Institutional quality, human capital and structural transformation in sub-Saharan Africa

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Abstract

This research investigates the direct and interactive effects of institutional quality and human capital development on structural transformation in an unbalanced panel of 30 sub-Saharan African countries over the period 2002-2022. It employs the two-step system-generalized method of moments to account for the dynamic effects of structural transformation. The results show that improving institutional quality through control of corruption, government effectiveness, and regulatory quality stimulates structural transformation. In addition, developing human capital also accelerates structural transformation in the region. Moreover, the positive effects of institutional quality on structural transformation improve with human capital development and *vice versa*. These results suggest that enhancing institutional quality and developing human capital can significantly accelerate structural transformation in sub-Saharan Africa.

Keywords: Institutional quality, human capital, structural transformation, sub-Saharan Africa

JEL codes : E02, L16, O11, O14, O15, P10

1. Introduction

Structural transformation is defined as a gradual phenomenon involving a reallocation of activities and factors of production, particularly labour, from low-productivity sectors to more modern, high-value-added sectors (McMillan and Rodrik, 2011). Its driving force is the change in productivity in the modern sector dominated by manufacturing and services. The issue of structural transformation is now an important one in developing countries, which generally experience inefficient reallocation of resources from their sectors of economic activity. Development theories therefore recommend changing the structure of the sectoral distribution of jobs and the sectoral contribution to economic growth (Cadot and Melo, 2016; Touna and Ongono, 2019) to achieve better economic performance. Traditional theories suggest the existence of a traditional low-productivity sector with a surplus of labour earning above marginal productivity, and a modern sector characterized by returns to scale, technical and technological innovation and increased productivity gains. The new literature considers structural transformation processes to be essential to economic development, as they are not only a source of productivity growth but also of improved per capita income.

African countries will only be able to achieve high and sustained economic growth and good levels of social development if productivity changes are based on widespread economic diversification and dynamic movement of labour from agriculture to manufacturing (Todaro, 1989). For Kuznets (1979), it is difficult for a country to achieve sustained growth in real GDP per capita over a long period without structural transformation. Due to its importance, structural transformation is part of Africa's aspirations for 2063. Indeed, the African Union's (AU) Agenda 2063 calls for structurally transformed economies to create growth through entrepreneurship, and decent jobs for all. According to Cadot et al. (2016), structural transformation, which generally takes the form of a transfer of resources from the primary sector to the secondary sector and then to the tertiary sector, seems to have 'bypassed' the secondary sector in Africa. Africa in general, and sub-Saharan Africa (SSA) in particular, is marked by a low level of economic development, which is partly explained by inefficiencies in the production structure.

UNIDO (2022) shows that global manufacturing output grew by 7.2% in 2021 but fell by 0.5% in the Least Developed Countries (LDCs). In SSA, the industrial sector's share of GDP is 10.48%, while the primary sector's share is 25% in 2022 (World Bank, 2024). In 2022, agricultural employment represents around 5% of total employment in SSA, compared with 59% in 1991. Given the persistent productivity gap between agriculture and other

sectors of the economy, an acceleration of structural transformation in favour of non-agricultural sectors is desirable, both for a better allocation of resources and for poverty reduction (Gbemenou, 2020). This meets the needs of the Sustainable Development Goals (SDGs), particularly goals 1 and 8, which advocate the eradication of poverty in all its forms, decent employment and work for all, and sustainable and shared prosperity.

For McMillan and Headey (2014) and Martins (2019), the potential determinants of structural transformation include macroeconomic stability, the degree of integration into world trade, the exchange rate, human capital, physical capital, governance, the quality of institutions and the initial level of the sectoral employment share. This research analyses both the direct and interactive effects of institutional quality and human capital development on structural transformation in SSA.

Since the contributions of the neo-institutionalists (North, 1981; Acemoglu et al., 2005; Rodrik, 2005), economic, political and cultural institutions have contributed to the economic prosperity of nations. According to North (1991), "Institutions are the rules of the game in society. They are the humanly designed constraints on human interaction. They are made up of formal constraints, informal constraints, and enforcement devices; and they define the structures of societies and economies". They can play an important role in the transformation of African economies (Anaman and Osei Amponsah, 2009; Totouom et al., 2019). The same applies to human capital (Martins, 2019).

The analysis of human capital begins with the assumption that individuals decide on their education, training and medical care by weighing up the benefits and costs (Becker, 1993). Standard economic theory (Guillard and Roussel, 2010) postulates a causal relationship between human capital, increased productivity and increased wage income.

For developing countries, North (1990) and Olson (1993) show that public policies and institutional quality are fundamental sources of growth and development. Better institutions act as insurance for investors and provide the legal framework for defining the structure of management and contractual relations. Economic institutions frame interactions in the economic sphere and political institutions define the rules in the political sphere (Acemoglu et al., 2005). Economic institutions are necessary for economic growth and development because they determine the motivations of the key economic players in society through the influence they exert on investment in human and physical capital and in technology, as well as on the organization of the production process. These authors also distinguish between inclusive institutions and extractive institutions. Inclusive institutions are necessary for economic growth and development, whereas extractive institutions have

favoured the extraction of resources for the benefit of the metropolis and not for the development of countries (Acemoglu, 2005; Acemoglu and Robinson, 2008). By preserving property rights and respect for contracts, inclusive institutions encourage entrepreneurial freedom and innovation, the main source of economic growth, whereas extractive institutions encourage the enrichment of elites. Rodrik (2005) shows that economic institutions such as the control of corruption and regulatory quality encourage the adoption and implementation of innovations that boost productivity. Totouom et al. (2019) show that political institutions such as political stability and the absence of violence and acts of terrorism, government effectiveness and the rule of law play an important role in the structural transformation process in SSA countries. Noland and Pack (2007) show that bureaucracy, corruption and rent-seeking activities have increased uncertainty about the rules of the game, ultimately hindering private investment and blocking structural change and growth in SSA. In a comparative analysis between Africa and East Asia, Newman et al. (2016) highlight the key role of policy choices in explaining the difference in industrialization outcomes between the two groups of countries.

Transparency International's Corruption Perceptions Index (CPI) shows that in 2022, most African countries had a score below 50 on a scale of 0-100, indicating a situation of endemic corruption and weakening institutional quality in SSA. Corruption can have significant adverse effects on economic and social outcomes (Dimant and Tosato, 2018). On a scale ranging from -2.5 to 2.5, the World Bank (2024) shows that 44 of the 48 SSA countries assessed belong to the bottom half of countries, meaning that corruption is high in the region. The most unstable countries in 2022 according to their data are, in ascending order: Burundi, the Democratic Republic of Congo (DRC), Somalia, Sudan and South Sudan. Human capital is also low in the region.

Over the period 2002-2022, on average, 54.29% of African countries did not achieve the average net primary school enrolment rate of 75.30% of the region. In most African countries, less than 50% of children are enrolled in secondary school without repeating a year. Higher education remains the least accessible in Africa. Life expectancy has risen from 52 years in 2002 to 62 years in 2022. Differences between 10% and 30% in gross domestic product per capita are attributable to the variability of human capital from one country to another (World Bank, 2019), indicating that human capital is important for economic development.

Improving institutional quality and developing human capital can accelerate structural transformation. Indeed, according to UN-Habitat (2013), modern growth and development

depend on both the institutional environment and the availability of appropriate human resources. By placing particular emphasis on the effect of institutions on economic growth, North (1990) and Williamson (1995) represented a major advance in the literature on economic growth. However, there is a lack of work on the types or forms of institutions that are most conducive to structural transformation in SSA. The same applies to the extent of the industrial effects of institutions. There is no consensus on this issue. For example, using the competitiveness index as an indicator of institutions, Mensah et al. (2016) conclude that its effect on industrial performance is not significant whereas Anaman and Osei Amponsah (2009) and Martorano et al. (2017), using an indicator of political stability and absence of violence/terrorism as an indicator of institutions conclude a strong association with industrialization. Furthermore, the role of human capital in the effects of institutional quality on structural transformation has not been addressed in these works.

Given the low level of structural transformation, institutional quality and human capital development in SSA, the following question is formulated: what are the direct and interactive effects of institutional quality and human capital on structural transformation in sub-Saharan Africa? This research therefore investigates the direct and interactive effects of institutional quality and human capital on structural transformation in SSA. Our research attempts to shed more light on both the individual and the combined effects of institutional quality and human capital on structural transformation in SSA. It considers both political and economic institutions, unlike previous research (e.g. Totouom et al.,2019), which is limited to political institutions. We also accounted for the dynamic effects of structural transformation by employing the two-step GMM system.

The rest of this work is organized into four sections. Section 2 presents the literature review. Section 3 presents the methodology, the data and the variables. Section 4 presents and discusses the main results. Section 5 concludes with economic policy implications.

2. Direct and interactive effects of institutional quality on structural transformation: A literature review

This section presents a review of the literature on the direct and interactive effects of institutional quality and human capital of structural transformation.

2.1. Theoretical review

In this section, we present institutional theories and the theoretical contribution of institutions to structural transformation, as well as the role of human capital in this contribution.

2.1.1. Institutional and structural transformation theories

Endogenous growth theory indicates that institutional quality encourages innovation, the accumulation of human capital and promotes structural transformation. Traditional theories of institutional change generally focus on the work of Commons (1931) and Veblen (1909). For Commons (1931), violence and conflict are simply the manifestations of the divergent interests of political forces seeking to control the evolution of institutions. Veblen (1909) developed an approach to institutional change based on conflict and tension. Based on the process of industrialization in Germany and Japan, Veblen (1909) shows that the beneficiaries of traditional technologies are hostile to the adoption of new technologies to preserve their power. The archaic institutional structure is defended or protected by those who have acquired rights. Economic agents disadvantaged by the existing institutional form seek an institutional innovation that will improve their disadvantaged position. This observation gives rise to the idea that the prosperity of an economy depends on its institutions and human capital.

