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Does Financial Development Explain the Industrialization of Great Lakes Countries? A Multidimensional Approach

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Abstract

Purpose: The objective of this study is to analyze the effects of financial development on the industrialization of countries in the Great Lakes region. To this effect, we use data from secondary sources mainly from the World Bank databases covering the period 1985 to 2020.

Methodology: The methodology was based on the Feasible Generalized Least Squares and Autoregressive Distributed Lag model as an estimation technique.

Results: The results show that financial development through domestic credit granted to economies, negatively influences the industrialization of Great Lakes countries. This effect is true for the quality of institutional and the total rent of natural resources. In addition, the

rate of trade openness, human capital, and private investment have a positive and significant effect on the industrial process of the countries of the region under examination.

Unique Contribution to Theory, Policy and Practice: For the financial system to be sufficiently robust and contribute to the process of industrialisation in the region, it is necessary to strengthen positive financial sector reforms appropriately, improve the business climate to enhance private sector participation in industrial transformation, strengthen the accountability and effectiveness of governments in the region and, most importantly, mitigate the effects of war by ensuring long-term political stability to promote better governance structures for industrial development.

Keywords: *Financial development, Industrialization, Great Lakes Countries, CEPGL*

JEL Codes : C13, G20, N27, O14

1. Introduction

Recent decades have seen an increase in economic convergence due to the continued globalisation of economies, particularly in trade and financial flows, which have had a substantial impact on several economic factors. Economic development theories recognise industrialisation as an integral and fundamental part of the structural transformation of economies. Many economists and institutions still regard it as a prerequisite for increasing GDP per capita and improving people's livelihoods. In its report on industrialisation, the United Nations Industrial Development Organisation (UNIDO) stated that: "Industrialisation is an integral part of economic growth and development; few countries have developed without industries" (UNIDO, 2009). It is therefore considered a significant measure of modern economic growth and development.

According to World Bank statistics (2022), the structure of industrialisation of the Great Lakes region economies shows that these economies still have strong deficiencies and are lagging in terms of industrial and manufacturing transformation. Statically, and on average, the share of manufacturing value added in GDP (10.9%) remains below the African average in all the sub-periods considered. Its trend is also downward in Burundi (from 9.85% between 1985-1990 to 8.72% between 2015-2020) and Rwanda (from 13.25 to 7.70% in the same time intervals) with a significant growth in the Democratic Republic of Congo (from 7.03% between 1985 and 1990 to 18.71% between 2015 and 2020).

The share of industrial employment as a percentage of total employment, which is also considered in the literature as a measure of industrialisation (Ongo, 2016), is still not very significant, with only 4.41% in Rwanda, 2.69% in Burundi and 8.83% in DRC on average between 1985 and 2020. The region as a whole averages less than 5.31% of industrial employment as a percentage of total employment, with 80.81% of employment in

agriculture and 13.84% in the service sector (WDI, 2022). These facts point to the need for a massive shift of labour from agriculture to manufacturing and services to improve the industrial transformation process in the region.

Given this situation, it is natural to point out that good literature abounds to justify industrialisation as a pathway to economic development and growth. While the link between financial development and economic growth has long been the subject of intense scrutiny, little has been done to examine the link between financial development and industrial growth on a multidimensional level.

While previous studies attempt to reach a theoretical consensus on financial development and economic growth, it is more than interesting to examine in the same vein the path of industrialisation in the wake of financial development. This work will build on Schumpeter (1912) and the enormous body of academic work that has followed from the debate on financial intermediation and economic growth by Mckinnon (1973) and Shaw (1973). They argue that financial deepening and savings, increase investment and therefore have a positive impact on economic growth; our thesis is that this impact comes through investment in the industrial sector. The views of Robinson (1962) and Stiglitz (1994), who question the role of the financial system in promoting economic development, remain valid, as industrial growth also creates a demand for additional financial services, which in turn will lead to more developed financial sectors.

With regards to the above, we are tempted to ask ourselves what is the effect of financial development on industrialisation in the countries of the Great Lakes region? Following this question, the objective of our paper is then to examine the contribution of financial development indicators (captured mainly by domestic credit to the economy and stock market deepening) on industrialisation in the Great Lakes countries. Industrialisation is captured by manufacturing value added to GDP and by the weight of industrial employment in total employment. The central hypothesis is that financial development contributes to the industrialisation of the Great Lakes economies. The methodology used is based on the feasible generalized least squares method and a country-by-country analysis through the ARDL in terms of robustness.

This paper contributes to the empirical literature on financial development and industrialisation in Africa and more specifically in the Great Lakes region where this link is very poorly studied. The paper shows how financial development negatively explains industrialization in the countries of the region and shows why the results were found to challenge the optimistic view of this link in the particular economic-financial, political and institutional contexts of the region under study.

The rest of the article is organized as follows: section 2 presents some stylized facts of Industrialization, section 3 a critical review of previous works, section 4 presents the methodology while the 5th section presents and discusses the results and the last section concludes and proposes some policy recommendations.

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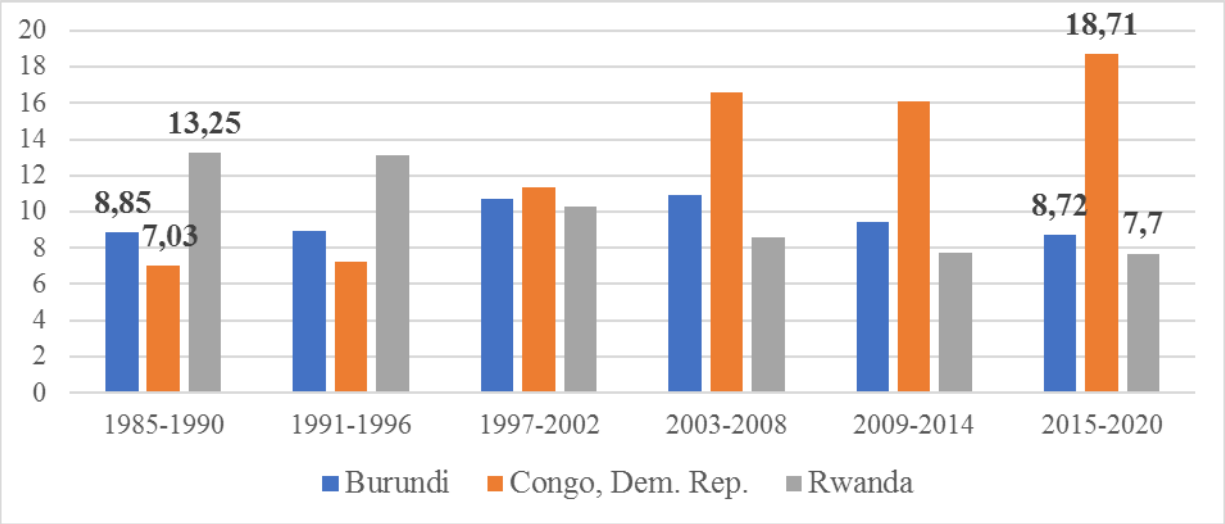
2. Industrialization of the Great Lakes countries: some stylized facts

2.1. Evolution of manufacturing value added as a percentage of GDP

The Great Lakes region today has many assets for successful manufacturing transformation. It has a priori close access to raw materials with the Democratic Republic of Congo, a giant in the region, reputed to be a geological scandal worldwide thanks to its enormous wealth of natural resources (an asset to the region's industrialisation). This includes timber, oil and gas, gold and diamonds, as well as minerals essential to the energy transition, such as cobalt, copper etc.

