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AFRICAN DEVELOPMENT BANK GROUP

Impact of the Business Environment on Output and Productivity in Africa

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Abstract

We develop a general equilibrium model to assess the quantitative effects of the business environment, including regulations, crime, corruption, infrastructure and access to finance, on output and total factor productivity (TFP) in Sub-Saharan Africa. The first four dimensions are modeled as a tax on output and the finance dimension is modeled as a borrowing constraint. The model is simulated for a sample of Sub-Saharan African countries using the country-specific financial development and the country-specific joint distribution between productivity and taxes. We find that the simulated output and TFP are highly correlated with that in the data and the model accounts for 48% of the variation of output in the data. Access to finance alone accounts for 39% and the other four dimensions account for 11% of the dispersion in output.

Key words: Business environment, financial development, Productivity, misallocation, African Development

JEL classification: O16, O47, L23

1 Introduction

Africa is by far the poorest part of the world. Although several African countries have recently experienced positive economic development outcomes, it is clear that there has been a failure to develop sound policies in many African countries. In particular, African countries rank poorly in most dimensions of business environment that are essential to long-term business success. Table 1 compares different indicators of the business environment from the World Bank Enterprise Surveys (ES) for the OECD and Sub-Saharan Africa (SSA).[1] It is clear that firms in SSA are highly constrained compared with their counterparts in the OECD. For example, on average, 45.6% of firms in SSA identify access to finance as a major constraint while the corresponding number for the OECD sample is 14.6%. In addition, 50.3% of firms in SSA identify electricity availability as a major constraint while the corresponding number for the OECD sample is 16.4%.

In this paper, we focus on African institutions and policies related to the business environment that create inefficiencies at the establishment level as well as distortions in the allocation of resources across establishments. The development literature has shown that both channels are important in accounting for cross-country income and TFP differences[2]. Our objective is to build a model that specifies links between various aspects of the business environment and establishment output and to quantify the aggregate effects of these dimensions of the business environment on income per worker and total factor productivity for Sub-Saharan African countries. Specifically, the paper focuses on five aspects of the business environment: the regulatory environment, crime, corruption, access to infrastructure and financial development. Table 2 shows that the first four dimensions are negatively correlated with income, with correlation coefficients ranging from -0.15, for regulation, to -0.43, for infrastructure. In contrast, the level of financial development is highly positively correlated with income, with a correlation coefficient

[1] The numbers in the table are simple averages across firms and countries derived from the custom query of the ES webpage. The OECD includes nine countries (the Czech Republic, Germany, Greece, Hungary, Ireland, South Korea, Portugal, Slovakia and Spain), and SSA includes 39 countries. When documenting the business environment statistics in section 5.1, the sample size for SSA is reduced to 30 countries to include only countries with harmonized questionnaires and enough data to calculate the total losses due to different dimensions. In the simulation, the sample size for SSA is further reduced to 18 countries to include only countries with enough data to calculate establishment level TFP.

[2] See Parente and Prescott (1999); Howitt (2000); Herrendorf and Teixeira (2011); Fang (2009) for the first channel and Hsieh and Klenow (2009); Amaral and Quintin (2010) for the second channel.

of 0.53.

Restuccia and Rogerson (2008) argue that a country's policies and institutions can create taxes or subsidies on establishment output that leads to lower aggregate TFP and output. We follow this idea and measure most of our indicators of the business environment as a tax on output. We introduce the policy distortions as modeled by Restuccia and Rogerson (2008) into the general equilibrium model studied by Amaral and Quintin (2010). In the model, a worker is born with a given level of managerial ability and must decide whether to operate a business. If he chooses to do so, he can either use his own savings or borrow to finance capital for production. Financial development is modeled as the degree of contractual enforcement. Lower enforcement, which corresponds to poor financial development, creates tighter borrowing constraints. The model is calibrated to match the debt to GDP ratio and the establishment level statistics in the U.S. economy. The calibrated model is then used to analyze the effects of business environments on output and TFP in African countries.

