Does institutional quality contribute to increasing labour productivity in sub-Saharan Africa? An empirical analysis.

KPOGNON, Koffi and BAH, Mamadou

Pan African University, Pan African University

13 March 2019

Does Institutional quality contribute to increasing Labour Productivity in Sub-Saharan Africa? An empirical analysis

Koffi KPOGNON[1]

Mamadou BAH[2]

Abstract

The objective of this work is to study the effect of institutional quality on labour productivity in sub-Saharan Africa. To do this, we considered a panel of 31 countries over the period from 1996 to 2016. Thus, we constructed an empirical model based on the stochastic frontier production function developed by Battese and Coelli (1995), to which we applied panel estimation techniques (static and dynamic), particularly with GMM system and *Within* estimators. Our results show that institutional quality indicators have a positive and significant influence on labour productivity. Political stability, government effectiveness and the rule of law are the indicators that contribute most to increasing labour productivity in sub-Saharan Africa. A series of robustness tests were performed to confirm our results. Thus, we suggest that African governments take a closer look at policies that promote good governance in their labour productivity growth strategies to improve the competitiveness of their economies.

Keywords: Institutional quality, Labour productivity, GMM system, Sub-Saharan Africa.

1. Introduction

According to recent literature on economic growth, investment and capital accumulation alone cannot explain economic growth, but much more by productivity growth (Hall & Jones, 1999; Easterly & Levine, 2001; Caselli, 2005). For Krugman, productivity is not everything, but in the long run, productivity becomes almost everything (Krugman, 1997). He states that without it there will be no long-term economic growth. Thus, several studies have focused on the factors that explain productivity growth. Many authors highlight the importance of the quality of institutions. For example, Hall and Jones (1999) explain that observed productivity

[1] PhD student at the Pan-African University of African Union - Institute of Governance, Humanities and Social Sciences, Yaoundé - Cameroon E-mail: kkoffide7@gmail.com, Corresponding author.
[2] PhD student at the Pan-African University of African Union - Institute of Governance, Humanities and Social Sciences, Yaoundé - Cameroon

differences between countries are related to differences in institutions and government policies; what they refer to as "social infrastructure". Thus, for example, countries with more secure property rights tend to have higher productivity and therefore higher per capita income levels (North, 1991). Olson et al (2000) empirically show that the quality of governance[3] significantly improves productivity growth in fast-growing developing countries. Rigobon and Rodrik (2005) argue that when political and economic institutions strengthen and foster each other, they contribute positively to productivity and growth.

In particular, some empirical studies have focused on the impact of institutional quality on labour productivity (measured by output per worker). For example, Mustafa and Jamil (2018) conducted a study of 12 Asian countries and found that government efficiency and regulatory quality were positively related to average labour productivity. Over a sample of 22 OECD countries, Salinas-Jiménez and Salinas-Jiménez (2007) showed that, different indicators of corruption are negatively related to labour productivity. Jankauskas and Šeputienė (2007) on the other hand, analyses data from 23 European countries and finds that several governance indicators are positively and significantly related to labour productivity.

To our knowledge, there is no empirical study that has focused on the specific case of sub-Saharan African countries[4]. The region has the lowest labour productivity according to a World Bank report (2018)[5]. At the same time, sub-Saharan Africa has relatively poor governance performance (Global Competitiveness Index, 2018)[6].

The following table presents the classification of the last 10 countries in the region with low labour productivity with their respective average global governance indices over the period 1996-2016. It reveals that all the poor performing countries in governance, have low labour productivity.

[3] Governance here refers to the quality of institutions. Both terms will be used interchangeably in this work.

[4] The studies identified in Africa, dealing with this link, are generally microeconomic studies. For example, Goedhuys, Janz and Mohnen (2008), using data on Tanzanian firms, show that the business environment positively affects their labour productivity. Similarly, Eifert, Gelb and Ramachandran (2005) found that high indirect costs - due to high costs of transport and utilities, bribes, security, etc. - are a major cause of poverty. - and losses related to the business environment reduce the productivity of African firms.

[5] According to Africa's Pulse, a biannual World Bank report, in 2018, global labour productivity remained below 10% of that of the United States over the past 50 years, compared to 31.7% for developing countries except sub-Saharan Africa and 77.8% for advanced economies.

[6] The Global Competitiveness Index covering 140 countries measures the national competitiveness of economies, which is defined as all the institutions, policies and factors that determine the level of productivity. The competitiveness index in sub-Saharan Africa is 45.2 out of 100 (below the global average of 60%). According to the authors of the report, this low score for African economies is due to a weakness in the institutions set up by States, as well as the inadequacy of their public policies. The average institutional score for sub-Saharan Africa is **47.5**, which is lower than the global average of **55.3**.

Table 1: Classification of the last 10 low labour productivity countries (1996-2016 average)

The last 10 countries with low average labour productivity	Average labour productivity (constant 2011 PPP $)	Average governance indices
Sierra Leone	3423.66	-0.86
Togo	2816.79	-0.87
Malawi	2414.98	-0.36
Rwanda	2337.81	-0.58
Mozambique	2277.41	-0.39
Liberia	2244.66	-1.12
Central African Republic	2095.98	-1.35
Niger	2060.02	-0.63
Burundi	1775.43	-1.25
DRC	1619.23	-1.66

Source : les auteurs à partir des données de WDI(2018) et WGI(2018)

The emphasis on labour productivity in this work is explained within the context of sub-Saharan Africa, by the fact that a very large proportion of the active population is found in agriculture and the informal service sector where productivity and income are low and there is a high degree of vulnerability to work (Szirmai, Gebreeyesus, Guadagno, & Verspagen, 2013). The region has the highest vulnerable employment rate in the world, at around 66% (ILO, 2018). Mckinsey (2012) estimates that the African continent must create 122 million jobs in 2020, with demographics implying that by 2035, the number of people seeking employment on the continent will exceed that of China or India. However, Bhalla (2007) notes that job creation alone is insufficient. More specifically, it believes that most of the poor in developing countries are employed, but despite this, they remain poor. She stresses that, in order to reduce poverty, to achieve a certain degree of inclusiveness, it is necessary to improve the productivity of existing jobs (with a view to making them more productive) and to create new productive jobs.

The main objective of this study is to measure the effect of institutional quality on productivity growth. Specifically its endeavours to identify the institutional quality indicators that contribute most to increasing labour productivity[7] in sub-Saharan Africa. To do this, we chose to study the case of a sample composed of 31 countries in sub-Saharan Africa.

[7] Our study, following Benjamin and Mbaye (2012), focuses on labour productivity, rather than total factor productivity (TFP). Indeed, three criticisms are generally addressed to the estimation of TFP:(i) it is calculated by assuming constant returns to scale, which may lead to the effect of scale on input efficiency being unduly attributed to technological variation; (ii) it assumes that factor shares in total costs are identical across sectors, which is not always the case, as technology can vary from one firm to another and from one sector of activity to another; (iii) the capital stock used in this method is generally calculated using the perpetual inventory method,

The rest of the work is organized as follows: in section 2 we will review the literature on the relationship between institutional quality and labour productivity. Section 3 will describe the methodology used in this work. The presentation of the model, data and sources, and estimation techniques will be discussed. In section 4, we will interpret the results obtained. We will conclude with the conclusion in section 5.