Figure 1: Evolution of manufacturing value added in % GDP (MVA)of the CEPGL countries

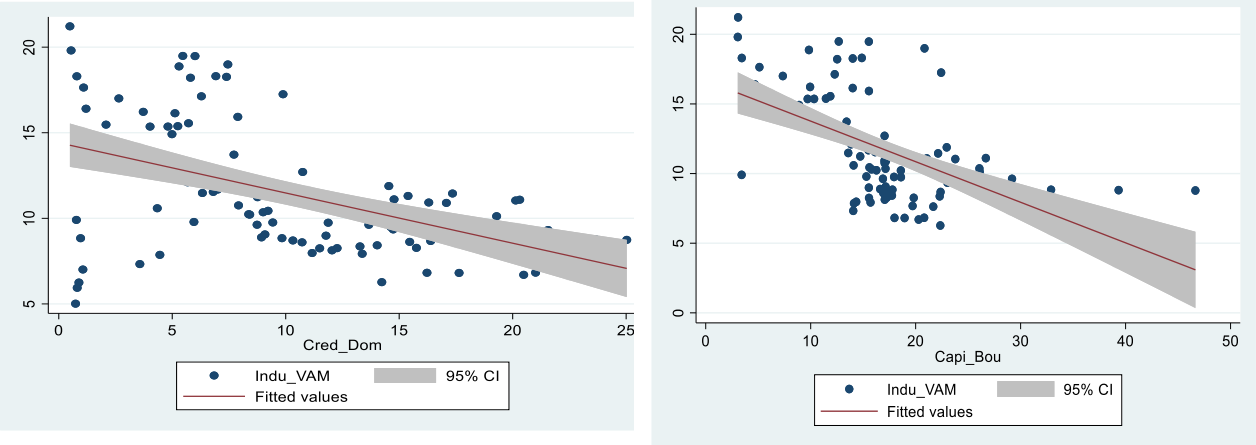


Source: Author's construction

The MVA in Burundi and Rwanda decreased from 9.85% to 8.72% between 1985 and 1990. This situation, which could not be otherwise, is explained by the predominance of the agricultural sector in these countries, which were initially poor in natural resources. This trend towards de-industrialisation can be explained by the economic structure of these countries, whose economy is essentially based on tourism and the development of the tertiary sector. The DRC is the only country in the Great Lakes region where the trend has increased from 7.03% to 18.71% over the last six years of the study.

These countries are still lagging in terms of industrialisation compared to other African countries such as Nigeria (13.7%), Egypt (16.4%) and South Africa (17.64%) which have slightly higher shares of MVA as a percentage of their GDP and which have visibly started the process of industrial transformation of their economies.

Figure 2: Graphical correlation between financial development and industrialisation in the Great Lakes countries



Source: Author's construction

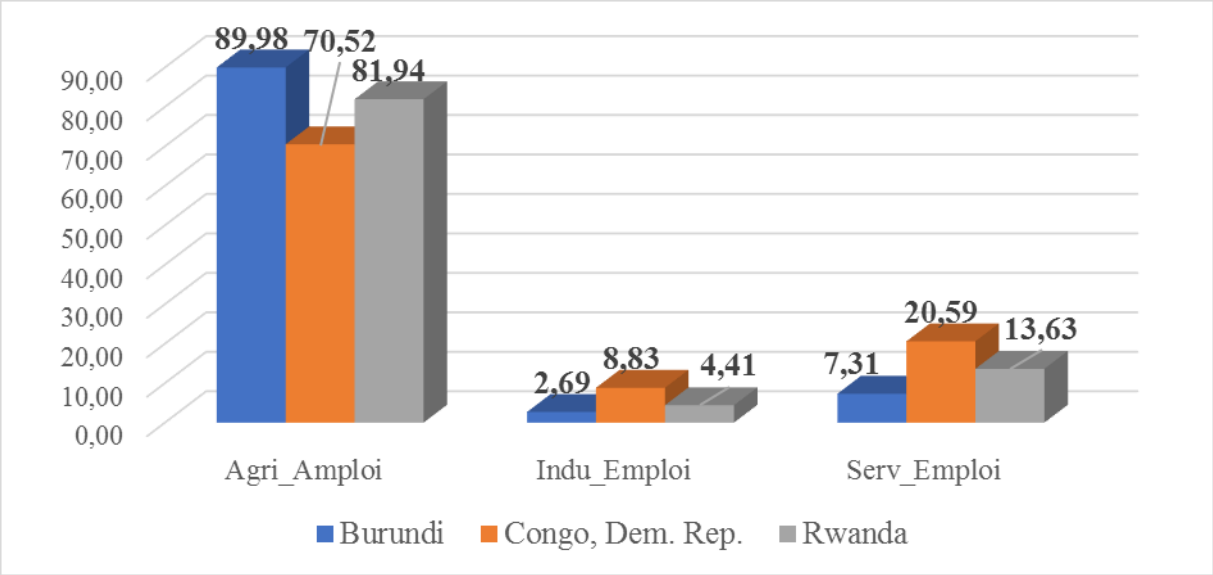
As can be seen in Figure 2, this situation is not unique to the CEPGL countries. The decline in MVA also reflects the highly concentrated export structure of countries in the region. According to Page (2012), more than 50 per cent of manufacturing firms in sub-Saharan Africa are small, informal and produce goods based on natural resources.

Some of the reasons identified include an unstable business climate, poor human capital, low-income levels, lack of energy and transport infrastructure, credit market failures and poor trade policies (Arbache and Page, 2009).

2.2. Employment in different sectors in the CEPGL countries

From this graph, relating to the distribution of employment in the three different sectors of the economy, it can be seen that the share of industrial employment as a percentage of total employment is still not very significant, with only 4.41% in Rwanda, 2.69% in Burundi and 8,83% in the DRC. These figures are less significant compared to other African countries, such as South Africa (26.14), Egypt (26.86) and Morocco (16.12) in the same period, which have achieved much more significant performances (WDI, 2022).