We first conduct several baseline experiments to highlight the channels through which the tax and financial development affect output and productivity. We find that homogenous taxes on establishments do not cause misallocation and the effects are a proportional decline in TFP and a lager decline in capital per worker and therefore a larger decline in output. For instance, with a 20% tax rate (which is about the average for Africa), TFP declines by 20% and output declines by 27%. Financial frictions also have sizeable negative effects. Reducing the financial intermediation to 10% of the U.S. level (which is about the average for Africa) leads to a decline of 37% in output and a decline of 10% in TFP. The effect of financial frictions comes from three channels. First, lower financial intermediation leads to tighter borrowing constraints and lower capital per worker. Second, lower financial intermediation leads to the operation of establishments with less talented managers. Third, lower financial intermediation distorts the allocation of capital and labor towards managers with more savings. These channels cause misallocation of resources and drive down output and TFP.

The ES database reports the percentage of sales lost due to various dimensions of the business environment. The average loss over our sample of countries ranges from 3.4% for corruption to 5.6% for crime. We aggregate these losses to create the measure of tax on output

for each establishment. A distribution of taxes and the level of financial development are then used to simulate the model for each country. In the simulation, it is important to preserve the distributional structure of the tax and productivity in the data. For this purpose, we construct establishment level TFP using data on sales, number of workers and measures of capital. We employ a copula to fit the joint distribution of TFP and the tax at the establishment level for each country.[3] Using taxes drawn from the fitted copula, we then simulate the model for each country taking into account the country-specific financial development. The implied output, TFP and capital per worker are highly correlated with that observed in the data. The model accounts for 48% of the variation of output in the data. Except the channels mentioned above, the misallocation caused by heterogeneous taxes also contributes to the decline in output and TFP.

We find that taxes and financial development have comparable effects on TFP. However, the majority of the drop in GDP per worker arises from poor financial development because underdeveloped financial markets lead to large declines in capital per worker. As a result, financial development accounts for 39% and taxes account for 11% of the dispersion of output. Furthermore, we simulate the model using individual tax dimensions as opposed to the total tax. We find that regulation, infrastructure and crime accounts for 5%, 4%, and 3% of the dispersion of output, respectively, while corruption has little contribution on the dispersion of output.

We conduct a number of robustness tests to assess the strength of our results. We show that the results from a Pareto distribution for managerial skills are similar to those obtained with a log normal distribution used in the benchmark calibration. We also calibrated the model to an African economy and asked how output and productivity would increase if taxes are removed and financial development is increased to the US level. Increases in output and TFP were similar to losses obtained with the opposite exercises of using the US as the benchmark and introducing taxes and reducing financial development. The simulation results for output, TFP, and capital per worker, based on the calibration for Africa, are also highly correlated with that

[3] A copula is a multivariate probability distribution for which the marginal probability distribution of each variable is uniform. Copulas are used to describe the dependence between random variables. Sklar's Theorem states that any multivariate joint distribution can be written in terms of univariate marginal distribution functions and a copula which describes the dependence structure between the variables.

observed in the data. With the new calibration, the business environment accounts for 30% of the dispersion in output.

In addition to the papers mentioned above, our paper is closely related to Alfaro et al. (2009), which quantifies the role of distortions in income differences across countries. They introduce the types of distortions emphasized by Restuccia and Rogerson (2008) in a model of heterogeneous establishments based on Melitz (2003). Using establishment data from 79 countries, they infer from the model the distortions needed to match the plant-size distribution in each country. They then use these distortions to calculate the aggregate loss of output. Our analysis differs from theirs in that we use a direct measure of distortions instead of inferring them from the model. Another related paper is Bartelsman et al. (2009), which uses establishment-level data in a model with idiosyncratic distortions to study the aggregate effects of resulting misallocations. Our modeling framework is different, as our distortions are in the form of a tax and collateral constraints.

Several other authors emphasize the effect of specific distortions on TFP and output. Parente and Prescott (1999) and Herrendorf and Teixeira (2004) argue that vested interests in the labor market can prevent establishments from adopting more efficient technologies. Lagos (2006) also studies the effects of frictions in the labor market on aggregate TFP. Fang (2009), by contrast, examines the role of entry barriers and competition in the product market. Greenwood et al. (2010), Buera et al. (2011), Midrigan and Xu (2013), and Buera and Shin (2013) study the effect of poor financial development. D'Erasmo and Boedo (2012) explore the effect of the financial market structure and the costs of informality on cross-country TFP differences. Barseghyan and DiCecio (2011) examine the effects of entry costs on income and TFP differences across countries, while Moscoso Boedo and Mukoyama (2012) evaluate the effects of entry regulations and firing costs. Closely related to Restuccia and Rogerson (2008), Guner et al. (2008) study misallocation due to restrictions on establishment size.