The theory of public choice regulation (Stigler, 1971; Mc Chesney, 1987) has shown that economic institutions, through the effective regulation they provide, are necessary for the development of investment and therefore for economic growth. Economic regulation is based on the existence of market failures, incomplete markets, externalities, income and redistribution effects. This theory has formulated a regulatory model for network industries that recognizes the structural and institutional characteristics of developing countries (DCs) and has emphasized the importance of effective regulation in the equitable provision and sustainable expansion of infrastructure.

Dependency theory (Wone, 1981; Conway and Heynen, 2014) argues that the richest countries need the poorest to ensure their continued growth. This theory goes beyond

traditional explanations of underdevelopment. Import-substitution industrialization involves producing goods locally that were previously imported. It saves foreign currency, reduces the country's dependence on imports and strengthens the country's productive potential. Most of the time, it is part of an "upstream" approach, meaning that local production must first involve consumer goods (light industry), then move on to the production of intermediate goods and finally capital goods. This strategy consisted of moving away from dependence on imports of processed goods, by producing them within the country.

The new institutional economy recognizes that changes have different effects on individuals, households, firms and locations within economies. North (1990) and Olson (1993) show that public policies and institutional frameworks are a fundamental part of growth and development. Similarly, institutions explain a large part of the income gap between countries. Rodrik (2005) and Acemoglu and Johnson (2005) show that good economic institutions have a positive impact on structural transformation through the adoption and implementation of innovations that boost the economy's productivity. They encourage the transition from an economy based on agriculture to one that is more diversified and focused on higher value-added industries. For Acemoglu and Robinson (2008), economic institutions frame interactions in the economic sphere and political institutions define the rules in the political sphere. Jerzmanowski (2006) shows that economic institutions have a positive and significant effect on economic growth through investor protection. This requires the creation of conditions conducive to the emergence of new industries, the development of vocational training, access to finance and the protection of workers' rights. The quality of economic institutions remains an ultimate factor insofar as the incentive to invest is based on industrial factors (transport, location and production costs, technological advantages), commercial factors (market size, proximity of demand) and institutional factors. According to Edison (2003), institutional quality has a significant influence not only on income but also on growth and stability. Institutional reforms have therefore often been presented as determining factors in a country's economic development (Easterly et al., 1997). Taking literature, the picture that emerges is one where growth and development are intimately linked to structural and institutional change, even if the causality is complex and non-linear.

2.1.2. The role of human capital in structural change

The concept of human capital, as the economic value of education or training, is based on two assumptions: in an industrial society, the proportion of low-skill jobs is decreasing, while the proportion of high-skill jobs is increasing; and the levels of education required for jobs are increasing because the same jobs require more skills (Forquin, 1997; Nembot Ndeffo, 2010). These two postulates underline the fact that the level of a country's human capital is a factor that favours industrialization and improved income levels. Indeed, the more educated or trained individuals are, the more likely they are to access better-paid and more prestigious jobs.

According to Démurger (1996) and Mody and Wang (1997), human capital in the form of skilled labour adapted to technology enables manufacturing industries to move up the value chain of high-quality products and increase their productivity. Increasing skill levels improves labour productivity (Lucas, 1988) and therefore manufacturing productivity. Although much of the historical evidence on the relationship between human capital and industrialization seems to suggest a weak link, the results are different when human capital is decomposed into literacy and 'higher' knowledge. Part of the structural transformation is linked to changes in factor endowments as physical, human and institutional capital accumulate (Hausmann and Klinger, 2007; Rodrik, 2012). Structural change and growth can be hindered by constraints on the reallocation of labour, skills or physical capital from one activity to another (Hopenhayn and Rogerson, 1993; Bertola, 1994).

2.2. Empirical review

This section discusses the empirical link between institutional quality and structural transformation on the one hand and the effect of institutional quality and human capital on structural transformation on the other.

2.2.1. Effects of institutional quality on structural transformation

The quality of institutions has a differential effect on structural transformation depending on their size. Martorano et al. (2017) conducted their research on developing countries over the periods 1970-1990 and 1991-2014. They argue that initial economic conditions, demographic and geographical factors, and institutional factors are necessary for the successful conduct of industrialization in these countries. They also stress the importance of financial development and trade openness in the process. Similarly, according to the UNECA (2016), the implementation and practice of the principles of good governance are

essential to achieving structural transformation in Africa, as they define the interaction between the various actors and stakeholders in the economy. Good governance is also a prerequisite for creating an environment conducive to economic diversification (OECD and United Nations, 2011). The business environment in Africa suffers from weak public services and the absence of good quality regulation. According to Totouom (2018), public authorities often struggle to set up high-quality public services and a legal framework that is attractive to investors.

Chêne (2014), based on empirical data, shows that corruption could have an indirect negative effect on businesses, via its effects on factors such as business growth and productivity, investment plans, efficiency and innovation. Totouom et al. (2019) point out that the quality of political institutions plays a key role in the structural transformation of SSA countries. Their research covered 45 SSA countries over the period 1997-2016 and used the generalized method of moments as an estimation strategy. Anaman and Osei Amponsah (2009) found a strong positive effect of institutions on industrialization in Ghana over the period 1974-2006. Their research also highlights the role of factors that can be controlled by policymakers, such as financial sector development and the promotion of macroeconomic stability. Mensah et al. (2016), Beji and Belhadj (2016), and Totouom et al. (2019) have adopted a dynamic specification to analyse the effects of institutions on industrialization in SSA.

Kumssa and Mbeche (2004) assess the role of institutions in the development process of African countries. They attribute the development problems experienced by these countries, in part, to the weakness of institutions and the lack of firmness of the legal systems put in place in these countries. They believe that the poor application of the rule of law, corruption and mismanagement, the absence of a strong civil society and the lack of competition in business hurt economic efficiency. The bureaucracy, corruption and rent-seeking established by autocratic regimes and their administrative systems have increased uncertainty about the rules of the game, hindering private investment and ultimately blocking structural transformation and growth in some countries, particularly those in SSA (Noland and Pack, 2007). Newman et al. (2016), in a comparative analysis between Africa and East Asia, highlight the key role of policy choices in explaining the difference in industrialization outcomes between the two groups.

However, according to UN-Habitat (2013), the relationship between the institutional environment and structural transformation can only be identified through content analysis. Mensah et al. (2016), Beji and Belhadj (2016) found an insignificant effect between

institutions and structural transformation. Miamo Wendji et al. (2024) show that institutional quality negatively explains the level of structural transformation in the countries of the Economic Community of Central African States (ECCAS). Their research focused on a panel of 11 countries over the period 1996-2021. They used the Pool Mean Group estimator. This effect remains the same for indicators of institutional quality such as regulatory quality and the rule of law but becomes positive for government effectiveness and political stability.

Although few countries such as Mauritius and South Africa have experienced structural transformation in their economies since 2000, it has been slow and limited in most SSA countries due to a lack of economic diversification, particularly in countries that are highly dependent on the extraction of natural resources and are therefore vulnerable to external shocks (UNECA, 2016). This fact further justifies the need for this research to investigate and disentangle the direct and indirect effects of institutional quality and human capital on structural transformation in SSA.

2.2.2. The interactive effects of institutional quality and human capital on structural transformation

According to Adejumo et al. (2013) whose research focused on Nigeria, human capital development is seen as a lever to boost industrial development, reduce unemployment and increase the supply of entrepreneurs in any economy. Beji and Belhadj (2016) conducted research on a sample of 35 African countries and found that human capital significantly influences industrialization in Africa, with more pronounced effects in East and West Africa. Martins (2019), using a fixed-effects panel, finds a positive effect of human capital on structural change. The higher the level of education and skills of the population, the higher the labour productivity and the greater the capacity for innovation. This accelerates the process of structural transformation of the economy. It also shows that the pace of structural transformation is largely determined by human physical capital and that investment in education and economic infrastructure is essential to accelerate structural transformation.

Fang and Chao (2015) found that human capital has a positive and significant effect on the development of the industrial sector in China's Shandong province from 1996-2010. However, this is not the case in most SSA countries. Since the early 2000s, the region has been experiencing a cycle of strong economic growth, but the structural transformation that will ensure the development of the region has been slow to materialize. Decent jobs are still scarce, and informality remains the norm in the labour market (Nkouatchet, 2022).

According to UN-Habitat (2013), the interaction between the institutional environment and the availability of appropriate human resources is an important factor in modern growth and development. Their relationship is mutual and bidirectional. Growth in the modern sector would also entail structural transformation, the establishment of good institutions and a good education system. As a result, there is growing interest in considering both the direct and the interactive effects of institutional quality and human capital on structural transformation in SSA. This research therefore aims to enrich literature in this perspective.

3. Methodology and data

This section presents the theoretical and empirical models, the data, the variables and the estimation method.