2. Institutional Quality and Labour Productivity: what the literature teaches us

From the 1990s, considerable attention has been paid to the role of institutional quality in explaining differences in output per worker[8] (or average labour productivity). Thus, it has been discussed to explain not only the differences in productivity between countries but also why some countries invest more in human and physical capital (North 1990, Knack & Keefer 1995; Acemoglu et al, 2001, Easterly & Levine 2002, Hall & Jones 1999). Thus, Hall and Jones (1999) explain that differences in productivity and therefore in output per worker are fundamentally linked to differences in social infrastructure, i.e. the institutions and government policies that determine the economic environment in which individuals accumulate skills, and firms accumulate capital and produce goods. Institutions are the "rules of the game" that guide and shape human interactions (Coase, 1998; North, 1991, Williamson, 1987). They can be formal - including laws, regulations, property rights - or informal rules, such as norms, habits and practices, social conventions. Together, they form the basis of the incentive structure for economic agents, reduce transaction costs, making markets more efficient, and thus promoting labour productivity. For Islam (2008), Lio and Liu (2008), the institutional environment should be considered as an important factor of productivity. Del Rio (2018) explains that more accountable and equitable governance encourages the accumulation of social infrastructure by government, which promotes productivity (TFP and labour productivity).

Thus, in his study, Dawson (1998) argues that economic freedom[9] directly influences growth through total factor productivity and indirectly through investment. Klein and Luu

---

generally based on sound assumptions regarding the depreciation rate and the initial capital ratio (Harrigan, 1997; Mbaye, 2002).

[8] Accounting breaks down differences in production per worker (i.e. labour productivity) into differences in factor allocations and Solow's residue, which is TFP (TFP represents technological or efficiency differences).

[9] Economic freedom is the fundamental right of every human being to control his own work and property. In an economically free society, individuals are free to work, produce, consume and invest as they see fit. In economically free societies, governments allow factors of production (labour and capital) and goods to move freely and refrain from any coercion or constraint of freedom beyond what is necessary to protect and maintain freedom itself (Index of freedom economic, 2019).

(2003) use a stochastic border model to examine the relationship between economic freedom, policies[10] that, promote political stability, economic performance, and find that economic freedom and policy stability contribute to economic efficiency and labour productivity. His study covers a sample of 39 countries between 1975 and 1990; and find that economic freedom and stabilization policies have a positive and significant impact on labour productivity. Similarly, Adkins, Moomaw and Savvides (2002), show that increasing economic freedom leads to increased efficiency and therefore to growth in total factor productivity. Increased economic freedom, according to Zhang, Hall, and Yao (2018) can reduce the transaction costs of productive activities, make foreign capital more accessible and national capital more productive, and improve educational performance, all of which stimulate productivity. Meon and Weill (2005) analyse the effect of governance on technical efficiency for a sample of 62 countries. Their results reveal that Kaufmann's six governance indicators have a negative impact on technical inefficiency and thus improve labour productivity. The authors go further and show that government efficiency is the indicator that has the greatest impact on labour productivity. Mustafa and Jamil (2018), on the other hand, find that government efficiency and the quality of regulation have a positive and significant impact on labour productivity.

Hall and Jones (1999), after analysing 127 countries, argue that institutional differences are the main cause of differences in productivity and GDP per capita between these countries. By tracing the influence of institutions on the influence of colonies or colonization in Western Europe and their adaptation to social infrastructure. They find that institutions promote productivity and growth. Cavalcanti et al (2005) submits similar estimates to Hall and Jones (1999). The authors find that a 1% increase in institutional variables is associated with a 5% increase in GDP per worker in 1988 in an analysis of cross-sectional data. Doyle and Doyle, Martínez-Zarzoso (2007) in a study on the relationship between productivity, trade and institutional quality for a panel of countries over the period 1980-2000, adduce to results that indicate that institutional quality measurement, as well as openness, area and three of the dummies related to the continent, are determinants of labour productivity. Del Rio (2018) develops a neoclassical growth model in which the government accumulates social infrastructure, which promotes productivity. In its calibrated model, for a country in the bottom decile of the social infrastructure index distribution, improving governance equity by one point of its standard deviation increases social infrastructure by an

[10] The authors distinguish between these policies and political stability itself

average of 84% and GDP per worker by about 38%. In their study on the relationship between trust and productivity, Bjørnskov et Méon, (2015) found that trust has a positive effect on TFP. But this effect is indirect and passes through the economic-judicial institutions but not through the political institutions.

3. Methodology

This section elaborates the model adopted in this research work, the data and their sources, and the estimation techniques used to measure the effect of institutional quality on labour productivity in sub-Saharan Africa.

a. The empirical model

Our empirical model is based on a stochastic production frontier model, initially developed independently by Aigner, Lovell and Schmidt (1977) and Meeusen and Van Den Broeck (1977). Battese and Coelli (1995) propose an extension of the original version of the previous authors. Its model[11] is as follows:

$$Y_{it} = f(X_{it}, \beta) \exp(V_{it} - U_{it}) \quad (1)$$

Where Y_{it} represents the production of firm i (i=1... N) at the period t (t=1,..., T), X_{it} represents a vector of production inputs associated with the i-th firm in the i-th period. β is a vector of unknown parameters to be estimated. The V_{it} are the random errors of distribution N (0, σ_v^2); the U_{it}, independent of random errors, follow a distribution truncated to zero with average $m_{it} = z_{it}\delta$ and variance σ_u^2. The U_{it} are specified by the following function: $U_{it} = z_{it}\delta + W_{it}$ with $z_{it}\delta$ represent all the variables associated with the technical inefficiency of production units[12] is a vector of unknown parameters and W_{it} is a residual term. Technical efficiency is measured by the ratio of production observed to optimal production. The closer this ratio is to 1, the closer the observed production is to optimal production, which reflects high labour productivity (Y/L). "The new institutional economics suggests that countries with high levels of economic freedom (protection of private property rights, respect for the rule of the law, an unhampered price system, and so on) and policy stability (commitment not to change the rules of the game ex-post) will be closer to the best-practice frontier" (Klein & Luu, 2003:

[11] The stochastic boundary model is initially used to study the technical efficiency of individual firms and then generalized to macroeconomic research (Aigner, Lovell & Schmidt, 1977; George E. Battese & ; Meeusen Coelli, 1988and van den Broeck, 1977). Several studies on the effect of institutional quality on labour productivity have used this model (Méon and Weill, 2005; Klein and Luu, 2003).

[12] We focus here on the labour factor as a unit of production, a factor that is more abundant in developing countries, including sub-Saharan Africa.