The remainder of the paper is organized as follows. Section 2 reviews the literature on the effects of different dimensions of the business environment. Section 3 describes the model, which is calibrated to the US economy in section 4. In section 5, we analyze the business environment and explore the relationship between different dimensions with establishment level

productivity for each country. The results of the simulations are analyzed in section 6 while robustness tests are conducted in section 7. We highlight conclusions of the study and policy implications in section 8.

2 Literature Review on Areas of the Business Environment

In this section, we review the literature on several dimensions of the business environment. The availability of cross-country data from the World Bank Enterprise Surveys since the 1990s has allowed researchers to analyze how establishments and the aggregate economy are affected by a poor business environment. The data have mostly been used to empirically test the relationship between a given aspect of the business environment and measures of establishment success[4].

The literature on the relationship between financial development and economic growth and development is very large. Levine (2005) conducts a comprehensive review of the theoretical and empirical work in this area. Finance has many functions, among which are the pooling and allocation of savings, the production of information about borrowers and monitoring of projects, the diversification of risk and the facilitation of the exchange of goods and services. Each of these functions affects savings, investment and the efficient allocation of resources and hence economic growth. The theoretical papers model some of these functions and show that financial frictions or poor financial development lead to low TFP and output (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991).

On the empirical side, many authors have shown that there is a strong negative correlation between measures of financial development, generally measured as liabilities of the financial system divided by GDP, and economic growth (King and Levine, 1993; Ndikumana, 2000), a correlation that is not due to simultaneity bias (Levine et al., 2000). Financial development affects economic growth through increases in TFP, savings rates and capital accumulation (Beck et al., 2000). However, the effects of poor financial development are not uniform across industries and the size distribution of establishments. Industries that require more external financing

[4]See Aterido et al. (2011) for a recent exception.

grow faster in more financially developed countries (Rajan and Zingales, 1998). Additionally, small establishments are more severely affected by poor financial development, and industries dominated by small firms for technological reasons grow faster in countries with greater financial development (Beck et al., 2008).

Another topic that has received significant attention in the literature is corruption. While few authors emphasize the positive effects of corruption, effects that arise from a decrease in the regulatory burden on businesses and a potential increase in effort by corrupted government officials (Leff, 1964), most authors argue that corruption cannot be limited to specific activities and is in general highly damaging to economic growth (Shleifer and Vishny, 1993; Bardhan, 1997; Blackburn et al., 2006). Corruption is a rent-seeking activity that affects output through various channels. It distorts incentives and market signals, leading to misallocation of resources. When talented people put their efforts into rent-seeking instead of productive activities, overall efficiency and output decline (Krueger, 1974; Murphy et al., 1991). Rent-seeking also raises the costs of production and transaction costs because it represents an uncertain and inefficient tax. Mauro (1995, 1996) and Knack and Keefer (1995), using cross-country data, find that higher levels of corruption, measured as an index based on subjective assessments, are associated with lower investment shares and GDP growth rates and that such effects are large. Mauro (1995) finds that a reduction in the corruption index by one standard deviation leads to a five percentage point increase in the investment to GDP ratio and to a half percentage point increase in the GDP growth rate. For Africa, Gyimah-Brempong (2002) finds that a one unit increase in the Transparency International index, measuring perceptions of corruption, reduces the level and growth rate of GDP per capita by 0.4 and 0.66 percentage points, respectively.

Corruption of government officials also alters government spending and investment allocation. Corruption is strongly correlated with the investment rate and some components of government expenditures such as education and transfer payments (Mauro, 1995, 1996). It also increases public investment but discourages private investment and has a negative effect on income growth (Baliamoune-Lutz and Ndikumana, 2008). Other transmission channels are: lower government revenues, lower expenditures on operations and maintenance, lower quality of public infrastructure and lower productivity of public government expenditure (Tanzi and

Davoodi, 1997).

Infrastructure services (transport, energy, water and sanitation) are consumed by households and used by firms in their production processes and delivery of goods and services. Infrastructure is often modeled as public capital, distinct from other type of physical capital, and included in the production function. As an input in the production function, investment in infrastructure will increase growth in the transition and lead to higher steady state income per worker. However, we know that infrastructure investment has no growth effects in the long run unless it improves productivity, and many studies have found that differences in income across countries cannot be explained by differences in inputs. There is a large empirical literature that estimates the elasticity of output with respect to infrastructure. A review of this literature accordingly appears every several years (Romp and de Haan, 2007; Duarte Bom and Ligthart, 2008; Straub, 2011).

