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Road to Industrialized Africa: Role of Efficient Factor Market in Firm Growth

by Manabu Nose

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African Department

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Role of Efficient Factor Market in Firm Growth

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Abstract

After a decade of rapid growth, industrialization has lost ground with shrinking manufacturing sector and high informality in sub-Saharan Africa (SSA). This paper explores how land market and labor regulations affect factor allocative efficiency and firm performance in SSA. Using pooled data on firm balance sheets for 40 countries in SSA, the results identify significant land and labor misallocations due to limited market allocation of land and inappropriate regulatory policies. Using variations in ethnic diversity and the intensity of regulatory actions to peer firms at subnational level as instrumental variables, local average treatment effects show large productivity gains from factor reallocations, especially for marginally productive firms. Panel data results for Nigerian firms confirm factor market inefficiency as a principal driver of declining productivity, while showing that the 2011 minimum wage reform increased firm size. The results imply that improving formal regulation is critical to support firm growth at the stage of weak legal capacity, while informal sector monitoring gets effective as legal capacity develops.

JEL Classification Numbers: O14, O17, J08, J21, J88, O55

Keywords: Firm growth, misallocation, land market, labor regulations

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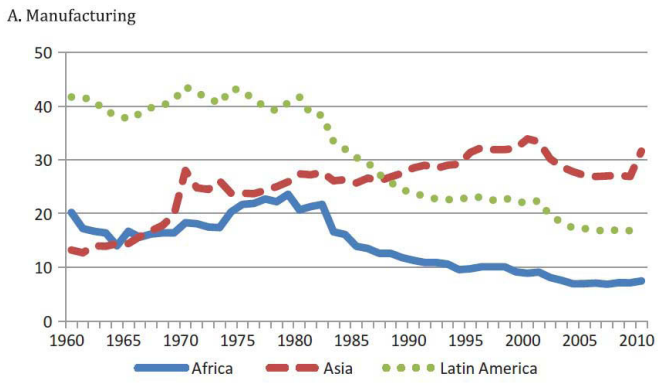
I. INTRODUCTION [1]

After a decade of strong growth, buoyed by a supercycle of global commodity prices and surging investments in natural resources, economic growth in sub-Saharan Africa (SSA) has recently faltered. The sustained decline in global commodity prices and a prolonged slowdown of growth among the region's main trading partners (China in particular) have weighed on Africa's convergence – at least superficially – toward higher income levels.

Moreover, the recent slowdown in economic performance served as a reminder that the region continues to lack competitive industrial base that would have shielded economies from excessive commodity price volatility. Despite rapid urbanization driven by fast population growth, Africa has in fact *de-industrialized* since mid-1970s (Jedwab, Christiaensen, and Gindelsky, 2017). Africa's high growth contributed little to the formal manufacturing industries, leaving the manufacturing sector dominated by many small and informal firms. Manufacturing share of employment stands well below at 8 percent, and manufacturing output, measured by a percentage of GDP, has declined from 15 percent in the mid-1970s to around 10 percent today. Based on data from the Groningen Growth and Development Center, Rodrik (2016) found that African countries are under-industrialized at all income levels, while industrialization in Asia has progressed approximately in the same proportion as income levels.

Another reason why Africa did not grow in conformity with neoclassical growth convergence model is informality, which remains widespread (38 percent of GDP during 2010-14). Average productivity of the informal sector in SSA is only about 20 percent of the formal sector (IMF, 2017b). Few informal firms grow out of informality, dragging on the region's overall productivity (Figure 1) (de Vries, Timmer, and de Vries, 2015).

Figure 1. Regional comparison of manufacturing productivity (USA=100)



Source: de Vries, Timmer, and de Vries (2015)

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At the same time, SSA's population is expected to more than double over the next decades, growing from 1.2 billion today to nearly 2.5 billion in 2050. With ample young population entering the labor force, firms will have the opportunity to realize significant productivity dividend if they manage to reallocate factor inputs more efficiently (IMF, 2017b; Hsieh and Klenow, 2009; Restuccia and Rogerson, 2017).

Two primary sources of production factor misallocation are important to the present study. First, Duranton et al (2015) using manufacturing plant-level data in India found that less productive firms have better access to land, and the misallocation in land has a secondary effect on the allocation of capital through the credit system. As firms use land as collateral in the borrowing process, productivity distortions due to land misallocation are amplified by capital misallocation.

Second, while in theory, stronger labor and business regulations should induce firms to formally register and comply with the requirements of social insurance schemes, recent studies have shown that little formalization is actually achieved by regulating small and informal firms in developing economies (Benhassine, 2018; Andrade, 2014). As informal firms rationally exit the formal sector when the benefits of formal registration outweigh the costs (e.g., tax payments) (Maloney, 2004), the impact of new regulation is often highly context specific (see Bhorat, Kanbur, and Stanwix (2017) on minimum wage).

Consequently, if high informality in SSA economies is the equilibrium outcome of firms weighing costs vs. benefits, product markets in the formal economy should improve to increase market efficiency and expand formal firms. In reality, however, product markets in SSA are still at infancy stage as markets in most SSA economies tend to be dominated by state-owned and foreign-owned enterprises (Bai, Hsieh and Song, 2016; McKinsey 2017). Furthermore, weak state capacity (*a la* Besley and Persson, 2011) and wage rigidities constrain factor market efficiency.

How efficient are factor markets in SSA compared to developing Asia? How can policy makers promote firm growth and reduce informality in SSA? This paper presents a dual economy model with input-financing frictions that predicts how factor market regulatory reforms will affect firm growth when the minimum wage is set below the market clearing wage. Using data on firm balance sheets from the World Bank's Enterprise Surveys (WBES), the paper estimates the allocative efficiency of land and labor markets in 40 SSA countries and investigates the determinants of factor market allocations. The causal effects of factor allocative efficiency on firm size and productivity are estimated using a pooled country sample, which is verified in a single country case (Nigeria) using firm panel data. In identifying this relationship, the endogeneity of factor allocations is addressed by using unique institutional variations in SSA – ethnic diversity and the intensity of regulatory actions to peer firms at subnational level – in the instrumental variable (IV) regression.

The empirical results show that limited market allocation of land and inappropriate regulatory policies, including a low minimum wage, contribute significantly to the inefficiency in land and labor allocation in SSA. OLS and IV-Tobit regressions show that the

reallocation of land and workers across firms would allow firms to survive longer and achieve higher productivity growth and operational scale on average. The IV results highlight significant heterogeneity in policy effects, showing bigger local average treatment effect (LATE) for marginal firms that are induced to reallocate factors in response to the policy changes. To improve factor allocation, the results underscore that regulatory design needs to account for local legal capacity. Against a theoretical prediction, strengthening monitoring of informal activities, through frequent inspections, does not necessarily support firm growth in SSA. Improving regulations to formalize the land allocation process and labor contracts with social insurance benefits are effective in supporting firm growth when legal capacity is weak. As legal capacity develops, stronger informal sector monitoring would prompt the reallocation of workers to productive formal activities.

The paper is organized as follows. Section II describes the characteristics of private firms in Africa compared to developing Asia as well as land and labor markets in SSA. Section III provides a dual-economy model, including its predictions on factor market reforms; and section IV explains the data. Section V estimates factor market efficiency and its impact on firm growth at aggregate and disaggregated levels. Section VI concludes.

II. Stylized Facts

A. Firm Size, Age, and Productivity

Past studies have found that private enterprises in developing countries typically remain small during their life cycle (Hsieh and Klenow, 2014). Balance sheet data from the WBES in SSA used in this paper confirm this finding. Middle- and large-sized firms as measured by the size of employments are conspicuously absent in Africa, compared to developing Asia, making the firm size distribution highly skewed. On average, African firms are only a third of the size of Asian firms, and most firms are young and unproductive (see Appendix table A). Kolmogorov-Smirnov test supports that the distributions of firm age, size, and productivity in SSA and Asia as statistically distinct (Figure 2).

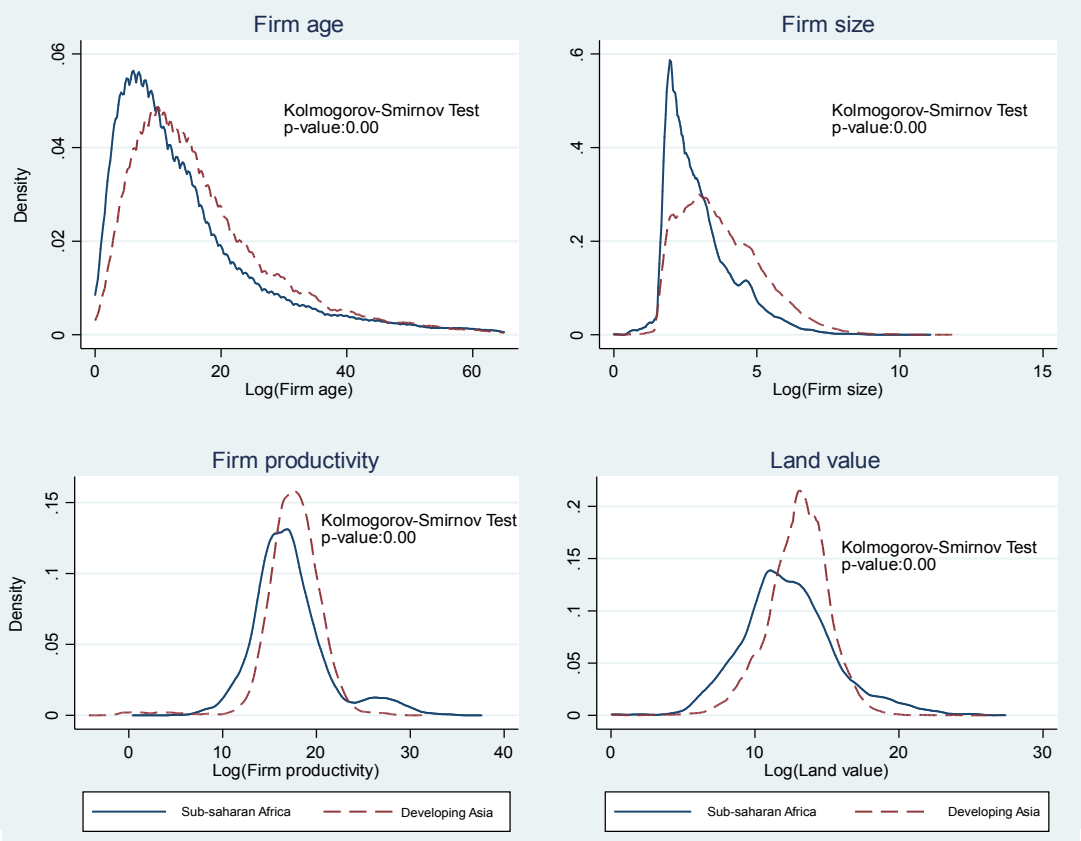
Specifically, the firm size characteristics of enterprises in Africa suggest that firms face systematic market imperfections that decrease their ability and incentive to grow. In addition to the country's income level in which firms operate, structural and institutional factors such as market size, human capital, limited access to valuable land, and segmented labor market also explain why many SSA firms remain small.

B. Land and Labor Markets in Sub-Saharan Africa

Past literature also found that land and labor tend to be misallocated among firms in developing countries. Lack of access to land can prevent firms from scaling up business operations and from using land as collateral to obtain loans. As land size increases, firm size also significantly increases in both SSA and developing Asia (Figure 3). While large parts of SSA is land-abundant, land with access to utilities and transport links to markets is scarce. Land title systems are weak and land rental markets are severely underdeveloped. More

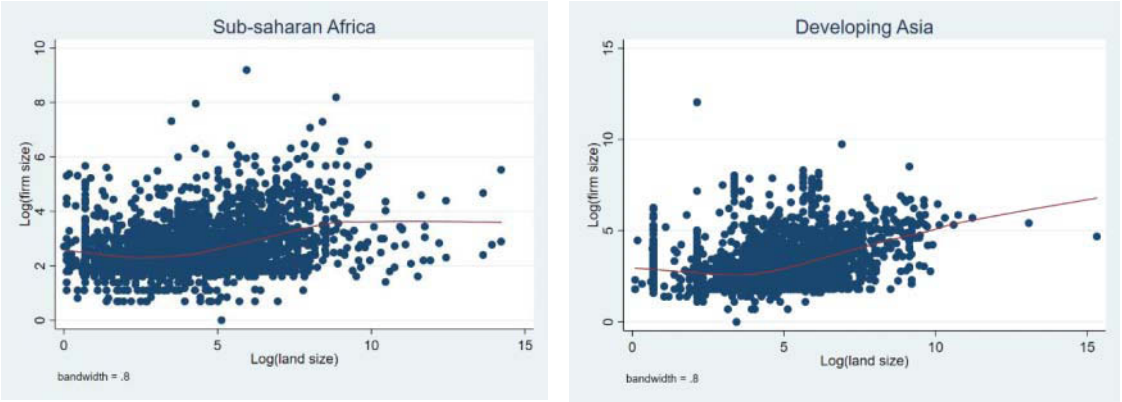
secure property rights and removal of restrictions on land markets are critical as population grows with more intense use of land (Holden and Otsuka, 2014; World Bank, 2012).