434). According to Méon and Weill (2005), technical inefficiency is explained by poor governance. Low quality institutions result in lower technical efficiency, and therefore lower productivity. We can therefore write: $U_{it} = f(inst\_Qual_{it})$[13] where $inst\_Qual$ is a $(p \times 1)$ vector of institutional quality indicators. Then consider the Cobb Douglass production function[14] with constant returns to scale. We can therefore derived from this function our empirical model as follows:

$$ln(Y/L)_{it} = \alpha_0 + \alpha_1 ln(K/L)_{it} + \alpha_2 \ln(H/L)_{it} + V_{it} - U_{it} \quad (2)$$

where (Y/L) , (K/L) and (H/L) are respectively output per worker, physical capital per worker and human capital per worker. $inst\_Qual$ represents the vector of the six Kaufmann institution quality indicators that are widely used in studies on institution quality (these are: government effectiveness (GE), regulatory quality (RQ), political stability and absence of violence (PSAV), voice and accountability (VA), rule of law (RL) and corruption control (CC)).

b. Data and sources

This study uses non-cylindrical panel data from 31 countries in sub-Saharan Africa. It covers the period 1996-2016. The choice of this period is dictated by the availability of data. The data are mainly from the *World Development Indicators* (2018), *World Governance Indicators (*2018), Barro and Lee (2013) and La Porta (1999) (see Table 2 in the Appendix for the definition of variables and their sources). A descriptive analysis of the different variables in this work is presented in Table 3 in the appendices.

c. The estimation technique

This study tries attempting to apply two panel estimation techniques (static and dynamic) to estimate the effect of institutional quality indicators on labour productivity in sub-Saharan African countries over the period 1996-2016. The static panel estimation technique will focus on the *within* model while the dynamic panel estimation method will focus on system GMM (Generalized Moments Method System). This process will be carried out using the

[13] Studies on the relationship between technical inefficiency and institutional quality generally adopt a two-step approach. In our study, however, following Battese and Coelli (1995) and Méon and Weill (2005), we adopt the one-step approach. Indeed, according to this approach, the stochastic production boundary model includes a production boundary as well as an equation in which inefficiencies are specified according to explanatory variables (here institutional quality indicators). This approach is widely used in studies on the determinants of technical efficiency at the macroeconomic level

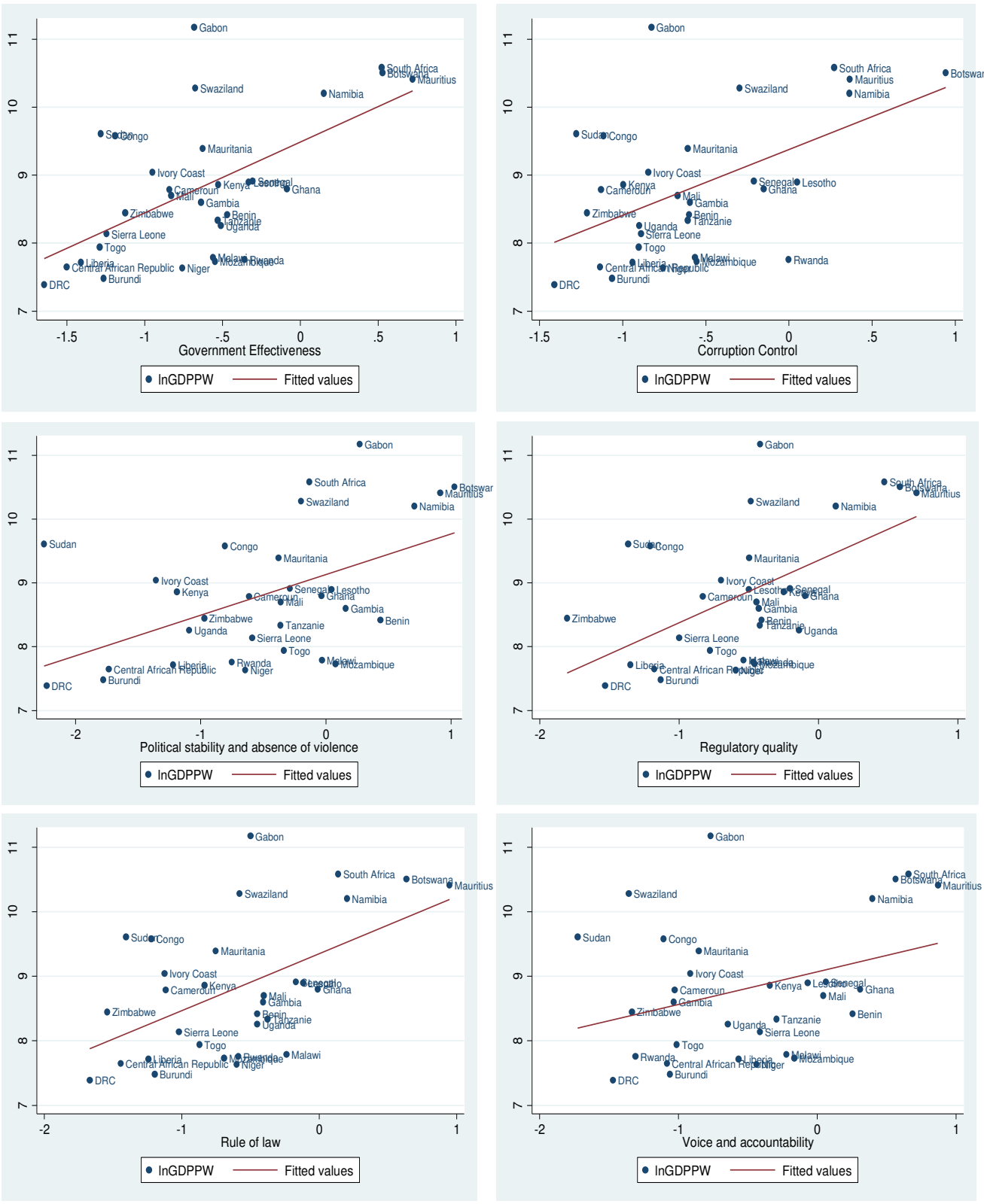
[14] This function has been used by many authors (Moroney & Lovell, 1997; Dawson, 1998; Méon & Weill, 2005)

econometric software STATA 14. The choice of these two estimation techniques (*Within* and GMM-system) allows us, on one hand, to identify the problem of bias and efficiency of estimators and, on the other hand, to strengthen the robustness of our results.

4. Effect of institutional quality on labour productivity in sub-Saharan Africa

Before arriving at the results of the estimates, we make a cross-analysis of the evolution of labour productivity and the indicators of the quality of institutions. Graph 1 below shows the crossed-evolution of institutional quality indicators and labour productivity indicators. Its analysis shows a strong correlation between the six indicators and labour productivity, reflecting a relationship between the two variables. Indeed, maintaining, for example, the rule of law, which refers to "the extent to which agents have confidence in the rules of society and in particular the quality of contract enforcement, the police and the courts, as well as the likelihood of crime and violence" (Kaufmann, Kraay, and Mastruzzi, 2006: 4) would contribute to protecting citizens against theft, expropriation by the government and repudiation of contracts and guarantee property rights which, in effect, reduce transaction costs. This would make markets more efficient and promote productivity. However, this graph does not take into account other potential factors that may affect labour productivity. Moreover, the correlation between two variables does not provide information on the cause-and-effect relationship. Thus, we turn to regression models.

With regard to regression results, those with the *within* model are presented in Table 5. In order to avoid the problem of multicollinearity associated with the six indicators of institutional quality, because of the strong correlation between these six indicators (see Table 4), we have introduced the six indicators into regression models in an alternative way. The results reveal, in accordance with the literature, that both human and physical capital per worker have a positive and significant impact on labour productivity. Similarly, indicators of the quality of institutions positively affect labour productivity, but their signs are not significant. According to North (1991), countries with better institutions, more secure property rights and less distorting policies will invest more in physical and human capital and use these factors more effectively to achieve higher income levels. Using data from 1984-2008 for a total of 71 developed and developing countries, Ahmad, Ullah and Arfeen (2012) find that the capital stock per worker has a positive and statistically significant effect on GDP per worker. Similarly, human capital, which they measure by the secondary school enrolment rate, has a positive and significant impact on GDP per worker.