Figure 3: Sectoral employment in the CEPGL countries



Source: Author's construction

This distribution of sectoral employment in total employment shows a high concentration of labour in the agricultural sector to the detriment of the industrial and service sectors. This situation shows a delay in the transformation of the productive structure of the economies of the major lakes, whereas, in other regions of Africa and the world, this transformation has taken a rather positive and rapid evolutionary momentum, such as the North African region with 25.30% of industrial employment against 22.48% and 52.22% respectively of agricultural and service employment. The best evolutions are also observed in East Asia and the Pacific, Latin America and the Caribbean.

3. Review of the literature

It should be highlighted right away that the literature has extensively investigated the connection between financial development and economic growth. The expenses of gathering information, carrying out agreements, and finishing transactions are, in theory, reduced by financial intermediaries and financial markets. Improvements in information flows, capital allocation, corporate governance, risk improvement, savings pooling, and trade facilitation are all factors that contribute to growth in a positive way (Acemoglu and Zilibotti, 1997; Khan, 2001; King and Levine, 1993).

Empirically, cross-country studies and time series (Alege and Ogunrinola, 2008; Ewetan and Okodua, 2013; Mccaig and Stengos, 2005; Beck & Levine, 2005; Levine et al., 2000) offer solid and convincing evidence in favour of the idea that healthy stock markets and well-functioning banking systems independently spur economic growth. In other words, stock markets and banking systems both offer different but complementary financial services that help the economy flourish.

The vast literature on the finance-growth nexus reveals four possible scenarios on the nature of the relationship between financial development and economic growth. These

are finance-led growth, known as the supply-side hypothesis, finance-led growth, known as the demand-side hypothesis, a two-way relationship, known as feedback, and no relationship between financial development and economic growth. The relationships between financial development and economic growth have been studied using a variety of approaches, including country, panel, time series, country-specific, industry-specific, and case study studies (Levine, 2005; Aug 2008; Beck, 2009; Ewetan and Okodua, 2013; Akinlo and Egbetunde, 2004).

However, about industrialisation, although there is mixed evidence in the literature supporting a positive or negative link between financial development and industrialisation, the issue of industrial transformation in both developed and developing countries has attracted the interest of several economic researchers. In this respect, industrialisation is seen as a prerequisite for economic growth and development. The driving role that financial development could play in a nation's industrialization process through increased access to credit and financial markets for industries is the focus of one of the transmission channels (Kabango and Paloni, 2011).

From an optimistic viewpoint between financial development and industrialisation, the work of Schumpeter (1912), Mckinnon (1973) and Shaw (1973) provides evidence of strong links between financial intermediation and economic growth. These researchers argue that financial deepening and savings improve investment, especially in the industrial and manufacturing sectors. This has a positive impact on economic growth. Financial deepening promotes the development of the financial sector, which is usually accompanied by an easing of the credit constraints faced by domestic firms, especially small and medium-sized enterprises.

The most significant investigations were those by King and Levine (1993). They expanded on the legacy of Goldsmith (1969). In their research, 80 nations from 1960 to 1989 were examined. After carefully adjusting for variables that may have an impact on long-term economic growth, these authors investigate the pathways leading to capital accumulation and increases in industrial productivity. They build financial development indicators and examine whether financial development forecasts economic expansion, capital accumulation, and increased productivity. The following variables were used to construct measures of financial development: (1) the liquid liabilities of the financial system as a share of GDP, (2) the amount of credit given to private firms, (3) the percentage of credit provided by banks, and (4) the percentage of total credit given to private non-financial firms. According to these writers, there is a correlation between the financial development indicators and each of the chosen economic growth factors, including industrial productivity (King and Levine, 1993). They do not, however, address the question of whether financial development and industrialization are causally related, as is the case in our study.

Beck and Levine (2002), used industry-level data and found evidence that greater financial development accelerates the growth of financially dependent industries. To assess

competing views on financial structure, their paper examines the impact on industrial expansion, new establishment creation and capital allocation efficiency. The authors highlight the positive role of banks in financing innovative projects that are a source of industrialisation.

The research does not, however, agree that the process of industrial transformation is always favourably influenced by financial development. This beneficial connection has been questioned in other research. Working on a reevaluation of the effect of finance on industrial growth, Ceccheti and Kharroubi (2012) investigate the intricate real consequences of financial development and draw two crucial conclusions. First, the size and scope of a country's financial system can be a drag on productivity growth. In other words, there comes a point where further expansion of the financial system can reduce real growth. And because the financial sector competes with the rest of the economy for resources, financial booms are generally not conducive to industrial growth. Second, using sectoral data, the authors examine the distributional nature of this effect and find that credit booms harm what they normally consider to be the engines of growth: research and development-intensive firms.

This evidence, together with the recent experience of the financial crisis, leads to the conclusion that there is an urgent need to reassess the relationship between finance and real growth in modern economic systems. They find that the size of the financial sector has an inverted U-shaped effect on productivity growth. In other words, expanding the financial system beyond a certain point can reduce real growth. More finance is certainly not always better (Ceccheti and Kharroubi, 2012).

Udoh and Ogbuagu (2012) used an aggregate output framework and an autoregressive distributed lag (ARDL) cointegration technique and found that the long-run and short-run dynamic coefficients of the financial sector development variables have a negative and statistically significant impact on industrial output in Nigeria. Extensions of Ewatan and Ike (2014), inform that after several decades of repressive financial policies and inefficient financial institutions, it is not surprising that the impact of the financial sector on industrialization has been only negative. Similarly, Lin and Huang (2012) find that banking sector volatility hurts the growth of industries that are more dependent on external finance.

The results of previous work, as presented, show a lack of consensus on the effect of development on industrialisation. This work does not take into account the institutional context, the recurrent political instability, and the difficulty of access to financial services and even financial markets in some regions of sub-Saharan Africa.

4. Methodology of the study

4.1. The model

To estimate the effect of financial development on industrialisation in the study region, we start with an endogenous growth model according to the approach of Rebello (1991), developed and complemented by Szirmai and Verpagen (2015). Indeed,

industrialisation has an impact on long-term growth. The output of a country can be characterised by a Cobb-Douglas function of the form :

$Y_t = AK_t^{\gamma} (HL)_t^{\theta}$ (1)

Where Y is real output; A is technical progress; K is the stock of physical capital; H is the stock of skills and experience; L is labour power;γ and are the respective elasticities of the stock of capital and human capital concerning output.