Figure 2. Comparison of firm age: sub-Saharan Africa vs. Developing Asia



Note: Firm productivity is defined as real output per employees. Both firm productivity and land value are in 2005 international dollar term.
Source: WBES

Figure 3. Land size and firm size: sub-Saharan Africa vs. Developing Asia



Source: WBES

In many parts of SSA, land is customary and land-use rights are allocated locally by village chiefs. Land ownership is often inherited, and land transfers are severely restricted (see Restuccia and Santaeulalia-Llopis (2017)). Given weak institutions and pervasive corruption, political connections also affect access to land (Faccio, 2006). Such weak regulatory and institutional situations in Africa raise a concern that land is not allocated to the most productive firms.

Labor markets, by contrast, are dominated by subsistence agriculture and informal employments in urban areas. Wage earners only make up a small portion of the region's labor force (Bhorat et al, 2017), further contributing to small size and stagnant productivity growth. As urbanization proceeds in SSA, labor and product market regulations need to be designed to allocate more productive workers to formal sector where transactions and employment relations are recorded.

However, large informality in SSA complicates the effective regulation design as many small firms do not comply with law (Besley and Persson, 2013). Besides, many governments in SSA have weak capacity to execute labor and business regulations and often seek informal payments from small firms for granting business licenses, land, or utility access. As a result, business owners may remain informal to avoid costly regulatory requirements, delaying the structural change of the economy. From worker's perspective, formal employments are attractive only if labor regulation is enforced that mandates firms to pay social benefits like pension, insurance, or severance payments under a contract (Almeida and Carneiro, 2012).

C. Minimum Wage and Firm Productivity

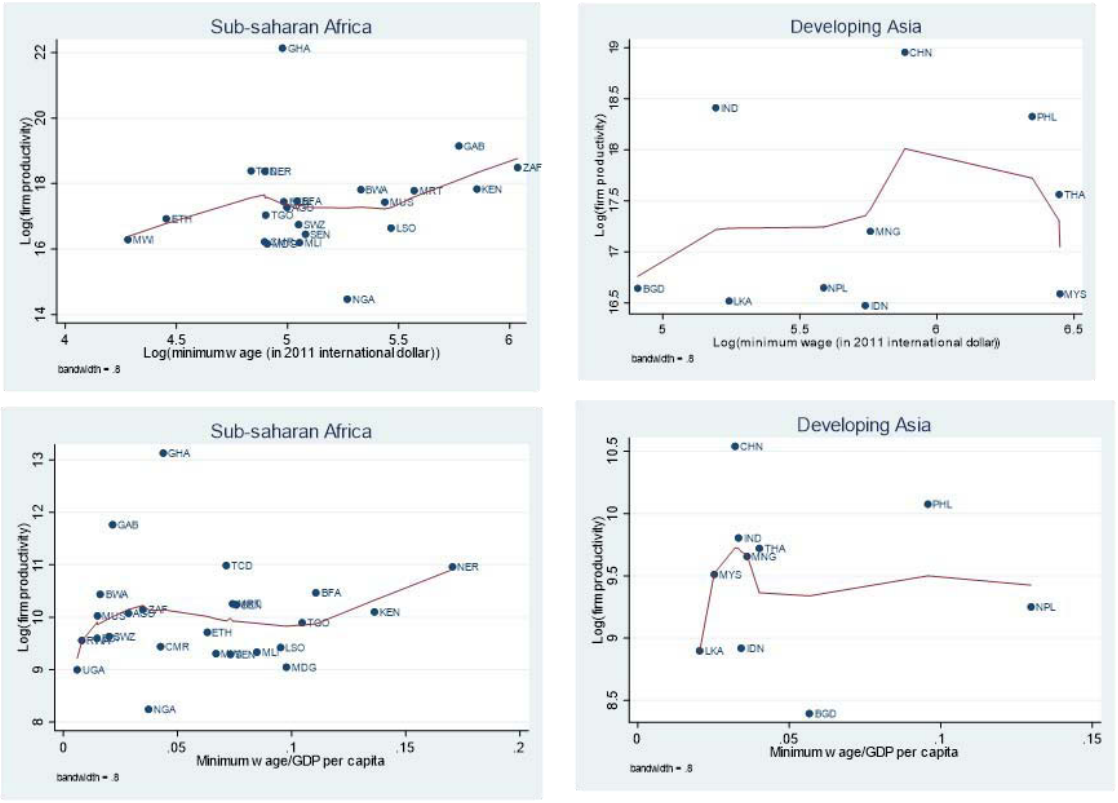
In addition to the provision of social insurance, labor codes often stipulate a wage floor for formal sector jobs. As the minimum wage prevents downward wage adjustments below the statutory floor, workers with marginal productivity below the minimum wage are induced to participate in the formal sector. ILO's data on statutory minimum wages show that the level of minimum wages in SSA is generally lower than in developing Asia with high non-compliance with the minimum wage law (Bhorat, Kanbur, and Stanwix, 2017).

How does minimum wage affect firm size and productivity? A demand-supply theory would suggest that firms will cut labor if the minimum wage is set above the market clearing wage. Conversely, if minimum wage is below the equilibrium level, raising the minimum wage could increase formal employments in equilibrium. Previous literature found small or statistically insignificant disemployment effect of higher minimum wage. Rather, in some cases, the enforcement of minimum wages benefits workers by providing higher wages and mandated social benefits under formal labor contract (Dinkelman and Ranchhod, 2012). [2] If social insurance benefits for workers outweigh the cost of employments for employers, the

[2] In case of South Africa, Dinkelman and Ranchhod (2012) identified positive impacts of the introduction of minimum wages on labor market conditions (e.g., higher wages and more employees with formal contract with pension and unemployment insurance benefits). They found insignificant dis-employment effects of higher minimum wages.

size of formal sector employment will expand. Interestingly, Figure 4 shows positive relationship between minimum wages (defined in level or as a ratio of GDP per capita) and firm productivity in SSA, while the correlation is not clear in Asia.

Figure 4. Correlation between minimum wage level and firm productivity



Note: *x*-axis is log(minimum wage) in 2011 international dollar values for the upper panel, while it is defined as the minimum wage as a ratio of GDP per capita in the lower panel.
Source: WBES, ILO labor statistics

III. THEORETICAL FRAMEWORK

Based on these stylized facts, a static dual-economy model is used to describe how land market development, and labor and tax regulations affect the equilibrium level of formal firm size. As the minimum wage is normally set below market clearing wage in many SSA countries, our focus is when minimum wage is set below market clearing wage ($\underline{w} < w^*$).

A. Model

Consider a labor market model similar to Almeida and Carneiro (2012) and Fortin, Marceau, and Savard (1997) with formal (F) and informal (I) employees. Firms can hire workers under

formal or informal contracts simultaneously.[3] The model is extended by incorporating firms' labor demand decisions under input-financing frictions with a collateral constraint: land can be used as a collateral to access bank or non-bank financings. The value of land sets borrowing limit for the firm to use inputs at the optimal level.

Firm labor demand

Assume that firms use a Cobb-Douglas production technology with land size A, formal labor L_F, and informal labor L_I as inputs of production. Total workforce is N which is allocated to one of the sectors, i.e., $L_F + L_I = N$. Let W_F and W_I denote wages in formal and informal sectors, respectively. Firms will finance inputs by borrowing from local financial institutions with interest rate r. Most firms in SSA are small and financial institutions have little information on their credit capacity. To capture the information asymmetry between firms and lenders, the model incorporates a collateral constraint, such that firms can borrow only up to their land value. Firms decide optimal labor demand in each sector based on Eq. (1):

$$\max_{\{L_F, L_I\}} \pi = \theta A L_F^{\alpha} L_I^{1-\alpha} - (1+\tau) W_F L_F - (W_I + p(\delta)c) L_I$$
$$\text{s.t. } b = (1+\tau) W_F L_F + (W_I + p(\delta)c) L_I \leq \rho A \tag{1}$$

where b is corporate borrowing, ρ is land price, and θ is firm's managerial skill. Firm hiring formal workers face payroll tax τ for mandated benefit payments to workers, such as social security, severance pay, and health and disability insurance. The burden of payroll taxes is largely borne by employers to finance social insurance programs in many developing countries.[4] Firms hiring workers with informal contracts do not comply with regulatory obligations, thus facing penalties for non-compliance c per informal workers with detection rate $p(\delta)$.[5] The detection rate increases as the effort of regulatory inspection δ increases: $p'(\delta) > 0$. Optimal labor demand in two sectors can be derived as follows:

$$L_F^{D*} = \frac{\alpha(W_I + p(\delta)c)}{(1-\alpha)(1+\tau)W_F} \frac{\rho A - (1+\tau)W_F N}{W_I - (1+\tau)W_F + p(\delta)c}$$
$$L_I^{D*} = \frac{\rho A - (1+\tau)W_F N}{W_I - (1+\tau)W_F + p(\delta)c} \tag{2}$$

Labor supply decisions

Next, the allocation of labor depends on the wage-differential between two sectors. Formal sector workers receive the wage W_F, and social insurance benefits under the formal contract

[3] This is consistent with the fact that WBES only covers registered firms, but firms can have formal or informal employment contracts. Given data limitation on informal firms in SSA countries, we abstract from the firm's decision to be formal or informal at the extensive margin.

[4] See Gruber (1997) for the incidence of payroll taxation for Chilean firms.

[5] We consider that labor or tax inspectors can visit firms to detect their informal business and penalize them for hiring informal workers.

but with discounted value $v\tau$ where $0 < v < 1$. A smaller v means that workers perceive a lower benefit from formal labor contract as contracts are not well enforced under corruptive environment. Workers will choose between formal or informal jobs according to the following rule:

$$\text{Formal job if } e(\Omega)(1+v\tau)W_F \geq (1-p(\delta))W_I \tag{3}$$

where $e(\Omega)$ is the probability to find formal employment which depends on the labor market condition $\Omega(\tau, c, \delta)$. Labor market condition Ω depends on business environment, being affected by payroll tax τ, a penalty on informal employment c, and regulatory inspection efforts δ as they influence the size and productivity of registered enterprises. A lower Ω means a higher unemployment rate $(1-e)$ in the formal sector, reducing the expected earning in the formal sector.[6] No unemployment exists in informal sector assuming that the reservation wage in the informal sector W_I is perfectly flexible. However, informal workers will lose their wage with probability p when firms are detected and penalized for the informal operation.

Assume that worker's perception v is a random variable with distribution function $F(v)$. From Eq. (3), total labor supply in the formal and informal sectors are expressed as follows:

$$\begin{aligned} L_F^S &= (1 - F\left[\frac{\big(1-p(\delta)\big)W_I - e(\Omega)W_F}{e(\Omega)\tau W_F}\right])N \\ L_I^S &= F[\frac{(1-p(\delta))W_I - e(\Omega)W_F}{e(\Omega)\tau W_F}]N \end{aligned} \tag{4}$$

Combined with Eq. (2), formal labor market equilibrium condition is defined as follows:

$$\frac{\alpha(W_I + p(\delta)c)}{(1-\alpha)(1+\tau)W_F} L_I^{D*} = (1 - F\left[\frac{\big(1-p(\delta)\big)W_I - e(\Omega)W_F}{e(\Omega)\tau W_F}\right])N \tag{5}$$

The left-hand side of Eq. (5) defines formal labor demand curve which is decreasing in W_F. The right-hand side defines formal labor supply curve which is increasing in W_F.

B. Policy Effects in Theory

This simple framework is used to analyze the effects of an improvement in the access to land, an increase in the payroll tax, stronger inspection in informal activity, and a higher minimum wage. In doing so, the framework accounts for labor market friction with a floor on the minimum wage.

[6] The job security in the formal sector also matters. If survival rate of local business is low, workers hold pessimistic career prospect in the formal sector and move to the informal sector.

H1: Effect of improved access to land

Land policies that improve the access to and the value of land relax collateral constraints, allowing firms to borrow more to expand production. Therefore, holding highly valued land increases labor demand in both formal and informal labor markets, while labor supply remains fixed. The labor demand curve shifts up and the equilibrium formal employment increases as $\frac{\partial L_F}{\partial A} > 0$.

H2: Payroll tax incidence (enforcement in formal labor regulation)

Higher payroll taxes to strengthen mandated benefits in the formal sector increases the cost of doing formal business and firms may substitute formal labor with informal labor: $\frac{\partial L_I^{D*}}{\partial \tau} > 0$. On the other hand, an increase in mandated benefits creates an incentive to work for the formal sector with elasticity of labor supply to payroll tax: $\frac{\partial L_F^{S*}}{\partial \tau} / \frac{L_F^{S*}}{\tau} = -\frac{\tau F_\tau(\cdot)}{L_F^{S*}} > 0$. However, the labor supply elasticity could drop if the payroll tax adversely affects the formal employment rate $\frac{\partial \mathrm{e}(\Omega)}{\partial \tau} < 0$.

When $\underline{w} < w^*$, the equilibrium outcome depends on the elasticities of labor demand and supply to increased mandated benefits. As illustrated in the appendix figure A-2, if labor demand elasticity to τ is high, stronger regulation may decrease the size of formal sector employment in the equilibrium. On the other hand, if labor demand elasticity is low and labor supply elasticity is high, formal sector employment will increase.

H3: Effect of stricter informal sector monitoring

Enforcing higher penalties in the informal sector through stricter inspections reduces demand for informal labor ($\frac{\partial L_I^{D*}}{\partial c} < 0$ and $\frac{\partial L_I^{D*}}{\partial \delta} < 0$) while increasing formal labor demand. Equilibrium formal sector employment increases in both cases. When $\underline{w} < w^*$, stricter inspection leads to an expansion of formal sector employment with higher equilibrium wages at all segments of the labor market.