Source: Authors based on World Bank data (2018)

Graph 1: Crossed-evolution of governance and labour productivity indicators (1996-2016 average)

The insignificance of institutional quality indicators may be related to the estimation method used here (the *within* estimator, although adapted for panel data, does not take into account

endogeneity bias). Indeed, indicators of the quality of institutions can be subject to problems of endogeneity[15].

Table 4: Correlation between the six governance indicators

	GE	CC	PSAV	RQ	RL	VA
GE	1					
CC	0.87	1				
PSAV	0.72	0.70	1			
RQ	0.90	0.81	0.70	1		
RL	0.90	0.87	0.80	0.90	1	
VA	0.76	0.70	0.68	0.75	0.81	1

Source: Authors based on WGI data (2018)

The sources of endogeneity are mainly of three kinds: measurement error, dual or inverse causality and the existence of omitted variables. In the first case, as Acemoglu et al (2001) point out, institutional variables are derived from expert opinions and survey data, and are therefore potentially subject to systematic measurement errors. For example, this could happen if experts tend to observe better institutions in countries with high labour productivity growth. The second is the reverse causality: indeed, high-income countries with higher levels of productivity seem to have better institutions (Rodrik, Subramanian, & Trebbi, 2004). Klein and Luu (2003) argue that economic freedom and policy constraints remain determinants of productivity, but the relationship can go the other way. They affirm that the most productive countries are richer and that rich countries can put in place stable "laissez-faire" policies. Similarly, Farhadi, Islam and Moslehi (2015) believe that countries with higher productivity growth can have greater economic freedom. In the third case, it should be noted that several variables (which are not necessarily taken into account in our model because of the forgotten or lack of data), according to the literature, influence labour productivity. Also, the empirical literature emphasizes the dynamic dimension[16] in the process of labour productivity growth. In order to correct these problems, we propose the GMM estimation technique (Generalized Moment Method Estimation)[17].

[15] Endogeneity is a situation where an explanatory variable is correlated with the error term

[16] The dynamic dimension involves integrating the delayed dependent variable among the explanatory variables in the model; since the dependent variable is correlated with the error term, so is its delayed value; this also raises an endogeneity problem; in this case the estimate *within* is no longer appropriate.

[17] This method suits the structure of our data (a non-cylindrical panel with T=21 < N=31)

Table 5: Results of the estimates with the *within* model (fixed effects)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
H/L	0.0817**	0.0825**	0.0822**	0.0843**	0.0803**	0.0835**	0.0839**
	(2.328)	(2.144)	(2.174)	(2.494)	(2.194)	(2.333)	(2.355)
LnK/L	0.139***	0.136***	0.133***	0.130***	0.127***	0.123**	0.126***
	(3.395)	(3.276)	(3.040)	(3.086)	(2.950)	(2.668)	(2.756)
GE	0.0774						
	(0.945)						
CC		0.0339					
		(0.421)					
PSAV			0.0257				
			(0.813)				
RQ				0.0912			
				(1.186)			
RL					0.119		
					(1.602)		
VA						0.0941	
						(1.369)	
GG							0.120
							(1.236)
Constant	7.839***	7.819***	7.828***	7.871***	7.927***	7.908***	7.914***
	(36.30)	(38.02)	(36.34)	(36.06)	(35.80)	(31.51)	(33.01)
Observations	511	511	511	511	511	511	511
R-squared	0.389	0.380	0.383	0.395	0.403	0.394	0.397
Number of id	31	31	31	31	31	31	31
F-test:	10.88	9.045	9.433	11.08	10.87	12.70	11.56
Prob (F)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: The values in parentheses represent absolute t-statistics; ***, **,* mean significantly to 1% respectively; 5% ; 10%.
Sources: Authors

This method has the advantage of providing not only efficient and unbiased estimators, but also resolving the issue of heteroscedasticity of residues. It was originally developed by Holtz-Eakin, Newey and Rosen (1988) and Arellano and Bond (1991). There are two types of GMM estimators: the GMM difference estimator and the GMM system estimator. The first estimation method (the GMM difference estimator) is advantageous compared to other dynamic model estimation methods on panel data because it eliminates the biases generated by the omission of certain explanatory variables and also allows, through the use of instrumental variables (i.e. level variables used as instruments), to estimate the parameters more accurately. According to Bond, Hoeffler and Temple (2001), the use of instrumental variables also leads to better results, even in the case of measurement errors. However, the GMM difference estimator has some shortcomings. For this reason, Blundell

and Bond (1998), in their Monte Carlo simulations, proposed the GMM system estimator, which consists of combining for each period the equations in first differences with the level equations in which the variables are instrumented by their first differences. The resulting equation system is estimated simultaneously using the generalized moment method. In addition, the two authors in 2000 show that when the explanatory variables and the dependent variable are highly persistent, the instruments used for the GMM difference estimator are small and this estimator is not relevant. According to them, the GMM system estimator is therefore the most appropriate. However, the latter generally uses more instruments, which may make it inappropriate. Hansen's test of over-identification of restrictions, proposed by Arellano and Bover (1995), is applied here to verify the overall validity of the instruments. But this test loses its relevance if the number of instruments is too high. This problem can be solved by ensuring that the ratio *r* measured by the ratio between the number of countries *i* and the number of instruments *iv* ($r = {}^{i}/_{iv}$) is greater than or equal to 1 (Roodman, 2009). Thus, when $r < 1$, the assumptions underlying the estimation procedure may be violated. In addition, a low *r* increases the susceptibility of estimates to a standard deviation of 1, i.e. it produces significant results even if there is no underlying relationship between the variables involved (Roodman, 2009).

As mentioned above, the literature suggests that the past level of labour productivity may affect its current value (Salinas-Jiménez and Salinas-Jiménez, 2007). Thus, in order to integrate this dynamic dimension into our empirical model (2), we reformulate a working model taking into account the initial level of labour productivity (Barro, 1991).

$$ln(Y/L)_{it} = \alpha_0 + \rho \ln\left(\frac{Y}{L}\right)_{it-1} + \alpha_1 ln(K/L)_{it} + \alpha_2 \ln(H/L)_{it} + V_{it} - U_{it} \qquad (3)$$

Where $(Y/L)_{it-1}$ represents the value of labour productivity in the past period, the other variables are defined as before.

The results of the estimates of the new model with the GMM in system are listed in Table 6. They reveal that the six indicators of institutional quality have positive and statistically significant effects on labour productivity. The most significant indicators are: Political stability and the absence of violence and the quality of regulation. An increase in the standard deviation of government effectiveness, control of corruption, political stability and absence of violence, quality of regulation, rule of law and voice and one point responsibility

leads to an increase in labour productivity of 4.551%; 3.99%; 6.11%; 4.15%; 5.32%; 3.66%[18] respectively. The indicators that have the greatest impact on labour productivity are therefore political stability and absence of violence, the rule of law and government effectiveness. Then we have the quality of regulation, the control of corruption and finally voice and responsibility.