In detail, A = tpf * mi, technical progress is a combination of total factor productivity (tpf) and manufacturing output (mi) and HL = E^{δ} where E is the human capital function composed of the labour force L and the set of skills and experience H.

Dividing Y_t by E gives $\frac{Y}{E} = A\left(\frac{K^{\gamma}}{E^{1-\gamma\theta}}\right) \Rightarrow$ $y = Ak^{\gamma}$ with =1-γδθIn a situation of endogenous growth,γ +δθ≥ 1.

In this last equation of the AK model, y is real output per unit of human capital ; A is technical progress as described above, and k is the stock of physical capital per unit of human capital.

The interest function is then $y = AK^{\gamma}$ with = $\frac{K}{E}$. We assume that the economy grows over time. Then the interest function is $\dot{k} = \frac{K_t - K_{t-1}}{E}$ where K_t - K_{t-1} = I with I is an investment.

Thus, with $\dot{k} = \frac{I}{E}$ the time-dependent production function becomes : $\dot{y} = A\dot{k}^{\gamma}$ (2)

By replacing $\dot{k}$we obtain $\dot{y} = A\left(\frac{I}{E}\right)^{\gamma}$

The logarithmic formulation gives us the following equation

$\ln y = \ln A + \gamma \ln (I) - \gamma \ln E$ (3)

With A = tpf * mi, we obtain by decomposition :

$\ln y = \ln tpf + \ln mi + \gamma \ln (I) - \gamma \ln E$ (4)

We can then deduce the manufacturing output by the expression :

$\ln mi = - \ln y + \ln tpf + \gamma \ln (I) - \gamma \ln E$ (5)

Considering the study by Guadagno (2016), which assesses the determinants of industrialisation in developing countries, the following compact model is obtained:

$\ln mi_{it} = \beta_0 + F\beta_{it} + \alpha X_{it} + \varepsilon_{it}$ (6)

Where F_{it} is the matrix of financial development indicators, mainly the volume of domestic credit to the private sector and the size of the financial market measured by stock market depth (market capitalisation); X_{it} is the matrix of other explanatory variables. It takes into account digital infrastructure representing the number of people with a telephone line, human capital measured by education through the gross enrolment rate in secondary and higher education, trade openness measured by the value of exports and imports, private investment measured by gross fixed capital formation, total natural resource rents and an institutional variable that captures the quality of regulation.

Our econometric model is inspired by Gui-Diby and Renard (2015) and Ongo (2016) for the control variables and Bassirou and Ramde (2019) for the explanatory variables of interest.

In its compact version, the model to be estimated takes the following form:

$$Indu = \beta_0 + F\beta_{it} + \alpha X_{it} + \varepsilon_{it}$$

Where *Indu* measures industrialisation. In contrast to the above studies, we consider here two measures of industrialisation. First, manufacturing value added which captures the ability to transform natural resources into final goods (Di Maio, 2009), and second, the ratio of industrial employment to total employment which explains how intermediate goods are transformed and describes the quality of the necessary labour force (Kaya, 2010; Gui-Diby and Renard, 2015).

Considering the two measures of industrialisation, the models to be estimated take the following forms:

1. Industrialisation is measured by manufacturing value added (our baseline model)

$$\boldsymbol{Indu\_VAM_{it} = +\beta_0\ \beta_1\ Cedit\_Dom_{it} +\beta_2\ Ouv\_Com_{it} +\beta_3\ Educ\_Sec_{it} +\beta_4\ Invest\_Priv_{it} +\beta_5\ Ress\_Nat_{it} +\beta_6\ Qual\_Inst_{it} + \varepsilon_{it}}$$

Where *Indu_VAM* is industrialisation measured by manufacturing value added as a percentage of GDP.

2. Industrialisation is measured by the share of industrial employment in total employment (used in robustness)

$$\boldsymbol{Indu\_Employment_{it} = +\beta_0\ \beta_1\ Cedit\_Dom_{it} +\beta_2\ Ouv\_Com_{it} +\beta_3\ Educ\_Sec_{it} +\beta_4\ Invest\_Priv_{it} +\beta_5\ Ress\_Nat_{it} +\beta_6\ Qual\_Inst_{it} + \varepsilon_{it}}$$

Where *Indu_Employment* captures the employment of the industrial sector in total employment. The other variables are identical to the previous model.

Table 1: Presentation of variables

Variable	Abbreviation	Measure	Source

Industrialization	*Indu_VAM*	Manufacturing value added as a percentage of GDP	WDI 2022
	Indu_Employment	Industrial employment as a percentage of total employment	WDI 2022
Financial development	*Credit_Dom*	Domestic credit to the private sector as a percentage of GDP	WDI 2022
	Cap_Bou	Market capitalisation as a percentage of GDP	UNCTAD (2022)
Commercial opening	*Ouv_Com*	Trade volume (exports + imports) as a proportion of GDP	WDI 2022
Private Investment	*Invest_Priv*	Gross capital formation as a percentage of GDP	WDI 2022
Human Capital	*Educ_Sec*	Gross secondary school enrolment rate	WDI 2022
Natural resources	*Ress_Nat*	Total natural resource rent to GDP	WDI 2022
Quality of institutions	*Qual_Inst*	Composite index including anti-corruption, government effectiveness, regulatory quality and political stability	WGI 2022

Source: Authors' construction.

4.2. Estimation technique

As such, the current study carefully selects the two estimation techniques (FGLS and ARDL) based on their relevance to the objectives of the study and their particular characteristics.

The FGLS estimator used in this study was first developed by Parks (1967) and later popularised by Kmenta (1988). This is why it is often called Parks or Parks-Kmenta. This estimator can be used to estimate panels with heteroskedasticity and a contemporaneously correlated error matrix (Beck, 2001; Hoechle, 2007). However, this estimator only produces efficient, consistent and valid estimates when the time dimension (T) is larger or greater than the cross-sectional dimension (N), and therefore the estimator is not

appropriate for medium and large-scale micro econometric panels (Beck, 2001; Hoechle, 2007). This estimator is unbiased and efficient (minimum variance). The feasible generalized least squares technique takes into account omitted or misidentified variables and reduces measurement and model specification errors. The Parks-Kmenta estimator remains relevant for estimating panels with heteroskedasticity and contemporaneously correlated error matrix, especially when the time dimension is larger, as in the case of this study (T=36>N=3).

Given the small size of our sample, a country-by-country analysis is carried out as a robustness measure. The ARDL (Autoregressive Distributed Lag) model of estimators allows us to estimate the short and long-term effect of the main variables of interest on the industrialisation of the Great Lakes countries analysed individually.