H4: Effect of higher minimum wage

The effect of raising the statutory minimum wage on the formal sector employment depends on the level of the initial minimum wage relative to the market wage.

When the minimum wage is initially set below the market wage ($\underline{w} < w^*$), there is an excess demand for labor. As the minimum wage increases closer to the market clearing wage, labor supply increases ($\frac{\partial L_F^S}{\partial W_F} > 0$) and the formal sector expands. However, if the minimum wage is raised too far above the market clearing level (appendix A-4, right bottom chart), the minimum wage will be so expensive for firms that they may retrench formal labor demand

($\frac{\partial L_F^{D*}}{\partial W_F} < 0$). As a result, formal sector employment will contract compared to the initial equilibrium level in both segment of labor markets.

Summarizing theoretical predictions:

The following table summarizes the theoretical predictions and the signs of each policy effect are tested in the following empirical section:

H1. Improved access to land ($A \uparrow$)	+
H2. Increase in formal labor regulations ($\tau \uparrow$)	?
H3. Stricter informal sector monitoring ($c, \delta \uparrow$)	+
H4. Higher minimum wage ($\underline{w} \uparrow$)	?

IV. DATA

As discussed in earlier sections, policies and regulations that improves the efficiency of land and labor allocations are essential to reduce informality and improve competitiveness.

This paper uses World Bank's firm-level data (the WBES) collected in low- and middle-income countries in SSA and developing Asia. The WBES sample frame consists of formal manufacturing and service firms with at least five employees.[7] This paper uses 23,000 firms in 40 SSA and about 29,000 firms in 14 developing Asian countries (see Appendix B for the list of country sample). Because informal manufacturing firms are not covered in this sample, factor allocation measures developed in the next section might be overestimated and give an upper bound of overall factor allocative efficiency.

The WBES is conducted using stratified sampling procedures based on the industry group (using the 2-digit ISIC classification), the level of average sales, firm size and geographical location. The aggregate-level analysis in section V.A uses cross-sectional firm balance sheet data for countries surveyed since 2006 until today. Later in section V.B, the WBES's panel data for Nigeria is used to examine the role of factor markets in determining firm productivity at the micro level.

Summary statistics are provided in appendix table A. Spatial distributions of firm size and firm productivity are also provided in Appendix C. For the pooled firm sample of 40 SSA countries, the average firm size is 58 employees, only a third of the average size in Asia. The upper map in Appendix C shows that the average firm size is less than 31 in many SSA countries. The value added per employee and land value shows larger variance and spatial variations in SSA, showing wide disparity in firm productivity and land values in Africa. The land ownership and access to credit are about 20 percent and 12 percent smaller in SSA than

[7] As the WBES covers formal firms, labor regulations such as social insurance benefits are important determinant of the factor allocative efficiency. A comprehensive analysis using each country's census data is needed to represent small scale firms.

Asia, respectively. More foreign owned firms exist in SSA sample. 81 percent of SSA firms is manufacturing firms, and the rest is in the service sector.

V. Empirical Analysis

A. Aggregate Level Analysis

V.A.1 Degree of factor misallocations

The first step to understand sluggish firm growth in SSA is to study how (in)efficiently factors of production are allocated to productive firms. This section estimates the efficiency of land and labor allocations based on the correlation between firm productivity and actual factor allocation data following Olley and Pakes (1996). Models of heterogeneous firms predict that productive firms should produce more output by using larger factor inputs. This paper investigates whether or not land and labor allocations are targeted toward more productive firms each district in a country.

Following the approach of Hsieh and Klenow (2009), real output TFP (*TFPQ*) is used as firm's productivity measure.[8] The allocative efficiency index is the correlation between the TFPQ and factor usage (s_{isj}) for firm i in sector s in a district j. The correlation is weighted by firm *i*'s share of production in each sector-district group to define the firm-level measure of misallocation M_{isj}:

$$M_{isj} = w_{isj,t-3}\rho(TFPQ_{isj}, s_{isj}) \quad (6)$$

The weight w_{isj} is firm *i*'s past market share in sales (to compute land allocation index) or labor input (for labor allocation index), i.e., the lagged values by 3 year before each survey year *t*. Both allocation measures are standardized around the mean. As M_{isj} gets larger in positive values, factors are allocated more efficiency to productive firms with greater factor usage. Smaller positive or negative values of M_{isj} mean factor misallocation that results in less output compared with the output under an efficient allocation.

Appendix D-(a) shows the spatial distribution of land allocation index (upper figure) and labor allocation index (lower figure). Land allocation is negative in most SSA countries, but worse in southern Africa. Labor allocation has more variations across SSA regions, showing that some countries have relatively more efficient labor market.

V.A.2 Determinants of factor allocative efficiency

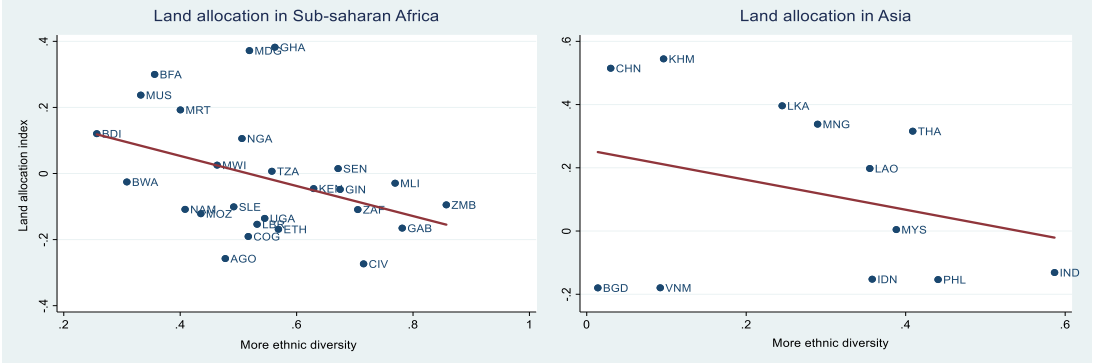
What policies or institutions determine the variation in factor allocative efficiency? Since the seminal contribution by Easterly and Levine (1997), ethnic diversity is found to shape bad

[8] The WBES provides nominal sales but firm-specific price is not observed. Assuming that all firms in an industry use the same Cobb-Douglas technology and that industry output is a CES production aggregate of the outputs of all firms with constant elasticity of substitution $\sigma = 3$, we infer real output TFP from nominal sales based on the assumed demand function.

policies, conflicts, and inefficient resource allocation in SSA. In SSA, local socio-economic hierarchies define who gets access to land. Ethnic diversity often creates land-related disputes, making land allocation inefficient. This paper uses the ethnic fractionalization index developed at sub-national level by Alesina and Zhuravskaya (2011). For each district j of country c, the fractionalization index captures the probability that two randomly drawn individuals belong to different groups: $F_{jc} = \sum_{m=1}^{M_c} \pi_{mjc}(1 - \pi_{mjc})$ where π_{mjc} stands for the fraction of group m in region j of country c.

Figure 5 examines how ethnic diversity (x-axis) and land allocative efficiency (y-axis) are correlated in SSA compared to developing Asia. The figure uses the sampling weight to compute the average level of land allocative efficiency and land ownership variables at the country level. The figure shows that land allocation tends to be less efficient in countries with higher ethnic diversity.

Figure 5. Determinants of land allocative efficiency

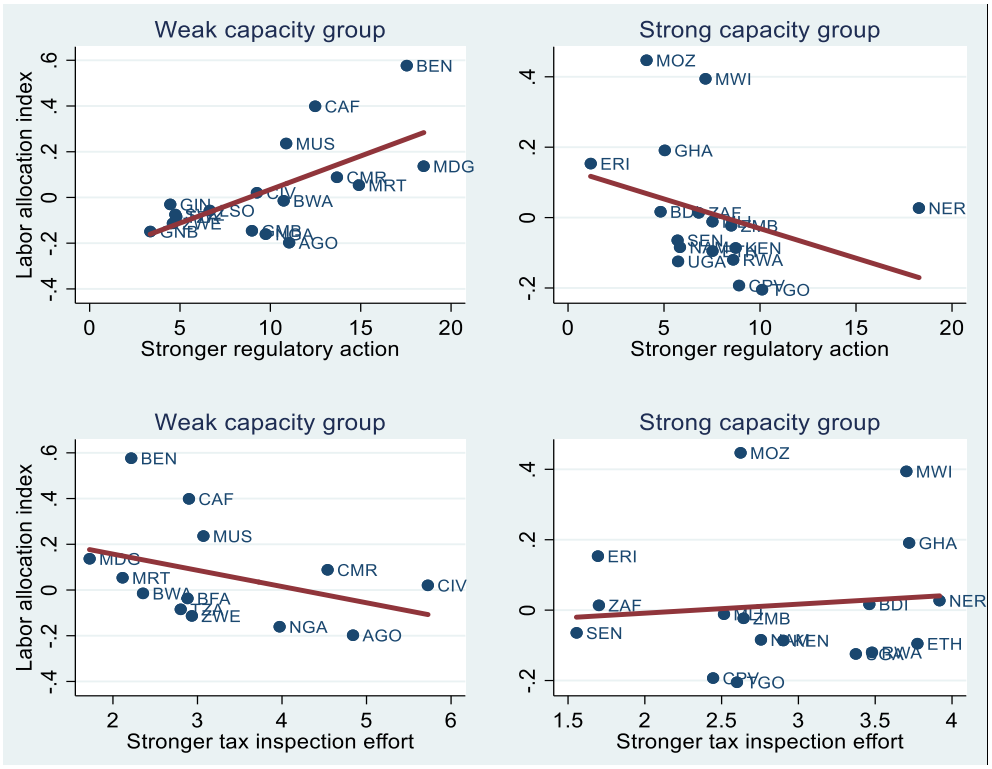


Note: x-axis is the average level of ethnic diversity for each country using the sampling weight.
Source: WBES

Next, Figure 6 shows the relationship between labor allocative efficiency and the country's regulatory quality. The x-axis is about the regulatory environment of firms in each country. The variable is constructed based on firm's responses on business environment in the WBES – defined by the intensity of regulatory action to enforce labor codes (r_{isj}) and the frequency of tax inspections to regulate informal activities (t_{isj}) – in each sector-district where firms operate. The regulatory environment is district-specific, thus the average level of regulatory action in each district j is computed by taking its expectation for individual firms within the same sector: $R_j = E_s(r_{-isj})$. The tax administration efforts vary by sector, thus the average tax inspection effort is computed similarly but for each sector s: $T_s = E_j(t_{-isj})$. In both expressions, $-i$ indexes peer firms (all except own firm) that operate in the same sector (to compute district average for R_j) or in the same district (to compute sector average for T_s). The analysis accounts for heterogeneity due to legal capacity in designing proper regulatory

and tax inspection framework. Firms are grouped into those operating in districts with weak or strong state capacity based on how they perceive prevailing corruption. [9]

Figure 6. Determinants of labor allocative efficiency



Note: Strong state capacity group is defined as countries where the proportion of firms which found corruption as major obstacles for their business is greater than the regional average, while weak state capacity group is those with below average corruption level.
Source: WBES

The upper panel indicates that stricter enforcement of labor regulation improves labor allocation only in the weak state capacity group (countries with higher corruption level than average SSA level), while intensive regulatory actions create a burden for private business in the strong state capacity group.

Weak state capacity is defined as a situation where contract enforcement is weak and informal activity is widespread, thereby reducing the benefit from formal market regulation. This situation is captured by lower value of social insurance benefits perceived by workers ($v \to 0$) in the model developed in Section III. In such environments, more intensive regulatory action is needed to enforce labor code, which in turn promotes more efficient

[9] The WBES survey asks firms whether corruption is severe obstacles for their business. This paper computes the proportion of firms facing corruption for each district and compare each district's corruption level with the regional average to categorize each district into either weak or strong state capacity group.

labor allocation. If an adequate regulatory environment is already in place, additional regulation is too burdensome for firms to do business as predicated by the model.

The lower panel compares the relationship between the inspection level (tax and social security collection efforts by the authority) and labor allocative efficiency for both strong and weak state capacity groups. It gives the opposite picture that stricter inspection efforts *decrease* labor allocative efficiency for the weak sate capacity group, presumably because inspection agencies under weak institutional environment tend to demand informal payments (bribe), which puts a particular burden on small-sized firms. The correlation is slightly positive for strong state capacity group where inspection efforts improve compliance and reduce informality, making labor market more efficient.

The above descriptive patterns imply that ethnic fragmentation and weak regulatory capacity, as typically observed in SSA, are important drivers of factor misallocation in SSA. This descriptive pattern is confirmed by the OLS regression that estimates the determinants of factor allocative efficiency in Table 1:

$$M_{isjck} = \delta_0 + \delta_1 Z_{sjck} + \delta_2 x_{isjck} + \kappa_s + \mu_k + \varepsilon_{isjck}$$

$$Z_{sjck} = \begin{cases} F_{jck} & \text{for land allocation index} \\ (R_{jck}, T_{sck}) & \text{for labor allocation index} \end{cases} \qquad (7)$$

where i indexes firms, s indexes sector, j indexes district, c indexes country, and k indexes SSA regions (western, central, eastern, and southern Africa dummies). M stands for either land or labor allocation index. x controls for firm-level variables such as machines and equipment investments, manager's work experience, and firm ownership dummies (state owned enterprise, foreign enterprise). Country-level variables such as real GDP per capita growth, private credit-to-GDP ratio, judicial efficiency (the quality of legal system including the judicial administration, processing time, and court regulations to enforce contracts), and trade openness are also included.[10] κ_s and μ_k are sector and region fixed effects.