Regarding political stability, Carmignani (2003) argues that political instability generates uncertainty and that the latter, in turn, affects the incentives for private agents and companies to invest and accumulate factors. Uncertainty also affects the motivations of policymakers, who may be tempted to implement "myopic" policies[19] to increase their survival in office, broaden their electoral consensus or tie the hands of their potential successor. All this has the effect of reducing production inefficiency, and thus reducing labour productivity. Klein and Luu (2003), working on 39 countries over the period 1975-1990, find that policies that promote political stability have a positive and significant impact on output per worker. Repkine (2014), out of a sample of 48 African countries from 1996 to 2010, shows that ethnic minorities, when given access to education, would promote greater political stability and therefore greater productive efficiency.

With regard to government effectiveness, it refers to "the quality of public services, the quality of the public service and its degree of independence from political pressures, the quality of policy formulation and implementation and the credibility of government commitment" (Kaufmann, Kraay and Mastruzzi, 2006: 4). It would reduce transaction costs by improving the provision of public services and thus promote productivity. Mustafa and Jamil (2018) also find that government efficiency positively and significantly affects labour productivity. With regard to the rule of law, Méon and Weill (2005) explain that weak rule of law can lead to widespread theft that will force agents to invest in protecting their assets rather than in productive activities, thereby reducing productive efficiency.

[18] These values are obtained by multiplying the respective coefficients of the six institutional quality indicators by the standard deviations of the latter

[19] By myopic policies, the author refers to the increase in the taxation of capital for redistribution purposes, the increase in public consumption for compensation purposes, the reduction of investment in the judicial system, the delay (or reversal) of structural reforms and the return on previous commitments.

Table 6: Results of estimates with GMM system

VARIABLES	(8)	(9)	(10)	(11)	(12)	(13)	(14)
LnGDPPW(-1)[20]	0.856*** (0.0438)	0.911*** (0.0309)	0.910*** (0.0351)	0.879*** (0.0335)	0.861*** (0.0562)	0.925*** (0.0319)	0.860*** (0.0295)
H/L	0.00107 (0.0143)	0.00548 (0.00928)	0.00486 (0.0118)	0.0131 (0.0112)	0.0211 (0.0155)	0.0125 (0.0131)	0.00420 (0.00931)
LnK/L	0.0755** (0.0282)	0.0362* (0.0208)	0.0352* (0.0179)	0.0429* (0.0232)	0.0188 (0.0388)	0.0138 (0.0183)	0.0685*** (0.0166)
GE	0.0740* (0.0407)						
CC		0.0679* (0.0381)					
PSAV			0.0627*** (0.0185)				
RQ				0.0672** (0.0260)			
RL					0.0825* (0.0442)		
VA						0.0514* (0.0297)	
GG							0.0867** (0.0377)
Constant	0.958*** (0.286)	0.638*** (0.198)	0.647** (0.251)	0.838*** (0.210)	1.100** (0.412)	0.578** (0.218)	0.937*** (0.192)
Observations	488	488	488	488	488	488	488
Nber of id	31	31	31	31	31	31	31
No instruments	19	21	25	23	23	26	20
AR1 p-value	0.0234	0.0244	0.0298	0.0258	0.0198	0.0247	0.0248
AR2 p-value	0.961	0.241	0.986	0.211	0.340	0.429	0.863
Hansen p-value	0.496	0.869	0.674	0.499	0.409	0.418	0.593

Note: The values in parentheses represent absolute t-statistics; ***, **,* mean significantly to 1% respectively; 5% ; 10%.
Sources: Authors

Similarly, for regulatory quality, which measures the ability of governments to design and implement good policies and regulations that support private sector development (Kaufmann, Kraay and Mastruzzi, 2006: 4), can be equated with economic freedom. Klein

[20] The estimator of the dynamic panel model by the command xtabond2 with Stata gives the value ρ of the coefficient of the delayed variable. But it is necessary to calculate the value of the coefficient of this variable which is (ρ-1) in the growth model as well as its absolute t-statistics which is $\frac{(\rho-1)}{Standard\ deviation\ of\ \rho}$ (Kpodar, 2007). The results (which can be obtained on request) give a negative and significant sign of ρ reflecting the process of labour productivity convergence in sub-Saharan Africa. The other signs remain unchanged.

and Luu (2003) show that economic freedom has a positive and significant impact on output per worker.

Regarding the control of corruption, according to Bjørnskov and Méon (2010), problems, such as corruption, can encourage the diversion of resources from productive activities to rent-seeking and dishonest practices, thus reducing productive efficiency. Ahmad et al (2012) find that the ICRG (*International Country Risk Guide*) corruption index positively and significantly affects GDP per worker, while its quadratic term has a negative effect on GDP per worker.

Finally, the voice and responsibility indicator, which measures how a country's citizens participate in the selection of their leaders, as well as freedom of expression, association and the press (Kaufmann, Kraay and Mastruzzi, 2006: 4), seems to be the indicator that has the least impact on labour productivity. Méon and Weill (2005) also propose the same results for a group of 62 countries. On the other hand, human capital per worker remains positive but is no longer significant according to Méon and Weill (2005).

We continue with the analysis of the robustness of our results by using external instruments. One of the advantages of GMM is that it allows the use of external instruments, i.e. variables that serve as instruments to correct endogeneity but are not included in the model (Farhadi and al, 2015). Following La Porta et al (1999), we have chosen three instruments: ethnolinguistic fractionalization (ELF), latitude and a *dummy* variable reflecting the country's legal origin (it takes the value 1 if the country's legal origin is French and 0 otherwise). The latitude represents the areas of residence of Europeans during the colonial period. Due to their lack of immunity to tropical diseases, they were more likely to reside in more temperate latitudes, which is therefore linked to the creation of economic institutions. Ethnolinguistic fractionalization reflects the extent of political differences in society between social, ethnic, class or other interests. It measures the probability that two people chosen at random in a country belong to different ethnic or linguistic groups. These three variables have already been used by Boschini, Pettersson and Roine (2013) and Farhadi and al, (2015) as potential instruments of institutional quality in their estimates of cross-sectional and panel data.

The results are presented in columns 15, 16, 17, 18, 18, 19, 20, 21 of Table 7. They are consistent with the previous results in Table 6. In addition, they reveal an improvement in the significance of the coefficients of the institutional quality indicators. The most important

indicators of institutional quality are political stability (5.32%) and the rule of law (5.48%)[21]. On the other hand, the capital stock per worker, while keeping its positive sign, is no longer significant. This indicates the importance of the effect of institutional quality on labour productivity. Hall and Jones (1999) find that disparities in physical and human capital only partially explain differences in output per worker, much of which is due to differences in Solow residuals that are fundamentally explained by differences in social infrastructure. The authors also use several instruments (including our three instruments) in their regressions.

Still with a view to analysing the robustness of our results, we examine the sensitivity of our baseline results with GMM system (see Table 6) following the addition of new control variables based on the literature on labour productivity. It is about:

The quality of infrastructure captured by the number of fixed telephone subscriptions (per 100 inhabitants): access to telephone, electricity and paved roads offers individuals a better choice and can lead to a higher standard of living. A quality infrastructure ensures the reduction of transaction costs and thus promotes productivity. The expected sign is positive.

Urbanization captured by the urban population (% of the total): Jayasuriya and Wodon (2005) believe that cities are developing, with the presence of universities, research centres and many companies, through learning and innovation, thus facilitating spill over effects. Similarly, for Mills, Epple and Oates (2000), cities provide economies of scale, encourage division of labour and provide a better environment for adapting skills to needs. They therefore promote productive efficiency and increase productivity. His expected sign is positive.

