.

3.1. Defining variables and data

In this research work, temporal data from 2006 to 2020 from the databases of the Central Bank of West African States (CBWAS), the World Bank (World Development Indicator, WDI) and the WAEMU commission are used. To measure the industrial performance of WAEMU countries, we prefer as a variable the added value of the manufacturing sector to the total added value of the industrial sector (the latter including manufacturing but extractive activities, the production and distribution of electricity, gas and water and construction). This indicator makes it possible to measure all the added value created by the manufacturing sector on products intended for internal or exported consumption. The importance of this indicator is that it makes it possible to understand the industrial production capacity of economies by including the capacity to be able to satisfy internal demand. It has also been noted in recent research that the increase in manufacturing added value has a particularly higher poverty reduction effect, and more particularly in relation to the mining/oil sector which occupies a preponderant place in many African economies (Cadot et al. 2015). Also, its data is available over the study period. We take it as a percentage of GDP in order to take into account its contribution to national wealth. The data is calculated from CBWAS data.

In this research, we use explanatory variables which are likely to explain the evolution of the added value of the manufacturing industry and from which we were able to obtain data over the entire study period for all countries. The details of the variables are as follows:

Credit provided to the private sector as a percentage of GDP (credit). Credit constitutes a means of financing for private companies. This therefore stimulates local production. The expected sign is positive. Data is obtained from the World Development Indicators (WDI, 2023).

Total, external and domestic public debt as a percentage of GDP (respectively **td, ed and dd).** Public debt can crowd out investment in manufacturing by reducing the funds available to the private sector and leading to tax increases. Also, public borrowing in WAEMU countries, for the most part, is not oriented towards the manufacturing sector. The expected signs are therefore negative. The data is obtained from the annex of the semi-annual execution report of multilateral surveillance of December 2020 of the WAEMU commission.

Growth rate of real GDP per capita (GDP). The data is obtained from the CBWAS database. Income growth leads to the development of domestic demand and the efficiency of economic activities; what drives industrialization. The expected sign is therefore positive.

Trade opening rate (TO). It is the sum of imports and exports as a % of GDP. The data is calculated from the CBWAS database. Trade openness facilitates the exchange of sophisticated capital goods necessary for the production of industrial goods. The expected sign is therefore positive.

Control of corruption (corr). This is the EPIN ranking of transparency, accountability and corruption in the public sector (1=low and 6=high). Source: WDI, 2023. Indeed, good governance can improve the business climate and stimulate the spirit of entrepreneurship. The expected sign is therefore positive.

Foreign direct investments (FDI) (Source: WDI, 2023). Generally speaking, FDI boosts the manufacturing industry; since inbound FDI constitutes the path to industrial development for host countries through technology transfer. The expected sign is therefore positive.

Total investments, public and private (inv, inpu and inpr). They are measured by Gross Fixed Capital Formation (total, public and private respectively) as a % of GDP (Source: CBWAS, 2023). They generally consist of production infrastructures and can support the industrialization process. The expected sign is therefore positive.

Population growth rate (pop) (Source: CBWAS, 2023). The population constitutes a consumer base for manufacturing production and also a workforce. The expected sign is therefore positive.

Official exchange rate (exch) (Source: WDI, 2023). A currency depreciation makes the prices of domestic manufacturing goods lower relative to the prices of imported goods, thereby making local businesses more competitive. The expected sign is therefore negative.

3.2. Definition of models

The various theoretical and empirical works have shown that it is obvious that public debt has an impact on industrialization (in particular on manufacturing value added). For this article, we start from an extension of the neoclassical model on the hypothesis of a Cobb-Douglas type production function with two production factors:

$$manuf_{i,t} = F(K_{i,t}, L_{i,t}) = A_{i,t}{K_{i,t}}^{\alpha}{L_{i,t}}^{\beta}$$

$manuf_{i,t}$, $A_{i,t}$, $K_{i,t}$, et $L_{i,t}$ represent respectively the manufacturing value added, the total factor productivity, the stock of physical capital and the total workforce, relative to country i in year t; as for the parameters α and β, they refer directly, according to the hypothesis of constant returns to scale (1 = β + α), to the statistics

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of the distribution of value added between wages (remuneration of labor) and profit (return on capital).

