Business environment and productivity in Africa: macro evidence

Issahaku Haruna
Department of Finance, School of Business, University for Development Studies, Tamale, Ghana, and
Charles Godfred Ackah
Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, Accra, Ghana

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Abstract

Purpose – Africa's business environment (BE) is characteristically unfriendly and poses severe development challenges. This study evaluates the impact of business climate on productivity in sub-Saharan Africa (SSA).
Design/methodology/approach – Macroeconomic data for 51 sub-Saharan African economies from 1990 to 2018 are employed for the analysis. The seemingly unrelated regression model is used to address inter-sectorial linkages.
Findings – The study uncovers several findings. First, a high start-up cost substantially leads to productivity losses by limiting the funds available for investment in productivity-enhancing labour and technology and limiting the number of businesses that see the light of day. The productivity impacts of start-up costs are most enormous for industry, followed by services and agriculture. Second, economies with favourable financing environments tend to be more productive economy wide and sector wise. Third, high taxes and tax inefficiency lower productivity by reducing the resource envelope of firms, thus lowering investment amounts. Fourth, poor business infrastructure inflicts the most damage on productivity. Lastly, business administration and macroeconomic environments impact sectoral and economy-wide productivity.
Practical implications – SSA economies must strive to lower the cost of starting a business as high start-up costs injure productivity. One way of reducing start-up costs is to create a one-stop shop for registering and formalising a business. Another way is to automate business registration and administrative processes to reduce red tape and corruption.
Originality/value – The authors extend the body of knowledge by analysing sectoral and economy-wide productivity effects of various business climate indicators while accounting for inter-sectoral linkages, cross-sectional dependence and endogeneity.

Keywords Business environment, Productivity, Sub-Saharan Africa, Seemingly unrelated regressions
Paper type Research paper

Introduction

A favourable business climate can be critical in promoting entrepreneurship and innovation for economic growth and development, especially in developing countries where market failures are common. The areas government can intervene in include, but are not limited to, providing fiscal incentives, ensuring macroeconomic stability, reducing legal and regulatory barriers, enforcing law and order, stabilising the financial system, providing regimes for licencing technology, ensuring the protection of property rights and creating a suitable environment that encourages risk-taking by the private sector (Casanova *et al.*, 2017). There

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are lots of benefits to be derived from a supportive business environment (BE). Some of these include the entrenchment of an entrepreneurial culture, acceleration of innovation, enhanced employment creation, increased productivity and economic growth, poverty reduction and sustainable development (The Innovation Platform, 2018; Chaminade and Esquist, 2010).

Various World Bank Ease of Doing Business reports show that African economies cannot reap the full benefits of suitable BEs due to their characteristically poor business climates. On a scale of 0–100 (0 is worst; 100 is best), sub-Saharan Africa scores less than 50% in BE indicators such as resolving insolvency, enforcing contracts, protecting minority shareholders and getting credit (World Bank, 2020a). The top 10 obstacles named by Ghanaian businesses are access to finance, tax rates, corruption, infrastructure deficits, inflation, foreign currency regulations, tax regulations, policy instability, poor work ethic and poor public health (World Economic Forum [WEF], 2017). These obstacles to business growth are not unique to Ghana. Indeed, a poor business climate damages African development as businesses lose significant portions of their sales due to government regulations, weak infrastructure, corruption and crime (Bah and Fang, 2015). However, the extent to which various dimensions of the business landscape affect the productivity of various sectors of the economy is still an open empirical question.

Studies consistently point to low productivity becoming a pattern in African economies compared to economies of other continents. For example, an analysis of productivity data from 2008 to 2017 for various continents shows that SSA's productivity (measured in terms of GDP per person) lags behind that of all regions (World Bank, 2020b). This low productivity has been found to be driven by BE factors such as government regulations, weak infrastructure, corruption and crime (Bah and Fang, 2015) and access to finance (Cao and Leung, 2020; Fowowe, 2017). However, we are yet to know the full extent of the effect of a wide range of business climate variables on the economy's productivity and sectors of the economy, in particular. The issue of productivity is relevant because it has been projected to be the primary predictor of economic growth and human progress in the next 50 years (Organisation for Economic Co-operation and Development, 2016).

Notwithstanding the emerging literature on business climate and performance, some gaps remain. Studies that examine the effects of the BE on productivity often focus on access to finance as firms' binding constraint (see Fowowe, 2017; Hyytinen and Toivanen, 2005). Studies investigating other business climate variables and productivity often focus on a limited number of dimensions of the business climate. For instance, Asaftei *et al.* (2008) focused on competition and institutional architecture variables and examined how they affect productivity in Romania, while You *et al.* (2018) covered only the technological dimension of the business climate.

Bah and Fang (2015) are closest to this current study. The authors assessed the impact of five BE dimensions on productivity in Africa: corruption, infrastructure, financial development, crime and regulatory framework. Our work differs from that of Bah and Fang (2015) in two main ways. First, we cover essential BE dimensions such as the cost of starting a business, tax environment, credit information quality and economic environment, which have not been captured in the models of Bah and Fang (2015). Second, unlike Bah and Fang (2015), who measure business climate effects on the economy's productivity as a whole, we assess the productivity impact at the economy-wide and sectoral levels using a model that considers inter-sectorial linkages. This ensures that we do not miss out on the differential impacts of the business framework on the various sectors of the economy.

Some recent studies have examined how the Fourth Industrial Revolution technologies, corporate governance and environmental, sustainable and governance impact the performance of firms (see Alkaraan, 2021; Hussainey *et al.*, 2022; Radicic and Alkaraan,

2022; Alkaraan *et al*., 2022, 2023; Alkaraan, 2022). We add to the above contributions by expanding the discussion beyond the firm level to cover sectoral and economy-wide analysis.

The above literature gives rise to some teething questions. (1) To what extent does the BE thwart or boost productivity? (2) Is there a differential impact of BE factors on the general economy and the constituent sectors? (3) Is the impact of the BE on productivity in the global literature consistent with the African situation after accounting for inter-sectoral linkages? These questions are the focus of this study.

The study's niche in the literature is four-fold: Firstly, it bridges the gap in knowledge regarding how business climate may serve as a hindrance or springboard to productivity by employing a wide range of measures of the BE, including those ignored by the extant literature. Secondly, it measures the productivity implications of the BE from both economy-wide and sectoral perspectives. Thirdly, it focuses on a continent that lags in the BE and lacks rigorous studies on how the BE affects productivity (Bah and Fang, 2015; Abdu and Jibir, 2018). Lastly, this study employs a modelling framework that addresses inter-sectorial linkages, an issue not attended upon by the extant literature.

Conceptual and theoretical issues

Conceptual issues

The BE refers to the policies, institutions, regulations and conditions that characterise the space in which businesses operate. In some circles, the BE is sometimes called investment or business climate (see Dollar *et al*., 2005; Gogokhia and Berulava, 2021). Reyes *et al.* (2021) classify BE into three categories: basic, refined and agglomeration. Basic BE relates to the fundamental necessities of development, such as property rights protection, control of corruption, human capital, security, availability of finance and infrastructure. Refined BE entails entry and exit barriers, labour regulations and tax climate. Finally, the agglomeration environment encompasses the nearness of firms to a big city, proximity to vibrant firms and informal competition.