3.1. Theoretical model

The theoretical model derives from Romer (1986) endogenous growth model based on the accumulation of knowledge and simplified by Hall and Jones (1999), in which we integrate the various institutional indicators. Indeed, the leading model of economic growth is the Solow-Swan model, which focuses on the role of capital accumulation and technological change in explaining the process of economic development. However, because of its minimalist structure, this model ignores the question of structural transformation. Post-Solow and Swan economists worked on so-called endogenous growth models during the 1980s. Most models therefore refer to savings and consumption behavior for the intertemporal maximization of a utility function that may depend solely on consumption:

$$U = \int_0^{\infty} e^{-\rho t} u[c(t)]dt \qquad (1)$$

Endogenous growth models explain the origin of technological progress within the system of equations. The first endogenous growth model is Romer (1986) model, which is based on the accumulation of knowledge and constant returns to the accumulation of growth factors. Assuming that knowledge and physical capital can be assimilated to each other, we can also speak of growth based on the accumulation of productive equipment incorporating the latest technical knowledge discovered. We can then pose the aggregate production function as:

$$Y = A\, K^{\eta} K^{\alpha} \qquad (2)$$

Y is the total output of the economy; A is the technology factor and K is capital. The term in K^{η} is a positive externality for each firm, representing the positive but inappropriate effect that knowledge accumulation represents for each firm. α is the rate of capital depreciation and η is the rate of population growth. This positive externality term implies that investment decisions taken by firms will be sub-optimal. The stability of the growth path then depends on the value of the parameters α and η. If α + η = 1, aggregate returns to capital are constant and the economy behaves like the AK model. The growth rate g of the economy is then:

$$g = \frac{\alpha . A - \rho}{\sigma} \qquad (3)$$

With ρ, the rate of preference for the present and σ the intertemporal elasticity of substitution. If the sum of the coefficients exceeds 1, the economy is on an explosive growth path, because the marginal return on capital is always increasing. Linearizing equation (2) gives:

$$\log(y) = \log(A) + (\eta + \alpha) \log(K) \qquad (4)$$

Because the level of past structural transformation can improve the current transformation (presence of dynamic effects), and applying the exponential equation (4) can therefore be written as follows:

$$y = \alpha_0 y_{t-1} + \alpha_1 A + \alpha_2 K \quad \text{with } \alpha_2 = e^{(\eta+\alpha)} \qquad (5)$$

3.2. Empirical model

Based on the theoretical model, our basic empirical model is described by the equation below:

$$TS_{it} = \alpha_0 + \alpha_1 TS_{it-1} + \beta QI_{it} + \theta X_{it} + \mu_{it} \quad (6)$$

Where i is the country and t is the year, TS is structural transformation, TS_{it-1} is the level of previous transformation, QI is the average quality of institutions (control of corruption, political stability and absence of violence/terrorism, regulatory quality, voice and accountability, government effectiveness, rule of law) or one of these indicators, X is a vector of control variables that are trade openness, human capital, urbanization, financial development, size of the economy, foreign direct investment; μ the error term.

To analyse the specific effects of institutional quality, we introduce these variables individually because they are highly correlated with each other (Table A1). This avoids the

problem of multicollinearity between these variables. The extended version of equation (6) is written as follows:

<u>Model 1:</u> direct effect

$$TS_{it} = \alpha_0 + \alpha_1 TS_{it-1} + \beta QI_{it} + \Theta_1 CH_{it} + \Theta_2 Ouv_{it} + \Theta_3 \mathrm{Df}_{it} + \Theta_4 log(\mathrm{PIBHBT})_{it} + \Theta_5 \mathrm{Fdi}_{it} + \Theta_6 \mathrm{Urb}_{it} + \Theta_7 \mathrm{Caph}_{it} + \mu_{it} \quad (7)$$

Where TS_{it-1} is the lagged level of structural transformation of order 1, QI is institutional quality, Open is trade openness, CH is human capital stock, Df is financial development, PIBHBT is GDP per capita measuring the size of the economy, Fdi is net foreign direct investment inflow, Caph is physical capital, Urb is urbanization rate and μ is the error term. The effects of institutional quality on structural transformation are positive if β is positive.

We estimate the interactive effects between institutional quality and human capital on structural transformation in SSA over the period 2002-2022. Institutional quality could have not only a positive direct effect but also a positive interactive effect with human capital on structural transformation such that the development of human capital reinforces the positive effect of improving institutional quality. To determine the interactive effect between institutional quality and human capital on structural transformation, we specify and estimate the following equation:

<u>Model 2:</u> interactive effect

$$TS_{it} = \alpha_0 + \alpha_1 TS_{it-1} + \beta_1 QI_{it} + \beta_2 QI_{it} * CH_{it} + \Theta_1 CH_{it} + \Theta_2 Ouv_{it} + \Theta_3 \mathrm{Df}_{it} + \Theta_4 log(\mathrm{PIBHBT})_{it} + \Theta_5 \mathrm{Ide}_{it} + \Theta_6 \mathrm{Urb}_{it} + \Theta_7 \mathrm{Caph}_{it} + \mu_{it} \quad (8)$$

Where $QI * \mathrm{CH}$ represents the interaction variable between institutional quality and human capital; β_2 is the coefficient associated with the interaction variable. This interaction allows us to examine the existence of a synergistic effect between institutional quality and human capital on structural transformation in SSA. According to UN-Habitat (2013), the movement of labour is severely affected by the existence of opportunities in skill-intensive sectors because, even if these opportunities exist, labour can only move to a new sector if it is properly trained to be absorbed by the industrial sector. The existing workforce would therefore need the required training before moving to the new sector. This reveals the

importance of human capital in the process of structural transformation. The synergistic effect exists if and only if β_2 is positive and statistically significant.

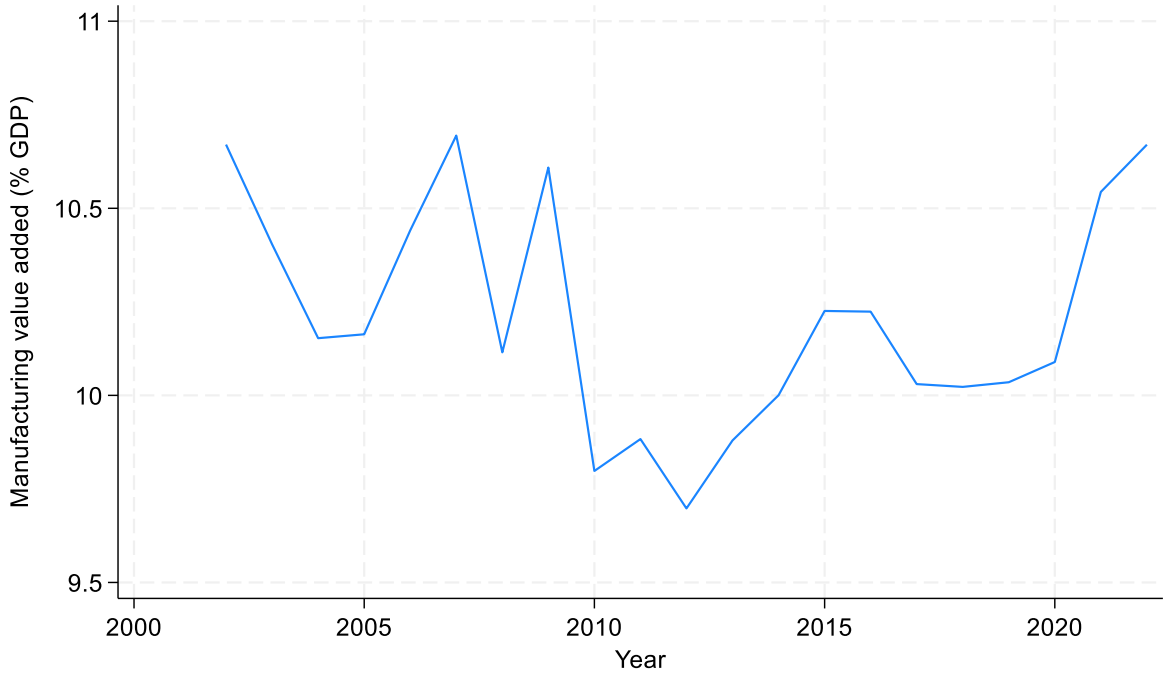
3.3. Data and variables

The data used are annual. They relate to an unbalanced panel of 30 SSA countries over the period 2002-2022. The choice of the period and the size of the sample can be explained by the availability of data. The data used come from the World Development Indicators (WDI) and the Worldwide Governance Indicators (WGI) of the World Bank (2023, 2024). These data relate to the dependent variable, the independent variable of interest, and the control variables. The list of countries in the sample is given in Table A2.

The dependent variable is structural transformation. This refers to the gradual and sustained reallocation of factors of production from the least productive to the most productive sectors of economic activity (Klinger and Lederman, 2004). Two indicators are mainly used in the literature to measure structural transformation. These are the share of manufacturing value added in GDP at constant prices and the share of manufacturing employment in employment (Touna and Ongono, 2019). Kang and Lee (2011), and Gui-Diby and Renard (2015) have used the share of manufacturing value added in GDP to measure the level of industrialization. Productivity growth is decomposed into productivity gains resulting from inter-sector and intra-sector reallocation. Our research focuses solely on inter-sector reallocation because the primary sector, which is less productive, employs a large proportion of the workforce, whereas the industrial sector is more productive but less developed in SSA. We use the share of manufacturing sector value added in GDP at current prices as a measure of structural transformation.

Figure 1 shows a general downward trend in the level of structural transformation in SSA countries over the period 2002-2022. Regarding volatility, it is shown that industrial production is more stable in developed countries than in developing countries (Acemoglu et al., 2003). From 2002 to 2005, manufacturing value added as a percentage of GDP fell from 10.9% to 10.3%. It also fell sharply between 2009 and 2012, from 10.5% of GDP to around 10.3%, before recovering. It will fall again from 10.3% to around 9.6% from 2016 to 2020. This can be explained by the 2007 financial crisis, which had a strong effect on the global business climate, and the health crisis marked by COVID-19. We are seeing a recovery that can be justified by the resilience of businesses.