Then, we generalize this model like Fogang and Tchitchoua (2020) (but taking into account other variables) as follows: $manuf = f(credit, touv, tch, pop, pibr, ide, corr, inv, d)$

d is public debt which can be internal, external or total.

3.3. Estimation methods

Preliminary tests show that the residuals are autocorrelated at order 1 and 2 (Appendix 2) and heteroskedastic (Appendix 3). The ordinary least squares (OLS) estimators are therefore biased and no longer have minimum variance. In this case they are not effective. The BLUE estimators are then those of generalized least squares (GLS) and instrumental variables (IV). We therefore first estimate the models using the GLS estimator.

However, for the sake of robustness, we estimate the models also through the generalized method of moments estimator (GMM) because it combines the generalized least squares (GLS) method with that of IVs taking into account endogeneity. This approach is also suitable for short panels.

But, there are two GMM estimators, namely the GMM in difference (DGMM) proposed by Arellano and Bond (1991) and the system GMM (SGMM). The SGMM is an extension of the DGMM proposed by Arellano and Bover (1995) and Blundell and Blond (1998). The consistency of the DGMM estimator is based on two hypotheses: (i) the absence of second-order autocorrelation of the residuals and (ii) the validity of the instruments used. In addition, this estimator transforms the first difference model in order to remove individual effects and estimate the first difference equation using instrumental variable techniques. This differentiation of the equation in level therefore eliminates inter-country variations and only takes into account intra-country variations.

It is to overcome this difficulty that Arellano and Bover (1995) and Blundell and Blond (1998) successively proposed as a solution the SGMM estimator which concerns the simultaneous estimation of the first difference equation associated with the equation in level. This estimator is much more efficient than the difference estimator. We therefore retain it in our study as a reference estimator for the robustness test.

4. Results and implications of economic policies

In this section, the aim is to present and discuss the results with a view to drawing economic policy proposals.

4.1. Results

4.1.1. Generalized least squares (GLS) estimates

The estimation of the GLS model in table 5 indicates R^2 between 0.95 and 0.97; which means that more than 95% of the fluctuations in the value added of the manufacturing industry in the WAEMU zone are explained by the variables of the models. The probabilities of the Fisher statistic are below the 5% threshold; the models are therefore globally significant.

4.1.2. Search for robustness

To ensure the robustness of the results taking into account endogeneity, we carry out the estimation using the system generalized method of moments (SGMM).

The estimation of the GLS and SGMM model (table 6) gives close results for the majority of variables. The SGMM estimate indicates R^2 between 0.92 and 0.93; which means that more than 92% of the fluctuations in the value added of the manufacturing industry in the WAEMU zone are explained by the variables of the models. The robust results can therefore be discussed.

4.2. Discussion and economic politics implications

After the robustness test, the results suggest that the determining factors of manufacturing value added are public debt (total, external and domestic), control of corruption, credit to the private sector, the rate of commercial openness and the population growth rate.

Public debt and the control of transparency, accountability and corruption in the public sector: Regarding total debt, the results indicate that its accumulation leads to growth in the added value of the manufacturing industry of the countries of WAEMU. Further, the results indicate that external public debt has a positive effect while domestic debt has a negative effect on manufacturing value added. Indeed, external debt makes it possible to import industrial inputs which make it possible to support manufacturing industries (according to Chenery's models). As for domestic debt, its accumulation reduces the production efficiency of manufacturing industries through the reduction of their investment funds. The positive effect of external debt corroborates with Fogang and Tchitchoua (2020) who find a positive effect over the period 1996-2006 for a sample of 10 franc zone countries (taking into account six WAEMU countries). External debt is therefore preferable to internal debt for the industrialization of WAEMU countries.