This study offers a more granular classification of the BE in six categories. The first category is the start-up BE which embodies the cost of registering a business measured against per capita income. The second dimension is the financing environment which captures the ease with which firms can access funding and the factors that condition credit access (credit reference bureaus). The third category is the tax environment covering labour taxes and corporate taxes. The fourth is the business infrastructure environment which captures access to electricity and port infrastructure quality. The fifth category is the macroeconomic environment which refers to the quality of management of the general economic climate in which businesses operate. The last category is the business administration environment which includes the time it takes to build a warehouse, register a business and resolve insolvency.

Regarding productivity, it is a bedrock for permanent changes in income and well-being (Schreyer, 2001). This is because productivity increases the output volume far above the cost of producing the output, leading to increased sales, profitability and income. Based on economic theory, the firm's productivity can be measured as the ratio of output to input (Owyong, 2000). Productivity measures the efficiency with which inputs are translated into output(s) (Diewert and Nakamura, 2007). Over the years, productivity has often been measured in terms of the ratio of output to the most essential input, say, crop output per acre as a measure of agricultural productivity and output per worker as a measure of productivity in the industry sector where labour is scarce (Owyong, 2000).

The measurement of productivity can be conceived at three levels: single-factor productivity measures, total factor productivity (TFP) and multifactor productivity (MFP) (see Diewert and Nakamura, 2007). Single-factor productivity relates to the output to a single

factor, such as labour or capital. Examples include output per unit capital (capital productivity) and output per unit labour (labour productivity) (see Schreyer, 2001). The most complete measure of productivity is TFP which captures the ratio of total output to total input. TFP expresses total output as a ratio of a price-weighted average of quantities of all inputs used in producing the output. Because of the difficulty in capturing all inputs in measuring productivity, statistical agencies have used MFP as a surrogate for TFP (Diewert and Nakamura, 2007). MFP expresses output as a ratio of a set of inputs such as the KLEMS (capital, labour, energy, materials).

Theory development

Based on Romer (2019), we build our theoretical model on a Harrod-neutral technological progress neoclassical production function with four variables as follows:

$$Y_t = F(K_t, A_t L_t) \tag{1}$$

where Y is output, K is capital, A is technological progress, L is labour. We assume that these inputs are available at any time and can be combined to produce some output. The multiplicative term $A_t L_t$ is the effectiveness of labour, describing labour augmenting technological progress (Harrod-neutral technological progress). We further assume that capital and effective labour exhibit constant returns to scale. This means that if we double inputs, the output will also double.

This is illustrated as:

$$zF(K_t, A_t L_t) = zF(K_t, A_t L_t) \text{ for all } z \geq 0 \tag{2}$$

where z is a positive constant. We can express the production function in an intensive form. Suppose $z = \frac{1}{A_t L_t}$, equation (2) becomes,

$$F\left(\frac{K_t}{A_t L_t}, 1\right) = \frac{1}{A_t L_t} F(K_t, A_t L_t) \tag{3}$$

In equation (3), $\frac{K_t}{A_t L_t}$ is capital per unit of effective labour, $F\left(\frac{K_t}{A_t L_t}, 1\right)$ is output per unit of effective labour (productivity). Let $k_t = \frac{K_t}{A_t L_t}$, $y_t = F\left(\frac{K_t}{A_t L_t}, 1\right)$ and $f(k_t) = F(k_t, 1)$, we can express equation (3) as follows:

$$y_t = f(k_t) \tag{4}$$

Equation (4) says that productivity (output per effective labour) depends on capital per unit of effective labour. We invoke institutional theory by North (1991) to introduce the BE into the neoclassical growth model in the equation in a panel form as follows:

$$y_{it} = f(k_{it}, Business\ Environment_{it}) \tag{5}$$

where i is the cross-sectional dimension and t is the time index. *Business Environment* captures BE variables such as business start-up, financing, infrastructure, tax, economic and business administration. North (1991) expresses how institutions influence economic performance by determining the "rules of the game". In this light, institutions can be informal (customs, codes of conduct, sanctions, taboos, traditions, informal market rules, normative rules) or formal (administrative rules, constitutions, contractual rules, laws, property rights, technical standards) in nature which can be equated to the BE. In this spirit, a well-forged BE will engender orderliness and reduce uncertainty, thereby contributing positively to economic activity. Acting with other economic factors, the BE determines the costs of production and transactions and, by extension, the viability of an economic

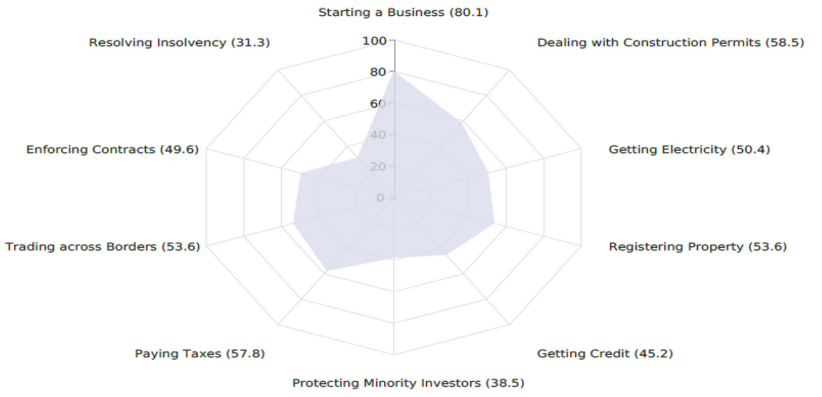
endeavour and the extent of profitability. By and large, within the institutional theory framework, the BE influences productivity through its role in determining society's incentive structure, the evolution of which impacts the trajectory of economic growth -upward (increased productivity), downward (decreased productivity), or stagnant.

Overview of business environment in Africa and empirical literature review

A key stylised fact of the business climate in SSA is its generally unfriendly nature. This is supported by the region's poor performance in key BE indicators covered by World Bank Ease-of-doing-Business Report 2020 (see Figure 1). Out of 10 ease-of-doing-business indicators, SSA scores below the median mark (50) in 4 (resolving insolvency, enforcing contracts, protecting minority investors and accessing credit) and within the median mark for five indicators (trading across borders, paying taxes, registering property, getting electricity and dealing with construction permits). The region, however, scores high on starting a business (80.1).

The extant literature provides evidence of the BE's important role in output and productivity growth. The evidence provided by Asaftei *et al.* (2008) based on a panel of Romanian firms shows that the BE complements privatisation to bring about productivity. In a study that covered thousands of firms in 25 European Union countries, Gaganis *et al.* (2018) revealed that eradicating corruption and friendly investment climates where there are limited constraints to credit access and fewer bureaucratic rules on starting and closing businesses boost the performance of firms. In a study among Canadian SMEs, Cao and Leung (2020) argued that when financing constraints are not factored into the model, productivity estimates are exaggerated by 4%. Focusing on the productivity effects of infrastructure among Indian manufacturing firms, Khanna and Sharma (2020) revealed that infrastructure facilities have varying positive impacts on productivity. In specific terms, an 11% upturn in the infrastructure base leads to a 0.16% rise in manufacturing productivity. Turning to tax environment and productivity, Zhang (2019) assessed the implications of tax rebates on exports for the productivity of manufacturing firms in China and found that tax incentives have a favourable effect on firms' productivity.