It is generally agreed that adequate supply benefits firms and increases productivity growth (Morisson and Scwartz, 1996). Effects on the aggregate economy are also found to be positive and significant, but there is debate on the magnitude of the net effect (Esfahani and Ramirez, 2003; Canning and Pedroni, 2008). Fernald (1999) finds evidence for the US that investment in roads enhances productivity. Fan and Chan-Kang (2005) find that huge investments in roads in China have improved GDP growth and that the effects on poverty reduction in rural areas have been substantial. Duarte Bom and Ligthart (2008), using a meta-analysis, estimate the average output elasticity of public capital at 0.08 after controlling for publication bias. In his review, Straub (2011) highlights the shortcomings of modeling and estimation techniques used in the literature. Calderon et al. (2011) seek to overcome the shortcomings of previous literature with respect to measurement and estimation methods. They construct an infrastructure index, using a principal component analysis, and find that the long-run output elasticity with respect to the index ranges between 0.07 and 0.10.

In Africa, the supply of infrastructure is very low. Poor infrastructure increases transaction costs and makes African firms less competitive than their international counterparts. The costs of transportation, logistics, telecommunication, water, electricity, security, and bribes are high, and firms suffer great losses due to transportation problems, power and water outages and

crime (Eifert et al., 2005). Collier and Gunning (2000) argue that poor infrastructure is a serious constraint on growth in Africa. A recent economic brief by the African Development Bank (Mafusire, 2010) argues that Africa has a large deficit in infrastructure and that improvement could have large spillover effects on development and poverty reduction. Gollin and Rogerson (2010) suggest that decreasing transportation costs would be important in improving agricultural productivity in Uganda. Calderon (2009) uses principal components analysis to construct an infrastructure index, which he uses to rank countries. He finds that increasing the index for Sub-Saharan Africa to the level of the leader, Mauritius, would accelerate GDP growth by 2.3 percentage points.

3 The Model

The model is built on Amaral and Quintin (2010), which quantifies the effects of poor financial development on output and productivity. The framework is a discrete-time overlapping generations model. In each period, a mass one of two-period lived agents are born. Each agent is endowed with one unit of time in each period. An agent is born with managerial ability $z \in Z$, which is constant over the agent's life. Managerial talent is public information, and the distribution $g(z)$ is identical across generations. In the first period, the agent can only be a worker but has the option of becoming a manager in the second period. The utility function of an agent is given by:

$$U(c_1, c_2) = \log(c_1) + \beta \log(c_2), \tag{1}$$

where $\beta \in (0,1)$ is the discount factor.

A manager with ability z combines labor and capital into a single consumption good, using a decreasing returns to scale technology, which is described as follows:

$$F(k,l) = zk^{\theta} l^{\mu} \tag{2}$$

where $\theta + \mu < 1$. To incorporate the effects of distortions emphasized by Restuccia and Rogerson (2008), we assume that a fraction τ of output is lost due to the poor business environment.

We refer to τ as a tax because it acts as a proportional tax on output, where the proceeds are wasted. As it will become clear later, the tax rate for each establishment will be measured as a share of sales lost due to red-tape regulations, poor infrastructure, crime and corruption.

We assume that capital must be purchased before production takes place. A manager can finance capital either through personal savings, a, from the first period or through external borrowing at a rate r.[5] Capital fully depreciates after each period, which is not unreasonable, as one period is calibrated to twenty years.

The solution to this problem has been discussed extensively by Amaral and Quintin (2010). Here, we formulate the problem and discuss briefly several predictions of the model before turning to quantitative experiments. Let b be the amount borrowed by a manager, and let w be the wage rate. The profit for a manager with ability z, savings a, and capital $k = a + b$ is given by[6]:

$$\pi(k, z; w, r, \tau) = \max_{l} (1-\tau) z k^{\theta} l^{\mu} - wl - k(1+r) \tag{3}$$

The financial market is imperfect, as managers have the option to default. If a manager defaults, a fraction η of his assets is lost. Because there is no uncertainty in this model, the financial intermediary will impose a debt limit, so that managers find it rational not to default in equilibrium. Therefore, a financial contract for a manager with ability z and savings $a \geq 0$ solves:

$$\begin{aligned} &\max_{b \geq 0} \pi(a+b, z; w, r, \tau) \\ \text{s.t} \quad &\pi(a+b, z; w, r, \tau) + a(1+r) \geq \\ (1-\eta)\,&[\pi(a+b, z; w, r, \tau) + (a+b)(1+r)] \end{aligned} \tag{4}$$

[5] Amaral and Quintin (2010) explores a version of this model where the interest rate is endogenously determined, finding that the pattern of output resembles the benchmark formulation but that the effect of the financial constraint is larger.