Figure 1: Change in manufacturing value added in SSA, 2002-2022



Source: Authors

"Institutions are constraints devised by people to structure their interactions. They are made up of formal constraints, informal constraints and enforcement mechanisms. They define the structures of societies and economies" (North, 1994). Daude and Stein (2007) and Kessing et al. (2009) distinguish three main measures of the quality of institutions: the quality of governance (control of corruption, government effectiveness), the existence of laws protecting property and their application (rule of law, quality of regulation) and the limits imposed on political leaders (political stability and absence of violence, voice and accountability). Rodrik (2005) makes a typology of economic institutions. He distinguishes between institutions for creating the market (property rights, compliance with contracts), institutions for regulating the market (regulatory bodies, mechanisms for correcting market failures), institutions for stabilizing the market (monetary and fiscal institutions, institutions of regulation and prudential control) and institutions for legitimizing the market (democracy, institutions of social protection and insurance). Acemoglu and Robinson (2012) distinguish economic institutions from political and economic institutions, and inclusive institutions from extractive institutions.

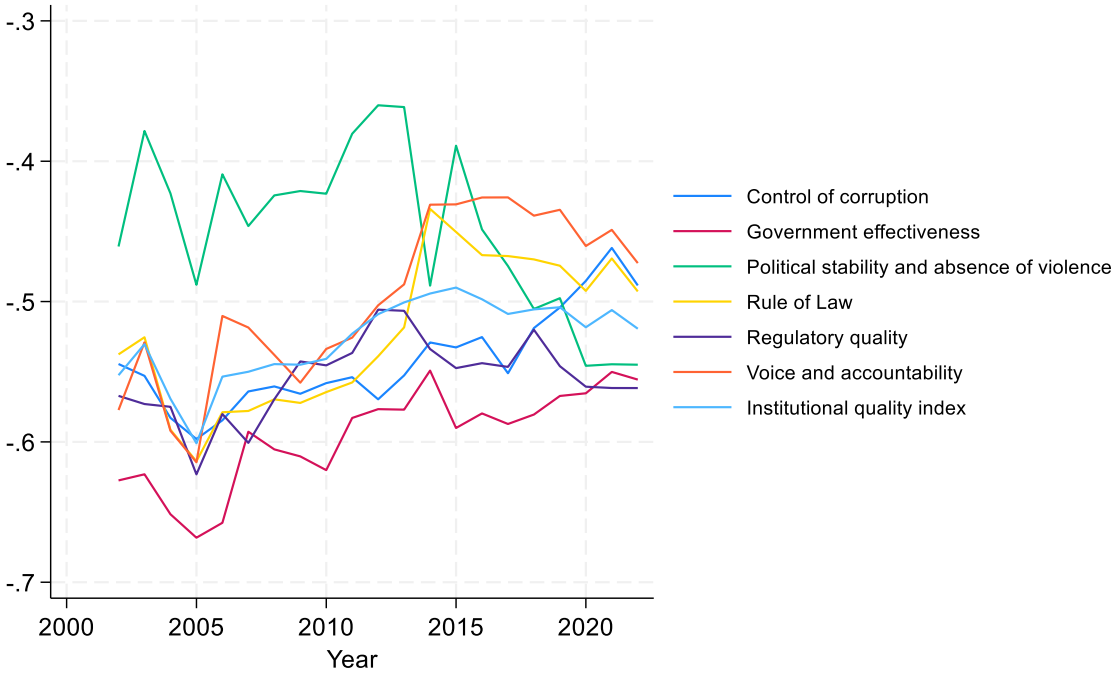
Structural transformation is supported in large part by inclusive economic and political institutions that encourage the development, adoption and use of technologies to

change what and how an economy produces (Acemoglu and Robinson, 2012; UN-Habitat, 2013). High institutional efficiency can reduce imperfections as well as distortions caused by public policies to make resource allocation more efficient in Africa (UNECA, 2016).

In this research, we use Kaufmann and al. (2010) six indicators of institutional quality. These six indicators are control of corruption (Corr), regulatory quality (Rq), political stability and absence of violence (Sp), voice and accountability (Va), government effectiveness (Ge) and rule of law (Rd). Following Asamoah (2021) and Ouedraogo et al. (2022), we calculated an overall indicator of institutional quality by taking the arithmetic mean of these six indicators.

Figure 2 shows changes in the level of institutional quality in SSA countries over the period 2002-2022. The level of control of corruption and government effectiveness has been falling since 2002 and improved slightly in 2017. This shows that citizens have less confidence in their leaders and institutions. SSA countries have long suffered from poor governance and institutional quality linked to low levels of control of corruption and political or economic crises in some countries. Similarly, the rule of law and accountability were high in 2015, after which there was a downward trend. This means that citizens have fewer opportunities to express their opinions and political choices, and the judicial system has become less independent and effective. The regulatory quality was on the rise until 2013 before falling. This means that the government has regulated the market and the environment less well, and this has worsened in recent years. As for political stability and the absence of violence, there has been a sharp deterioration, especially since 2006. This points to political instability marked by military and institutional coups d'Etat, as well as a deteriorating security situation with terrorist attacks in some countries. As a result, citizens are more exposed to violence and conflict. Overall, the institutional quality fluctuates, hovering around -0.6 over the period 2002-2022. The region has not succeeded in converging towards higher international standards for improving its institutional quality.

Figure 2: Trends in institutional quality indicators in SSA, 2002-2022

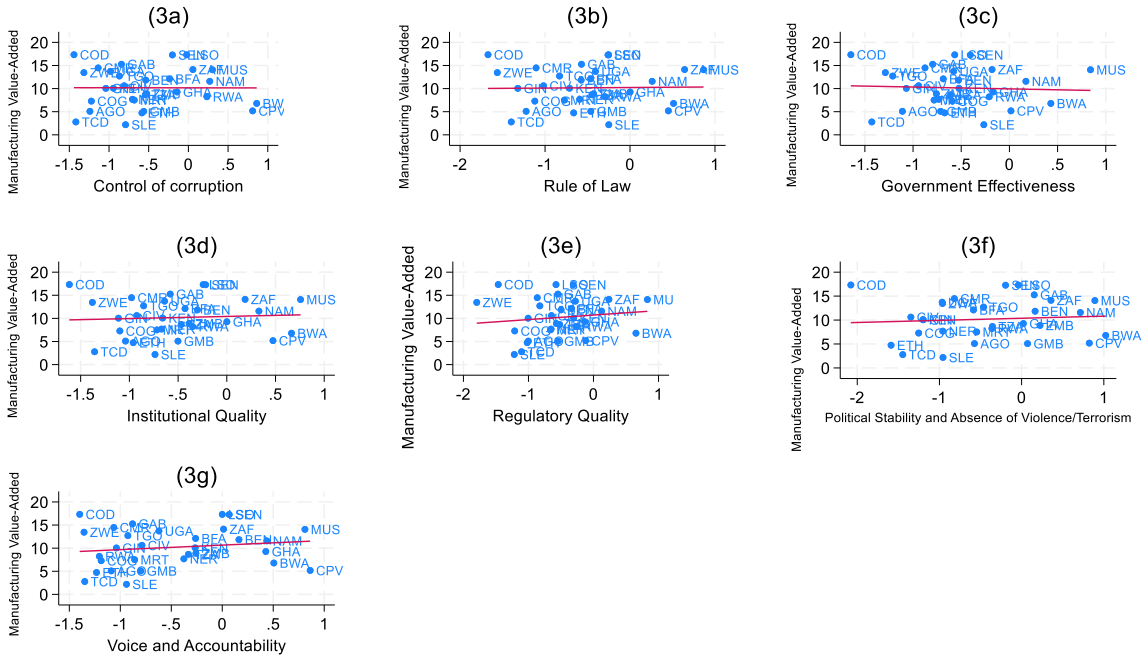


Source: Authors

The correlations between indicators of institutional quality and structural transformation over the period 2002-2022 in SSA are shown in Figure 3. This figure shows a positive correlation between all indicators of institutional quality and structural transformation in SSA over the period 2002-2022. There is also a positive correlation between overall institutional quality and structural transformation (Figure 3d). This means that countries with better institutional quality tend to have higher levels of structural transformation. However, the correlation is much stronger between the regulatory quality and structural transformation (Figure 3e). This strong positive correlation is corroborated by the correlation matrix for the variables (Table A3), which indicates a correlation coefficient of 0.86 between the two variables. This means that regulation favourable to the development of the private sector is associated with an improvement in the business climate, creation and innovation, and hence an expansion in the level of industrialization. The rule of law is also strongly correlated with structural transformation in SSA over the period 2002-2022 (Figure 3b), with an estimated correlation coefficient of 0.69 (Table A3). This means that legal rules and the protection of property rights are positively and strongly associated with increased structural transformation. The rule of law guarantees the efficiency and impartiality of the judicial system, which gives investors the confidence to invest their resources in the industrial

sector. Voice and accountability is the third dimension of institutional quality that is most positively associated with structural transformation (Figure 3g), with a correlation coefficient of 0.10 (Table A3). Citizen participation strengthens the transparency and accountability of government, which limits opportunities for corruption and tax evasion.