Some recent studies have looked at how the Fourth Industrial Revolution technologies and corporate governance impact the performance of firms. For instance, Alkaraan *et al.* (2023)



Source(s): Figure courtesy of World Bank 2020b

Figure1. Ease of doing business scores on doing business topics (2020) – Sub-Saharan Africa

revealed the synergetic role of industry 4.0 technologies and circular economy in boosting the financial efficiency of firms. Hussainey *et al.* (2022) highlighted the effect of corporate governance mechanisms on the move of corporations towards industry 4.0 narrative reporting. Radicic and Alkaraan (2022) discussed the impact of open innovation strategies on the innovativeness of small and medium enterprises. Alkaraan *et al.* (2022) assessed the role of environmental, social and governance factors in accentuating the positive impact of corporate transformation towards industry 4.0 on the financial performance of firms.

In terms of Africa specific literature, Eifert *et al.* (2005) have underscored the very high cost of doing business in Africa compared to the other parts of the world. Upon a thorough review of firm-level literature on the business climate in several African countries, the authors conclude that the low productivity among African firms relative to other parts of the world is primarily attributed to the high cost of operations imposed by an unsupportive business landscape. You *et al.* (2018) have argued that if African countries were to improve the technological climate in which businesses operate, this would significantly impact total factor productivity.

Bah and Fang (2015) investigated the impact of five business climate factors on productivity in Africa: corruption, infrastructure, financial development, crime and regulatory framework. According to the authors, corruption, infrastructure, crime and regulatory framework should be viewed as constituting output tax, while access to finance should be treated as a limitation on borrowing. Based on a general equilibrium framework, the study found that access to finance is responsible for 39% of the variation in output. In comparison, the other four factors are responsible for 11% of changes in output. Similar results were found by Kramo and Koné (2023) in Cote d'Ivoire. Enisan (2005) dealt with the effects of the macroeconomic environment on productivity in SSA economies and revealed that inflation, foreign debt and lending interest rate have adverse effects on productivity.

While the above literature has endorsed a favourable and significant impact of a suitable BE on productivity, other studies have found no impact of some business climate indicators on productivity. For instance, Fernandes (2008) discovered the impact of credit on productivity to be insignificant in Bangladesh, as did Moreno-Badia and Slootmaekers (2009) in Estonia.

The above-reviewed literature has shed light on the influence of some BE indicators on productivity. However, gaps remain. First, there is an over-concentration on the role of funding constraints in productivity. Second, the assessment usually focuses on the firm-level or national level. This study fills these gaps by assessing the effects of several business climate variables on productivity at the national and sectorial levels.

Methodology

Seemingly unrelated regressions

The seemingly unrelated regressions (SUR) model was first developed by Zellner (1962). This estimation strategy accounts for cross-equation contemporaneous correlations and heteroscedasticity in the error terms. For example, given k = 1 ... m equations, for $i = 1$ ... n individuals (cross-sections), we can write out a set of separate linear equations in compact form as follows:

$$y_k = X_k \alpha_k + \in_k \tag{6}$$

where y_k and $\in_k$ are n-dimensional vectors, α_k is a P_k dimensional parameter vector, X_k is the n by P_k dimensional matrix of explanatory variables. We can express all m equations in a matrix form as follows:

$$\begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{pmatrix} = \begin{pmatrix} X_1 0 & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & X_m \end{pmatrix} \begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \vdots \\ \alpha_m \end{pmatrix} + \begin{pmatrix} \in_1 \\ \in_2 \\ \vdots \\ \in_m \end{pmatrix} \tag{7}$$

The standard assumptions are that the error terms are normally distributed, independent across individual units and independent across equations. So long as these assumptions hold, an equation-by-equation estimation of the system of equations using the ordinary least squares (OLS) technique will yield consistent results. However, when the error terms of different equations are correlated (heteroscedastic), OLS estimation will yield biased results. In this case, the SUR model will yield unbiased results as it can account for contemporaneous correlation and heteroscedasticity among the error terms of different equations. The SUR estimation procedure involves two stages: in stage 1, the equations are estimated individually, and the resulting residuals are used to estimate the variance-covariance matrix ($\sum$). The second stage involves substituting the estimated variance-covariance matrix ($\widehat{\sum}$) for the variance-covariance matrix ($\sum$) of the generalised least squares (GLS) estimator:

$$\alpha_{GLS} = \left\{ X' \left(\widehat{\sum}^{-1} \otimes I_N \right)' X \right\}^{-1} \left\{ X' \left(\widehat{\sum}^{-1} \otimes I_N \right)' y \right\}^{-1} \tag{8}$$

In the presence of cross-correlations among error terms of different equations, equation-by-equation estimation of the system will produce consistent but inefficient parameter estimates. However, SUR estimation of the system jointly will produce more precise estimates and forecasts of the future values of the dependent variable. Also, the SUR approach enhances the performance of hypothesis testing around the coefficients and the values of other parameters (Zellner, 1962).

We employed the Bruest-Pagan LM Test to examine cross-correlations among the disturbances. The null hypothesis is that the error terms are homoscedastic. A rejection of the null hypothesis suggests that the errors of different equations are correlated, and for that matter, the equations are not independent but somewhat related.

Concerning our empirical macro analysis, four indicators are used to proxy productivity: GDP per person employed (overall productivity), agriculture value added per worker (agric productivity), service value added per worker (services productivity) and industry value added per worker (industry productivity). There is an intrinsic relation among these variables due to forward and backward linkages among the sectors of the economy. This being the case, equations involving the productivity measures will not be independent and unsuitable for estimation via OLS. The SUR estimation strategy becomes a suitable alternative as it can address cross-equation correlations in the error terms. Based on the above theoretical presentation, the models can be specified within the SUR framework as follows:

$$Overall\ Productivity_{it} = \omega_o + \omega_1 Business\ Environment_{it} + \omega' Z + \varepsilon_{it} \tag{9}$$

$$Agric\ Productivity_{it} = \varphi_o + \varphi_1 Business\ Environment_{it} + \varphi' Z + \gamma_{it} \tag{10}$$

$$Services\ Productivity_{it} = \theta_o + \theta_1 Business\ Environment_{it} + \theta' Z + \mu_{i1} \tag{11}$$

$$Industry\ Productivity_{it} = \pi_o + \pi_1 Business\ Environment_{it} + \pi' Z + \sigma_{i2} \tag{12}$$

where the dependent variables are measures of productivity, the BE is made of a gamut of indicators encompassing business start-up costs (costs of starting a business by gender),

financing environment (private sector credit, private credit reference bureau coverage), tax environment (labour tax, tax payments), business infrastructure (access to electricity, quality of port infrastructure), economic environment (quality of debt management) and business administration (time to build a warehouse, time to register property, time to resolve insolvency). Z is a vector of macroeconomic determinants of economic productivity. These covariates are derived from standard growth models, which portray the primary determinants of economic growth, such as land, labour, capital and technology. Land size is measured in terms of agricultural land for equation (10) and total land size for the other equations. Land is a proxy for the natural resource base of the country. A large natural resource base is expected to provide the raw materials required to underpin productivity in all sectors of the economy. Capital is proxied by both foreign and domestic sources of capital. Foreign capital is measured by foreign direct investment (FDI) and international migrant remittances. Government investment in education, health and social services is used to proxy for human and social domestic capital. The number of telephone subscriptions is used to approximate the role of technology in the economy. See Table 1 for the definition of variables. Each of the error terms in equations (9)–(12) has three components. The first component deals with unobserved country-level effects, and the second caters for time effect, while the third is the stochastic error term.