The results also indicate that the control of transparency, accountability and corruption in the public sector has a direct negative effect on manufacturing production and also negatively influences the impact of different types of debt on manufacturing production. This may be because monitoring of transparency, accountability and corruption in the public sector is very weak in WAEMU countries. With this low level of control, public debt cannot be optimally managed and this is not profitable for manufacturing industries.

It would therefore be better for WAEMU countries to direct a large part of the external debt towards the development of the manufacturing industry and to reduce the accumulation of internal debt in order to boost manufacturing production. Also, more rigor will be required in monitoring transparency, accountability and corruption in the public sector to achieve a high score. Strong control will therefore stimulate investment of public debt in more productive sectors.

Credit to the private sector: It has a negative effect on manufacturing value added. This means that credit granted to the private sector is invested in other sectors to the detriment of the manufacturing sector. This result is in contradiction with those found by Fogang and Tchitchoua (2020) over the period 2007-2017 and also Anyanwu (2017) for the case of North African countries over the period 1990-2014. Therefore, to boost industrialization in WAEMU countries, private promoters must also invest by directing part of their credit into the manufacturing industry. It is also up to the various governments to create favorable environments for them.

Trade openness rate: It has a negative effect on manufacturing value added; since it allows a massive entry of manufacturing products that are more competitive compared to local

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manufacturing products. This therefore discourages local manufacturing production. This result corroborates with Diop et al. (2018) for the particular case of Senegal over the period 1980-2015 and also Ouinsou and Chabossou (2021) for Sub-Saharan Africa over the period 1991-2018. Therefore, an improvement in trade policies would be important for WAEMU countries to boost production in manufacturing industries. It will also be necessary to encourage local consumption by encouraging the adoption of more modern means of production with a view to reducing the cost of manufacturing production to make local industries more competitive.

Population growth rate: Regarding the population growth rate, it positively influences manufacturing value added. Indeed, the population is a large consumer of manufactured products. This corroborates with several results, notably those of Dabla-Norris et al. (2013) who took into account the WAEMU countries except Cote d'Ivoire over the period 1970-2010, Ongo Nkoa (2016) who took into account all the WAEMU countries over the period 1975-2014 and also Anyanwu (2017) for the case of North African countries over the period 1990-2014. It will therefore be necessary to encourage the population to consume local products.

Conclusion

Industrialization has returned as a worrying issue for African countries in general and WAEMU countries in particular. Reason why the programs of international institutions aimed at the emergence of African countries retain it as a major factor. For WAEMU countries in particular, it is important to know the factors that can boost industrial production and those that slow it down. The objective of this article was therefore to analyze the determining factors of the manufacturing industry in WAEMU countries. To achieve this objective, panel data from the WAEMU commission reports, the CBWAS database and the World Bank were estimated by the GLS estimator and also by the SGMM estimator for the sake of robustness. The value added of the manufacturing industry was used as an indicator in this research due to its relevance and the availability of data over the study period.

The results reveal that the source factors of industrial production are external debt and the population growth rate and that the factors that hinder industrial production are domestic debt, credit to the private sector, the rate of trade openness and the weak control of transparency, accountability and corruption in the public sector.

In view of these results, the economic policy perspectives which are suitable for the industrialization of the WAEMU countries are the reduction of the accumulation of internal public debt, the investment of a large part of the external debt and the credit to the private sector in industrialization, adoption of better trade policies and greater enforcement in controlling transparency, accountability and corruption in the public sector.

However, like any other research work, this work has limitations. A first limitation of this work is the diversity of data sources. A second limitation is the fact of grouping the countries. This can hide realities specific to each country. It may therefore be possible to carry out further research by country and over longer periods.

Appendix

a) Normality tests

The assumption of normality of the error terms specifies the statistical distribution of the estimators. It is therefore, thanks to this hypothesis that statistical inference can be carried out. This test is carried out using the Jarque-Bera statistic and follows a chi-square law with two degrees of freedom at the 5% threshold equal to 5.99.