Figure 3: Correlation between indicators of institutional quality and structural transformation in SSA, 2002-2022



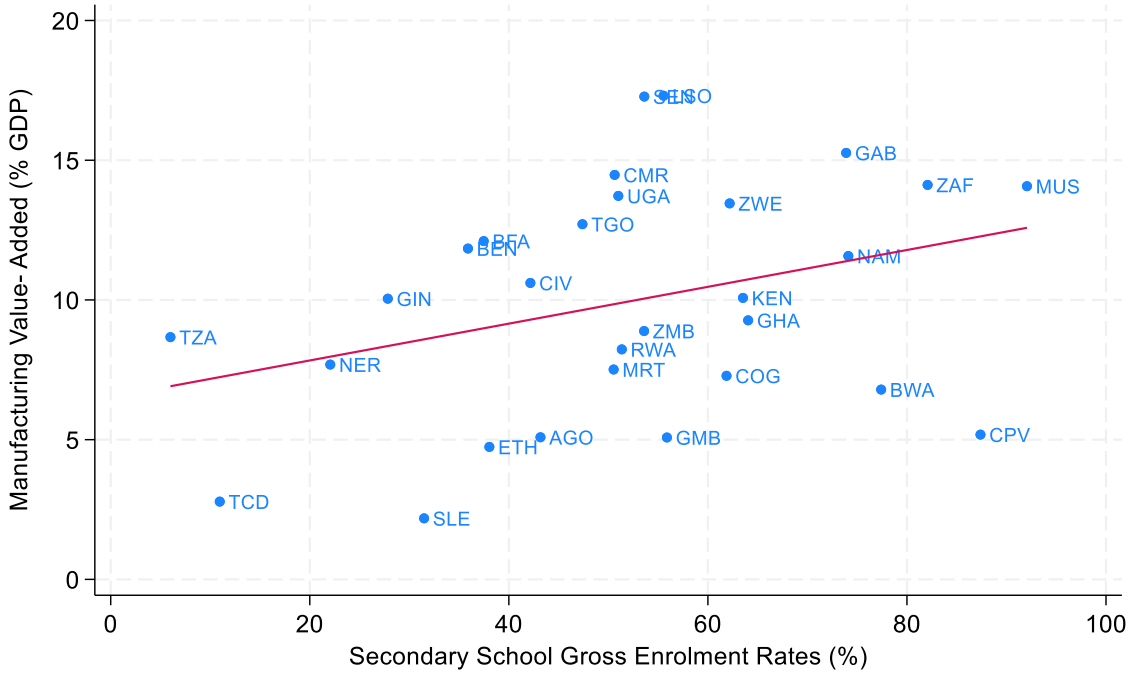
Source: Authors

The control variables are selected based on the existing literature. These variables are trade openness (Ouv), human capital (CH), financial development (Df), the size of the economy (GDPHBT) and foreign direct investment (Fdi), the urbanization rate (Urb) and physical capital (Caph).

Human capital, the knowledge, skills, competencies and other qualities of an individual that promote personal, social and economic well-being (OECD, 2001). Lucas (2002, 2004) uses human capital to explain the shift from agriculture to manufacturing. He points out that, over time, an increasing number of skilled workers are valued by the non-agricultural sector, triggering a reallocation of labour away from agriculture. Martins (2019) points out that investments in education and economic infrastructure are essential to accelerate structural transformation because the pace of structural transformation is largely determined by human and physical capital. Over the period 2002-2022, human capital is positively correlated with structural transformation (Figure 4), with an estimated correlation

coefficient of 0.21 (Table A3). This shows that a skilled workforce accompanies structural transformation in SSA. It is measured by the gross secondary school enrolment rate and the assumed rate of return to education. The expected sign is positive.

Figure 4: Correlation between human capital and structural transformation in SSA, 2002-2022



Source: Authors

A deep financial system, ensuring an acceleration of capital accumulation and consequently the formation of a solid industrial base, is also suggested as a determinant of structural transformations (Acemoglu and Zilibotti, 1997; Estrada et al., 2010). The weakness of the financial sector in developing countries is then seen as an obstacle to the creation of new activities and structural change. Kim et al. (2016) argue that financial development, through the channel of bank credit, promotes rapid growth of industrial sectors made up of small and medium-sized enterprises in economies where the structure of the financial system relies more on banks than on financial markets. Ewetan and Ike (2014) show that credit to the private sector has a positive effect on industrial growth in Nigeria. Udoh and Ogbuagu (2012) also find that financial development has a negative and significant effect on the industrial output of the Nigerian economy in both the long and short runs. Financial development is measured by domestic credit to the private sector (% of GDP). The expected sign is positive or negative.

The role of foreign direct investment (FDI) in industrialization is justified by its ability to promote access to technology and global markets and, has the potential to have spillover effects on the national economy (UNIDO, 2016). FDI is measured by net FDI inflows as a % of GDP. The expected sign is positive.

Physical capital refers to all acquisitions of productive elements and basic infrastructure (roads, dams, bridges, schools). Improving the quality of infrastructure lowers transaction and production costs (transport, energy) and consequently stimulates demand and supply, which is likely to promote competitiveness (Gannon and Liu, 1997) and structural transformation. Its expected sign is positive.

Trade openness is generally measured by the ratio of the sum of exports and imports to GDP. The effect of trade openness on the development of the industrial sector has produced controversial results in the literature. Indeed, Keller (2010) finds that it could allow domestic firms to benefit from the advanced technologies of foreign firms and thus increase their efficiency. Both importing and exporting can encourage economic growth through efficiency, the adoption of modern technologies and the efficient use of resources (Chatri et al., 2019). Opening trade would accelerate this process of transforming the economy and enabling developing countries to catch up with the rest of the world. However, Kaya (2010) shows that imports harm the industrialization process. The expected sign can be positive or negative.

Urbanization is known to be a vehicle for economic and social transformation at the national level. In Burkina Faso, it promotes economic growth (Ouedraogo, 2022). Planned urbanization is expected to bring rapid economic progress and prosperity, with industrialization as the result (UN-Habitat, 2013). Cities are known to be centres of change and innovation, mainly because the concentration of people, resources and activities are supposed to foster innovation and industrial growth. The expected sign is positive.

The size of the economy is measured by real GDP per capita, which is a measure of a country's overall economic performance. Beji and Belhadj (2016) show in a sample of 35 African countries that the size of the economy has a positive effect on the level of industrialization, albeit with a moderate effect. The expected sign is positive. The definition of the variables, their sources and the expected signs are presented in Table A4. Table 1 presents the descriptive statistics of the variables.

Table 1: Descriptive statistics

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
Manufacturing value added	601	10.482	4.665	0.2326	24.557
Institutional quality	609	-0.519	0.610	-1.726	0.870
Control of corruption	609	-0.533	0.647	-1.592	1.244
Political stability	609	-0.430	0.850	-2.403	1.201
Regulatory quality	609	-0.531	0.587	-2.201	1.196
Voice and accountability	609	-0.482	0.697	-1.697	0.975
Government effectiveness	609	-0.607	0.565	-1.841	1.150
Rule of law	609	-0.531	0.663	-1.870	1.023
Trade openness	595	69.873	27.802	24.006	1650.48
Human capital	567	54.285	20.996	3.620	95.053
Real GDP per capital (log)	609	28.141	2.539	22.208	32.838
Foreign direct investment	609	3.557	4.657	-17.292	46.275
Financial development	527	24.156	26.660	0.491	142.422
Urbanisation rate	609	3.682	1.277	-0.215	7.604
Physical capital	566	23.231	8.567	2.0004	78.001

Source: Authors

Table A3 and Table 2 indicate the absence of multicollinearity between the independent variables. In Table A3, all the correlation coefficients between the variables are below 0.8. According to Field (2005), this indicates that there is no presumption of multicollinearity between the variables. The calculation of the Variance Inflation Factor (VIF) corroborates this. According to Bourmont (2012), there is a multicollinearity problem when a VIF has a value greater than or equal to 10 and/or when the average of the VIFS is greater than or equal to 2. Otherwise, the effect of multicollinearity is not worrying, and all the explanatory variables can therefore be retained for the analysis. If, on the other hand, these values were reached, the problem of multi-collinearity would have to be dealt with by the researcher. Table 2 corroborates that there is no multi-collinearity between the explanatory variables in the model.

Table 2: Variance Inflation Factor

Variables	VIF	1/VIF
Structural transformation	2.04	0.489
Institutional quality	2.12	0.471
Commercial opening	1.88	0.532
Size of economy	1.53	0.653
Foreign direct investment	1.37	0.729
Financial development	2.36	0.424
Urbanisation rate	1.82	0.549
Physical capital	1.87	0.535
Mean of Vif	1.87	

Source: Authors

After the multicollinearity test, we also check the stationarity of the variables. The Fisher-type test combines the tests of Maddala and Wu (1999) and Choi (2002), which are tests of two different generations and can be performed on unbalanced panels. The Fisher-type test is specified according to several laws, namely the inverse of Chi-square (P), the inverse of Gauss's law (Z), the inverted logit (L*) and the modified inverse of Chi-square (Pm). The results of this test, presented in Table 3, indicate that all the variables in the model are stationary at level.[1].

Table 3: Summary of the results of the stationarity test

Variables	P	Z	L	Pm	Décision
Structural transformation	84,426**	-1,865**	-2,012**	2,453***	I(0)
	(0.013)	(0.031)	(0.023)	(0.007)	
Institutional quality	86.274**	-1.643*	-1.579*	2.625**	I(0)
	(0.009)	(0.050)	(0.058)	(0.004)	
Human capital	93.076***	1.770	1.159	3.760***	I(0)
	(0.000)	(0.961)	(0.875)	(0.000)	
Commercial opening	81.966**	-1.825**	-2.051**	2.225**	I(0)
	(0.020)	(0.034)	(0.021)	(0.013)	
Size of economy	83.209**	-0.472	0.538	2.340***	I(0)
	(0.016)	(0.318)	(0.195)	(0.009)	
Foreign direct investment	214.087***	-8.108***	-9.825**	14.492***	I(0)
	(0.000)	(0.000)	(0.000)	(0.000)	
Financial development	87.552***	0.346	-0.868	2.743***	I(0)
	(0.007)	(0.635)	(0.193)	(0.003)	
Urbanisation rate	196.516***	0.325	-3.981***	12.860***	I(0)

[1] In such a situation, cointegration tests are of no use. Consequently, we will not carry out a cointegration test for the variables in this analysis.