A cursory examination of equations (9)–(12) may give one the impression that the equations are not related. However, should there be more than one non-linear equation, unobserved country-level factors can influence each dependent variable. The equation-by-equation estimation of the system will be inappropriate because some common unobserved factors may influence observed country-level factors which affect productivity in various sectors of the economy. Moreover, the dependent variables share some relationships among them. It has been argued that the ability of a sector (agriculture, industry, services) to promote growth and productivity is dependent on (1) its own growth performance, (2) its indirect effect on the growth of other sectors, (3) the extent of participation of poor people in the sector, (4) the share of the sector in the entire economy and (5) the population reallocation effect between the economic sectors (Christiaensen *et al.*, 2011).

This analysis suggests that agricultural, industrial and services growth are interdependent. These interdependencies lead to a situation where the disturbances of equations (9)–(12) are correlated contemporaneously. We resolve the estimation difficulties by employing the unbalanced panel data SUR model. While the SUR technique addresses the correlation among the disturbances, the panel data approach deals with the issue of heterogeneity arising from unobserved factors (Xu *et al.*, 2018).

The data used for this study were obtained from the World Development Indicators (WDI) of the World Bank. The data is an unbalanced panel covering 51 African Countries from 1990 to 2018.

Empirical findings

Descriptive statistics

Table 2 describes the variables used for this study. Over the period of the study, the overall productivity in SSA was US$14,556.81 GDP per person. The industry sector has the highest productivity, with average productivity of US$20,578.24 value added per person. Thus, the sector can improve productivity growth in the continent if given the needed attention. Next to industry is services, with mean productivity of US$7,082.5 value-added per worker. Though the agric sector has the least productivity values, it remains the most dominant employer of the workforce in most African countries.

In terms of the BE variables, on average, the cost of starting a business in Africa is more than the gross national income (GNI) per capita. The average cost of starting a business is

Notation	Description	Measurement
Productivity measures		
Overall productivity	GDP per person employed	GDP per person employed is gross domestic product (GDP) divided by total employment in the economy
Agric productivity	Agricultural value added per worker	Agriculture, value-added per worker (constant 2010 US$)
Services productivity	Services value added per worker	Services, value-added per worker (constant 2010 US$)
Industry productivity	Industry, value-added per worker	Industry, value-added per worker (constant 2010 US$)
Business environment measures		
Start-up environment		
Start-up cost	Cost of business start-up procedures	The cost to register a business is normalised by presenting it as a percentage of gross national income (GNI) per capita
Start-up cost, female	Cost of business start-up procedures, female	The cost for a female to register a business is normalised by presenting it as a percentage GNI per capita
Start-up cost, male	Cost of business start-up procedures, male	The cost for a male to register a business is normalised by presenting it as a percentage of GNI per capita
Financing environment		
Domestic credit	Domestic credit to the private sector	Domestic credit to the private sector as a percentage of GDP
Reference bureau	Private credit bureau coverage	Private credit bureau coverage as a percentage of the adult population
Tax environment		
Labour tax	Labour tax and contributions	Taxes and mandatory contributions on labour paid by the business. (% of commercial profits)
Tax payments	Number of tax payments made by businesses	The total number of taxes paid by businesses, including electronic filing
Infrastructure environment		
Electricity access	Access to electricity	Access to electricity is the percentage of the population with access to electricity
Quality of port infrastructure	Quality of port infrastructure	Quality of port infrastructure, WEF (1 = extremely underdeveloped to 7 = well developed and efficient by international standards)
Economic environment		
Economic management	Debt policy rating	Assesses whether the debt management strategy is conducive to minimising budgetary risks and ensuring long-term debt sustainability (1 = low to 6 = high)
Business administration environment		
Corruption	Transparency, accountability and corruption	CPIA transparency, accountability, and corruption in the public sector rating (1 = low to 6 = high)
Time to build a warehouse	Time required to build a warehouse (days)	The number of calendar days needed to complete the required procedures for building a warehouse
Time to register property	Time required to register property	The number of calendar days needed for businesses to secure property rights
Time to resolve insolvency	Time to resolve insolvency	The number of years from the filing for insolvency in court until the resolution of distressed assets

(*continued*)

Table 1. Definition of variables

Notation	Description	Measurement
Controls		
Agric. land	Agricultural land	Agricultural land measured in squared kilometres
Land	Total land area	Total land area measured in squared kilometres
Technology	Use of technology in production	The total number of telephone subscriptions
Capital	Gross fixed capital formation	Gross fixed capital formation as a percentage of GDP
Govt. spend	Government spending	Government spending on education, health and social services as a percentage of GDP
FDI	Foreign direct investment	Foreign direct investment inflows as a percentage of GDP
Remittances	International remittances	International remittances inflows as a percentage of GDP
Inflation	Inflation rate	The consumer price index
Interest rate	Interest rate	The borrowing rate in the economy (%)

Table 1.
Source(s): Table by authors

Variable	Obs	Mean	Std. Dev.
Productivity variables			
Agric. productivity	1,068	2320.046	3136.625
Services productivity	1,057	7082.5	6734.756
Industry productivity	1,054	20578.24	53672.43
Overall productivity	1,344	14556.81	19996.44
Business climate variables			
cost_start-up	784	133.5432	239.6379
cost_start-up female	722	116.1917	184.4134
Debt management	489	3.185072	0.9348676
Private credit	2,237	18.51579	19.43054
Private reference bureau coverage	689	6.484906	15.61087
Electricity access	1,033	38.2191	28.25412
Quality of ports	353	3.629969	0.8046976
Labour tax	649	15.26348	9.633502
Corruption	489	2.716769	0.6513267
Time build warehouse	628	189.5091	86.0315
Time register business	682	74.21499	66.37682
Time resolve insolvency	599	2.85409	0.9367341
Controls			
Agric. land	2,568	42.22695	21.55501
Land	2,726	558517	585084.9
Technology	2,116	2.293287	4.626504
FDI	2,001	3.188281	7.914125
Govt. spend	2,117	15.27313	7.25322
Inflation	1,891	34.28377	571.7855
Remittance	1,537	5.195684	18.98462
Interest rate	1,031	7.719033	46.40791

Table 2.
Descriptive statistics
Source(s): Table by authors

133.5% of GNI per capita. The cost of starting a business is slightly lower for females, even though it is still very high (116.2% of GNI per capita). The very low scores in terms of private sector credit to GDP (18.5%) and private reference bureau coverage (6.5% of the adult population) point to the generally underdeveloped financial sector, which impedes access to

finance and financial services by African firms. Business infrastructure in Africa is weak, with only 38% of the adult population having access to electricity, while port infrastructure lacks quality (3.6 out of a possible 7).

Test of system heteroscedasticity

To determine the appropriateness of SUR versus OLS, we need to test whether the error terms in the system of equations (9)–(12) are cross-correlated. If cross-equation correlations in the error terms exist, then SUR is appropriate; if not, OLS will be more suitable. Table 3 shows that the three tests of system cross-correlations are all significant, implying that error terms of different equations are correlated. This means the appropriate estimation technique is SUR.