In column 1, the negative coefficient of ethnic diversity index confirms lower land allocative efficiency (both owned and rented land) in cities where ethnic diversity is higher. In column 2, a labor allocation index is regressed on two institutional variables (stronger formal regulations and inspection efforts) along with other controls, separately for weak and strong state capacity groups. As found in Figure 6, stronger regulatory action improves labor allocation in weak state capacity group, while it worsens the labor allocation in strong state capacity group. Also, stronger inspection efforts worsen (or statistically has no impacts on)

[10] Laeven and Woodruff (2007) shows that the improvement in the quality of legal system supports firm growth in Mexico by reducing the business risk faced by firm owners.

labor allocative efficiency in weak state capacity group while it improves the allocative efficiency in strong state capacity group.

Coefficients of other covariates indicate that land tends to be more efficiently allocated for firms with larger capital, more experienced manager, and foreign or state-owned enterprises. For country-level variables, financial deepening and judicial efficiency support efficient factor allocations while fast growth does not necessarily improve factor allocation. Trade openness is also associated with better labor allocation.

Table 1. Determinants of factor allocative efficiency (First stage regression)

	(1) Land allocation index		(2) Labor allocation index		
	Owned	Owned or rented			
Ethnic diversity index	-0.660***	-0.437***			
	[0.102]	[0.047]			
Stronger regulatory action			0.000	0.006**	-0.008***
			[0.002]	[0.002]	[0.002]
Stronger inspection efforts			0.009	-0.011	0.030***
			[0.008]	[0.011]	[0.009]
Ln(capital investment)	0.022***	0.011***	0.004***	0.005***	0.004***
	[0.004]	[0.001]	[0.001]	[0.001]	[0.001]
Ln(manager experience)	0.074***	0.068***	0.038***	0.028***	0.044***
	[0.019]	[0.007]	[0.005]	[0.009]	[0.008]
Foreign ownership	0.059**	0.126***	0.123***	0.138***	0.116***
	[0.029]	[0.018]	[0.014]	[0.020]	[0.021]
State ownership	0.315**	0.138**	0.023	0.022	0.061
	[0.134]	[0.056]	[0.033]	[0.044]	[0.055]
Whole sale and retail	0.199	-0.157***	-0.028**	-0.02	-0.038**
	[0.219]	[0.012]	[0.012]	[0.019]	[0.016]
Heavy industry	0.009	0.022	-0.027**	-0.030*	-0.024
	[0.029]	[0.022]	[0.013]	[0.017]	[0.021]
GDP per capita growth	-0.035***	-0.020***	-0.012***	-0.017***	-0.005
	[0.008]	[0.003]	[0.003]	[0.004]	[0.004]
Private credit/GDP	0.110	0.236***	0.134**	0.218**	0.062
	[0.139]	[0.075]	[0.053]	[0.100]	[0.074]
Judicial efficiency	0.260	0.511***	0.011	0.250*	-0.252**
	[0.188]	[0.113]	[0.091]	[0.147]	[0.115]
Trade openness	-0.283**	-0.105**	0.092*	0.165**	0.095*
	[0.116]	[0.041]	[0.048]	[0.070]	[0.048]
Constant	0.047	-0.190***	-0.211***	-0.373***	-0.082
	[0.171]	[0.072]	[0.080]	[0.116]	[0.083]
Observations	6,707	19,962	15,169	6,927	8,242
R-squared	0.059	0.056	0.040	0.071	0.044
Sample	All	All	All	Weak state capacity group	Strong state capacity group
Regional dummies	Y	Y	Y	Y	Y

*Significant at 10%; ** 5%; *** 1%. Standard errors clustered at sampling strata level are presented in the square brackets. The estimates are based on ordinary least squares regressions. Region dummies control for unobservable differences between eastern, central, western, and southern African countries.

Table 1 is used as the first stage regression for the IV-Tobit regression to identify the effect of factor allocative efficiency on firm performance in sub-section V.A.3.

V.A.3. The effect of land market and regulations on firm size

Next, Table 2 shows reduced-form estimates which regress firm size on land value, labor regulation and inspection actions to test our theoretical predictions. Besides the average effect, columns 3 and 6 account for the heterogeneous effects of land value and regulations by the minimum wage level by restricting the sample to places where the minimum wage is set below the market clearing wage.[11]

Columns 1-3 estimates the effect of higher land value on firm size. We use the value of industrial land that firms hold as an owner. As the model predicts, the ownership of higher value of land significantly increases firm size to reap scale benefits by relaxing collateral constraints. The effect is positive regardless of the minimum wage level.[12]

Table 2. Direct effect of land and labor regulations (reduced form)

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(firm size)					
Ln(land value)	0.039***	0.031***	0.033***			
	[0.002]	[0.003]	[0.004]			
Stronger regulatory action				0.015***	0.014***	0.011**
				[0.004]	[0.005]	[0.004]
Stronger inspection efforts				0.023	-0.003	0.014
				[0.020]	[0.023]	[0.023]
Ln(capital investment)	0.062***	0.083***	0.079***	0.045***	0.045***	0.046***
	[0.008]	[0.009]	[0.008]	[0.004]	[0.004]	[0.004]
Ln(manager experience)	0.222***	0.253***	0.236***	0.260***	0.262***	0.254***
	[0.024]	[0.026]	[0.030]	[0.016]	[0.018]	[0.019]
Foreign ownership	0.786***	0.747***	0.795***	0.772***	0.767***	0.804***
	[0.068]	[0.060]	[0.067]	[0.040]	[0.039]	[0.042]
State ownership	1.075***	0.968***	0.944***	0.450***	0.393***	0.368***
	[0.154]	[0.175]	[0.193]	[0.104]	[0.110]	[0.112]
Whole sale and retail	-0.045	0.079	0.076	-0.212***	-0.242***	-0.248***
	[0.181]	[0.181]	[0.172]	[0.041]	[0.043]	[0.043]
Heavy industry	0.094	0.163**	0.144**	0.107**	0.131***	0.122**
	[0.069]	[0.067]	[0.071]	[0.051]	[0.050]	[0.052]
Minimum wage/GDP per capita		-0.014***	3.027**		-0.007***	2.443**
		[0.002]	[1.443]		[0.002]	[0.970]
GDP per capita growth	0.007	0.009	0.016	0.028***	0.024*	0.026**
	[0.011]	[0.019]	[0.018]	[0.008]	[0.014]	[0.013]
Private credit/GDP	0.897***	0.825***	0.738***	0.626***	0.274	0.245
	[0.254]	[0.246]	[0.237]	[0.179]	[0.210]	[0.202]
Judicial efficiency	-0.632*	-0.25	0.007	-0.266	-0.236	-0.02
	[0.345]	[0.603]	[0.644]	[0.311]	[0.403]	[0.384]
Trade openness	-0.519***	-0.568**	-0.580**	-0.465***	-0.376***	-0.403***
	[0.175]	[0.252]	[0.239]	[0.122]	[0.133]	[0.123]
Constant	2.077***	1.797***	1.512***	2.152***	2.338***	2.058***
	[0.243]	[0.426]	[0.458]	[0.187]	[0.216]	[0.226]
Observations	7,997	6,023	5,598	19,237	15,414	14,417
Sample	All	All	MW below market wage	All	All	MW below market wage
Regional dummies	Y	Y	Y	Y	Y	Y

*Significant at 10%; ** 5%; *** 1%. Standard errors clustered at sampling strata level are presented in the square brackets. Region dummies control for unobservable differences between eastern, central, western, and southern African countries.

[11] The market clearing wage is defined as the average monthly earnings of employees from the ILOSTAT. For missing countries where ILOSTAT does not provide data, the mean wage data from Table 1 of Bhorat Kanbur and Stanwix (2017) are used.

[12] When we include rented land, the effect of land value on firm size becomes insignificant as rented land cannot serve as collateral for borrowing.

Estimates in columns 4 and 5 show that formal regulations increase firm size while stronger inspections have insignificant impact on average. Column 6 tests the effect of stronger regulation on firm size when the sample only covers where the minimum wage is set below market clearing wage. As appendix A shows, the effect is ambiguous in theory that depends on the labor demand and supply elasticity to regulation changes. The result shows that stronger regulation has positive effect on firm size, suggesting that the labor demand shrinks less to stronger regulations while formal workers increase more elastically.

Columns 2-3 and 5-6 show that an increase in the minimum wage (relative to per capita income) reduces firm size on average, but with very small magnitude, confirming limited disemployment effect of the minimum wage as found in the literature. However, higher minimum wage significantly increases firm size when the sample is restricted only to firms in places where the minimum wage is set below market clearing wage. This implies that the initial level of the minimum wage is significantly lower than market clearing wage, thus raising the minimum wage simply attracts more labor.

Other covariates show that firms with larger capital and experienced manager tend to be larger and survive longer. Foreign owned firms or state-owned enterprises are also larger than local private firms. Higher income growth and financial deepening also support firm growth, while judicial efficiency has no direct impact on firm size on average. Larger trade openness appears to adversely affect small firms for surviving market competition in SSA.

V.A.4. The effect of factor allocative efficiency on firm size and survival

What are the consequences of land and labor misallocations? Figure 2 and appendix table A show that SSA firms are significantly smaller (in employments) and less productive and their lifecycle is also significantly shorter than Asian firms. This sub-section uses the factor allocation index established in subsection V.A.1 and analyzes its impact on firm size and age in SSA. The analysis also controls for other factors which may explain why firms remain small and short-lived in SSA, and what type of firms survive under a certain environment.

To study factors which affect firm size and age, we run the following Tobit regression:

$$y_{isjck} = \max(0, \alpha_0 + \alpha_1 M_{isjck} + \alpha_2 x_{isjck} + \kappa_s + \mu_k + \varepsilon_{isjck}) \quad (8)$$

Same sets of explanatory variables as used in Eq. (7) are included. In Table 3, we first show OLS Tobit regression result that estimates the effect of factor allocative efficiency on the firm size (in columns 1-4) and firm age (in columns 5-8). Columns 1 and 5 show the effect of the allocative efficiency of owned land, while columns 2 and 6 show the result for the allocative efficiency of both owned and rented land. The result shows that higher land allocative efficiency significantly increases firm size and survival (both at 1 percent significance level).

Higher labor allocative efficiency also significantly increases firm size for both strong and weak state capacity groups (columns 3-4 and 7-8). The negative and significant square term of labor allocation index indicates that the effect of labor allocative efficiency on firm size and age is *concave*, i.e., the positive effect is particularly large when initial labor allocation is very inefficient. As labor market develops to achieve efficient labor allocation, the marginal effect gets smaller.

Other covariates show similar results as found in the reduced-form regression in Table 2.

Table 3. Firm performance and factor allocative efficiency (OLS Tobit)

	Ln(firm size)				Ln(firm age)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Land allocation index (owned)	0.574***				0.205***			
	[0.066]				[0.035]			
Land allocation index (owned or rented)		0.315***				0.113***		
		[0.065]				[0.022]		
Labor allocation index			1.380***	1.479***			0.243***	0.202***
			[0.132]	[0.139]			[0.046]	[0.045]
Labor allocation index squared			-0.295***	-0.303***			-0.074***	-0.058***
			[0.052]	[0.050]			[0.022]	[0.022]
Ln(capital investments)	0.074***	0.047***	0.051***	0.047***	0.009***	0.006***	0.005***	0.006***
	[0.010]	[0.004]	[0.004]	[0.004]	[0.003]	[0.001]	[0.002]	[0.002]
Ln(manager experience)	0.217***	0.267***	0.176***	0.201***	0.558***	0.561***	0.523***	0.527***
	[0.023]	[0.015]	[0.023]	[0.023]	[0.016]	[0.010]	[0.017]	[0.015]
Foreign ownership	0.776***	0.683***	0.590***	0.683***	0.083***	0.061***	0.067**	0.062***
	[0.068]	[0.040]	[0.052]	[0.041]	[0.028]	[0.019]	[0.027]	[0.022]
State ownership	1.060***	0.506***	0.222**	0.445***	0.482***	0.252***	0.116**	0.303***
	[0.157]	[0.097]	[0.088]	[0.114]	[0.083]	[0.043]	[0.051]	[0.070]
Whole sale and retail	-0.210	-0.101**	-0.151**	-0.078	0.119	0.071***	0.022	-0.009
	[0.199]	[0.044]	[0.064]	[0.050]	[0.096]	[0.016]	[0.024]	[0.021]
Heavy industry	0.122*	0.170***	0.083	0.122*	0.069***	0.116***	0.071***	0.091***
	[0.074]	[0.052]	[0.064]	[0.063]	[0.026]	[0.019]	[0.027]	[0.025]
GDP per capita growth	0.017	0.017**	0.030***	0.032**	0.014**	0.009**	0.036***	-0.002
	[0.012]	[0.007]	[0.012]	[0.013]	[0.007]	[0.004]	[0.006]	[0.006]
Private credit/GDP	0.666**	0.615***	0.132	1.098***	0.348***	0.184***	0.115	0.364***
	[0.259]	[0.159]	[0.185]	[0.267]	[0.094]	[0.062]	[0.102]	[0.086]
Judicial efficiency	-0.345	-0.367	-1.657***	0.741**	-0.326	-0.598***	-1.055***	-0.268*
	[0.403]	[0.258]	[0.395]	[0.351]	[0.207]	[0.111]	[0.198]	[0.156]
Trade openness	-0.424**	-0.337***	-0.451**	-0.815***	-0.119	-0.294***	-0.615***	-0.131**
	[0.194]	[0.106]	[0.190]	[0.155]	[0.084]	[0.043]	[0.073]	[0.057]
Constant	2.069***	2.228***	3.387***	2.007***	1.214***	1.504***	2.158***	1.305***
	[0.259]	[0.144]	[0.225]	[0.216]	[0.126]	[0.076]	[0.132]	[0.091]
Observations	7,687	22,295	6,927	8,242	7,539	21,770	7,253	8,861
Sample	All	All	Weak state capacity	Strong state	All	All	Weak state capacity	Strong state
Regional dummies	Y	Y	Y	Y	Y	Y	Y	Y

*Significant at 10%; ** 5%; *** 1%. Standard errors clustered at sampling strata level are presented in the square brackets. Region dummies control for unobservable differences between eastern, central, western, and southern African countries.