Table 1: Normality tests

Model	**Jarque-Bera Statistics**	**Prob**
Model (1)	2253.037	0.0000
Model (2)	2242.230	0.0000
Model (3)	2402.511	0.0000
Model (4)	2573.163	0.0000
Model (5)	3699.877	0.0000
Model (6)	2229.389	0.0000
Model (7)	2160.378	0.0000
Model (8)	2025.710	0.0000
Model (9)	2131.545	0.0000
Model (10)	2384.974	0.0000
Model (11)	2203.051	0.0000
Model (12)	2338.874	0.0000

Source : Authors's calculations

The table 1 indicates that the residuals are normal because the Jarque-Bera statistics are all greater than 5.99 with probabilities less than 5%, we therefore accept the hypothesis of normality of the residuals.

a) Autocorrelation test

The appropriate estimation method depends on a possible error dependence. We use the LM autocorrelation test, which is to test the non-autocorrelation nature of the errors. The null hypothesis is that there is no autocorrelation versus the alternative hypothesis of the existence of autocorrelation. The test results are:

Table 2: Error autocorrelation test

Model	**Lag**	**LM-Stat**	**Prob**
Model (1)	1 à 2	345.169	0.000
Model (2)	1 à 2	315.108	0.000
Model (3)	1 à 2	377.960	0.000
Model (4)	1 à 2	401.648	0.000
Model (5)	1 à 2	379.518	0.000
Model (6)	1 à 2	498.687	0.000
Model (7)	1 à 2	400.345	0.000
Model (8)	1 à 2	425.040	0.000
Model (9)	1 à 2	429.391	0.000
Model (10)	1 à 2	376.562	0.000
Model (11)	1 à 2	431.713	0.000
Model (12)	1 à 2	457.917	0.000

Source : Authors's calculations

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The table 2 indicates that there is an autocorrelation at order 1 and 2 of the residuals at the 5% threshold because the LM-Stat probabilities are less than 0.05.

a) Heteroscedasticity test (White test)

The general idea of this test is to check if the square of the residuals can be explained by the model variables and also to identify a misspecification of the model. One of the main assumptions of linear models is the assumption of homoscedasticity, that is, that the residuals or error terms of the model have the same variance.

Table 3: Heteroscedasticity test

Model	**Chi-sq**	**df**	**Prob**
Model (1)	4028.580	3575	0.0000
Model (2)	4013.080	3575	0.0000
Model (3)	4062.926	3575	0.0000
Model (4)	5477.600	5082	0.0000
Model (5)	5490.735	5016	0.0000
Model (6)	5493.322	5016	0.0000
Model (7)	5503.309	5016	0.0000
Model (8)	5429.056	5016	0.0000
Model (9)	5426.613	5016	0.0000
Model (10)	5437.634	5016	0.0000
Model (11)	5456.095	5016	0.0000
Model (12)	5457.375	5016	0.0000

Source : Authors' calculations

We see from the table 3 that the probability values of the Xhi-square statistics are less than 0.05, so there is a presence of heteroscedasticity.

Table 4: Summary of some recent empirical work

Authors (date)	**Countries or areas**	**Methods/Periods**	**Results**
Gao (2004)	Chinese provinces	Instrumentales variables (IV)/ 1985-1993	**Positive effect**: Local competition, exports and FDI.
Bouoiyour and Toufik (2007)	18 Moroccan manufacturing sectors	OLS and GLS/1987-1996	**Positive effect**: FDI, TO and human capital.
Zhao and Zhang (2010)	China	OLS/ 2001-2006	**Positive effect**: FDI.
Ilias et al. (2010)	Pakistan	Autoregressive distributed lag (ARDL)/ 1965-2007	**Negative effect:** level of investment. **Positive effect:** total factor productivity.
Dabla-Norris et al. (2013)	168 countries (including WAEMU countries except Cote d'Ivoire)	Linear and quantile regression methods/1970-2010	**Negative effect:** arable land, share of mining production, dependence on age (old or young) and the square of GDP/capita. **Positive effect:** FDI, population size and TO and GDP/capita.
Diarra (2014)	Burkina Faso	ARDL / 1960-2011	**Positive effect**: agricultural sector in the long term.
Sammouel and Aram (2016)	35 African countries (including WAEMU countries execpt Benin)	GMM/ 1970-2012	**Negative effect:** effective exchange rate, labor market conditions and imports. **Positive effect:** human capital, GDP/capita and exports.
Ongo Nkoa (2016)	53 African countries (including WAEMU)	SGMM/1975-2014	**Negative effect:** private investment and infrastructure. **Positive effect:** FDI, human capital, population size, TO and GDP/capita.
Kutu and Ngalawa (2016)	Brasil, Russia, India, China and South Africa (BRICS)	ARDL/ 1994:01-2013:12 (monthly data)	**Negative effect**: currency appreciation (long term); then import and export (in the short term). **Positive effect**: capital, labor and income/head (long term); then exchange rate (short term).
Mijiyawa (2017)	53 African countries	GMM/ 1995-2014	**Negative effect**: size of the domestic market and the square of GDP/capita. **Positive effect**: good governance, low level of corruption, depreciation of the exchange rate and GDP/capita.
Anyanwu (2017)	5 North African countries (Libya,	Fixed effects model and instrumental variables	**Negative effect**: dependence on oil, minerals and natural gas rents, domestic investment rate, political globalization, institutionalized