Business start-up and productivity

The cost of starting a business is vital because some businesses never get established due to exorbitant start-up costs. In this regard, we analysed the effect of start-up costs on productivity as shown in Tables 4 and 5. The results reveal that high start-up cost significantly negatively impacts national and sectoral productivity. This is seen in the negative and significant coefficients of start-up costs in all 12 equations in Tables 4 and 5. Specifically, if start-up costs (as a % of GNI per capita) increase by 1%, overall productivity will decrease by US$13.3 PPP GDP per person, and agriculture, services and industry productivity will fall by US$3.3, US$6.6 and US$13.6 per worker, respectively. These are very massive impacts on productivity. The productivity impacts are largest for industry, followed by services and agriculture, respectively. Disaggregating start-up costs by gender does not reveal any difference in the impact of start-up costs on productivity for females and males. The results, however, confirm that a high start-up cost does substantially lead to productivity losses. A business start-up cost affects productivity by limiting the funds available for investment in productivity-enhancing labour and technology and by limiting the number of businesses that see the light of day.

The results that the BE shapes agricultural, services and industrial productivity are consistent with Kramo and Koné (2023). According to the authors, a unit improvement in the BE index increases productivity in agriculture, services and industry by 29%, 44.3%, 44.1%, respectively, in Côte d'Ivoire.

Financing environment and productivity

The financing environment has a very strong impact on productivity, as evidenced by Table 6. Countries with higher private credit to GDP ratios have higher productivity both nationally and sectorally. A 1% increase in private credit as a percentage of GDP increases overall productivity by US$57.2 PPP GDP per capita and a respective increase in agriculture, services and industry productivity by US$21.3, US$86.2, US$34.55 per worker. Also,

Test	Chi square	*p* value
Breusch-Pagan LM test	594.6015	0.0000
Likelihood Ratio LR test	609.0573	0.0000
Wald test	318.9998	0.0000

Note(s): Ho: No Overall System Heteroscedasticity
Decision: Reject Ho. This means SUR is appropriate due to cross equation correlations in the errors
Source(s): Table by authors

Table 3.
Test of cross correlations in the errors

Variables	(1) Agric. productivity	(2) Services productivity	(3) Industry productivity	(4) Overall productivity
	Cost of start-up procedures			
Start-up cost	−3.303***	−6.645***	−13.55***	−13.26***
	(0.927)	(0.947)	(2.656)	(2.162)
Start-up cost: female				
Start-up cost: male				
Agric. land	12.06			
	(7.839)			
Technology	280.8***	557.3***	339.3***	1,388***
	(29.85)	(30.32)	(85.04)	(69.19)
FDI	0.781	−10.81	−72.80	−43.51
	(20.04)	(20.48)	(57.45)	(46.77)
Govt._Spend	143.5***	503.0***	947.8***	592.9***
	(36.10)	(37.01)	(103.8)	(84.51)
Capital	−61.23**	−103.3***	−32.99	−183.6***
	(24.46)	(25.51)	(71.69)	(57.84)
Inflation	−43.23	40.61	445.6***	72.02
	(38.32)	(39.60)	(111.1)	(90.42)
Remittance	−186.4***	−295.3***	−676.2***	−512.9***
	(39.76)	(42.31)	(118.9)	(96.00)
Interest rate	−54.86***	−63.29***	−187.1***	−251.7***
	(19.64)	(20.18)	(56.61)	(46.09)
Land		0.0009***	0.0060***	0.0059***
		(0.000294)	(0.000848)	(0.000592)
Constant	2,406**	1,511*	−2,774	5,876***
	(946.3)	(859.5)	(2,412)	(1,960)
Observations	353	353	353	353
R-squared	0.374	0.720	0.501	0.715
F-statistic	23.36***	100.96***	37.89***	98.55***

Source(s): Table by authors

Table 4. Business start-up cost and productivity

countries with more private bureau coverage are more productive. An increase in reference bureau listing by 1 leads to a rise in economic productivity by US$328.2 PPP GDP per person and a surge in agriculture, service and industry productivity by US$57.9, US$192.8 and US$280.0 per worker, respectively.

The coefficients of the financing environment variables are generally larger than those of the business start-up costs variables supporting the critical role of finance in the performance of businesses (see Fowowe, 2017; Hyytinen and Toivanen, 2005). The financing environment influences productivity in several respects. First, when more credit is available to the private sector, they have more funds to invest in areas that drive productivity. Second, more credit reference bureau coverage provides good information on the borrowing history of firms/individuals, which helps reduce default risks and hence the cost of borrowing. This will further make more funds available for investment to promote productivity.

Furthermore, the positive impact of the availability and accessibility of finance on agricultural productivity is heart-warming to agricultural financiers and policymakers. With funding available at the right time and in the right quantities, farm households will plant the right seeds at the right time, acquire improved breeds of livestock, purchase desired inputs and farm machinery, expand farm sizes, market their produce and adopt modern technology

Variables	(5) Agric. productivity	(6) Cost of start-up procedures (female) Services productivity	(7) Industry productivity	(8) Overall productivity	(9) Agric. productivity	(10) Cost of start-up procedures (male) Services productivity	(11) Industry productivity	(12) Overall productivity
Start-up cost								
Start-up cost: female	−3.435**	−6.382***	−15.25***	−21.62***				
	(1.418)	(1.482)	(4.141)	(3.207)				
Start-up cost: male					−3.434**	−6.381***	−15.25***	−21.62***
					(1.418)	(1.482)	(4.141)	(3.207)
Agric. land	5.118				5.118			
	(8.498)				(8.497)			
Technology	291.1***	576.9***	364.3***	1,399***	291.1***	576.9***	364.3***	1,399***
	(30.88)	(31.76)	(88.64)	(68.91)	(30.88)	(31.76)	(88.64)	(68.91)
FDI	9.456	5.432	−39.87	−20.52	9.456	5.433	−39.87	−20.51
	(19.98)	(20.96)	(58.49)	(45.47)	(19.98)	(20.96)	(58.49)	(45.47)
Govt._Spend	178.6***	561.0***	1,053***	613.3***	178.6***	561.0***	1,053***	613.3***
	(38.71)	(40.24)	(112.3)	(87.32)	(38.71)	(40.24)	(112.3)	(87.32)
Capital	−73.62***	−120.7***	−82.16	−245.9***	−73.62***	−120.7***	−82.16	−245.9***
	(25.17)	(26.58)	(74.35)	(57.24)	(25.17)	(26.58)	(74.35)	(57.24)
Inflation	−19.55	92.92**	563.7***	218.9**	−19.55	92.92**	563.7***	218.9**
	(37.67)	(39.81)	(111.1)	(86.39)	(37.67)	(39.81)	(111.1)	(86.39)
Remittance	−212.5***	−341.1***	−757.3***	−552.0***	−212.5***	−341.1***	−757.3***	−552.0***
	(40.27)	(44.10)	(123.3)	(95.04)	(40.27)	(44.10)	(123.3)	(95.04)
Interest rate	−21.94	−6.680	−69.62	−134.6***	−21.94	−6.680	−69.62	−134.6***
	(19.83)	(20.49)	(57.20)	(44.46)	(19.83)	(20.49)	(57.20)	(44.46)
Land		0.00098***	0.00632***	0.0066***		0.00097***	0.00632***	0.0066***
		(0.000306)	(0.000879)	(0.000592)		(0.000306)	(0.000879)	(0.000592)
Constant	1,965**	12.21	−5,341**	5,185***	1,965**	11.98	−5,341**	5,185***
	(969.2)	(882.4)	(2,463)	(1,914)	(969.1)	(882.4)	(2,463)	(1,914)
Observations	340	340	340	340	340	340	340	340
R-squared	0.388	0.720	0.507	0.743	0.388	0.720	0.507	0.743
F-statistic	23.95***	96.94***	37.36***	109.23***	23.95	96.94	37.36	109.22