[6] We implicitly assume that establishments will use all their savings to finance capital before turning to the financial market. The reasons for this assumption are twofold. First, it is generally cheaper to use internal funds to finance capital. Second, Amaral and Quintin (2010) proves that a financially constrained establishment will use all its savings to finance capital.

Simple manipulation of the above constraint gives:

$$b \leq \frac{\eta}{1-\eta} \frac{\pi(k,z;w,r,\tau)+a(1+r)}{1+r} \tag{5}$$

This inequality defines a debt limit for a manager with ability z and savings a. As in Amaral and Quintin (2010), the debt limit has the property that managers with more savings and better productivity can borrow more from the financial market. Hence, managers' savings play two roles. First, managers with more savings can finance more capital using their savings. Second, managers with more savings can also borrow more from the financial market to finance their capital. For future reference, note that lower financial development (low η) and higher taxes (poor business environment) both lead to a lower borrowing limit and hence less capital and output.

The problem of young agents is as follows:

$$\max_{c_1,c_2,a} \quad \log(c_1)+\beta\log(c_2)$$

$$\text{s.t:} \quad c_1+a = w \tag{6}$$

$$c_2 = a(1+r)+\max(w,\pi(a+b,z;w,r,\tau)) \tag{7}$$

where $\pi(a+b,z;w,r,\tau)$ is the net profit of a manager with savings a and ability z, subject to the borrowing constraint.

Income in the second period takes into account that an agent has a choice of occupation. As $\pi(a+b,z;w,r,\tau)$ is increasing in z, the young agent's problem implies that there is an ability threshold, $\underline{z}(\eta,w,r,\tau)$, below which agents become workers and above which agents become managers.

4 Calibration

In this section, we calibrate the model to the US economy. In the calibration, we assume that the tax rate in the U.S. is zero. The calibration procedure follows Amaral and Quintin (2010) and Restuccia and Rogerson (2008).

A period in the model is 20 years, corresponding to 40 years of work life for an individual. The yearly interest rate is set to 4%, implying $r = 1.04^{20} - 1$ and $\beta = \left(\frac{1}{1.04}\right)^{20}$. According to the literature (Basu and Fernald, 1997; Guner et al., 2008), returns to scale of the production function, $\alpha + \mu$, are between 0.8 and 0.9, and Atkeson and Kehoe (2005) argue for a value approximately 0.85. Therefore, we use the value of 0.85 and set α and μ to match the capital and labor shares of income. From US data, the capital share is 1/3 of returns to scale, which implies that $\alpha = 0.85/3 = 0.283$ and that $\mu = 0.85 * 2/3 = 0.567$.

The distribution of managerial talent will determine the size distribution of establishments. We assume that managerial talent follows a log normal distribution with 100 grid points. We choose the range of skills to match the range of employment in the data. Normalizing the lowest skill level to one, the maximum skill level is chosen to obtain a maximum employment of 10,000, as in the 2007 US census data.[7] The data also show that 73% of establishments have less than 10 employees, while only 2.3% have more than 100 employees. To replicate these features in the data, we choose the mean and standard deviation of the distribution to match the share of the total number of establishments at different sizes in the U.S. economy. As shown in figure 1, the model matches the data well. In addition, the implied distribution from the calibration also matches the share of total employment by size in the data, as shown in figure 2.[8]

A common measure of financial development in the empirical literature is the ratio of debt to GDP, which has been found to be positively correlated with economic development.[9] In quantitative work, such as Amaral and Quintin (2010), Buera et al. (2011), and Midrigan and Xu (2013), authors have used this measure to pin down the cross-country variation in financial development. We follow the literature and adjust η to match the intermediated capital to GDP ratio in the model to the credit to the private sector as a fraction of GDP in the data. The data comes from the World Bank Development Indicators (WDI). We use the average from 2005 to 2010 to minimize short-term fluctuations, obtaining a ratio of 1.95 for the US. Table 3 summarizes the parameter values.