V.A.5. Instrumental variable results: heterogeneity in effects of factor allocative efficiency on firm performance

The identification of allocation efficiency index faces endogeneity problem for potential reverse causality, i.e., firm performance could affect allocative efficiency. Firms whose land and labor allocations are affected by ethnic diversity and regulations are marginally productive firms in the local market (Imbens, 2010). The decision to reallocate factors of production varies with firm productivity, thus we estimate local average treatment effect (LATE) of the factor allocative efficiency on firm performance using an IV-Tobit regression.

As defined in Eq. (7), different IVs are used in the first stage regression. The sub-national level ethnic diversity index is an only IV for the land allocation index that influences firms' access

to land. The ethnic diversity index is computed based on census data near 2000, thus it offers pre-determined ethnic diversity for each district before the WBES was conducted.

The model is over-identified by using two IVs for labor allocation index: the average level of regulatory action taken by sub-national governments toward peer firms in the same district (R_j) and the average inspection efforts taken for peer firms to regulate tax evasion in the same sector (T_s). The first variable captures the average level of *formal regulatory measures* to formalize labor contracts while the second variable is the intensity of informal sector monitoring – penalty or cost of non-compliance imposed on firms (*informal tax*) (Olken and Singhal, 2011). As the hypotheses H2 and H3 predict in Section III, labor demand and supply curves will shift by the change in regulatory environments, but the impact of regulations on labor allocation will differ by each district's corruption level.[13]

The identifying assumption is that the average regulatory situations for peer group will affect own firm performance only through the factor allocation. The rationale for the exclusion restriction is that when looking at the same district across sectors (for R_j) or the same sector across districts (for T_s), government actions to peer firms will affect the factor allocation in the same labor market, but is external to own firm's production decision, i.e., regulatory actions to peers have limited impact on own firm's production.[14]

Table 4 shows IV Tobit estimates which are LATE of land and labor allocation index for marginally productive firms. In the lower panel of Table 4, the first stage F-statistics is sufficiently high for all specifications (p-value=0.00), showing that the ethnic diversity and regulations are valid instruments for land and labor allocation index.

Columns 1-2 and 5-6 show that land allocation matters for marginal firms to grow and survive longer (significant at 1 percent). In columns 2-3 and 5-6, the positive square term and negative linear term of labor allocation index suggest that the effect of labor allocative efficiency is *convex*: the effect exponentially increases as labor market develops and the labor allocation gets more efficient. The convex LATE of labor allocative efficiency differs from the concave effect found by the OLS-Tobit regression in Table 3 for the average firm. This suggests large heterogeneity in the effect of labor allocative efficiency. The effect of labor allocation index is statistically significant for firms operating business in countries with both weak and strong state capacity. Overall, both OLS and IV-Tobit estimates found that efficient labor allocation would significantly increase firm size and age.

[13] In weak states with prevalent corruption, tax officials tend to request small business owners to pay bribes. The bribe-seeking behavior often creates uncertainty as firms perceive higher cost than an equivalently sized tax (Malesky and Samphantharak 2008). Because of high marginal effective tax (bribe) rate, firms may choose to remain informal if strict inspection is imposed in the weak state capacity environment (Olken and Pande, 2012).

[14] Similar identification assumption was used in other papers. For example, Guasch, Laffont and Straub (2007) uses the average prevalence of the price cap regulation to PPP contracts signed in the same sector in different countries, and n different sectors in different countries as IVs to identify the effect of the price cap regulation on PPP contract performance.

Table 4. Firm performance and factor allocative efficiency (IV Tobit)

	Ln(firm size)				Ln(firm age)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Land allocation index (owned)	0.408***				0.416***			
	[0.114]				[0.072]			
Land allocation index (owned or rented)		0.288***				0.569***		
		[0.089]				[0.062]		
Labor allocation index			-0.708	-3.856***			-1.412***	-0.935*
			[0.790]	[0.805]			[0.435]	[0.561]
Labor allocation index squared			1.684***	1.722**			0.124	1.312**
			[0.618]	[0.715]			[0.347]	[0.531]
Ln(capital investments)	0.062***	0.047***	0.050***	0.060***	0.001	0.002	0.013***	0.009***
	[0.004]	[0.001]	[0.004]	[0.003]	[0.002]	[0.001]	[0.002]	[0.002]
Ln(manager experience)	0.185***	0.239***	0.191***	0.306***	0.511***	0.500***	0.509***	0.426***
	[0.022]	[0.013]	[0.033]	[0.032]	[0.014]	[0.009]	[0.018]	[0.022]
Foreign ownership	0.808***	0.665***	0.485***	0.957***	0.079***	-0.006	0.256***	-0.01
	[0.038]	[0.023]	[0.101]	[0.066]	[0.024]	[0.016]	[0.056]	[0.048]
State ownership	0.984***	0.436***	0.129	0.412***	0.384***	0.152***	0.128**	0.137
	[0.114]	[0.051]	[0.105]	[0.146]	[0.073]	[0.036]	[0.056]	[0.103]
Constant	2.213***	2.354***	3.091***	1.366***	1.375***	1.729***	1.824***	1.252***
	[0.125]	[0.069]	[0.247]	[0.211]	[0.077]	[0.047]	[0.135]	[0.156]
First stage: F-statistics for excluded instrumental variables [p-value]								
Land allocation index (owned)	174.5				165.8			
	[0.00]				[0.00]			
Land allocation index (owned or rented)		298.2				287.9		
		[0.00]				[0.00]		
Labor allocation index			24.8	49.5			22.4	46.8
			[0.00]	[0.00]			[0.00]	[0.00]
Labor allocation index squared			8.2	13.3			7.1	11.0
			[0.00]	[0.00]			[0.00]	[0.00]
Observations	6,707	19,962	6,927	8,242	6,564	19,462	6,687	8,050
Sample	All	All	Weak state capacity group	Strong state capacity group	All	All	Weak state capacity group	Strong state capacity group
Regional dummies	Y	Y	Y	Y	Y	Y	Y	Y
Sector dummies	Y	Y	Y	Y	Y	Y	Y	Y
Country-level controls	Y	Y	Y	Y	Y	Y	Y	Y

*Significant at 10%; ** 5%; *** 1%. Standard errors clustered at sampling strata level are presented in the square brackets. Region dummies control for unobservable differences between eastern, central, western, and southern African countries.

V.A.6. The effect of factor allocations on credit access and tax contributions

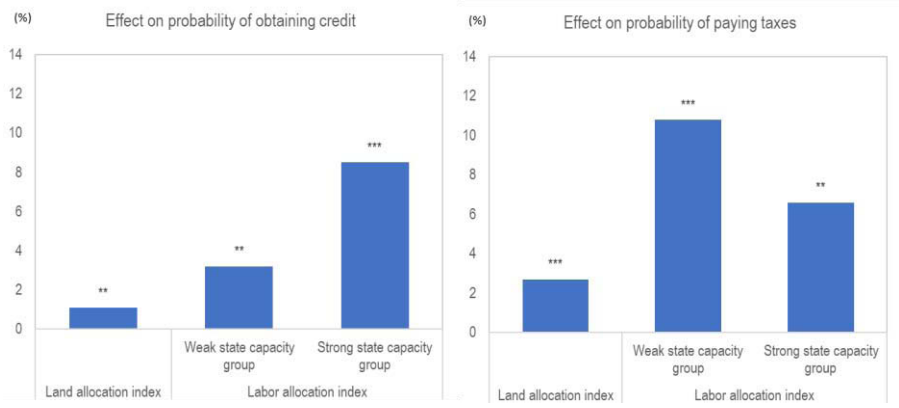
This subsection further investigates whether better factor allocation helps firm grow through credit access and tax contributions. Better land allocation, which acts as a collateral, as well as more efficient labor allocation, may help firms obtain credit and grow faster. With stronger labor and tax regulations, labor contract would be more formalized and firm's tax contributions to the government may increase.

We run OLS regressions to estimate the effects of land and labor allocative efficiency on firm's access to credit (loans from banks or other intermediations) and on tax contributions (percent of sales reported for tax payments). The coefficient of each allocative efficiency index on two outcomes are reported in Figure 7 below.

The result suggests that firms perform better as factor allocation becomes more efficient. Better land and labor allocations increase the probability of obtaining credit by about 1 and 6 percent respectively, on average. The estimate also shows significant productivity gains by improving factor allocative efficiency, which would propel formalization of industries through higher tax contributions. In weak institutional regions, an improvement in labor allocation efficiency through stronger regulation increases tax contributions by about 11 percent, significantly higher than the same effect in strong institution regions. If land is

allocated more to productive firms, they can expand their business for longer periods with more chance in obtaining a credit line from banks, increasing their tax contributions.

Figure 7. Effect of land and labor allocative efficiency on firm performance



*Significant at 10%; ** 5%; *** 1%. Note: The bar captures the coefficient of each allocation index on the probabilities of obtaining credit (from the linear probability OLS regression) and paying taxes (from the OLS-Tobit model).
Source: Author's estimate

B. Case Study: Panel Data Analysis for Nigeria

V.B.1. Set-up

This section examines whether the aggregate-level findings in the previous section can be confirmed at a single country case using firm panel data from Nigeria. The WBES Nigeria panel data allows us to estimate total factor productivity (TFP) using Levinsohn and Petrin (2003) (LP)'s productivity estimation method.[15] We focus on firm-level variations within Nigeria and remove time-invariant firm-level heterogeneity using panel data to better identify policy effects.

Nigeria is the most populous country in SSA, composed of more than 250 ethnic groups (including Hausa-Hulani 29 percent, Yoruba 21 percent, and Ibo 18 percent) and endowed with the 10th largest oil reserves in the world (the World Factbook). However, the GDP per capita (in PPP constant 2011 international dollar) is ranked 133 in 191 countries (IMF World Economic Outlook, April 2018) with the poverty rate continued to increase in recent years. Poverty is most prevalent in the northern part of the country, with Jigawa state's headcount poverty rate the highest at 78 percent (World Bank; Nwude, 2013), while the southern part near the Niger delta is wealthier endowed with oil. The quality of governance has been low: in the Transparency International's Corruption Perception Index, it scores as one of the most corrupt countries in the world (ranked 148 in 180 countries). Furthermore, underdeveloped

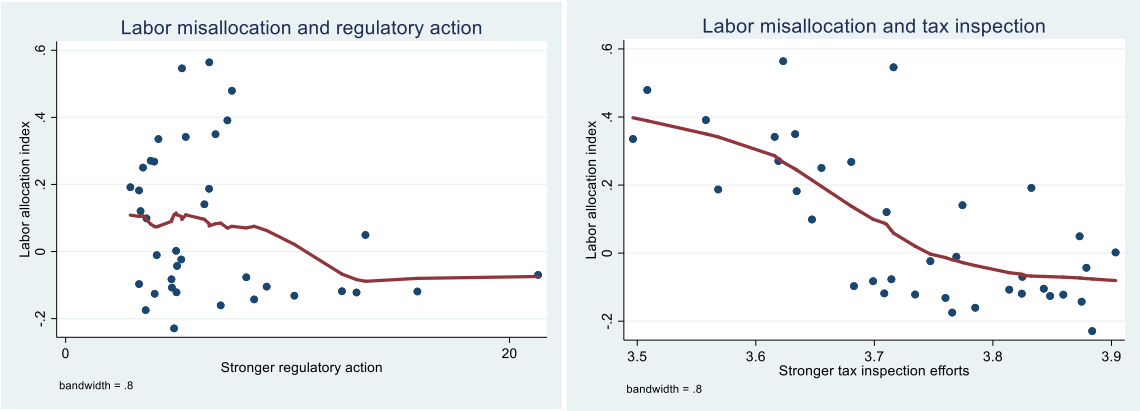
[15] LP's method accounts for capital, labor, and factor input cost to estimate TFP. It also deals with the correlation between unobservable productivity shocks and production input levels.

areas in the north are plagued by conflicts (e.g., Islamist extremist insurgency by *Boko Haram*), again leading to weak state capacity.

Land tenure system and land rental market are underdeveloped in Nigeria. The land allocation index for Nigerian states computed using Eq. (6) is mapped in Appendix D-(b) (upper figure). In the map, many states in the north-west and the south-east regions are scored negative or low positive values, suggesting inefficiency in its land allocation.