	(0.000)	(0.627)	(0.000)	(0.000)	
Physical capital	81.184**	-1.124	-1.118	2.374***	I(0)
	(0.015)	(0.130)	(0.132)	(0.008)	

Note: Robust standard errors in brackets, *** p<0.01; ** p<0.05; * p<0.1
Source: Authors

3.4. Estimation methods

The institutional quality variable is endogenous. Indeed, institutions are assumed to be endogenous in the model because of the reverse causality that can run from institutions to industrialization and from industrialization to institutions. For example, if good institutions can foster industrial development, industrialization and the improvement in living standards it implies will probably make people less corrupt and more willing to create better institutions (Totouom et al., 2019). Because of this reverse causality, these variables may be correlated with the error term. Measurement errors are another source of endogeneity bias. Indeed, variables capturing institutions contain measurement errors due to their subjective nature (Edison, 2003; Ouedraogo et al., 2022). Instead, institutions are correlated with certain unobserved characteristics that also determine industrial performance. The data on the institutional quality are estimated and unobserved and may therefore have problems of measurement errors. As a result, the use of standard econometric techniques such as Ordinary Least Squares (OLS) and Generalized Least Squares (GLS) leads to biased results because the assumptions of these methods are violated. In the case of dynamic panels where the sample size (N) is greater than the study period (T) (here N= 30 and T=20, N is greater than T) the Generalized Method of Moments (GMM) of Arellano and Bond (1991) and Arellano-Bover (1995) and Blundell-Bond (1998) is used. Specifically, the two-step GMM system is used. Level values lagged by one or two periods of institutional quality are used as internal instruments. To ensure that the results obtained by the GMM are valid, we use Arellano and Bond (1991) AR (1) and AR (2) tests of serial correlation properties, Hansen (1982) test of overidentifying restrictions, which tests the validity of the instruments, and the instrument non-proliferation test, which certifies that Hansen's test is not vitiated by the proliferation of the internal instruments.

4. Direct and interactive estimated effects of institutional quality and human capital on structural transformation in Sub-saharan Africa

This section presents and discusses the main findings on the direct effects of institutional quality on structural transformation. It also presents and discusses the interactive effects of institutional quality and human capital on structural transformation. The robustness of the results is also analysed.

4.1. Direct effects of institutional quality on structural transformation in Sub-Saharan Africa

The Hansen tests for the results of the estimates (Table 4) give probabilities greater than 10%. The null hypothesis of the validity of the internal instruments used cannot therefore be rejected. Similarly, Arellano-Bond AR (2) autocorrelation tests do not allow us to reject the null hypothesis that there is no autocorrelation of second-order errors. Its probability is greater than 10%. The probabilities of the AR (1) tests are all less than 1%. This confirms the hypothesis that first-order errors are autocorrelated. In addition, there is no instrument proliferation problem: the number of countries is greater than the number of instruments. These results confirm that the estimators are efficient and valid.

The level of previous structural transformation explains the level of current structural transformation. Indeed, if the level of past structural transformation was one percentage point, it improves the level of current transformation by 0.79 percentage point. This lagged variable was used by Mensah et al. (2016), Beji and Belhadj (2016) and Totouom et al. (2019). They found that the presence of a previous structural transformation improves the level of the current structural transformation. This makes it possible to consider the catching-up or cumulation of the industrialization process, thus confirming the relevance of adopting a dynamic model in this research.

In the first column of Table 4, institutional quality has a positive and significant effect on structural change in SSA. The better the institutional quality, the higher the level of structural transformation. An improvement in the institutional quality of one unit increases structural transformation by 5.67 percentage points. This result confirms the idea that institutional quality is a determining factor of structural transformation. Indeed, better institutional quality implies better compliance with the laws, rules and conventions that frame economic activities, greater transparency and political stability to allow innovation and creation, and the movement of labour towards greater efficiency in the industrial sector. Our results corroborate those of Totouom et al. (2019), Anaman and Osei Amponsah (2009) and Martorano et al. (2017), who have shown that institutional quality plays a crucial role in the structural transformation of SSA countries. However, this overall effect of institutional quality on structural transformation hides differentiated effects according to the dimensions of institutional quality.

In Table 4, the results show that the different dimensions of institutional quality have varying effects on structural transformation. For example, control of corruption, government effectiveness and regulatory quality have positive and significant effects on structural

transformation. This corroborates preliminary results that these aspects of institutional quality accelerate more structural transformation in SSA. At a significance level of 1%, in SSA, a one-unit improvement in corruption control, government effectiveness and regulatory quality leads to an improvement in the level of structural transformation of around 3.48, 2.82 and 3.47 percentage points, respectively.

These dimensions of institutional quality are crucial in providing investors with a guarantee of confidence. Controlling corruption makes it possible to reduce the obstacles to structural transformation arising from the misappropriation of public funds, tax evasion and contracts that are not or are poorly executed. Corruption is an important informal institution, and controlling it helps to control other institutional indicators that could foster structural transformation. The quality of regulation makes it possible to avoid excessive or arbitrary obstacles to economic activity and to allow labour mobility between economic sectors. Government effectiveness makes it possible to improve the quality and efficiency of public services, which can encourage agents to invest more in the industrial sector.

As for the rule of law and voice and accountability, they have positive and significant effects at the 5% level on structural transformation (Table 4), which suggests that a one-unit improvement in these aspects of institutional quality increases structural transformation in SSA by 3.88 and 2.10 percentage points, respectively. These results are partly consistent with those of Totouom et al. (2019) who find that law enforcement is crucial in the structural transformation of SSA countries. The rule of law guarantees property rights and regulates market competition. The voice and accountability can increase democratic participation and control over public decisions and strengthen confidence in institutions. These results also corroborate those of Heo and Tan (2001), who showed that democracy tends to encourage and prepare actors to exercise economic freedom, and to encourage governments to promote economic freedom that favours the private initiative of entrepreneurs. Feng (2004) argues that democratic governments are more favourable to good economic performance than other political arrangements in both developed and less developed countries.

Finally, political stability and the absence of violence have a positive and statistically significant effect at the 10% threshold on structural transformation (Table 4). This means that a one-unit improvement in political stability can increase structural transformation by 0.58 percentage points. This result is in line with those of Totouom et al. (2019). Political stability and the absence of violence is a necessary condition for a sound economy, as political instability makes investors anxious and limits cooperation and investment. Political instability is not conducive to industrialization and structural change.

Human capital has a positive and statistically significant effect on structural transformation at the 1% threshold. This means that the more skilled the workforce, the higher the level of structural transformation. This result corroborates those of Adejumo et al. (2013) and Beji and Belhadj (2016). Adejumo et al. (2013) argue that human capital development is a lever for industrial development, reduces unemployment and increases the supply of entrepreneurship in economies. Beji and Belhadj (2016) find that human capital has a significant influence on industrialization in Africa. This means that a well-trained workforce is conducive to creation and innovation and to the migration of workers from less productive sectors to more productive ones.

Foreign direct investment has a positive and significant effect on structural transformation in SSA. Indeed, FDI brings technology and innovation which are important in the industrialization process. Both import and export can encourage structural transformation through efficiency, the adoption of modern technologies and the efficient use of resources (Chatri et al., 2019). Physical capital has a positive and statistically significant effect on structural transformation. This means that the more quality infrastructure a country has (roads, energy, communication networks), the better it can structurally transform its economy thanks to easier access to the necessary resources and lower costs. These results corroborate those of Gannon and Liu (1997), who show that improving the quality of infrastructure lowers costs and therefore stimulates demand and supply. This in turn promotes competitiveness and structural transformation.

The rate of urbanization has a positive and statistically significant effect on structural transformation at the 1% threshold. This means that when the urbanization rate increases by one percentage point, structural transformation increases by 0.35 percentage points. This result corroborates that of UN-Habitat (2013), which points out that planned urbanization is supposed to bring rapid economic progress and prosperity, with industrialization as the result. According to their research, cities are known to be centres of change and innovation because the concentration of people, resources and activities is supposed to foster innovation and industrial development.

Tableau 4: Direct Effects of institutional quality on structural transformation in Sub-Saharan Africa

	Estimation method: Two-step GMM system Dependent variable: Manufacturing value added (% of GDP)						
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Lag. Manufacturing value added	0.7958***	0.8796***	0.9603***	0.8341***	0.9157***	0.9037***	0.9191***
	(0.0508)	(0.0516)	(0.0342)	(0.0348)	(0.0301)	(0.0252)	(0.0217)
Human capital	0.0197***	0.0130***	0.0055***	0.0126***	0.0078***	0.0077**	0.0082***
	(0.0043)	(0.0050)	(0.0018)	(0.0038)	(0.0030)	(0.0034)	(0.0023)
Commercial open	-0.0081	-0.0187**	-0.0512***	-0.00308*	-0.0218	-0.0345***	-0.0012
	(0.0055)	(0.0083)	(0.0152)	(0.0179)	(0.0137)	(0.0105)	(0.0193)
Size of economy (log)	1.1688	0.2429	0.7202	2.1482***	-0.9041	0.3922	-2.8933*
	(0.9688)	(1.2759)	(1.6875)	(0.6580)	(1.2931)	(0.8524)	(1.6476)
Foreign direct investment	0.0097**	0.0074*	0.0379**	0.0516***	-0.0855**	0.0031	-0.1011***
	(0.0038)	(0.0039)	(0.0192)	(0.0140)	(0.0386)	(0.0061)	(0.0362)
Urbanization rate	0.3500***	0.2765***	-1.8888*	-0.7196	-0.5917	-2.2891**	-0.3896
	(0.0304)	(00.766)	(1.1060)	(1.3450)	(0.5570)	(0.9467)	(0.6607)
Physical capital	0.0206***	0.0199**	0.1593***	0.1729***	0.1086**	-0.0365	-0.1713
	(0.0057)	(0.0100)	(0.0308)	(0.0037)	(0.0503)	(0.0494)	(0.0521)
Financial development	-0.0063	-0.0010	-0.0198	0.0037	-0.0291*	-0.0125	-0.0385**
	(0.0060)	(0.0086)	(0.0138)	(0.0060)	(0.0156)	(0.0101)	(0.0193)
Institutional quality	5.6756***						
	(1.8045)						
Control corruption		3.4816***					
		(0.5346)					
Government effectiveness			2.8219***				
			(0.8782)				
Political stability				0.5879*			
				(0.3366)			
Regulatory quality					3.4740***		
					(1.2870)		
Rule of law						3.8851**	
						(0.7465)	
Voice and accountability							2.1035**
							(0.7848)
Constant	0.7914	-0.0069	0.0631	0.7447**	-0.4695*	0.4618*	0.5848*
	(0.6289)	(0.5848)	(0.2680)	(0.3369)	(0.2842)	(0.1869)	(0.2987)
Observations	420	420	420	420	420	420	420