4.3. The data

The data are from the World Bank (*World Development Indicators and the World Governance Indicators*, 2022) and UNCTAD (2022). All these data are in percentages except for the composite index of institutional quality. This facilitates the interpretation of the results[1] . The study period is from 1985 to 2020. The study covers all countries in the Great Lakes region.

The data, the descriptive statistics and the correlation matrix are presented in Tables 1 and 2.

Table 2: Descriptive statistics

Variables	Observation,	Average	Standard deviation	Minimum	Maximum
Indu_VAM	108	10,909	3,911	5,015	21,217
Employment_Indu	108	5,349	2,95	2,2	9,94
Credit_Dom	108	9,752	6,646	0,491	24,668
Cap_Bou	108	17,382	7,402	0	46,649
Ouv_Com	108	41,669	15,63	19,684	90,748
Educ_Sec	108	25,056	13,829	3,575	49,254
Invest_Priv	108	14,859	5,867	2,1	28,722
Ress_Nat	108	15,858	9,472	1,676	40,492

[1] Another method is to apply the logarithm. However, the negativity of some variables poses a real problem in the calculation.

Qual_Inst	108	-1,036	0,627	-2,813	0,246

Source: Authors' construction

The summary of the descriptive statistics of the variables is given in Table 2. It is noted that MVA as a percentage of GDP (Indu_MVA) registers an average of 10.9% in the whole panel, which means that the share of manufacturing value added as a percentage of GDP is still very low in the ECGL countries and reflects a weak industrial transformation in the region. It varies between 5.01 and 21.22% in the period under study. The average volume of domestic credit granted to the private sector during the period from 1985 to 2020, within the framework of the internal financing of economic activities, is of the order of 9.75% of GDP on average and is still relatively low compared to the need for industrial financing necessary to reverse the trend and boost the industrial transformation of the countries of the region. The characteristics of the other variables can be seen in the table presented.

Table 3: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Indu_Vam	1,000								
(2) Empl_Indu	0,874	1,000							
(3) Cred_Dom	-0,348	-0,437	1,000						
(4) Capi_Bou	-0,369	-0,535	0,841	1,000					
(5) ouv_com	0,522	0,769	-0,365	-0,368	1,000				
(6) Educ_Sec	0,325	0,754	-0,050	0,000	0,593	1,000			
(7) Invest_Priv	0,039	0,592	0,058	-0,012	0,622	0,537	1,000		
(8) Ress_Nat	-0,475	-0,026	-0,221	-0,087	0,264	-0,065	-0,309	1,000	
(9) Qual_inst	-0,602	0,101	0,525	0,289	-0,019	0,155	0,562	-0,669	1,000

Source: Author's construction

The correlation between financial development and industrialisation in the Great Lakes region is negative. For the variables Cred_Dom and Capi_Bou with Indu_Vam, the correlation is -0.342 and -0.369. In itself, the correlation coefficient (r) only explains the dependency between two variables. It is relevant to calculate the coefficient of determination (r^2) which measures the proportion of the variability of Y (respectively X) linearly explained by X (respectively Y). Thus, 11.6% (-0.342^2) and 13.6% (-0.369)^2 of

the variability of industrialisation are respectively explained by domestic credit allocated to the economy and market capitalisation. On this basis, 27% of the variability of industrialisation is explained by trade openness. This variability is 10.5%; 22.5% and 36.2% for secondary gross enrolment ratio, natural resources and institutional quality respectively.

5. Estimation and discussion of results

5.1. Basic results

In the first step, we estimate the models for the effect of financial development on manufacturing value added as a percentage of GDP. In the second step, the effect of financial development on the share of industrial employment in total employment is estimated.

Preliminary tests of stationarity by Im, Pesaran and Shin (2003), heteroscedasticity by Breusch-Pagan, the autocorrelation of Wooldridge errors, multicollinearity and normality of residuals are performed (Appendix 1).

Since the ordinary least squares method does not take into account the problems of error autocorrelation and heteroscedasticity, to correct for these problems, we use here the Generalized Least Squares method (GLS) which is robust not only to the autocorrelation of the residuals but also to heteroscedasticity and other shortcomings of OLS for our industrialization regressions.

Dependent variable: Industrialisation measured by manufacturing value added as a proportion of GDP						
Estimation technique: Generalized Least Squares (GLS)						
	(1)	(2)	(3)	(4)	(5)	(6)
Cred_Dom	-0.293***	-0.192***	-0.119*			
	(0.0528)	(0.0698)	(0.0716)			
Capi_Bou				-0.291***	-0.176***	-0.141***
				(0.0455)	(0.0411)	(0.0346)

Ouv_Com		0.0464*	0.0246*		0.0535*	0.0915**
		(0.0320)	(0.0350)		(0.0259)	(0.0254)
Educ_Sec		0.0342**	0.0414***		0.0287**	0.0432*
		(0.0298)	(0.0336)		(0.0216)	(0.0226)
Invest_Priv		0.0524*	0.139*		-0.0552*	0.0494*
		(0.0798)	(0.0847)		(0.0703)	(0.0703)
Ress_Nat		-0.059	-0.0887*		-0.912	-0.413**
		(0.646)	(0.913)		(0.520)	(0.619)
Qual_Inst			-0.570***			-0.317***
			(1.154)			(0.730)
Constant	14.42***	10.14***	4.824**	16.68***	12.21***	7.355***
	(0.653)	(1.893)	(2.297)	(0.863)	(1.553)	(1.571)
Comments	108	108	108	108	108	108
Prob > chi2	0,001	0,0000	0,0000	0,0003	0,0000	0,0000
Wald chi2	10,82	75,44	81,96	13,59	85,22	97,65

Table 4: Regression on industrialisation captured by manufacturing value added as a percentage of GDP

Source: Author's construction

Note: Standard deviations are in parentheses; *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively.

Tables 4 and 5 give the results of the estimates of the industrialization model captured by manufacturing value added as a percentage of GDP and by the share of industrial employment in total employment. The first three columns of the two tables present respectively the results considering the variable of interest (Cred_Dom) and the economic and institutional control variables. The other three columns give the results considering the variable of interest (Cap_Bou) with the same control variables.

Table 5: Regression on industrialisation captured by the share of industrial employment in total employment.