Trade openness is measured by the ratio of the sum of exports and imports to GDP: a country's trade openness allows the diffusion of knowledge in the economy encourages competition and promotes economic growth (Dollar & Kraay, 2004). Similarly, Edwards (1998) finds that openness can be significantly and positively linked to productivity and productivity growth. The expected sign is therefore positive.

The employment rate measured by the employment to population ratio: the employment rate can reduce labour productivity by bringing low-skilled workers into the labour market. Artus and Cette, (2004) explain that the slowdown in labour productivity in European countries is often linked to the increase in the employment rate induced by proactive labour market policies. Its expected sign is therefore negative.

[21] These values are obtained by multiplying the respective coefficients of the six institutional quality indicators by the standard deviations of the latter

Table 7: Results of the estimates with GMM system (Use of external instruments)

VARIABLES	(15)	(16)	(17)	(18)	(19)	(20)	(21)
LnGDPPW(-1)	0.914*** (0.0363)	0.950*** (0.0281)	0.925*** (0.0459)	0.947*** (0.0402)	0.907*** (0.0579)	0.934*** (0.0420)	0.923*** (0.0365)
H/L	0.00377 (0.00472)	0.00841* (0.00446)	0.0134* (0.00786)	0.00816* (0.00475)	0.0111 (0.0117)	0.0125* (0.00625)	0.00761** (0.00369)
LnK/L	0.0320 (0.0218)	0.00187 (0.0286)	0.00117 (0.0293)	0.00578 (0.0325)	0.0122 (0.0481)	0.000641 (0.0295)	0.0218 (0.0264)
GE	0.0530** (0.0211)						
CC		0.0491** (0.0200)					
PSAV			0.0585*** (0.0181)				
RQ				0.0561** (0.0216)			
RL					0.0850* (0.0440)		
VA						0.0603** (0.0292)	
GG							0.0485** (0.0225)
Constant	0.634*** (0.227)	0.441** (0.161)	0.643** (0.288)	0.445* (0.220)	0.777* (0.382)	0.571** (0.250)	0.579*** (0.209)
Observations	488	488	488	488	488	488	488
Nbre de pays	31	31	31	31	31	31	31
Nbre d'instruments	22	24	28	26	26	29	23
AR1 p-value	0.0265	0.0272	0.0327	0.0285	0.0219	0.0265	0.0270
AR2 p-value	0.491	0.155	0.553	0.138	0.359	0.404	0.332
Hansen p-value	0.730	0.476	0.654	0.544	0.590	0.439	0.598

Note: The values in parentheses represent absolute t-statistics; ***, **,* mean significantly to 1% respectively; 5% ; 10%.
Sources: Authors

In line with the previous results, all indicators of institutional quality are positive and significant except for corruption control (see Table 8). The quality indicators of institutions that have the greatest impact are political stability (5.06%), government effectiveness (5.03%), voice and accountability (5.28%) and the rule of law (4.58%)[22].

[22] These values are obtained by multiplying the respective coefficients of the six institutional quality indicators by the standard deviations of the latter

Table 8: Results of the estimates with GMM system (Additional control variables)

VARIABLES	(22)	(23)	(24)	(25)	(26)	(27)	(28)
lnGDPPW(-1)	0.872***	0.841***	0.862***	0.897***	0.864***	0.882***	0.886***
	(0.0370)	(0.0508)	(0.0559)	(0.0370)	(0.0591)	(0.0552)	(0.0459)
H/L	0.00750	0.0231	0.0156**	0.00543	0.0127	0.00875	0.00984
	(0.00605)	(0.0138)	(0.00623)	(0.00658)	(0.0111)	(0.0119)	(0.00800)
LnK/L	0.0322**	0.00265	0.0379**	0.0266**	0.0315**	0.0314**	0.0286*
	(0.0133)	(0.0300)	(0.0184)	(0.0105)	(0.0142)	(0.0144)	(0.0159)
Ln(trade)	0.00859	0.000258	0.00397	0.00567	0.0114	0.0141	0.00781
	(0.00747)	(0.0182)	(0.00573)	(0.00634)	(0.00746)	(0.00991)	(0.00625)
Ln(Fix_tel)	0.00167	0.0182	0.00147	0.00423	-0.000515	-0.000235	-0.00857
	(0.0112)	(0.0215)	(0.0124)	(0.0104)	(0.0155)	(0.0111)	(0.0127)
Ln(Empl_Pop)	-0.187**	-0.360**	-0.230*	-0.182**	-0.245*	-0.238*	-0.229**
	(0.0781)	(0.155)	(0.114)	(0.0851)	(0.121)	(0.138)	(0.0934)
Ln(Urb_ Pop)	0.0209	0.0210	-0.0193	0.00813	0.0183	0.00211	0.00601
	(0.0246)	(0.0260)	(0.0203)	(0.0179)	(0.0232)	(0.0325)	(0.0244)
GE	0.0818***						
	(0.0260)						
CC		0.0652					
		(0.0616)					
PSAV			0.0557**				
			(0.0218)				
RQ				0.0575**			
				(0.0232)			
RL					0.0772*		
					(0.0414)		
VA						0.0742**	
						(0.0314)	
GG							0.0833**
							(0.0363)
Constant	1.657***	2.736***	1.985**	1.492**	1.939**	1.803**	1.759***
	(0.492)	(0.956)	(0.794)	(0.559)	(0.867)	(0.870)	(0.610)
Observations	471	471	471	471	471	471	471
Nombre de pays	31	31	31	31	31	31	31
Nbre d'instruments	29	31	28	28	29	29	25
AR1 p-value	0.0574	0.0741	0.0735	0.0618	0.0490	0.0529	0.0615
AR2 p-value	0.571	0.137	0.989	0.166	0.481	0.602	0.454
Hansen p-value	0.230	0.174	0.627	0.305	0.623	0.421	0.498

Note: The values in parentheses represent absolute t-statistics; ***, **,* mean significantly to 1% respectively; 5% ; 10%.
Sources: Authors

Keefer and Knack (1997) find, in their study on economic growth and convergence, that the coefficient of corruption becomes insignificant once other control variables are included in the regressions. Similarly, Ahmad et al (2012) report in their regression that the corruption index positively and significantly affects GDP per worker but becomes insignificant when control variables are introduced. On the other hand, Mauro (1995), in his study, finds a more significant coefficient of corruption following the addition of other control variables.

The employment rate coefficient is negative and significant. This reflects a decreasing scale yield of this variable. This result is in line with that found by Belorgey (2006), which shows that the employment rate has a negative and significant impact on labour productivity and growth. Thereafter, the coefficients of the other additional control variables (infrastructure quality, urbanization and trade openness) are not significant. As mentioned above, this is explained in particular by the primacy of the effect of the quality of institutions over other factors that explain labour productivity. For example, several studies have not been able to find a significant relationship between trade openness and productivity growth. Rodrik et al *(*2004) measure the effect of the quality of institutions, geography and trade on an economy's growth rate, but also on its income or productivity levels. They find that the effect of institutional quality outweighs other effects. Moreover, the coefficient related to trade is negative, unlike in the literature.