Number of countries	30	30	30	30	30	30	30
Number of instruments	25	27	26	26	26	27	25
AR test (1) (P-value)	-2.66	-2.83	-2.82	-2.71	-2.90	-2.78	-2.99
	(0.008)	(0.005)	(0.005)	(0.007)	(0.004)	(0.005)	(0.003)
AR test (2) (P-value)	-0.09	-0.39	-1.40	-0.80	-0.42	-0.54	0.70
	(0.928)	(0.696)	(0.160)	(0.422)	(0.675)	(0.593)	(0.485)
Hansen test (P-value)	15.39	16.21	13.33	11.30	17.47	16.09	17.49
	(0.568)	(0.509)	(0.648)	(0.791)	(0.356)	(0.518)	(0.290)

Note: Robust standard errors in brackets, *** p<0.01; ** p<0.05; * p<0.1
Source: Authors

4.2. Interactive effects of institutional quality and human capital on structural transformation in Sub-Saharan Africa

The estimated coefficient of the interaction in Table 5 between institutional quality and human capital is positive and significant at 1%, which means that the effect of institutional quality on structural transformation may be accentuated in the presence of a skilled labour force in SSA. β_2 = 2.51 is positive and statistically significant. This means that in the presence of efficient institutions, a well-trained workforce can achieve a higher level of structural transformation in SSA. The effect of the quality of institutions on structural transformation, considering human capital, can be expressed by deriving in model 2 the structural transformation in relation to institutional quality. We then obtain:

$$\frac{\partial TS_{it}}{\partial QI_{it}} = \beta_1 + \beta_2 * CH_{it} \qquad (7)$$

This equation can be rewritten using the results in Table 5, column (1) as follows:

$$\frac{\partial TS_{it}}{\partial QI_{it}} = 0{,}91 + 2{,}51 * CH_{it} \qquad (8)$$

With β_1 =0,91 and β_2 = 2,51.

This relationship makes it possible to determine the magnitude of the effect of institutional quality on structural transformation, given a given level of human capital. In the empirical literature, researchers generally choose between the median or the mean of the conditional variable to precisely determine this magnitude. In this research, we propose to choose the mean of human capital to calculate this magnitude. According to Table 1, the average gross secondary school enrolment rate is estimated at 54.29%. Thus, for a gross secondary enrolment ratio of 54.29%, when the institutional quality improves by one unit, the structural transformation increases by $\frac{\partial TS_{it}}{\partial QI_{it}}$ = 0.91+ 2.51*54.29% which is equal to 2.27 percentage points. For a gross enrolment ratio equal to the maximum in the countries of the region, 95.05% (Table 1), when the institutional quality improves by one unit, the structural transformation increases by $\frac{\partial TS_{it}}{\partial QI_{it}}$ = 0.91+ 2.51* 95.05%, i.e. by 3.30 percentage point.

As for the control of corruption, government effectiveness and regulatory quality, when they increase by one unit, with the highest secondary school enrolment rate in the region (95.05%), structural transformation accelerates by 3.11 (2.58+0.56*95.05%), 3.12 (2.57+0.58*95.05%) and 3.10 (2.62+0.47*95.05%) percentage points, respectively.

These results mean that human capital amplifies the effect of institutional quality on structural transformation. A good institutional framework, by guaranteeing effective governance, good regulatory quality, better control of corruption and government effectiveness to correct market imperfections, facilitates the mobility of factors, including labour. This confirms previous results, particularly those of UN-Habitat (2013), which show that the interaction between the institutional environment and the availability of appropriate human resources is an important factor in modern growth and development. The results also show that human capital better affects structural transformation in the presence of good institutions. If human capital increases by one percentage point, with the highest level of institutional quality in the region, 0.87 (Table 1), structural transformation improves by 2.21 percentage points (0.03+ 2.51*0.87).

Table 5: Interactive Effects of institutional quality and human capital on structural transformation in Sub-Saharan Africa

	Estimation method: two-step GMM system **Dependent variable: Manufacturing value added (% of GDP)**			
VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**
Lag. Manufacturing value added	0.6841***	0.9497***	0.9707***	0.9355***
	(0.0766)	(0.0331)	(0.0343)	(0.0231)
Human capital	0.0250***	0.0097*	0.0112***	0.0094**
	(0.0072)	(0.0051)	(0.0035)	(0.0044)
Interaction QI*CH	2.5086***	0.5595***	0.5807***	0.4655***
	(0.9257)	(0.2054)	(0.1328)	(0.1548)
Commercial opening	0.0042	0.0026	-0.0022	-0.0026
	(0.0120)	(0.0025)	(0.0019)	(0.0022)
Size of economy (log)	1.2756	-2.4723***	-1.1251	-2.2405*
	(0.8516)	(0.7855)	(0.7987)	(1.3560)
Urbanisation rate	0.2294**	0.2778	-0.9883**	-1.9097***
	(0.1120)	(0.2791)	(0.3986)	(0.7386)
Financial development	-0.0308	-0.0002	-0.0855***	-0.0227
	(0.0210)	(0.0205)	(0.0152)	(0.0375)
Physical capital	0.0313*	0.0340***	-0.0122	0.0073
	(0.0180)	(0.0107)	(0.0117)	(0.0123)
Foreign direct investment	-0.1123	0.0375***	0.0216**	0.0275***
	(0.0746)	(0.0108)	(0.0097)	(0.0103)
Institutional quality	0.9051***			
	(0.3328)			
Control corruption		2.5846***		
		(0.7825)		
Government effectiveness			2.5703***	
			(0.5795)	
Regulatory quality				2.6194*
				(1.4958)
Constant	0.3083	-0.2767	-0.4075	0.2888
	(1.2023)	(0.3044)	(0.3883)	(0.3459)
Observations	420	420	420	420
Numbers of countries	30	30	30	30
Numbers d'instruments	28	28	26	26
AR test (1) *(p-value)*	-2.75	-2.87	-2.69	-2.69
	(0.006)	(0.004)	(0.007)	(0.007)

AR test (2) *(p-value)*	0.72	-0.11	0.14	-0.33
	(0.472)	(0.910)	(0.889)	(0.744)
Hansen test *(p-value)*	13.69	15.96	15.51	18.31
	(0.689)	(0.527)	(0.415)	(0.370)

Note: Robust standard errors in brackets, *** p<0.01; ** p<0.05; * p<0.1
Source: Authors

4.3. Robustness checks

To check the robustness of our results, we use a broader indicator of structural transformation. This is an industrial value added in percentage of GDP. This indicator considers not only manufacturing but also non-manufacturing industries such as construction, mining, energy, gas, water and air conditioning. It has already been used by Totouom et al. (2019). To this end, we will take the share of industrial value added in GDP as a measure of structural transformation to check the robustness of our previous results. The results reported in Table A5 show that institutional quality and human capital have positive and statistically significant effects. The same is true for their interaction, which is statistically significant at the 1% level. All indicators of institutional quality have a positive and significant effect on structural transformation.

5. Conclusion and policy implications

This research investigated the direct and interactive effects of institutional quality and human capital on structural transformation in sub-Saharan Africa. On the one hand, the aim was to identify the specific forms of institutions that improve structural transformation. On the other hand, it involved analysing the interactive effects of institutional quality and human capital on structural transformation in SSA. It employed the two-step GMM system on an unbalanced panel of 30 countries covering the period 2002-2022. The results show that improving institutional quality increases structural transformation in the region. In addition, the control of corruption, government effectiveness and regulatory quality are the major specific forms of institutions that improve structural transformation in SSA. In addition, developing human capital can accelerate structural transformation in SSA. Moreover, the results show that human capital can be used as a lever to improve the effect of institutional quality on structural transformation in SSA and *vice versa*.

These results imply the implementation of institutional reforms aimed at improving institutional quality, effectively controlling corruption, increasing transparency in the management of public affairs, more government effectiveness and better market regulation. As a result, the public authorities can encourage good practice, increase the digitalization of public services and punish offenders. Digitalization makes services more fluid and reduces

corruption. In addition, the rule of law, democracy and political stability also improve structural transformation. Public authorities should guarantee property rights, political stability and democracy to enhance the region's structural transformation. This may involve putting in place effective strategies to combat insecurity in the region, and facilitating constructive dialogue so that the aspects necessary for structural transformation can be considered.

Our results also show that human capital is an important factor in structural transformation. When combined with institutional quality, it can accelerate the region's structural transformation. As a result, public decision-makers should improve the level of human capital through the establishment of a high-quality and equitable education system to strengthen the acquisition of skills required for market needs and structural transformation. The authorities can put in place modern educational and training infrastructures and improve the skills of supervisors. Public officials should prioritize scientific, technical and practical vocational training, which facilitates the rapid and solid acquisition of skills and can therefore be a source of creation and innovation. Such training would be more important for industrialisation and therefore for structural transformation.