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	Egypt, Tunisia, Morocco and Algeria)	method/1990-2014	democracy, age dependency ratio (young) and civil violence. **Positive effect**: secondary education, cultivable land, domestic credit to the private sector, TOUV, FDI, population and infrastructure/technology.
Diop et al. (2018)	Senegal	ARDL / 1980-2015	**Negative effect**: terms of trade, TO, overvaluation and undervaluation of the currency. **Positive effect**: consumption of public sector goods and services.
Guillaumont Jeanneney and Hua (2018)	40 Sub-Saharan African countries (including WAEMU)	SGMM/ 2000-2015	**Negative effect**: import of manufactured goods and real bilateral exchange rate of SSA/China countries. **Positive effect**: governance, financial development, domestic market size, real effective exchange rates of SSA countries and infrastructure.
Ahmad et al. (2020)	Sud Afrique	Nonlinear ARDL model/ 1980-2014	**Positive effect**: aggregate domestic consumption expenditure and technological innovation.
Ouinsou and Chabossou (2021)	Sub-Saharan African countries	SGMM/ 1991-2018	**Negative effect**: TO. **Positive effect**: innovation and FDI.
Effiom and Uche (2022)	30 Sub-Saharan African countries (including WAEMU countries except Guinea-Bissau)	PMG-ARDL (*Pool Mean Group Panel Autoregressive Distributed Lag*) and AMG (*Augmented Mean Group*)/ 2007-2019	**Negative effect**: regulation of quality, rule of law and control of corruption in the short and long term. **Positive effect**: GFCF and government efficiency in the short and long term.
Naute and Tregenna (2023)	18 African countries	GLS/1965-2018	**Negative effect**: precipitation (rainfall) and GDP/head squared. **Positive effect**: GDP/capita.
Kingue Moudoute et al. (2023)	Economic and Monetary Community of Central Africa	GMM/ 2006-2019	**Negative effect**: Domestic investment (GFCF). **Positive effect**: TO, infrastructure, human capital and FDI.