[7]The establishment statistics can be found in the table, "U.S. & States, Totals," at the following webpage: `http://www.census.gov/econ/susb/data/susb2007.html`.

[8]The model implied average employment level of 18.7 is also close to the data value of 15.7.

[9]See Levine (2005) for a comprehensive literature review.

5 The Business Environment for Sub-Saharan Africa

5.1 Business Environment

Before turning to the quantitative implications of the model, we discuss the business environment data for Sub-Saharan African countries. The data on GDP per worker are from the Penn World Table 7.0 (PWT7.0). As noted above, the measure of financial intermediation is from the WDI. The remainder of the data for the business environment comes from the World Bank Enterprise Surveys (ES). The ES database contains establishment level data for more than 10,000 establishments across 125 countries. The core questionnaire of the survey is the same across all countries. Here, we include only countries for which surveys were collected between 2006 and 2009. The sample sizes vary by country, and all establishments surveyed operate in the industrial and service sectors. The distribution of establishments between industry and services are consistent with the value added shares of these sectors in the economy (see figure 3).[10]

Although the economies of Sub-Saharan Africa are often viewed as primarily based on agriculture, agricultural value added shares are below 50 percent for most countries. Figure 4 plots the non-agricultural share of output for the sample of 30 countries, showing that only two countries have non-agricultural shares of output below 50%, and most have shares above 60%. Indeed, the cross-country average is 73.5%. The low share of agriculture in value added is due to the well-documented low agricultural productivity characteristic of African countries and the fact that the sector largely consists of unregistered family farms. Therefore, in most countries, output in industry and services consists of a large fraction of output from the formal economy, which is the focus of this paper.

The ES database contains objective measures of the impact of regulation, crime, access to infrastructure, and corruption. The impact of red-tape regulation on establishments is measured by the fraction of time managers spent dealing with various government regulations. The effect of crime is measured by the percentage of sales lost due to theft, robbery, vandalism and arson, the percentage of sales revenue used for security expenses, and the percentage of products shipped to domestic markets lost due to theft. The percentage of sales lost due to power

[10]Te data on value added shares are from the World Development Indicators (WDI) database. The proportions in the sample are computed using the answer to the question about the main sector of activity.

outages and the percentage of shipments lost during transit are used to measure the deficiency of infrastructure. Corruption is measured by informal payments as a percentage of sales.

Table 4 presents the average establishment level statistics for each country. In most countries, managers spend a large fraction of their time dealing with government regulations. The average is 5.5%, with large variation across countries. Managers in Côte d'Ivoire spend the least amount of time, 1.9%, while in Niger, managers spend up to 13.0% of their time dealing with bureaucratic regulations. While on average, more than 33% of establishments in Sub-Saharan Africa are expected to give gifts to government officials to get things done, average costs represent 3.4% of total sales, with a standard deviation of 2.5%. Countries like Botswana, Cape Verde and Ethiopia have very low costs, while Madagascar and Côte d'Ivoire have very high costs. Crime is very costly to establishments, a majority of which pay to secure their businesses. Average security costs and sales lost due to various crimes as a percentage of sales revenue is 5.6%, with a minimum of 1.2% in Kenya and a maximum of 12.3% in Guinea.[11] Poor infrastructure is also very costly for business operation. Establishments on average lose 5.5% of their sales revenue due to power outages and transportation failures. The minimum losses are in Ethiopia, while the maximum losses are in Guinea, where daily power outages are routine, and variations in voltage often cause fires and equipment damages. The sum of the losses associated with these four dimensions, as indicated by the column "tax", is quite high, with businesses losing on average one-fifth of their sales revenues. Variation across countries is also high, as the standard deviation is 6.6 percent.

Access to finance is a major issue for African establishments. Beck et al. (2009) point to the shallowness of the financial system in Africa, although there has been recent progress. The average financial intermediation of capital is 11.5% of the US level, if we include South Africa; if we do not include South Africa, it is 9.2%. Variations across countries are also large: 14.9% with South Africa included and 6.7% without South Africa. South Africa is by far the most financially developed African country. Other countries with high levels of capital intermediation include Cape Verde, Mauritius, Kenya and Ethiopia.

[11] As an example of high losses due to lack of security, in Guinea, a rally by opposition parties on February 26, 2013 led to the destruction of businesses at a cost estimated at approximately 6 million US dollars in the country's largest market.