Note(s): ***, **, * respectively means significance at 1%, 5 and 10%
Source(s): Table by authors

Table 5.
Business start-up cost and productivity (female and male)

Table 6. Financing environment and productivity

Variables	(1) Agric. productivity	(2) Services productivity	(3) Industry productivity	(4) Overall productivity	(5) Agric. productivity	(6) Services productivity	(7) Industry productivity	(8) Overall productivity
Domestic credit	21.32***	86.16***	34.55*	57.25***				
	(7.170)	(6.871)	(20.40)	(17.61)				
Reference bureau					–	192.8***	280.0***	328.2***
					(11.68)	(7.135)	(32.03)	(22.72)
Agric. land	13.38**				−2.892			
	(6.574)				(8.216)			
Technology	224.5***	344.2***	286.3***	1,265***	284.0***	542.6***	335.0***	1,382***
	(34.41)	(32.88)	(97.62)	(84.27)	(29.67)	(18.14)	(81.43)	(57.72)
FDI	0.0372	−15.45	−56.42	−50.49	−1.140	−28.76**	−86.07	−70.38*
	(19.59)	(19.20)	(56.94)	(49.33)	(19.81)	(12.18)	(54.65)	(38.79)
Govt. spend	91.29***	368.0***	842.1***	591.4***	105.6**	226.7***	607.9***	125.5
	(28.12)	(27.88)	(82.72)	(71.55)	(43.20)	(26.67)	(119.7)	(84.96)
Capital	−21.85	−2.969	157.3**	−57.36	−44.95*	−2.730	109.2	−8.134
	(20.34)	(20.69)	(61.55)	(52.77)	(24.95)	(15.70)	(70.63)	(49.63)
Inflation	−20.12	46.22**	140.2**	13.22	−27.05	78.85***	529.6***	168.0**
	(19.04)	(18.64)	(55.27)	(47.86)	(37.17)	(23.05)	(103.5)	(73.45)
Remittances	−96.13***	−188.5***	−591.8***	−352.0***	−127.0***	−30.18	−329.7***	−62.56
	(36.84)	(37.11)	(110.3)	(94.92)	(44.43)	(28.14)	(126.5)	(89.19)
Interest rate	−51.48***	−35.24**	−123.6**	−187.7***	−19.32	−14.77	−88.60	−157.7***
	(16.52)	(16.18)	(47.99)	(41.56)	(19.76)	(12.03)	(53.97)	(38.31)
Land		0.000415*	0.00604***	0.00662***		0.000724***	0.00546***	0.00551***
		(0.000247)	(0.000768)	(0.000567)		(0.000178)	(0.000824)	(0.000493)
Constant	1,067	−1,056	−6,477***	94.61	1,722**	−657.0	−7,592***	1,401
	(730.9)	(659.1)	(1,957)	(1,689)	(850.5)	(468.3)	(2,103)	(1,489)
Observations	466	466	466	466	330	330	330	330
R-squared	0.319	0.735	0.441	0.671	0.417	0.906	0.574	0.814
F-statistic	24.09***	144.37***	39.12***	106.10***	26.37***	356.74***	48.48***	162.41***

Note(s): ***, ** and *, respectively, mean significance at 1%, 5% and 10%
Source(s): Table by authors

(Issahaku *et al.*, 2020). These will lead to an increase in agricultural output per unit input and hence productivity.

Also, the positive impact of financing on industrial productivity is in line with expectations. Setting up and operating a manufacturing concern involves enormous capital outlays in the form of machinery and equipment, buildings and a workforce of diverse skills. In an economy where funding is available, entrepreneurs in the industry sector can easily acquire the requisite funding to satisfy the capital investment needs to improve productivity. However, the findings are not supported by Fernandes (2008) and Moreno-Badia and Slootmaekers (2009) in Bangladesh and Estonia. The divergence in result may be due to methodological differences and geographical context.

Likewise, the positive impact of finance on services sector productivity is unsurprising. With access to finance, service sector firms can meet their investment needs, increase their customer base, efficiently utilise available resources and by so doing, increase productivity (see Beck *et al.*, 2004; Beck and Demirgüç-Kunt, 2008).

Tax environment and productivity

The tax environment as described by labour taxes and the number of tax payments made by businesses, seems to have a generally regressive impact on productivity (Table 7). The coefficients are quite large, ranging from US$-60.8 to US$-265.0 per capita. Higher labour taxes negatively affect national, service and industry productivity (columns 2–4). Similarly, the higher the number of tax payments made by businesses, the lower is productivity in the economy and the agriculture and industry sectors (columns 5, 6, 8). High taxes and tax inefficiency lower productivity by reducing the resource envelope of firms, thus lowering investment amounts. Tax payments are also time-consuming and reduce the time available to firms for investment in productive activities.

The finding that agricultural productivity is significantly impacted by the number of tax payments but not labour taxes is unsurprising. The negative impact of the number of taxes paid by agricultural firms on productivity explains the adverse effects of input taxes, sales taxes and other taxes on firms' capital. Agricultural firms' productivity often responds positively to subsidies and negatively to taxes (see Lin *et al.*, 2022).

The industry sector is significantly impacted by labour taxes but not the number of tax payments. This may be explained by the comparatively formal and unionised nature of labour in the sector. With labour being an essential input for the sector's operation, high labour taxes increase production costs, reducing the number of people employed. This may negatively affect productivity if the remaining employees do not raise their work effort to compensate for the employment reductions. The results agree with Zhang (2019).

Service sector productivity, however, is adversely affected by both labour taxes and the frequency of tax payments. This is because, compared to the agriculture sector, the service sector is more formal and is likely to have unionised and formal labour contracts, which will be under the purview of the tax authorities. Services firms are also relatively more conspicuous and are often located in easy-to-find places where applicable taxes are easily exacted. Faced with these tax constraints, service sector firms may adjust to cope with the harsh operating environment, including reductions in investments and closure in some cases (see Damiani *et al.*, 2023).

Business infrastructure and productivity

Table 8 reveals how vital infrastructure, such as electricity and port infrastructure quality, is to the economy's productivity and its constituent sectors. A percentage increase in electricity coverage leads to a significant rise in productivity by US$311.0 PPP GDP per person nationally and in agriculture, services and industry respectively by US$100.8, US$75.21,