5. Conclusion

"The central issue of economic history and economic development is to account for the evolution of political and economic institutions that create an economic environment that leads to increasing productivity" (North, 1991: 98). As part of this work, we have sought to study the effect of institutional quality on labour productivity in sub-Saharan Africa. The analysis covered a sample of 31 countries from 1996-2016 using panel estimation techniques (static and dynamic). Initially, the regressions focused on a static panel with the *within* estimator. In a second step, we took into account the endogeneity related to institutional quality indicators but also the possibility of the continuous impact of labour productivity (the dynamic dimension), and used the method of estimation by generalized moments in systems (GMM system). We found that institutional quality indicators have a positive and significant impact on labour productivity. Political stability is proving to be the indicator that has the greatest impact (both quantitatively and qualitatively) on labour productivity. This result remains valid after a series of robustness tests. Then we have government efficiency and the rule of law.

In view of developments in the economic literature, but also of the results obtained from our regressions, we can argue that the quality of institutions is important for increasing labour productivity in sub-Saharan Africa. Improving the quality of institutions promotes labour productivity growth and thus the creation of productive jobs. Zhou (2018) argues that strong institutions facilitate the productive employment of workers by providing an efficient and informative labour market that actively responds to changes in labour supply and demand in declining and growing sectors. In their strategies to reduce unemployment, especially for young people, African governments must take a closer look at policies that promote good governance in order to ensure political stability and the protection of property rights, thereby reducing uncertainty, reducing the inefficiency of market systems in order to boost competitiveness, and increasing the effectiveness of public policies.

References

Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review*, *91*(5), 1369–1401.

Acemoglu, D., & Verdier, T. (1998). Property Rights, Corruption and the Allocation of Talent: a General Equilibrium Approach. *The Economic Journal*, *108*(450), 1381–1403.

Adkins, L., Moomaw, R., & Savvides, A. (2002). Institutions, Freedom, and Technical Efficiency. *Southern Economic Journal*, *69*(1), 92–108.

Ahmad, E., Ullah, M. A., & Arfeen, M. I. (2012). Does Corruption Affect Economic Growth? *Latin American Journal of Economics-Formerly Cuadernos de Economía*, *49*(2), 277–305.

Aigner, D., Lovell, C. A. K., & Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics*, *6*(1), 21–37.

Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*, *58*(2), 277–297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*, 29–51.

Artus, P., & Cette, G. (2004). *Productivite´, croissance et emploi. Rapport du Conseil d'analyse e´conomique*.

Battese, G. E., & Coelli, T. J. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics*, *20*(2), 325–332.

Battese, George E., & Coelli, T. J. (1988). Prediction of firm-level technical efficiencies with a generalized frontier production function and panel data. *Journal of Econometrics*, *38*(3), 387–399.

Benjamin, N. C., & Mbaye, A. A. (2012). The Informal Sector, Productivity, and Enforcement in West Africa: A Firm-level Analysis: Informality and Productivity in West Africa. *Review of Development Economics*, *16*(4), 664–680.

Bhalla, S. (2007). Inclusive Growth? Focus on Employment. *Social Scientist*, *35*(7/8), 24–43.

Bjørnskov, C., & Méon, P.-G. (2015). The Productivity of Trust. *World Development*, *70*, 317–331.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143.

Boschini, A., Pettersson, J., & Roine, J. (2013). The Resource Curse and its Potential Reversal. *World Development*, *43*, 19–41.

Caselli, F. (2005). *Accounting for Cross-Country Income Differences* (Handbook of Economic Growth) (pp. 679–741).

Cavalcanti, T. V. de V., & Novo, Á. A. (2005). Institutions and economic development: How strong is the relation? *Empirical Economics*, *30*(2), 263–276.

Coase, R. (1998). The New Institutional Economics. *The American Economic Review*, *88*(2), 72–74.

Dawson, J. W. (1998). Institutions, Investment, and Growth: New Cross-Country and Panel Data Evidence. *Economic Inquiry*, *36*(4), 603–619.

Del Rio, F. (2018). *Governance, social infrastructure and productivity*. MPRA Paper No. 86245, University of Santiago de Compostela.

Dollar, D., & Kraay, A. (2004). Trade, Growth, and Poverty*. *The Economic Journal*, *114*(493), F22–F49.

Doyle, E., & Martínez-Zarzoso, I. (2007). The Productivity , Trade , & Institutional Quality Nexus : A Panel Analysis.

Easterly, W., & Levine, R. (2003). Tropics, germs, and crops: how endowments influence economic development. *Journal of Monetary Economics*, *50*(1), 3–39.

Eifert, B., Gelb, A., & Ramachandran, V. (2005). Business Environment and Comparative Advantage in Africa: Evidence from the Investment Climate Data. *SSRN Electronic Journal*.

Farhadi, M., Islam, M. R., & Moslehi, S. (2015). Economic Freedom and Productivity Growth in Resource-rich Economies. *World Development*, *72*, 109–126.

Goedhuys, M., Janz, N., & and, and P. M. (2008). What drives productivity in Tanzanian manufacturing firms: technology or business environment? *The European Journal of Development Research*, *20*(2), 199–218.

Hall, R. E., & Jones, C. I. (1999). Why Do Some Countries Produce So Much More Output Per Worker Than Others? *The Quarterly Journal of Economics*, *114*(1), 83–116.

Harrigan, J. (1997). *Cross-country comparisons of industry total factor productivity: theory and evidence* (Research Paper No. 9734). Federal Reserve Bank of New York.

Holtz-Eakin, D., Newey, W., & Rosen, H. (1988). Estimating Vector Autoregressions with Panel Data. *Econometrica*, *56*(6), 1371–1395.

Isaksson, A. (2007). Determinants of total factor productivity: a literature review. Research and statistics branch staff working paper 02/2007. Retrieved from

Islam, N. (2008). Determinants of Productivity across Countries: An Exploratory Analysis. *The Journal of Developing Areas*, *42*(1), 201–242.

Jankauskas, V., & Šeputienė, J. (2007). The Relation between Social Capital , Governance and Economic Performance in Europe.

Jayasuriya, R., & Wodon, Q. (2005). Measuring and Explaining the Impact of Productive Efficiency on Economic Development. *The World Bank Economic Review*, *19*(1), 121–140.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2006). *Governance matters V: aggregate and individual governance indicators for 1996 - 2005* (Policy Research Working Paper Series No. 4012). The World Bank.

Klein, P. G., & Luu, H. (2003). Politics and Productivity. *Economic Inquiry*, *41*(3), 433–447.

Knack, S., & Keefer, P. (1995). Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures. *Economics & Politics*, *7*(3), 207–227.

Krugman, P. R. (1997). *The age of diminished expectations: US economic policy in the 1990s*. MIT press.

Lio, M., & Liu, M.-C. (2008). Governance and agricultural productivity: A cross-national analysis. *Food Policy*, *33*(6), 504–512.

Mauro, P. (1995). Corruption and Growth. *The Quarterly Journal of Economics*, *110*(3), 681–712.

Mbaye, A. A. (2002). *An industry level analysis of manufacturing productivity in Senegal* (No. 25488) (p. 1). The World Bank.

Meeusen, W., & van Den Broeck, J. (1977). Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error. *International Economic Review*, *18*(2), 435–444.