Similarly, the map in Appendix D-(b) (lower figure) shows that the labor allocation index is negative or close to zero in the north-western Nigerian states. Figure 8 shows further that the labor allocative efficiency is negatively correlated with regulatory and inspection efforts by the local government, reflecting ineffective regulations at the state level (World Bank, 2014). Despite slight improvements in business conditions, the World Bank's Doing Business scores are lower than the SSA average level in most Nigerian states. The start-up cost of a business is high due to multiple layers of regulatory requirements. Nigeria's fiscal regime also entails the extensive use of tax incentives and exemptions, eroding the fairness of tax treatments, and widespread tax evasion. Nigeria was the first SSA country to explore contributory social insurance system, but social security coverage has been limited with high tax non-compliance and the accumulation of tax arrears (e.g., unremitted withholding of pay-as-you-earn (PAYE)) due to weak regulatory capacity (IMF, 2005, 2018). As a result, current regulatory system is little trusted by the private sector, making firms to operate informally and distorting the labor allocation.

Figure 8. Labor allocation index and regulations in Nigeria



Source: WBES Nigeria panel data, 2007-14

In such context, the following panel regression tests hypotheses H1-H4 and estimates the effect of the land and labor allocative efficiency on firm size in Nigeria:

$$y_{isjt} = \alpha_0 + \alpha_1 M_{isjt} + \alpha_2 X_{isjt} + \lambda_i + \kappa_s + \mu_t + \varepsilon_{isjt} \quad (8)$$

where M_{isjt} is the factor market variable for firm i in sector s and state j at time t (t=2007/09 or 2014). X_{isjt} controls for firm characteristics and state characteristics such as the distance to capital city (Abuja), urbanization rate, and the mean suitability of land for agriculture from Gershman and Rivera (2018). λ_i, κ_s, and μ_t are firm, sector and year fixed effects.

V.B.2. Effect of minimum wage reform in 2011

In Nigeria, one of the major reforms executed in recent years is the revision of the old National Minimum Wage Act enacted in 2000. Nigeria provides an interesting case to evaluate the effect of higher minimum wage on firm performance. While living cost had risen due to high inflation around 11 percent since 2005, workers were under-remunerated and the minimum wage paid at the bottom of wage distribution was not sufficient to meet basic needs, resulting in declining labor productivity (Nwude, 2013). Nigeria's minimum wage is one of the lowest in SSA compared with its income level (Figure 4), and about 16 percent of firms was not compliant with the minimum wage (Figure 9, left chart).

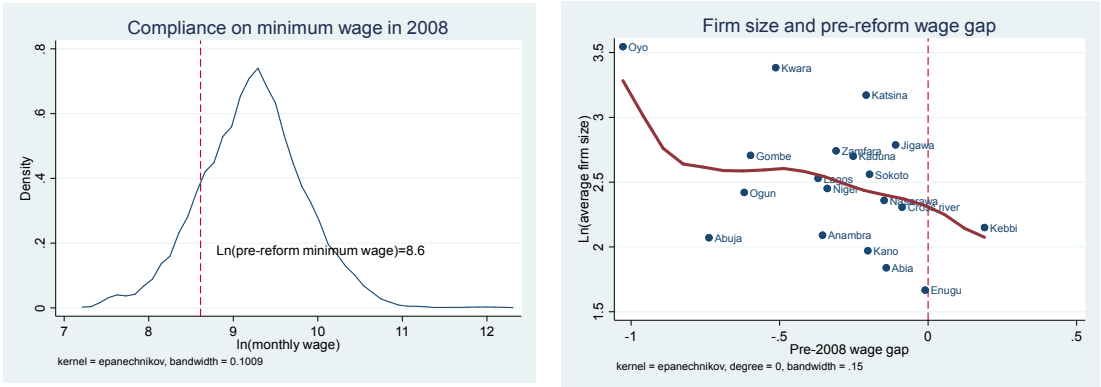
Against this backdrop, the government more than tripled the statutory nominal minimum wage from 5,500 Naira to 18,000 Naira per month in 2011 (ILO's minimum wage database). How did the minimum wage reform affect firm performance? Based on the model hypothesis H4, higher minimum wage increase or decrease the formal sector employment depending on the labor demand and supply elasticity and the magnitude of the minimum wage hike.

To measure the intensity of the minimum wage reform, the wage gap index (WG_{sj}) is constructed as a ratio of pre-reform national minimum wage level (MW_{pre}) to the median wage level of each sector s and state j:

$$WG_{sj,2008} = \ln(MW_{pre}) - \ln(Median\ wage_{sj,2008})$$

The right chart of Figure 9 shows that the wage gap is positive or near zero in some states, meaning that many firms operating in these states are not compliant with the national minimum wage in 2008. It also shows negative correlation between the average firm size and the wage gap, suggesting that firm could attract more workers to achieve higher productivity by paying higher wage above the minimum wage.

Figure 9. Pre-reform minimum wage: partial compliance and wage gap



Source: WBES Nigeria panel data, 2007-14; ILO minimum wage data

The following difference-in-difference model, as in Dinkelman and Ranchhod (2012), estimates the effect of the minimum wage reform on firm size and the LP's TFP measure using the pre-2008 wage gap index as treatment variable:

$$y_{isjt} = \alpha_0 + \alpha_1 POST_t + \alpha_2 WG_{sj,2008} + \alpha_3 POST_t \times WG_{sj,2008} + \gamma X_{isjt} + \varepsilon_{isjt} \quad (9)$$

where $POST_t$ is the post-reform dummy after 2011.

V.B.3. Empirical results from panel regressions

This section summarizes the empirical results of panel regressions (section V.B.1) and difference-in-difference regressions (section V.B.2).

At the bottom of Table 5, the Breush and Pagan Lagrange Multiplier (LM) test supports the random effect (RE) specification over pooled OLS regression, while the Hausman test supports the fixed effect (FE) over the RE model. The FE model estimates Eq. (8) which controls for firm specific unobserved heterogeneity.

In Table 5, both RE and FE estimates confirm that landholding with higher land value and efficient factor allocations significantly increase firm size in Nigeria. The coefficients get smaller in magnitude under the FE model, but the effects remain significant. Stronger inspection efforts significantly constrain firm growth as found in Figure 8, while the effect of formal regulation has no effect under the FE model. Wider pre-reform wage gap also constrains firm growth under the RE model as found in Figure 9 although the effect become zero when the FE model is applied. Estimates for the state-level variables show that firm size gets larger as firms locate in urbanized area with land that is less suitable for agriculture.

Columns 1-6 of Table 6 show the difference-in-difference estimates. Firms that paid relatively lower wages compared to the national minimum wage (i.e., larger wage gaps) are significantly smaller in size and have lower TFP than those that paid higher wages. The negative coefficient of post-reform dummy in columns 4-6 indicates that TFP dropped after the reform, reflecting the reduction in profits for higher labor costs caused by higher minimum wage. The interaction term between post-2008 dummy and the wage gap variable shows the treatment effect of the 2011 minimum wage reform. The interaction term is positive and significant only for firm size in columns 1-3. This implies that the positive effect of the minimum wage reform on labor supply dominates reduced labor demand. The results remain robust when the sample is restricted only to compliant firms with the minimum wage law as shown in the last specifications of columns 3 and 6.

Columns 7-12 show the triple difference estimates that account for the heterogeneity by regulation (in columns 7 and 10), corruption (in columns 8 and 11), and location (in columns 9 and 12). As summarized below, the results imply that the 2011 minimum wage reform increased firm size and total factor productivity especially in sub-national areas with stronger formal regulations and less corruption.

- *By regulation*: The average firm size and TFP are lower in highly regulated states (with stronger regulatory requirements than the average level) especially when firms pay less

wages compared to required level under the old minimum wage law. The result in column 10 also shows that TFP in highly regulated area increased more than less regulated area after the 2011 reform.

- *By corruption*: In column 8, the negative coefficient of the wage gap variable interacted with the high corruption area dummy shows that firms with larger wage gap were even smaller in high corruption area (with higher incidence of corruption or bribes than the average level) than in less corrupt area (reference group). The results also show that the 2011 reform increased firm size in less corrupt area, while firm size got even smaller after the reform in high corruption area.
- *Near Abuja vs. not*: Firm size is larger and TFP is higher for firms that located in the states near Abuja (within 250 kilometers from Abuja) on average. However, firms near Abuja did not grow and became less productive after the 2011 reform, while firm size increased after the 2008 reform in places further away from Abuja.

Table 5. Determinants of firm size (fixed vs. random effect regressions)

	(1)		(2)		(3)		(4)		(5)	
	Ln(firm size)									
	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE
Ln(land value, owned or rented)	0.022***	0.022***								
	[0.006]	[0.007]								
Stronger regulatory action			0.006**	0.000						
			[0.003]	[0.003]						
Stronger inspection efforts			-0.215***	-0.199***						
			[0.065]	[0.070]						
Wage gap pre-reform					-0.428***	0.049				
					[0.103]	[0.240]				
Land allocation index							0.109***	0.057**		
							[0.028]	[0.028]		
Labor allocation index									0.205***	0.129***
									[0.044]	[0.036]
Ln(capital investment)	0.012*	0.001	0.021***	0.009	0.022***	0.014***	0.023***	0.01	0.018***	0.008
	[0.006]	[0.007]	[0.005]	[0.006]	[0.005]	[0.005]	[0.006]	[0.006]	[0.006]	[0.006]
Ln(manager experience)	0.058	0.029	0.054	0.027	0.056	0.022	0.048	0.018	0.069*	0.038
	[0.039]	[0.045]	[0.039]	[0.045]	[0.039]	[0.045]	[0.042]	[0.051]	[0.040]	[0.048]
Foreign ownership	0.277**	0.173	0.269**	0.158	0.276**	0.178	0.210*	0.161	0.318***	0.239*
	[0.117]	[0.142]	[0.119]	[0.144]	[0.120]	[0.143]	[0.119]	[0.138]	[0.120]	[0.143]
State ownership	0.195*	0.164	0.139	0.13	0.144	0.122	0.245**	0.148	0.171	0.107
	[0.107]	[0.123]	[0.110]	[0.126]	[0.111]	[0.125]	[0.111]	[0.125]	[0.113]	[0.125]
Ln(distance to Abuja)	0.212***		0.209***		0.169***		0.209***		0.204***	
	[0.066]		[0.066]		[0.065]		[0.065]		[0.065]	
Urbanization rate	0.668***		0.685***		0.321		0.687***		0.724***	
	[0.188]		[0.187]		[0.206]		[0.186]		[0.183]	
Land suitability for agriculture	-0.094		-0.112*		-0.025		-0.097		-0.104*	
	[0.062]		[0.062]		[0.061]		[0.061]		[0.060]	
Constant	1.124**	2.402***	2.097***	3.339***	1.082**	2.512***	1.217***	2.473***	1.289***	2.493***
	[0.440]	[0.135]	[0.521]	[0.315]	[0.440]	[0.193]	[0.441]	[0.147]	[0.436]	[0.147]
Observation	1499	1499	1,499	1,499	1499	1499	1374	1374	1415	1415
R-squared (overall)	0.135	0.054	0.139	0.049	0.152	0.043	0.170	0.077	0.192	0.097
Sector dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Diagnostic test										
Breusch and Pagan LM test	220.61		212.38		205.89		130.46		158.96	
	[0.000]		[0.000]		[0.000]		[0.000]		[0.000]	
Hausman test	73.42		101.28		62.07		74.43		77.77	
	[0.000]		[0.000]		[0.000]		[0.000]		[0.000]	

*Significant at 10%; ** 5%; *** 1%. Robust standard errors are presented in the square brackets. Sector dummies control for unobservable differences between food manufacturing, other manufacturing, textile, retail and wholesale trade, and others.
RE = random effect; FE = fixed effect model.

Table 6. Effect of minimum wage (Difference-in-Difference regressions)

	Diference-in-Difference						Triple difference					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Ln(firm size)			Ln(TFP)			Ln(firm size)			Ln(TFP)		
Wage gap pre-reform	-0.942***	-0.574***	-0.892***	-0.488***	-0.422***	-0.549***	0.002	-0.302*	-0.604***	-0.19	-0.204	-0.510***
	[0.104]	[0.103]	[0.128]	[0.140]	[0.152]	[0.191]	[0.131]	[0.154]	[0.107]	[0.259]	[0.235]	[0.157]
Post-reform dummy	0.134	-0.023	0.112	-0.808***	-0.923***	-0.630**	-0.148	0.121	-0.024	-1.475***	-0.800***	-0.753***
	[0.096]	[0.095]	[0.127]	[0.183]	[0.195]	[0.298]	[0.160]	[0.126]	[0.099]	[0.283]	[0.265]	[0.202]
Wage gap x Post-reform	0.413***	0.356**	0.514***	0.124	-0.179	0.259	0.072	0.509**	0.343**	0.314	-0.257	0.006
	[0.147]	[0.148]	[0.195]	[0.280]	[0.300]	[0.454]	[0.259]	[0.210]	[0.157]	[0.467]	[0.444]	[0.312]
z variable (dummies)												
High regulation area							-0.834***			-0.549***		
							[0.121]			[0.191]		
High corruption area								0.037			0.065	
								[0.137]			[0.206]	
Within 250 kilometers from Abuja									0.803***			1.065***
									[0.215]			[0.340]
Triple interaction terms												
Wage gap x z variable							-0.873***	-0.359*	0.713**	-0.422	-0.295	1.391**
							[0.167]	[0.190]	[0.350]	[0.295]	[0.293]	[0.562]
Post-reform dummy x z variable							0.233	-0.331*	-0.079	0.882**	-0.425	-1.977***
							[0.192]	[0.189]	[0.304]	[0.371]	[0.392]	[0.700]
Wage gap x post-reform x z variable							0.497	-0.329	-0.183	-0.594	0.033	-2.752**
							[0.305]	[0.285]	[0.449]	[0.593]	[0.595]	[1.201]
Constant	2.017***	0.786**	1.053***	8.946***	7.187***	7.073***	1.588***	1.093***	-0.787	7.449***	7.309***	6.686***
	[0.072]	[0.337]	[0.368]	[0.093]	[0.691]	[0.749]	[0.364]	[0.358]	[0.627]	[0.726]	[0.715]	[1.243]
Observations	1,537	1,475	1,280	1,346	1,304	1,123	1,475	1,475	1,475	1,304	1,304	1,304
R-squared	0.073	0.202	0.218	0.053	0.097	0.099	0.237	0.211	0.211	0.119	0.098	0.102
Sample	All	All	Compliant firms only	All	All	Compliant firms only	All	All	All	All	All	All
Firm-level variables included	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
State-level variables included	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Sector dummies	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y

*Significant at 10%; ** 5%; *** 1%. Robust standard errors are presented in the square brackets. Sector dummies control for unobservable differences between food manufacturing, other manufacturing, textile, retail and wholesale trade, and others. Same firm-level and state-level variables included for regressions in Table 5 are used when they are controlled. Compliant firms are paying higher wages than the minimum wage in 2008.