Dependent variable: Industrialisation is measured by industrial employment in total employment.						
Estimation technique: Generalized Least Squares (GLS)						
	(1)	(2)	(3)	(4)	(5)	(6)
Cred_Dom	-0.193***	-0.131***	-0.177***			
	(0.0382)	(0.0291)	(0.0275)			
Cap_Bou				-0.171***	-0.158***	-0.166***
				(0.0349)	(0.0159)	(0.0160)
Ouv_Com		0.0499***	0.0337**		0.0313***	0.0201*
		(0.0134)	(0.0134)		(0.0100)	(0.0117)
Educ_Sec		0.114***	0.0820***		0.117***	0.0979***
		(0.0125)	(0.0129)		(0.0083)	(0.0104)
Invest_Priv		0.0121	-0.0662*		0.0656**	0.0623*
		(0.0334)	(0.0325)		(0.0271)	(0.0324)
Ress_Nat		-0.0849	-0.591*		-0.0595	-0.252**
		(0.272)	(0.350)		(0.200)	(0.285)
Qual_Inst			-0.119***			-0.786**
			(0.443)			(0.336)
Constant	7.230***	1.690**	5.845***	7.795***	2.146***	4.429***
	(0.452)	(0.793)	(0.881)	(0.658)	(0.599)	(0.724)
Comments	108	99	75	94	93	71
Prob > chi2	0,0002	0,0000	0,0000	0,0002	0,0000	0,0000

Wald chi2	25.36	89.1	107.1	24.05	95.0	101.9

Source: Author's construction

Note: Standard deviations are in parentheses; *, **, and *** represent significance at the 10%, 5%, and 1% levels respectively,

To the results obtained in Table 4, domestic credit allocated to the economy and stock market capitalisation (capturing financial development), give rather unexpected results in all the models considered. They negatively and significantly influence the share of manufacturing value added to GDP. The result is that an increase in domestic credit and stock market capitalisation of 1% leads to a decrease in MVA of 11.9 and 14.1% respectively (models 3 and 6).

The explanation for this unexpected situation would be that: the financial system in the Great Lakes Economic Community is generally considered underdeveloped and inefficient (banks finance in the short term while the industrialisation process requires long-term financing). This system is characterised by: repressive financial policy and underdeveloped financial institutions, the regulatory and institutional framework for the private sector to access formal credit is cumbersome and not easily accessible. Increased investment without verification of funding sources, increased corruption, black money, poor governance, high trade deficit, lack of quality service delivery to citizens, dependence on foreign loans for production and operations, and the predominance of small and cottage industries also explain these results. All these reasons make the financial system underdeveloped and ineffective in boosting the industrialisation process of countries in this region.

These findings are consistent with College and Montie (2006); Udoh and Ogbuagu (2012); and Avom and Ongo (2021), who argue that many African countries do not have a well-developed financial system that can act as an effective intermediary between domestic or external private creditors and domestic private firms. This manifests itself in a large external financing premium.

The gross secondary school enrolment rate has a positive and significant influence on the industrialization of the CGLPC. Indeed, a one per cent increase in secondary school enrolment increases industrialisation by 3.4 and 4.3 per cent in models (3) and (6) respectively. In other words, students at the baccalaureate level mainly in technical secondary education can participate in the increase of industrial production. This is certainly a small and medium industry, but it contributes positively to the increase of industry on a national scale. The work of Beji and Belhadj (2016); Adejumo et al, (2013) for the case of East and West Africa, confirms these results by documenting that education remains the pivot of human capital formation. This puts it at the heart of human capital analyses before the industrial transformation of African economies. Positive results of the

role of human capital have also been obtained in the empirical literature (Samuel and Aram, 2016).

Although their coefficients are low, the rate of trade openness and private investment contribute positively and significantly to the industrialisation of the Great Lakes region. Their one per cent increase translates into an increase in the share of manufacturing value added of 2.4 and 5.2% respectively in the model (3), and 5.3 and 5.5% in model (6). The literature argues that trade openness allows domestic firms to benefit from the advanced technologies of foreign firms *and* thus increase their efficiency. These results are consistent with those of Keller (2010) and Dodzin and Vamvakidis (2004). Barriers are restricted to entry as well as to exit, thus allowing the mobility of inputs necessary to increase manufacturing value added and the sale of goods produced. Ecclassato and Eggoh (2013) corroborate these results. Private investment, on the other hand, has a low significance and a very low coefficient, which is explained by the low participation of the private sector in the industrial process due to high factor costs. In Africa, 80% of private investment is dominated by small and medium-sized enterprises (SMEs) that cannot engage in a real industrial process. Private investment contributes to industrialisation, but at a low proportion that needs to be improved. This result confirms those obtained by Barios *et al*, (2005), Kang and Lee (2011) but contradicts the conclusions of Gui-Diby and Renard (2015).

From the above results, it follows that natural resources and institutional quality have a significant negative impact on the industrialization process in the countries of the Great Lakes region. The relationship between natural resources and the industrial transformation process varies according to indicators of institutional quality. These results are consistent with the resource curse or Dutch disease thesis theorised by Corden and Neary (1982). The effect of natural resources on growth is negative for countries with low-quality institutions and positive for those with high-quality institutions.

The Great Lakes region is the region with the highest level of political instability and security crises in the world. Corruption and low government effectiveness describe the low quality of institutions in these countries, which negatively impacts any industrial transformation process in the region.

5.2. Robustness Analysis: A Country-by-Country Study

The present robustness analysis concerns an individual study for each country in the region. First, we analyse the effect of financial development on industrialisation in Burundi, then in the Democratic Republic of Congo and finally in Rwanda.

However, different primary diagnostic tests are performed allowing us to choose the appropriate method to use. The results of the Augmented Dickey and Fuller stationarity tests (or ADF test) show that some variables are stationary in level and others in first difference for each country in our analysis. These results are given in the appendix (Appendix 2). Subsequently, the cointegration test of Peasaran et al, (2001) is carried out to

test the existence of a long-term relationship between the variables already characterised by a different order of integration. This is the bounds test approach of Peasaran et al, 2001 for a long-run relationship in an ARDL staggered lag autoregressive model. The results of this test confirmed the presence of cointegration between the variables in our study for the three countries analysed. The ARDL specification is then retained. It has two major advantages: on the one hand, it allows the joint estimation of the short-term and long-term parameters and, on the other hand, it allows the introduction into the model of variables that can be integrated of different orders, i.e. I(0) and I(1), or cointegrated. It also has good properties concerning small samples as is the case in the present analysis.

Table 6 presents the results of the short-term analysis for Burundi, the Democratic Republic of Congo and Rwanda individually.

For Burundi and Rwanda, it is observed that the financial development indicators (domestic credit to the private sector and stock market deepening) negatively influence industrialization depending on whether it is measured by MVA to GDP or by industrial employment to total employment for both countries. The statistics show that the coefficient of the error correction term or the recall force is negative and statistically significant in all specifications (which is theoretically correct).