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Appendices

Table A1: Correlation matrix of institutional quality variables

	VAM	QI	Corr	Sp	Rq	Va	Ge	Rd
VAM	1.000							
QI	0.056	1.000						
Corr	-0.026	0.918***	1.000					
Sp	0.044**	0.870***	0.745***	1.000				
Rq	0.085**	0.910***	0.799***	0.704***	1.000			
Va	0.097***	0.884***	0.763***	0.730***	0.763***	1.000		
Ge	0.039	0.900***	0.820***	0.682***	0.851***	0.729***	1.000	
Rd	0.069	0.961***	0.884***	0.785***	0.887***	0.814***	0.880***	1.000

Note: Robust standard errors in brackets, *** p<0.01; ** p<0.05; * p<0.1
Source: Authors

Table A2: List of countries in the sample

Country	**Country code**	**Country**	**Country code**
Afrique du Sud	ZAF	Lesotho	LSO
Angola	AGO	Maurice	MUS
Benin	BEN	Mauritanie	MRT
Botswana	BWA	Namibie	NAM
Burkina Faso	BFA	Niger	NER
Cameroun	CMR	Ouganda	UGA
Cap-Vert	CPV	République Démocratique de Congo	COD
Côte d'Ivoire	CIV	Rwanda	RWA
Ethiopie	ETH	République du Congo	COG
Gabon	GAB	Sierra Leone	SLE
Gambie	GMB	Sénégal	SEN
Ghana	GHA	Tanzanie	TZA
Guinée	GIN	Tchad	TCD
Kenya	KEN	Togo	TGO
Zambie	ZMB	Zimbabwe	ZWE

Source: Authors

Table A3: Variables correlation matrix

	VAM	QI	Ouv	CH	Ln(PIBHT)	Ide	Df	Urb	Caph
VAM	1.000								
QI	0.050	1.000							
Ouv	-0.12	0.210***	1.000						
CH	0.263***	0.593***	0.345***	1.000					
Ln(PIBHBT)	0.225***	-0.332***	-0.366***	-0.252***	1.000				
Ide	-0.156***	-0.022	0.248***	0.009	-0.135***	1.000			
Df	0.172***	0.612***	0.143***	0.619***	-0.091**	-0.114***	1.000		
Urb	-0.166***	-0.359***	-0.355***	-0.536***	0.329***	0.021	-0.560***	1.000	
Caph	-0.292***	0.039	0.276***	-0.070*	0.161***	0.403***	-0.116***	0.245***	1.000

Note: Robust standard errors in brackets, *** p<0.01; ** p<0.05; * p<0.1
Source: Authors

Table A4: Variables, definitions, expected signs and sources

Variables	Abbreviations	Definitions	Scale	Expected Signs	Sources
institutional Quality	QI	The arithmetic average of the six governance indicators	-2,5 à 2,5	Positive	WGI (2024)
Controlling corruption	Corr	It gives an account of the extent to which public power is exercised for private ends, including the smallest and largest forms of corruption, as well as the 'capture' of the state by elites and private interests.	-2,5 à 2,5	Positive	WGI (2024)
Political stability and absence of violence and terrorism	Sp	They measure the perceived likelihood of political instability and/or politically motivated violence, including terrorism. The estimate gives the	-2,5 à 2,5		WGI (2024)

		country's score on the aggregate indicator, in units of a standard normal distribution.			
Regulatory quality	Rq	The quality of regulation reflects the government's ability to formulate and implement sound policies and regulations that enable and promote private sector development. The estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately	-2,5 à 2,5		WGI (2024)
Voice and Accountability	Va	Captures perceptions of the extent to which a country's citizens can participate in the selection of their government, as well as freedom of expression, freedom of association and freedom of the media.	-2,5 à 2,5		WGI (2024)
Government effectiveness	Ge	Government effectiveness reflects perceptions of the quality of public services, the quality of the civil service and its degree of independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to these policies.	-2,5 à 2,5		WGI (2024)
Rule of law	Rl	The rule of law captures the extent to which agents have confidence in and comply with the rules of society and in particular the quality of contract enforcement, property rights, police and courts, and the likelihood of crime and violence.	-2,5 à 2,5		WGI (2024)
Human capital	CH	Human capital index, based on the gross enrolment ratio and the rate of return to education.	% Annual	Positive	WDI (2024)
Commercial opening	Ouv	Trade is the sum of exports and imports of goods and services, measured as a percentage of gross domestic product.	% of GDP	Positive /Negative	WDI (2024)
Size of economy	PIBHBT	GDP at purchasers' prices is the sum of the gross value added of all resident producers in the economy, plus taxes on products and subsidies not included in the value of products. It is calculated without deducting depreciation of manufactured assets or depletion and degradation of natural resources. Data are in current local currency.	GDP at current prices	Positive	WDI (2024)
Foreign direct investment	Ide	Foreign direct investment is the net inflow of investment aimed at acquiring a lasting management stake (10% or more of the voting shares) in a company operating in an economy other than that of the investor. This is the sum of equity capital, reinvested earnings, other long-term capital and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows minus disinvestments) into the reporting economy from foreign investors and is divided by GDP.	% Annual	Positive	WDI (2024)
Financial development	Df	Domestic credit to the private sector refers to financial resources provided to the private sector by financial corporations, for example through loans, purchases of non-equity securities, trade credits and other receivables, which establish a claim for repayment. In some countries, these claims include loans to state-owned enterprises. Financial corporations include monetary authorities and deposit banks, as well as other financial corporations for which data are available (including fund deposit companies).	% Annual	Positive	WDI (2024)
Urbanisation rate	Urb	Urban population refers to people living in urban areas as defined by national statistical institutes. It is calculated using the World Bank.	Annual % growth	Positive	WDI (2024)
Physical capital	Caph	Gross fixed capital formation includes land improvements; purchases of plant, machinery and equipment; and the construction of roads, railways and other infrastructure, including schools, offices, hospitals, private dwellings and commercial and industrial buildings.	Gross fixed capital formation	Positive	WDI (2024)

Source: Authors

Table A5: Robustness test results

Estimation method: Two-Step GMM system Dependent variable: Industrial value added (% of GDP)							
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Lag. Industrial value-added	0.9798***	0.9058***	0.9331***	0.9061***	0.8559***	0.8532***	0.9216***
	(0.0290)	(0.0364)	(0.0547)	(0.0310)	(0.0473)	(0.0307)	(0.0339)
Human capital	0.3901***	0.1379**	0.2811***	0.0429	0.5053*	0.1330	0.0958
	(0.1232)	(0.0648)	(1.4670)	(0.0575)	(0.3027)	(0.0895)	(0.0268)
Commercial opening	0.1323	0.0818***	0.0935***	0.0966***	0.0943***	0.0843***	0.0975***
	(0.0229)	(0.0091)	(0.0125)	(0.0141)	(0.0186)	(0.0090)	(0.0149)
Size of economy (log)	9.0673	7.7811***	9.6882***	7.8719***	8.8976***	0.0821***	10.1099***
	(0.0000)	(0.8664)	(0.6256)	(0.7372)	(0.9284)	(1.0337)	(0.6593)
Foreign direct investment	-0.0969***	-0.0888**	-0.0643**	-0.0284	-0.0707*	-0.0554**	-0.0285
	(0.0257)	(0.0393)	(0.0262)	(0.0316)	(0.0392)	(0.0412)	(0.0381)
Urbanization rate	-1.1323	-1.7281	-0.6072	-0.7193	-1.6028	-1.1249	-1.9333
	(1.1516)	(1.0778)	(1.3084)	(1.1342)	(1.1509)	(1.1993)	(1.2343)
Physical capital	-0.5128***	-0.3119***	-0.3092***	-0.3358***	-0.3319***	-0.3213***	-0.3249***
	(0.0402)	(0.0260)	(0.0356)	(0.0183)	(0.0273)	(0.0224)	(0.0260)
Financial development	-0.1527***	-0.0500	-0.0149	-0.0603**	-0.0660**	-0.0487**	2.0859***
	(0.0302)	(0.0363)	(0.0272)	(0.0237)	(0.0328)	(0.0459)	(0.9230)
Institutional quality * Human capital	0.5009***						
	(0.0894)						
Institutional quality	0.3494*						
	(0.1829)						
Control corruption		3.5419***					
		(1.0880)					
Government effectiveness			4.6733***				
			(1.4670)				
Political stability				0.9184***			
				(0.2005)			
Rule of law					4.5850*		
					(2.4563)		
Regulatory quality						3.6927***	
						(0.9732)	
Voice and accountability							2.2477*
							(2.2046)

Constant	0.6673	3.2461*	2.7080	1.6505*	2.2732***	4.3503*	2.0859**
	(0.7214)	(1.0434)	(1.7973)	(0.9186)	(1.0839)	(1.1177)	(0.9230)
Observations	424	424	424	424	424	424	424
Numbers of countries	30	30	30	30	30	30	30
Numbers of instruments	27	24	24	24	24	24	24
AR test (1) *(P-value)*	-3.12	-2.93	-3.08	-2.89	-2.99	-2.89	-2.81
	(0.001)	(0.003)	(0.002)	(0.004)	(0.003)	(0.004)	(0.005)
AR test (2) *(P-value)*	0.35	-1.10	-1.36	-0.83	-0.68	-1.07	-1.07
	(0.636)	(0.271)	(0.174)	(0.409)	(0.498)	(0.882)	(0.283)
Hansen test *(P-value)*	11.74	18.77	19.58	20.35	18.26	20.32	20.63
	(0.564)	(0.174)	(0.144)	(0.120)	(0.195)	(0.120)	(0.111)

Note: Robust standard errors in brackets, *** p<0.01; ** p<0.05; * p<0.1
Source: Authors