VI. CONCLUSIONS

Despite a long period of strong growth, pessimistic development prospects dominate in SSA due to its heavy reliance on natural resources and low competitiveness. This paper examined the roots of Africa's weak industrial performance by examining the efficiency of the factor market and its role in firm growth in SSA.

First, the paper estimates the allocative efficiency of land and labor in 40 SSA countries following Olley and Pakes (1996), which suggests significant land and labor misallocations in SSA. Factor market distortions stem primarily from fragile institutional environments, including conflict among diverse ethnic groups, customary land system, and weakly enforced regulations. Estimated factor allocation indexes suggest ample scope for improving the land and labor efficiencies through the factor reallocations to more productive firms.

Based on predictions from a dual-economy model with input-financing frictions, the paper conducts a series of empirical analyses to test whether African firms could achieve significantly more scale and productivity gains by improving factor market efficiency. The analyses use unique institutional variations in SSA – ethnic diversity and the intensity of

regulatory actions to peer firms at subnational level – as exogenous variations to examine the determinants of factor misallocations.

The first-stage of IV regressions confirm that African firms are constrained by such institutional bottlenecks in obtaining land and productive labor. Given that the allocation of land is informally determined and land disputes among ethnic groups are common in SSA, access to land is limited for productive African firms. In the absence of regulatory rule to enforce competitive wage level with social insurance benefits, workers are unwilling to continue formal business at a large scale. In low-income SSA countries where corruption is widespread, stricter monitoring of small and medium-sized enterprises by tax inspectors increases "informal tax" higher than the benefits they can gain from formal business.

Based on the first-stage results, the IV-Tobit regressions using pooled data of 40 SSA countries and a Nigerian panel data show that factor reallocation would allow firms to survive longer and achieve higher productivity growth and operational scale, with especially large policy effect (LATE) for marginally productive firms. The results also suggest that access to credit and tax contribution could increase by addressing factor misallocation, which may augment productivity gains within the wider community. Finally, difference-in-difference regression using a Nigerian panel data gives a specific example, showing that removing wage rigidity from the 2011 minimum wage reform increased firm size in Nigeria especially in sub-national areas with stronger formal regulations and less corruption.

From the policy perspective, the results imply that the effect of regulatory reforms on factor market efficiency and firm growth depends on local legal capacity. There is *no one-size-fit-for-all*, but regulation design needs to account for the level of corruption or the rule of law in the local economy. Against theory, strengthening monitoring of informal activities, through frequent inspections, does not necessarily support firm growth in SSA. Improving regulations to formalize the land allocation process and labor contracts with social insurance benefits are effective in supporting firm growth when legal capacity is weak. As legal capacity develops, stronger informal sector monitoring would prompt the reallocation of workers to productive formal activities.

As it stands, high informality in SSA could be the equilibrium outcome of informal firm's rational choice to stay in the informal sector. This may reflect that the informal sector provides safety nets to small African firms while the costs outweigh the benefit of operating formal business. In this regard, a natural way to reduce the informality and improve the competitiveness in SSA is to apply a simple formal rule or monitoring scheme to factor market, as they fit the local context, to achieve more efficient land and labor allocations to support growth of formal micro entrepreneurs.

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Appendix Table A. Summary statistics: cross-country pooled firm data

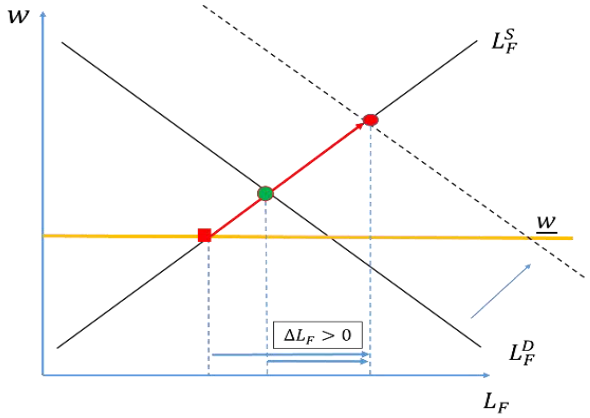
			Sub-saharan Africa						Developing Asia					
	Source	Definition	N	Mean	Median	Std dev.	Min	Max	N	Mean	Median	Std dev.	Min	Max
Firm-level variables														
Firm size	WBES	Number of employees	23,000	58.1	13.3	392.7	1.0	45,000.0	29,609	180.3	31.3	2,079.4	0.0	170,666.7
Firm age	WBES	Years after starting business	22,364	14.3	11.0	11.7	0.0	65.0	29,115	17.1	14.0	11.5	0.0	65.0
Ln(value added/employee)	WBES, IMF WEO	Log of sales minus labor and input costs (including electricity, raw materials and intermediate goods, and fuels) (in 2011 international $) divided by the number of employees	22,248	9.88	9.53	2.75	-7.23	24.41	27,272	9.46	9.56	2.17	-2.60	19.80
Ln(land value, owned)	WBES, IMF WEO	Net book values of land and buildings (in 2011 international $)	7,307	8.56	10.51	6.33	0.00	25.60	13,802	11.20	12.73	4.90	0.00	26.93
Ln(land value, owned or rented)	WBES, IMF WEO	Log of annual expenditure on purchases, re-purchases, and renting of land and building (in 2011 international$)	23,000	4.79	0.00	6.37	0.00	28.91	29,665	5.43	0.00	6.53	0.00	26.01
Percent owned land	WBES	The percent of land owned by the firm	18,594	43.75	0	48.51	0	100	22,587	62.32	100.00	47.36	0	100.00
Ln(capital investment)	WBES, IMF WEO	Purchase or re-purchase of equipment (in 2011 international $)	23,000	7.06	8.69	6.30	0.00	28.92	29,665	7.03	9.54	6.27	0.00	23.07
Ln(manager experience)	WBES	CEO's work experience in the same sector (in years)	22,604	2.49	2.48	0.69	0.00	4.33	28,432	2.60	2.71	0.65	0.00	4.26
State ownership	WBES	Dummy: owned by government	22,702	0.02	0	0.15	0	1	29,598	0.01	0	0.11	0	1
Foreign ownership	WBES	Dummy: owned by private foreign individuals or companies	22,683	0.16	0.00	0.36	0.00	1.00	29,600	0.07	0.00	0.26	0.00	1.00
Have credit access	WBES	Dummy: firm has a line of credit or loan	22,605	0.21	0	0.41	0	1	26,827	0.33	0	0.47	0	1
Heavy industry	WBES	Sector dummy	23,000	0.14	0	0.35	0	1	29,665	0.35	0	0.48	0	1
Whole sale and retail	WBES	Sector dummy	23,000	0.19	0	0.39	0	1	29,665	0.16	0	0.37	0	1
Eastern Africa region	WBES	SSA region dummy	23,000	0.40	0	0.49	0	1	…	…	…	…	…	…
Central Africa region	WBES	SSA region dummy	23,000	0.07	0	0.25	0	1	…	…	…	…	…	…
Western Africa region	WBES	SSA region dummy	23,000	0.42	0	0.49	0	1	…	…	…	…	…	…
Southern Africa region	WBES	SSA region dummy	23,000	0.12	0	0.32	0	1	…	…	…	…	…	…
Country-level variables														
GDP per capita growth	WB WDI	Percent (in real growth)	23,000	3.44	2.94	2.78	-3.39	12.53	29,665	5.19	5.16	1.71	2.01	11.65
Private credit/GDP	IMF database	Percentage	23,000	0.20	0.16	0.16	0.02	0.83	29,665	0.56	0.50	0.33	0.13	1.21
Judiciary efficiency	WB Doing Business	Distance to frontier (rescaled to 0 - 1; larger score is closer to frontier and thus more efficient)	23,000	0.53	0.53	0.10	0.26	0.67	22,575	0.43	0.33	0.16	0.27	0.72
Trade openness	IMF database	(Export + Import)/GDP	23,000	0.66	0.64	0.23	0.28	1.29	29,665	0.66	0.49	0.36	0.40	1.79

Source: WBES, IMF World Economic Outlook, International Financial Statistics, IMF African Department database, World Development Indicator, the Doing Business Database

Appendix A. Theoretical framework

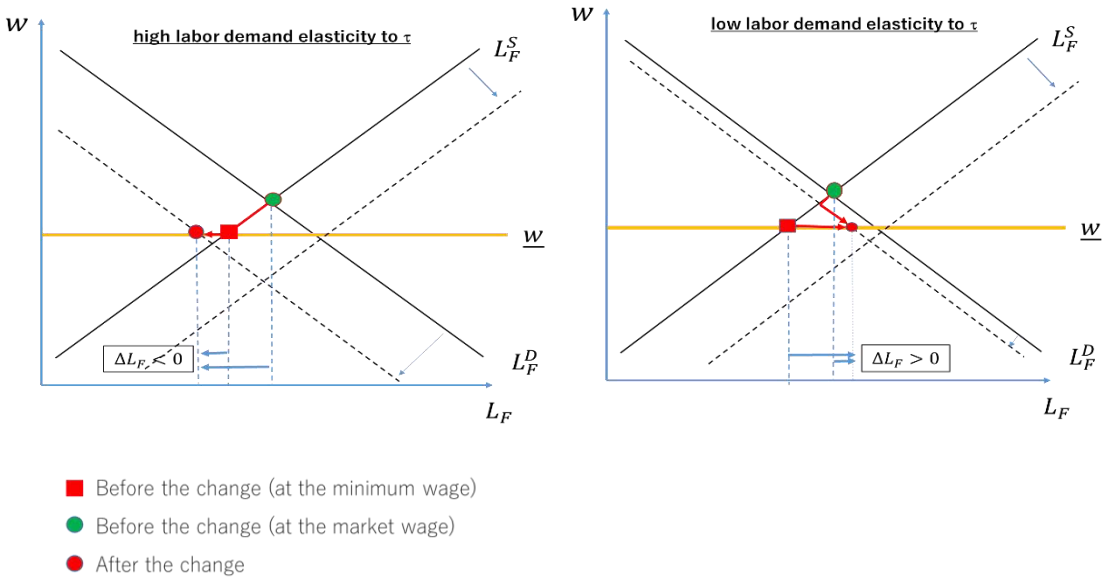
1. Effect of improving access to land

Holding larger land with higher value relaxes collateral constraint, increase production frontier, and expand formal employments.



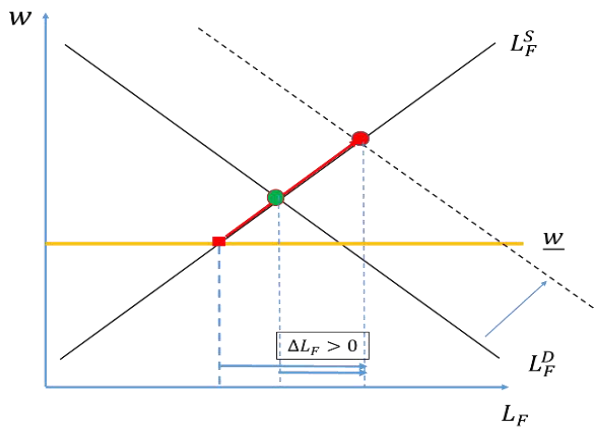
2. Effect of enforcement in formal labor benefits

An increase in mandated benefits reduce firm's labor demand while increase labor supply. If the substitution effect of the change in mandated benefits is larger than the income effect, work is more attractive and labor supply increases. Equilibrium outcome depends on labor demand and supply elasticities.