In models (1) and (2), this coefficient is -0.287 and -0.286. This suggests a lack of convergence of the models towards equilibrium. The speed of adjustment to shock or destabilisation is about 28% in each specification. This shows that external shocks, bad stabilization policies or discomfort in the Burundian industrial sector will continue to prevail in the coming years and that the current industrial policy needs to be revised. This also applies to models (9) and (10) for the case of Rwanda. The reasons put forward would be that both countries are naturally poor in natural resources, insufficient control of the financial market and lack of competition, external and internal effects of political instability and security crises in the region and weak institutions.

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Table 6: Short-term dynamics: Regression on industrialisation captured by MVA to GDP and Industrial employment for each country in the study

	BURUNDI				**RDC**				**RWANDA**			
	Indu_VAM		***Indu_Employment***		***Indu_VAM***		***Indu_Employment***		***Indu_VAM***		***Indu_Employment***	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
D(Cred_Dom)	-0,004*		-0,002**		0.168*		0.014**		-0.062*		-0.017*	
	(0,088)		(0,003)		(0.789)		(0.015)		(0.089)		(0.020)	
D(Cap_Bou)		-0,020**		-0,003**		0.145*		0.008**		-0.018**		-0.023**
		(0,044)		(0,001)		(0.315)		(0.019)		(0.101)		(0.016)
D(Ouv_Com)	0,015	0,016*	0,002*	0,004	0.045	-0.114	-0.003*	0.003	0.109	0.082	-0.019	-0.014
	(0,093)	(0,045)	(0,002)	(0,002)	(0.050)	(0.046)	(0.001)	(0.001)	(0.044)	(0.046)	(0.008)	(0.008)
D(Educ_Sec)	-0,026	-0,020	-0,007	-0,001	-0.104	0.294*	0.012**	0.003	0.005*	0.007*	0.022*	0.027*
	(0,040)	(0,026)	(0,004)	(0,005)	(0.258)	(0.190)	(0.004)	(0.009)	(0.037)	(0.039)	(0.008)	(0.007)
D(Inv_Priv)	-0,053	-0,045	-0,002	-0,001	0.387**	0.340*	0.443*	0.505*	0.024*	-0.131	0.012	0.007

	(2,494)	(0,092)	(0,003)	(0,003)	(0.298)	(0.309)	(0.202)	(0.303)	(0.094)	(0.092)	(0.017)	(0.016)
D(Ress_Nat)	-0,017	-0,016	-0,002	0,004	-0.138***	0.208***	0.001*	0.005	0.143	0.178	-0.013	-0.017
	(0,220)	(0,040)	(0,001)	(0,001)	(0.123)	(0.130)	(0.002)	(0.004)	(0.085)	(0.083)	(0.013)	(0.013)
D(Qual_Inst)	0,4037**	0,361*	0,127**	0,133	-4.445	-7.809	0.134	0.126	-0.386	-0.285	0.366**	0.286***
	(2,476)	(2,476)	(0,086)	(0,077)	(5.561)	(3.795)	(0.123)	(0.131)	(0.608)	(0.708)	(0.101)	(0.114)
CointEq (-1)	**-0,287****	**-0,286*****	**-0,177****	**-0,125****	**-0.575****	**-0.545****	**-0.615*****	**-0.533*****	**-0.310***	**-0.321****	**-0.098****	**-0.134*****
	(0,218)	**(0,216)**	**(0,143)**	**(0,149)**	**(0.168)**	**(0.133)**	**(0.039)**	**(0.098)**	**(0.156)**	**(0.167)**	**(0.083)**	**(0.061)**

Source: Author's construction

Note: *; ** and *** represent the significance of the variable at 10; 5 and 1%. Standard deviations are in brackets.

The estimation results for the Democratic Republic of Congo through models (4) and (6) indicate that the development of the financial system explains rather positively the industrialization of the country. The more domestic credit and the size of the financial market increase, the more the country's industrial sector develops. The statistics show that the coefficient of the error correction term is negative and statistically significant in all specifications. In models (5) and (6), this coefficient is -0.575 and -0.545. This suggests that the models are converging towards equilibrium. The speed of adjustment to shock or destabilisation is about 57.5 and 54.5% in both specifications, which is also valid for models (7) and (8). These results could be explained by an abundance of natural resources available to the country, an increase in domestic credit available to the private sector, an increase in the percentage of private investment as a share of GDP and an improvement in GDP growth.

Table 7 (Annex 3) presents the results of the long-term analysis of Burundi, the Democratic Republic of Congo and Rwanda individually. This long-term dynamic presents quite interesting results as there is an improvement in the contribution of domestic financing indicators to industrialisation in the countries of the Great Lakes region. In the case of DRC, the effect remains positive, while in the case of Rwanda and Burundi, the effect remains negative. The negative impact of financial development indicators on industrialisation diminishes over time. The results of the basic model of this study remain robust.

6. CONCLUSION AND POLICY RECOMMENDATIONS

Do financial development indicators contribute to the industrialisation of countries in the Great Lakes region? This question is the main theme of our article. To answer it, we first describe the panorama of the industrial process in the countries of the region. Then a review of the literature is made. The literature shows that the contribution of financial development to industrialisation can be divided into two effects (direct and indirect effects) and that the nature of these effects is twofold (positive and negative effects). The methodology has taken both types of effects into account. Financial development is measured by the volume of domestic credit allocated to the private sector on the one hand and by stock market deepening (market capitalisation) on the other. Industrialisation is captured by two variables: manufacturing value added in GDP and the share of industrial employment in total employment.

The estimation methodology is based on the Feasible Generalized Least Squares (FGLS) method in the basic model and on the Autoregressive Scaled Distribution Model (ARDL) in the robustness. Our estimations have generated several results: financial development through credits granted to the private sector and stock market deepening do not contribute positively to the industrialisation of the countries of the Great Lakes region. The political instability and security crises that have plagued the region for years, the underdevelopment of the financial sector, corruption and the low quality of regulation, and macroeconomic vulnerabilities are some of the reasons put forward to explain this paradox.

In addition, the rate of trade openness, human capital and private investment positively explain the industrial process of the countries in the region.

Based on these findings, the study proposes some policy recommendations. To the governments of the countries under study, however, it is necessary to (i) consolidate the positive reforms of the financial sector (by properly regulating this sector) to make it strong enough to support the industrial transformation process of the countries of the region; (ii) promote a better governance structure that favours industrial development by reducing the rate of corruption, improving the accountability and efficiency of the governments of the region, and above all, reducing the effects of wars and ensuring sustainable regional political stability. This will contribute both directly and indirectly to the growth of industrial development in the region's economies.