Table 5: Estimates of models using Generalized Least Squares

Model	(1)	(2)	(3)	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
credit	-0.05*** (-3.63)	-0.04*** (-2.90)	-0.07*** (-5.11)	-0.06*** (-4.82)	-0.05*** (-3.52)	-0.05*** (-3.03)	-0.04*** (-2.92)	-0.02 (-1.04)	-0.04** (-2.51)	-0.03 (-1.57)	-0.06*** (-4.56)	-0.07*** (-4.52)
touv	-0.02*** (-5.36)	-0.03*** (-6.31)	-0.007** (-1.99)	-0.01*** (-3.31)	-0.02*** (-4.78)	-0.02*** (-5.24)	-0.03*** (-7.43)	-0.03*** (-4.28)	-0.04*** (-7.59)	-0.04*** (-7.04)	-0.01*** (-4.25)	-0.01*** (-3.68)
tch	-0.001 (-1.37)	-0.001 (-1.05)	0.001 (1.31)	0.001 (1.49)	-0.001 (-1.47)	-0.001 (-1.35)	-0.001* (-1.87)	-0.001 (-0.97)	-0.002** (-2.29)	-0.003** (-2.04)	0.0006 (0.55)	-0.0003 (-0.33)
pop	2.99*** (5.42)	2.95*** (4.75)	2.38*** (4.80)	2.43*** (4.70)	2.79*** (4.46)	0.13 (0.03)	2.88*** (5.53)	2.65*** (3.69)	2.80*** (4.47)	3.08*** (4.37)	2.14*** (3.74)	1.43** (2.41)
pibr	0.03** (2.07)	0.04** (2.48)	-0.006 (-0.52)	-0.001 (-0.13)	0.05 (1.57)	0.03* (1.97)	0.01 (1.21)	0.0002 (0.01)	0.02 (1.34)	0.02 (1.47)	-0.01 (-1.37)	-0.02** (-2.09)
ide	0.03 (1.17)	0.04 (1.44)	-0.01 (-0.82)	-0.003 (-0.12)	0.02 (1.10)	0.02 (0.96)	-0.04** (-2.14)	-0.04 (-1.64)	-0.02 (-1.07)	-0.00 (-1.01)	-0.07*** (-3.68)	-0.07*** (-3.60)
corr	-0.41* (-1.88)	-0.46** (-2.32)	-0.03 (-0.49)	-0.66*** (-3.97)	-0.36 (-1.59)	-0.37* (-1.66)	-0.58*** (-3.53)	1.05** (2.37)	-0.61*** (-3.47)	-0.08 (-0.22)	0.006 (0.03)	0.57*** (2.71)
pibr_sqr					-0.003 (-1.25)							
pop_sqr						0.45 (0.65)						

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inv	-0.09*** (-5.87)	-0.09*** (-5.91)	-0.07*** (-4.93)		-0.08*** (-5.07)	-0.09*** (-5.88)						
inpu				-0.13*** (-7.58)			0.05*** (2.82)	-0.07*** (-3.28)	0.004 (0.21)	-0.07*** (-3.86)	-0.07*** (-3.58)	-0.07*** (-4.81)
inpr				-0.08*** (-6.00)								
dt	0.01*** (3.08)			0.01*** (5.18)	0.009** (2.61)	0.01*** (3.12)	0.02*** (7.10)	0.11*** (3.66)				
dt*corr								-0.04*** (-3.44)				
dt*inpu							-0.003*** (-8.11)					
de		0.01*** (4.78)							0.03*** (6.91)	0.07* (1.90)		
de*corr										-0.02 (-1.36)		
de*inpu									-0.004*** (-4.58)			
di			-0.03*** (-4.60)								-0.03** (-2.59)	0.05** (2.02)
di*corr												-0.03*** (-3.74)
di*inpu											-0.0005 (-1.35)	
Cons	8.05*** (5.07)	8.40*** (4.72)	6.91*** (4.94)	8.08*** (4.78)	8.44*** (5.12)	12.22* (1.92)	7.31*** (4.71)	4.02 (1.55)	8.59*** (4.78)	7.09*** (2.75)	7.72*** (4.64)	8.49*** (5.16)
Obs	120	120	120	120	120	120	120	120	120	120	120	120
Nbr de pays	8	8	8	8	8	8	8	8	8	8	8	8
R^2	0.95	0.95	0.95	0.97	0.95	0.95	0.96	0.96	0.96	0.97	0.97	0.96
Prob F-stast	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note : *, **, * respectively indicate the significance of the coefficients of 10%, 5% and 1%. The values in parentheses are those of the student.**