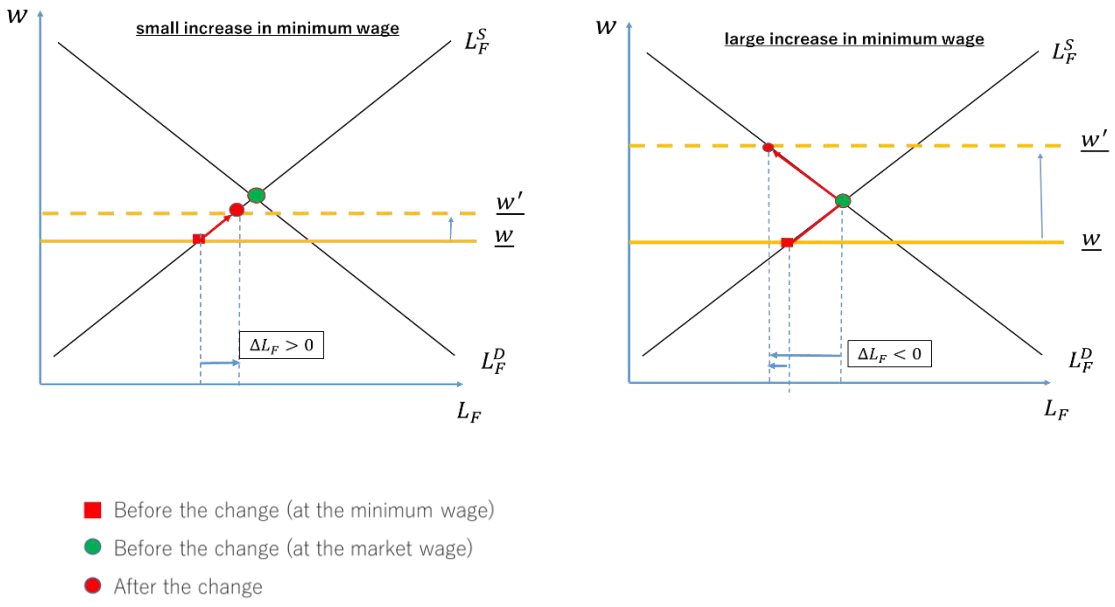
3. Effect of stricter informal sector monitoring

Enforcing higher penalty in the informal sector increases the equilibrium formal employment at both segment of labor markets.



4. Effect of higher minimum wage

When $\underline{w} < w^*$, higher minimum wage may increase or decrease equilibrium employment depending on the size of wage hike.



Appendix B. Country sample

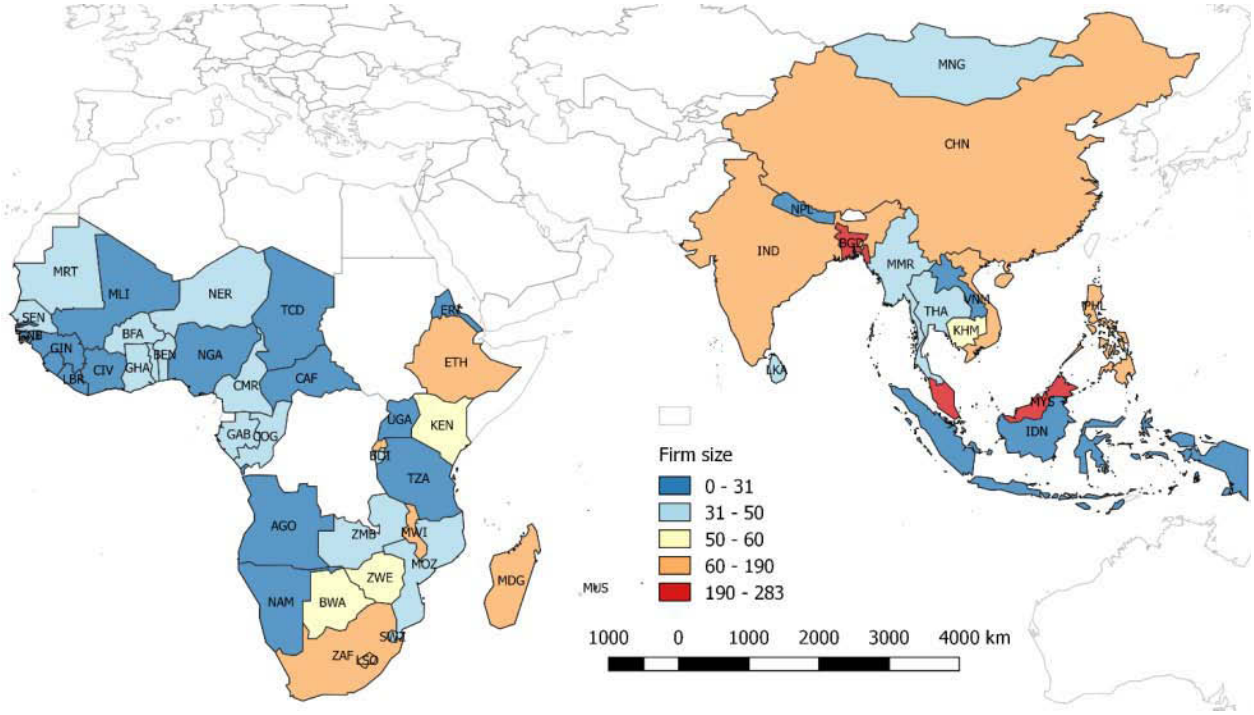
sub-Saharan Africa (40 countries):

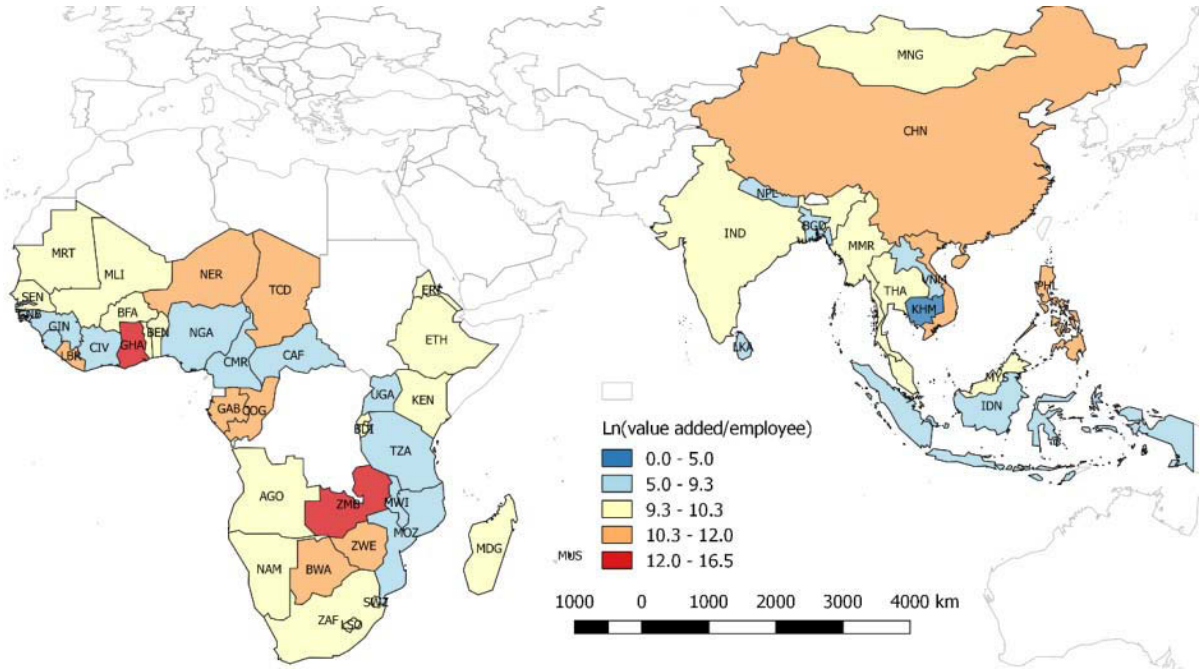
Angola, Benin, Botswana, Burkina Faso, Burundi, Cote d'Ivoire, Cameroon, Cape Verde, Central African Republic, Chad, Republic of Congo, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leonne, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe

Developing Asia (14 countries):

Bangladesh, Cambodia, China, India, Indonesia, Laos, Malaysia, Mongolia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam

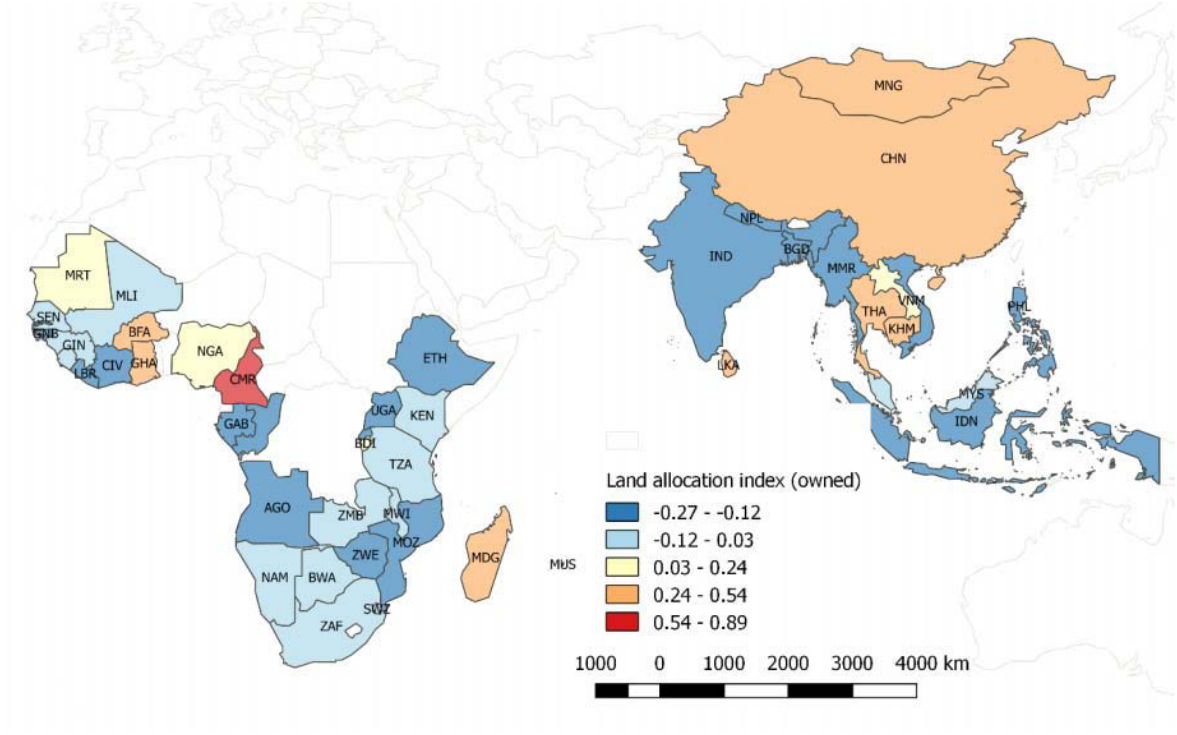
Appendix C. Spatial distribution of firm performance

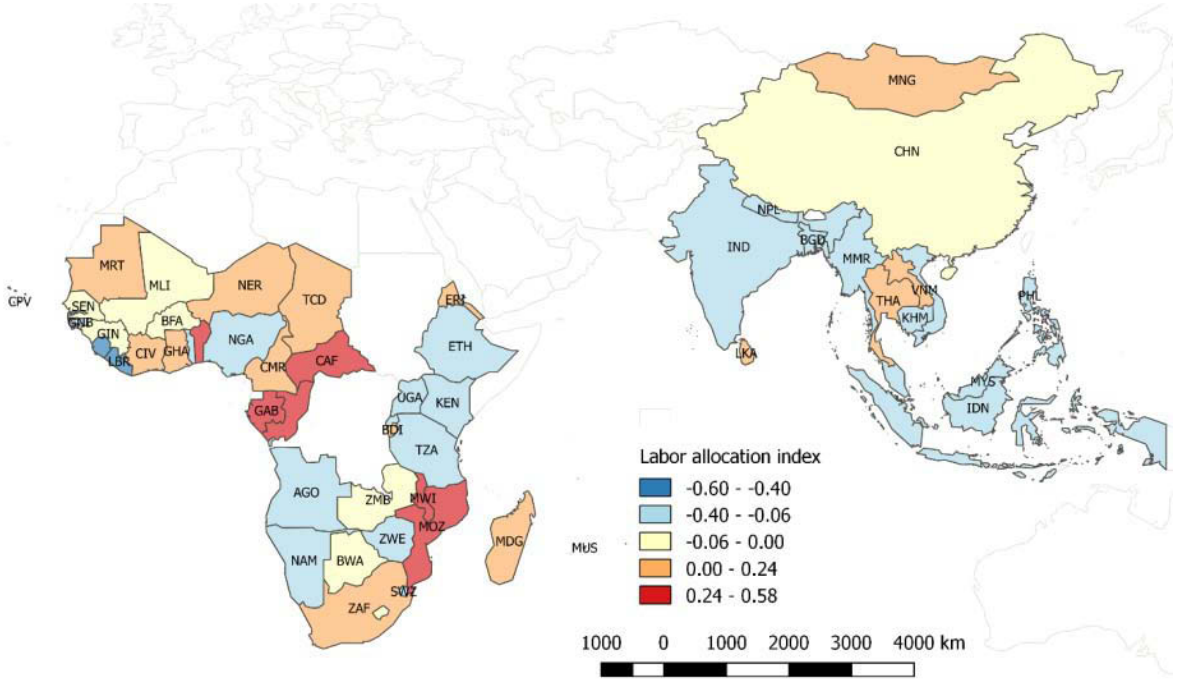




Appendix D. Spatial distribution of factor allocative efficiency

(a) Sub-Saharan Africa and Developing Asia





(b) Nigeria