Table 7.
Tax environment and productivity

Variables	(1) Agric. Productivity	(2) Services productivity	(3) Industry productivity	(4) Overall productivity	(5) Agric. productivity	(6) Services productivity	(7) Industry productivity	(8) Overall productivity
labour_tax	12.91	−265.0***	−411.5***	−180.0***				
	(22.19)	(20.70)	(63.85)	(55.12)				
Tax payments					−60.83***	−83.12***	10.29	−158.9***
					(20.78)	(21.02)	(60.55)	(48.15)
Land	0.00179***	0.00232***	0.00771***	0.00838***		0.000616**	0.00504***	0.00488***
	(0.000306)	(0.000286)	(0.000882)	(0.000761)		(0.000312)	(0.000925)	(0.000630)
Technology	328.7***	573.9***	340.3***	1,476***	249.7***	522.8***	440.0***	1,328***
	(28.12)	(26.24)	(80.92)	(69.86)	(39.60)	(39.90)	(115.0)	(91.31)
FDI	11.84	−48.30***	−134.1**	−54.38	1.463	−10.05	−37.06	−40.32
	(19.72)	(18.40)	(56.74)	(48.99)	(20.72)	(21.38)	(61.60)	(48.98)
Govt. spend	229.0***	342.1***	714.0***	576.0***	160.7***	520.3***	1,134***	621.1***
	(40.57)	(37.85)	(116.7)	(100.8)	(41.96)	(43.62)	(125.7)	(99.92)
Capital	−107.4***	−84.29***	6.641	−182.2***	−64.93**	−89.73***	−28.68	−153.1**
	(23.45)	(21.88)	(67.48)	(58.25)	(25.48)	(26.81)	(77.37)	(60.99)
Inflation	−5.997	−48.48	365.6***	110.4	−70.18*	32.49	565.4***	67.89
	(36.10)	(33.68)	(103.9)	(89.68)	(41.77)	(43.59)	(125.6)	(99.88)
Remittances	−157.9***	−191.1***	−529.1***	−420.1***	−190.0***	−294.5***	−806.3***	−532.9***
	(41.49)	(38.71)	(119.4)	(103.1)	(43.48)	(46.79)	(135.0)	(106.5)
Interest rate	−17.47	−90.38***	−207.7***	−199.7***	−48.62**	−55.32**	−90.13	−221.2***
	(19.43)	(18.13)	(55.91)	(48.27)	(21.78)	(22.73)	(65.47)	(52.06)
Agric land					7.076			
					(8.870)			
Constant	290.5	6,331***	3,468	4,479*	4,556***	3,443**	−8,935**	9,511***
	(975.3)	(909.9)	(2,806)	(2,423)	(1,576)	(1,465)	(4,221)	(3,352)
Observations	351	351	351	351	319	319	319	319
R-squared	0.441	0.798	0.536	0.716	0.396	0.714	0.468	0.703
F-statistic	30.73***	154.17***	45.09***	98.23***	23.25***	88.80***	30.02***	83.93***

Note(s): ***, ** and *, respectively, mean significance at 1%, 5% and 10%
Source(s): Table by authors

Table 8. Business infrastructure and productivity

Variables	(1) Agric. productivity	(2) Services productivity	(3) Industry productivity	(4) Overall productivity	(5) Agric. productivity	(6) Services productivity	(7) Industry productivity	(8) Overall productivity
Electricity access	100.8***	75.21***	186.5***	311.0***				
	(6.950)	(10.13)	(27.48)	(18.54)				
Port infrastructure					−189.4	1,538***	2,281**	1,794**
					(392.0)	(383.0)	(930.7)	(759.7)
	(5.554)				(12.40)			
Technology	−50.19	334.8***	−282.0**	295.3***	326.9***	526.3***	262.3***	1,372***
	(32.58)	(47.03)	(127.5)	(86.31)	(43.97)	(41.59)	(101.0)	(82.60)
FDI	61.39***	28.47	32.63	105.1***	−9.886	−22.69	−76.32	−58.27
	(15.99)	(20.92)	(56.62)	(38.89)	(35.22)	(34.10)	(82.85)	(67.69)
Govt. spend	180.4***	492.5***	1,006***	876.0***	161.8***	545.8***	954.7***	604.1***
	(22.76)	(30.12)	(81.52)	(56.00)	(49.83)	(47.38)	(115.1)	(94.10)
Capital	−33.52**	−46.56**	166.2***	−51.97	−47.48	−35.10	18.18	−75.79
	(16.25)	(22.12)	(59.90)	(40.91)	(38.10)	(37.03)	(90.02)	(73.30)
Inflation	2.864	45.39**	205.9***	120.2***	−16.76	196.7***	479.3***	316.3***
	(15.28)	(20.16)	(54.57)	(37.49)	(57.14)	(55.49)	(134.8)	(110.2)
Remittances	−225.8***	−334.3***	−870.6***	−833.7***	−230.3***	−301.5***	−670.2***	−509.4***
	(29.83)	(42.14)	(114.2)	(77.57)	(52.15)	(52.49)	(127.6)	(103.7)
Interest rate	−3.461	−11.01	−9.859	−5.243	−37.70	−8.586	−63.01	−77.93
	(13.77)	(18.28)	(49.50)	(33.97)	(28.01)	(26.00)	(63.20)	(51.53)
Land		0.000709**	0.00369***	0.00245***		0.00139***	0.00754***	0.00915***
		(0.000346)	(0.000945)	(0.000588)		(0.000459)	(0.00113)	(0.000825)
Constant	−4,117***	−2,705***	−12,944***	−10,356***	1,582	−8,140***	−15,372***	−8,325**
	(673.2)	(769.9)	(2,084)	(1,432)	(2,144)	(2,072)	(5,036)	(4,106)
Diagnostics								
Observations	433	433	433	433	217	217	217	217
R-squared	0.554	0.707	0.477	0.795	0.353	0.716	0.532	0.772
F-statistic	60.58***	115.94***	43.63***	186.29 ***	13.39***	60.48***	26.21***	81.89***

Note(s): ***, ** and *, respectively, mean significance at 1%, 5% and 10%
Source(s): Table by authors

US$186.5 per worker. Quality port infrastructure has the highest productivity impact so far. A unit increase in port infrastructure quality increases economic productivity by US$1,794.0 PPP GDP per person. It further increases service productivity by US$1,538 per worker and industry productivity by $2,281 per worker. This impact on port infrastructure is unsurprising because ports have become major revenue centres for African governments. Goods will gravitate towards efficient ports, thus raking in more revenues. Ghana, for instance, has tried improving port infrastructure quality through automation and expansion. Electricity infrastructure is critical for productivity because it is a major input in production. For instance, electricity is required for lighting, powering machines and factories. Places without reliable electricity infrastructure are not attractive to investors. These findings align with those of Khanna and Sharma (2020).

Electricity access and port infrastructure affect service and industry productivity, while agricultural productivity is impacted only by electricity access. The extant literature corroborates the positive effect of electricity on agricultural productivity. According to Candelise *et al.* (2021) access to electricity enhances welfare by increasing agricultural productivity, food utilisation and food security. Industry and services are heavily reliant on electricity in their operations. They rely on imported items as well. Hence, access to electricity and quality port infrastructure will make it easy and cost-effective for service and industry firms to operate, promoting productivity consistent with Bah and Fang (2015) and Khanna and Sharma (2020).