Méon, P.-G., & Weill, L. (2005). Does better governance foster efficiency? An aggregate frontier analysis. *Economics of Governance*, *6*(1), 75–90.

Mills, E. S., Epple, D., & Oates, W. E. (2000). A Thematic History of Urban Economic Analysis [with Comments]. *Brookings-Wharton Papers on Urban Affairs*, 1–52.

Moroney, J., & Lovell, C. A. K. (1997). The relative efficiencies of market and planned economies. *Southern Economic Journal*, *63*(4).

Mustafa, G., & Jamil, M. (2018). Testing the Governance-Productivity Nexus for Emerging Asian Countries. *The Lahore Journal of Economics*, *23*(1), 143.

North, D. C. (1990). *Institutions, Institutional Change and Economic Performance by Douglass C. North* (Cambridge University Press). Cambridge.

North, D. C. (1991). Institutions. *The Journal of Economic Perspectives*, *5*(1), 97–112.

OIT. (2018). *Emploi et questions sociales dans le monde - Tendances 2018*. Genève

Olson, M., Sarna, N., & Swamy, A. V. (2000). Governance and Growth: A Simple Hypothesis Explaining Cross-Country Differences in Productivity Growth. *Public Choice*, *102*(3), 341–364.

Rigobon, R., & Rodrik, D. (2005). Rule of law, democracy, openness, and income. *Economics of Transition*, *13*(3), 533–564.

Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development. *Journal of Economic Growth*, *9*(2), 131–165.

Roodman, D. (2009). A Note on the Theme of Too Many Instruments*. *Oxford Bulletin of Economics and Statistics*, *71*(1), 135–158.

Salinas-Jiménez, M. del M., & Salinas-Jiménez, J. (2007). Corruption, efficiency and productivity in OECD countries. *Journal of Policy Modeling*, *29*(6), 903–915.

Szirmai, A., Gebreeyesus, M., Guadagno, F., & Verspagen, B. (2013). *Promoting productive employment in Sub-Saharan Africa : a review of the literature* (MERIT Working Papers No. 062). United Nations University - Maastricht Economic and Social Research Institute on Innovation and Technology (MERIT).

Williamson, S. (1987). Financial Intermediation, Business Failures, and Real Business Cycles. *Journal of Political Economy*, *95*(6), 1196–1216.

Zhang, F., Hall, J., & Yao, F. (2018). Does Economic Freedom Affect the Production Frontier? A Semiparametric Approach with Panel Data. *Economic Inquiry*, *56*(2), 1380–1395.

Zhou, Y. (2018). Human capital, institutional quality and industrial upgrading: global insights from industrial data. *Economic Change and Restructuring*, *51*(1), 1–27.

Appendices

Table 2: Definition and data source

Variable	Definition of variables	data sources
GE	Government Effectiveness	WGI (2018)
CC	Control of corruption	WGI (2018)
PSAV	Political stability and absence of violence	WGI (2018)
RQ	Regulatory quality	WGI (2018)
RL	Rule of law	WGI (2018)
VA	Voice and Accountability	WGI (2018)
GG	Average governance (Arithmetic average of the six governance indicators)	Authors' calculation
GDPPW	Gross domestic product per worker	WDI(2018)
H/L	the average number of years of schooling for the population aged 25 and over	Barro et Lee (2013)
K/L*	Capital stock per worker	Authors' calculation
Urb_Pop	Urban population (%Total population)	WDI(2018)
Openness	openness (%GDP)	WDI(2018)
Fix_ Tel	Number of fixed-line telephone subscriptions (per 100 inhabitants)	WDI(2018)
Empl/Pop	Employment-to-population ratio	WDI(2018)
ELF	Ethno-linguistic fragmentation	La Porta (1999)
latitude	Latitude	La Porta (1999)
French	French legal origin	La Porta (1999)

* The capital stock was calculated using the perpetual inventory method according to Bjornskov and Meon (2015). This method is described in detail in Easterly and Levine (2001)
Source: authors based on data from WDI (2018) and WGI (2018)

List of countries included in our sample:

Benin, Botswana, Burundi, Cameroon, Central African Republic, Congo, Côte d'Ivoire, Democratic Republic of Congo, Gabon, Gambia, Ghana, Kenya, Lesotho, Liberia, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Togo, Uganda, Tanzania, Zimbabwe

Table 3: Descriptive statistics of the variables

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Ln(GDPPW)	651	80.796	10.048	60.767	110.429
GE	558	-0.654	0.615	-10.885	10.049
CC	558	-0.590	0.588	-10.723	10.217
PSAV	558	-0.507	0.909	-20.845	10.200
RQ	558	-0.560	0.618	-20.298	10.127
RL	558	-0.617	0.645	-20.130	10.077
VA	558	-0.518	0.712	-10.859	10.007
GG	558	-0.574	0.616	-20.100	0.880
H/L	651	40.277	20.056	0.800	90.430
Ln(K/L)	586	50.008	10.468	-0.666	80.845
Ln(Urb_Pop)	651	30.517	0.485	20.003	40.484
Ln(trade)	639	40.188	0.518	-10.926	50.741
Ln(Fix_Tel)	640	-0.043	10.433	-50.117	30.436
Ln(Emp/Pop)	651	40.084	0.230	30.627	40.462
FEL	651	0.661	0.237	0.000	0.890
latitude	651	0.133	0.095	0.000	0.326
french	651	0.516	0.500	0.000	1.000

Source: authors based on data from WDI (2018) and WGI (2018)

Table 9: Correlation between the different variables

	GE	CC	PSAV	RQ	RL	VA	GDPPW	H/L	K/L	trade	Fix_Tel	Emp/Pop	Urb_Pop	EFL	latitude	French
GE	1.00															
CC	0.86	1.00														
PSAV	0.69	0.69	1.00													
RQ	0.91	0.81	0.68	1.00												
RL	0.90	0.86	0.79	0.90	1.00											
VA	0.76	0.69	0.67	0.76	0.81	1.00										
GDPPW	0.55	0.48	0.45	0.52	0.51	0.33	1.00									
H/L	0.48	0.37	0.32	0.38	0.38	0.34	0.64	1.00								
K/L	0.43	0.39	0.39	0.40	0.40	0.26	0.91	0.64	1.00							
trade	0.13	0.23	0.39	0.14	0.21	0.18	0.31	0.23	0.33	1.00						
Fix_Tel	0.66	0.58	0.58	0.59	0.63	0.46	0.73	0.52	0.64	0.28	1.00					
Emp/Pop	-0.29	-0.30	-0.24	-0.30	-0.27	-0.17	-0.79	-0.24	-0.69	-0.25	-0.50	1.00				
Urb_Pop	0.16	0.15	0.34	0.16	0.16	0.22	0.57	0.44	0.55	0.35	0.35	-0.49	1.00			
EFL	-0.07	-0.20	-0.07	-0.02	-0.10	-0.06	-0.04	0.12	-0.14	-0.17	-0.14	0.12	0.18	1.00		
latitude	0.55	0.63	0.50	0.44	0.54	0.54	0.34	0.12	0.29	0.22	0.60	-0.42	0.18	-0.37	1.00	
French	-0.30	-0.28	-0.10	-0.23	-0.27	-0.18	-0.23	-0.31	-0.15	0.01	-0.31	0.29	0.05	0.06	-0.28	1.00

Source: authors based on data from WDI (2018) and WGI (2018