Source: Authors's calculations

Table 6: Model estimates using GMMS

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
credit	-0.06** (-2.07)	-0.04 (-1.49)	-0.07*** (-2.84)	-0.06** (-2.11)	-0.05* (-1.96)	-0.06** (-2.01)	-0.05* (-1.92)	-0.04 (-1.39)	-0.04 (-1.58)	-0.02 (-0.84)	-0.08*** (-2.90)	-0.08*** (-3.05)
touv	-0.03** (-2.54)	-0.04*** (-3.25)	-0.01 (-0.95)	-0.03** (-2.59)	-0.03** (-2.55)	-0.03** (-2.53)	-0.03** (-2.60)	-0.03*** (-2.70)	-0.04*** (-3.44)	-0.04*** (-3.78)	-0.01 (-1.51)	-0.01 (-1.32)
tch	-0.004 (-1.48)	-0.004 (-1.63)	-0.001 (-0.36)	-0.004 (-1.44)	-0.004 (-1.56)	-0.004 (-1.47)	-0.003 (-1.24)	-0.001 (-0.55)	-0.004 (-1.61)	-0.004 (-1.55)	-0.001 (-0.64)	-0.0003 (-0.11)
pop	3.12** (2.55)	3.10*** (2.63)	2.39* (1.96)	3.17** (2.59)	3.15** (2.57)	3.68 (0.48)	3.07** (2.55)	2.19* (1.92)	3.08** (2.60)	3.04*** (2.67)	2.25* (1.87)	1.51 (1.22)

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pibr	0.04 (0.95)	0.05 (1.33)	-0.002 (-0.05)	0.04 (0.95)	0.09 (1.19)	0.04 (0.94)	0.04 (0.59)	0.01 (0.44)	0.03 (0.93)	0.03 (0.97)	-0.007 (-0.19)	-0.01 (-0.30)
ide	-0.03 (-1.17)	-0.02 (-0.47)	-0.06 (-1.22)	-0.02 (-0.52)	-0.01 (-0.30)	-0.01 (-0.34)	-0.05 (-1.17)	-0.03 (-0.84)	-0.05 (-1.20)	-0.03 (-0.78)	-0.08* (-1.78)	-0.08* (-1.88)
corr	-0.41* (-1.88)	-0.78** (-2.14)	-0.18 (-0.48)	-0.76* (-1.94)	-0.80** (-2.03)	-0.78* (-1.97)	-0.86** (-2.21)	1.83** (2.28)	-0.89** (-2.43)	-0.60 (-0.93)	-0.25 (-0.65)	0.60 (1.06)
pibr_sqr					-0.005 (-0.80)							
pop_sqr						-0.10 (-0.07)						
inv	-0.05 (-1.60)	-0.06* (-1.75)	-0.04 (-1.15)		-0.06* (-1.68)	-0.05 (-1.57)						
inpu				-0.10* (-1.77)			0.04 (0.46)	-0.05 (-1.04)	0.01 (0.13)	-0.04 (-0.86)	-0.08 (-0.94)	-0.07 (-1.46)
inpr				-0.05 (-1.43)								
dt	0.01** (2.02)			0.01* (1.84)	0.01** (2.04)	0.01** (2.01)	0.02** (2.27)	0.17*** (3.93)				
dt*corr								-0.06*** (-3.71)				
dt*inpu							-0.003 (-1.59)					
de		0.02*** (3.13)							0.03*** (2.74)	0.19*** (3.06)		
de*corr										-0.05*** (-2.71)		
de*inpu									-0.003 (-1.36)			
di			-0.03** (-2.12)								-0.04 (-1.23)	0.10 (1.43)
di*corr												-0.05** (-2.01)
di*inpu											-0.0001 (-0.04)	
Cons	9.93** (2.46)	10.18** (2.59)	8.67** (2.16)	10.09** (2.50)	10.0** (2.47)	9.17 (0.80)	9.0** (2.15)	3.10 (0.71)	9.79** (2.40)	5.55 (1.27)	9.84** (2.46)	8.65** (2.22)
Obs	120	120	120	120	120	120	120	120	120	120	120	120
Nbr de pays	8	8	8	8	8	8	8	8	8	8	8	8
R^2	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.92	0.93	0.92	0.92

Note : *, **, * respectively indicate the significance of the coefficients of 10%, 5% and 1%. The values in parentheses are those of the student.**

Source: Authors's calculations

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