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Appendix

Appendix 1: Different preliminary diagnostic tests

Breusch-Pagan heteroscedasticity test	Wooldridge error autocorrelation test	Test of normality of residuals
Prob>F = 0.0036*** H_0 : Homoscedasticity Decision: **Presence of heteroscedasticity**	Prob>F = 0.0202** H_0 : Absence of first order autocorrelation Decision: **Presence of** autocorrelation	Prob>Chi2 (2) = 0.0709*** H_0 : The residuals follow a normal distribution Decision: **Presence of normality of residuals**
Multicollinearity Test		
Mean FIV = 3.09; All FIVs < 10 H_0 : Presence of Multicollinearity Decision: **No Multicollinearity**		

Source: Prepared by the author

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Appendix 2: ***Results of the Augmented Dickey Fuller (ADF) stationarity test for each country in the analysis***

RDC					RWANDA				BURUNDI			
	Level		Difference	IO	Level		Difference	IO	Level		Difference	IO
	With constant	Without constant			With constant	Without constant			With constant	Without constant		
Indu_VAM	-1,221	0,327	-4,790	**I(1)**	-1,430	-2,603	-8,103	**I(1)**	-3,259	-0,272	-7,286	**I(1)**
	(0,654)	(0,77)	(0,000)		(0,554)	(0,011)	(0,000)		(0,024)	(0,580)	(0,000)	
Cedit_Dom	1,0552	0,023	-5,147	**I(1)**	1,098	2,345	-4,625	**I(1)**	-1,765	0,969	-5,143	**I(1)**
	(0,925)	(0,954)	(0,000)		(0,967)	(0,994)	(0,000)		(0,390)	(0,908)	(0,000)	
Cap_Bou	-1,443	-1,167	-3,993	**I(1)**	-0,272	6,239	-5,122	**I(1)**	-3,707	-0,048	-6,101	**I(0)**
	(0,549)	(0,219)	(0,002)		(0,918)	(0,975)	(0,000)		(0,008)	(0,019)	(0,000)	
Infrastructure	-5,216	-3,929	-10,54	**I(1)**	-8,125	-6,912	-8,414	**I(0)**	-6,418	-6,062	-10,58	**I(0)**
	(0,001)	(0,003)	(0,000)		(0,000)	(0,000)	(0,000)		(0,000)	(0,000)	(0,000)	
Ouv_Com	-2,558	-0,095	-8,822	**I(1)**	-0,801	0,690	-4,077	**I(1)**	-2,034	-0,862	-6,992	**I(1)**

	(0,111)	(0,643)	(0,000)		(0,805)	(0,860)	(0,000)		(0,271)	(0,335)	(0,000)	
Educ_Sec	-0,429	1,956	-5,495	**I(1)**	-0,043	1,059	-1,667	**I(1)**	-1,056	-0,225	-1,845	**I(1)**
	(0,891)	(0,986)	(0,000)		(0,947)	(0,920)	(0,009)		(0,721)	(0,597)	(0,032)	
Invest_Priv	-5,217	-3,929	-10,54	**I(0)**	0,490	1,568	-6,669	**I(1)**	-2,034	-0,862	-6,992	**I(1)**
	(0,001)	(0,003)	(0,000)		(0,983)	(0,968)	(0,000)		(0,271)	(0,335)	(0,000)	
Ress_Nat	-2,208	-0,875	-5,767	**I(1)**	-2,481	-1,016	-7,216	**I(1)**	-1,880	-0,721	-5,877	**I(1)**
	(0,207)	(0,329)	(0,000)		(0,128)	(0,272)	(0,000)		(0,337)	(0,396)	(0,000)	
Qual_Inst	-5,5277	-0,145	-2,293	**I(0)**	-1,644	-2,708	-4,811	**I(0)**	-2,133	-1,470	-4,242	**I(1)**
	(0,003)	(0,623)	(0,024)		(0,045)	(0,009)	(0,000)		(0,234)	(0,129)	(0,002)	

Source: Author's construction

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Appendix 3**:** Regression on industrialisation captured by MVA to GDP for each country in our study (Long term dynamics)

	BURUNDI				RDC				RWANDA			
	Indu_VAM		***Indu_Employment***		***Indu_VAM***		***Indu_Employment***		***Indu_VAM***		***Indu_Employment***	
	(1)	2	3	4	5	6	7	8	9	10	11	12
Cred_Dom	-0,010*		-0,014**		0.675**		0.081***		-0.202*		-0.177***	
	(0,181)		(0,022)		(4.320)		(0.082)		(0.312)		(0.331)	
Cap_Bou		-0,042**		-0,143*		-0.224**		0.206***		-0.057*		-0.175***
		(0,094)		(0,868)		(0.482)		(0.618)		(0.314)		(0.154)
Ouv_Com	0,031	0,034	0,015*	0,164*	-0.262	-0.177	-0.002*	0.007*	0.352*	0.257*	-0.201	-0.109*
	(0,100)	(0,098)	(0,021)	(1,006)	(0.403)	(0.074)	(0.007)	(0.049)	(0.219)	(0.193)	(0.214)	(0.101)
Educ_Sec	-0,054	-0,041	0,040*	0,044*	-0.595	0.455	0.072	0.091	0.017**	0.002	0.229	0.203
	(0,046)	(0,050)	(0,008)	(0,070)	(1.899)	(0.276)	(0.026)	(0.159)	(0.121)	(0.123)	(0.148)	(0.075)
Inv_Priv	-0,110*	-0,094*	0,016*	0,054	0.505	-0.062	0.017	-0.018	_	_	0.125	0.053

									0.392**	0.429**		
	(0,191)	(0,187)	(0,023)	(0,308)	(0.821)	(0.174)	(0.012)	(0.116)	(0.332)	(0.336)	(0.169)	(0.116)
Ress_Nat	-0,035	-0,034	0,001	-0,016	-0.792*	-0.322*	0.007*	0.132**	0.461	0.555	-0.163	-0.132**
	(0,086)	(0,085)	(0,009)	(0,124)	(1.044)	(0.188)	(0.016)	(0.401)	(0.296)	(0.299)	(0.201)	(0.101)
Qual_Inst	0,828*	0,743**	-0,721	-0,178*	-2.394**	-0.095	-0.767*	1.205***	-1.252*	-0.891*	3.667	2.077*
	(4,938)	(4,930)	(0,780)	(30,36)	(4.949)	(0.299)	(0.752)	(8.712)	(1.901)	(2.161)	(3.397)	(1.311)
C	13,11***	13,66***	1,181***	5,34*	10.088***	14.11**	6.885***	7.377***	0.798**	1.305**	12.38*	9.895*
	(9,876)	(9,182)	(1,133)	(41,85)	(14.86)	(14.26)	(1.597)	(8.508)	(6.136)	(5.921)	(12.37)	(5.951)

Source: Author's construction