Variables	(1) Agric. productivity	(2) Services productivity	(3) Industry productivity	(4) Overall productivity
Economic mgt	466.6***	493.9***	−711.1	1,515***
	(76.08)	(177.9)	(823.3)	(312.5)
Agric. land	3.251*			
	(1.786)			
Technology	320.9***	355.7***	216.7	831.3***
	(24.22)	(58.47)	(270.8)	(101.2)
FDI	2.365	−49.67***	−141.1***	−74.18***
	(5.066)	(11.72)	(54.23)	(20.57)
Government	−73.08***	118.4***	302.3**	−100.7**
spend	(11.28)	(26.68)	(123.5)	(46.71)
Capital	−33.94***	−14.18	138.4	−46.70
	(8.250)	(19.92)	(92.24)	(34.56)
Inflation	11.74	139.2***	533.5***	172.3***
	(10.55)	(24.58)	(113.8)	(43.18)
Remittances	23.33*	114.1***	−0.629	121.1**
	(12.51)	(29.04)	(134.4)	(50.90)
Interest rate	−29.22***	−43.55***	−118.4**	−102.4***
	(5.152)	(12.12)	(56.07)	(21.26)
land		0.000593***	0.00453***	0.000744**
		(0.000223)	(0.00104)	(0.000303)
Constant	809.6***	−686.2	−1,995	1,144
	(279.7)	(635.5)	(2,941)	(1,113)
Observations	238	238	238	238
R-squared	0.531	0.473	0.231	0.389
F-statistic	30.29	23.50	7.49	16.72

Note(s): ***, ** and *, respectively, mean significance at 1%, 5% and 10%
Source(s): Table by authors

Table 9. Macroeconomic environment and productivity

Macroeconomic environment and productivity

Table 9 depicts the impact of the macroeconomic environment (as exemplified by the quality of debt management) on productivity. Clearly, quality macroeconomic management has a very consequential impact on overall productivity and agriculture and services productivity. An increase in the quality of the macroeconomic environment by 1 unit will increase overall productivity by $1,515 PPP GDP per person and agriculture and services productivity by US$466.6 and US$493.9 per worker, respectively. In addition, a conducive macroeconomic climate fosters productivity by ensuring stable prices, predictability in planning and high business confidence. These findings are in line with those of Enisan (2005).

For firms in the agriculture sector, a stable macroeconomic environment means they can plan and purchase inputs timeously, correctly forecast their income based on stable prices and save income for reinvestments. This can incentivise agri-entrepreneurs to take advantage of viable opportunities to increase efficiency and expand their businesses. Similarly, a stable macroeconomic environment for the industry sector implies that prices of raw materials, machinery and equipment are predictable and stable, which helps in planning and execution. Likewise, service sector firms such as hotels, telecommunication, banks and transport dislike the disruptions of a turbulent macroeconomy. Price instability, for instance, imposes on services sector firms high menu costs, operational and production costs, shoe leader costs, tax distortions and loss of international competitiveness, all of which can hurt productivity (see Yang and Mallick, 2014; Sharma and Sharma, 2015).

Business administration and productivity

Table 10 shows that a cumbersome business administration environment damages productivity at sectorial and economy-wide levels. The longer it takes to build a warehouse, register a business and resolve insolvency, the lower the productivity, *ceteris paribus*. Time to build a warehouse and register a business is more damaging to agriculture and services productivity, while the time to resolve insolvency is more injurious to industry productivity. In the agriculture sector, warehouses are essential for the post-harvest handling of produce to reduce post-harvest losses and store products for sale at profitable times. Delays in warehouse setup arising from bureaucratic bottlenecks can thus lead to post-harvest losses and lower profitability.

A similar situation applies to service sector firms that procure large amounts of products to store in a warehouse before distribution. If there are bottlenecks in setting up a warehouse, it can lead to contractual problems, exposure of goods to the vagaries and inefficiencies in procurement and supply chain management.

Variables	(1) Agric. productivity	(2) Services productivity	(3) Industry productivity	(4) Overall productivity
Time to build warehouse	−7.909***	−7.351***	−1.356	−19.64***
	(2.243)	(2.385)	(6.823)	(5.380)
Time to register business	−9.093***	−14.91***	7.366	−24.02***
	(2.579)	(2.754)	(7.947)	(6.356)
Time to resolve insolvency	−2,010***	−2,763***	−6,148***	−6,717***
	(253.7)	(235.6)	(476.0)	(453.9)
Controls	Yes	Yes	Yes	Yes
Diagnostics	Yes	Yes	Yes	Yes

Note(s): ***, ** and *, respectively, mean significance at 1%, 5% and 10%
Source(s): Table by authors

Table 10. Business environment and productivity

Given the huge capital outlay in setting up a manufacturing or industrial concern, prolonged and cumbersome insolvency resolution can drag productivity. This is because insolvency resolution complications can lead to a slowdown or a complete shutdown of operations, a dispirited workforce and legal battles, among other undesirables.

The findings imply that the environment in which businesses are governed is essential. The business administration environment will determine how frustrating or easy it is to register a business, construct business facilities such as factories and warehouses and resolve insolvency issues. Thus, it will determine the level of productivity a firm or an economy attains.

Controls

In most of the models, a number of the control variables meet theoretical expectations. Technology, land and government spending show a strong positive influence on productivity. A high-interest rate generally discourages productivity. Capital, FDI and remittances show mixed results.

Conclusion

This study analysed the impact of a gamut of BE variables on productivity at the national and sectoral levels using macroeconomic data for 51 SSA economies from 1990 to 2018. The study revealed six main findings. First, high start-up costs markedly lead to productivity losses by limiting the funds available for investment in productivity-enhancing labour and technology and limiting the number of businesses that see the light of day. The productivity impacts of start-up costs are largest for industry, followed by services and agriculture, respectively. Again, start-up costs impact male- and female-controlled businesses to the same degree. Second, economies with good financing environment tend to be more productive economy wide and also in terms of individual sectors. The coefficients of the financing environment variables are generally larger than those of the business start-up costs variables supporting the critical role of finance in the prosperity of businesses. Third, high taxes and tax inefficiency lower productivity by reducing the resource envelope of firms, thus lowering investment amounts. Fourth, poor business infrastructure inflicts the most severe damage on productivity. Fifth, a favourable macroeconomic environment is critical for productivity in the economy. Sixth, a cumbersome business administration environment depresses productivity.

The findings have the following practical and policy implications. Given the established impact of start-up cost in this study, SSA economies must strive to lower the cost of starting a business as high start-up costs injure economy-wide and sectoral productivity. One way of reducing start-up costs is to create a one-stop-shop for registering and formalising a business. Another way is to automate business registration and administrative processes to reduce red tape and corruption. An unequivocal impact of financing environment on productivity calls for a need to improve the financing environment in African economies. This can be done through effective regulatory oversight of financial markets and institutions, strengthening credit information agencies and improving the general macroeconomic environment. The adverse impact of taxes on the economy and its constituent sectors implies that the tax regime in SSA economies requires reforms to make payment of taxes easy, more efficient and pro-business. More so, critical supporting infrastructure is crucial for improved business performance in African given the positive role of the infrastature environment in economy-wide and sectoral productivity established in this study. Thus, SSA countries must provide pieces of infrastructure in sufficient scale and quality to make doing business easy for firms in the region. The criticality of the macroeconomic environment in productivity has been

firmed in this study, implying that macroeconomic stability should thus be pursued vigorously by SSA governments. This will entail enacting and implementing sound macroeconomic policies that engender economic growth, low inflation, low unemployment, stable currency and stable balance of payments. Also, given the finding that a bureaucratic business administration environment is inimical to productivity, SSA economies must ensure that the business administration environment is made investment friendly by reducing the time spent by businesses in building business facilities and resolving disputes. Finally, the findings generally imply that institutional theory has a strong explanatory power in the link between the BE and productive efficiency in SSA.

This study has some limitations. First, productivity is measured in terms of single-factor productivity measures, which are limited in how they capture productivity. Future studies can consider employing TFP and MFP measures to explore how business climate indicators impact them. Also, this study did not explore asymmetries in the effect of the BE on productivity. It may well be that increases in the quality of the BE may have a different magnitude of impact on productivity compared to decreases in the quality of the BE. This can be the subject of future research endeavours.

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Corresponding author
Issahaku Haruna can be contacted at: iharuna@uds.edu.gh