5.2 Tax and Productivity

Restuccia and Rogerson (2008) find that the quantitative effect of correlated distortions are larger than those of uncorrelated distortions because correlated distortions lead to a misallocation of resources across establishments with different productivity. In the context of our model, as shown in the next section, homogenous taxes on establishments lead to a proportional drop in TFP but do not cause a misallocation of resources. In contrast, heterogeneous taxes, either positively or negatively correlated with productivity, distort the occupational decision and the optimal production scale and therefore lead to a misallocation of resources across establishments with different productivity. This section investigates the correlation between establishment level taxes and productivity for African countries using the ES data set. We later use the documented correlations to examine the effect of taxes on output and TFP in African countries.

The impact of crime, access to infrastructure, and corruption are all reported as a percentage of total sales lost for each establishment in the data. The percentage of total sales lost is equivalent to a proportional tax on output of the same percent in the context of our model. The impact of regulation is reported as the fraction of managers' time in dealing with various government regulations. In the context of our model, this time does not produce output and is also equivalent to a proportional tax on output of the same percent. Hence, we can sum up the equivalent taxes due to different indicators and create the measure "tax" for each establishment. For a given country, we compute total taxes for each establishment by ignoring missing values and obtaining a tax distribution across establishments.

Total factor productivity for each establishment is calculated using the real value of sales, the capital stock and the total number of workers.[12] The capital stock is measured as the inflation adjusted actual value of machinery, vehicles and equipment or their replacement costs.[13] Data on capital stock is not available for all establishments. Table 4 shows that the number of observations with sales data in column 1 is much larger than the number of observation with

[12] CPI inflation from the IMF statistics are used to convert nominal values into real variables.

[13] A capital share of 0.33 was used for all countries. In the previous version of the manuscript, we used sales per worker as a proxy of productivity and all 30 countries had at least 100 establishments with productivity and tax data.

sufficient data to calculate TFP. From now on, we will focus our analysis on the countries with at least 100 establishments for which we can compute TFP. This amounts to 18 countries.

Table 5 reports the correlation coefficients between establishment level TFP and taxes along with the levels of significance. Column 1 shows large and significant correlation between establishment TFP and real value of sales per worker. This implies that more productive establishments produce more output. As reported in column three through six, the correlation between TFP and different tax dimensions can be positive or negative but are in general small and insignificant. The correlations between TFP and our measure of tax, reported in column 2, are also small for most of the countries. However, the coefficients are significant at the 10% level for 11 countries among which 4 are negative. Moreover, 5 of the remaining 7 insignificant correlation coefficients are negative.

Table 5 also reports the correlation between productivity and tax expenditures, measured by the product of tax rates and real value of sales. The reported correlation coefficients are all positive and significant at the 10% level with most significant at the 1% level. This implies that although more productive establishments may not face higher tax rates in some countries, they lose more sales due to the tax burden in all our countries.

6 Quantitative Effects for African Countries

6.1 Baseline experiments

In this section, we conduct several experiments to highlight the channels through which tax and financial development affect output and productivity, using the calibrated economic model. In the baseline experiments, we impose a homogenous tax rate on all establishments. The case with heterogeneous tax rates will be discussed next. The baseline results are reported in table 6. The statistics shown, all relative to the US, are GDP per worker, TFP, capital per worker (K/L), average employment (size), the ability threshold for individuals to become managers (Z_{cut}), average managerial talent at producing establishments (Z_{avge}), share of managers, and output per establishment. In these exercises and subsequent simulations, TFP is approximated

using an aggregate production function.

$$TFP = \frac{Y}{K^{\alpha} N^{\mu}}, \tag{8}$$

where Y is aggregate output, K is aggregate capital and N is the aggregate number of workers.

In the first experiment, we examine the effects of tax rates ranging from 10% to 40% while maintaining financial development at the benchmark level. The 10-40% range roughly corresponds to the range found in Africa. When the tax rate increases to 10%, output and TFP decline to 86% and 90% of their benchmark values, respectively. With a 40% tax rate, output per worker is more than halved, while TFP declines to 60% of the benchmark. Moreover, there is no change in the distribution of producing establishments and the average size of establishments. Hence, there is no misallocation across establishments but a proportional drop in TFP. The decline in output is larger than the increase in the tax, so does the output per establishment. This is because capital used in the production declines more than the tax rate, as illustrated by capital per worker.

In the second experiment, we vary financial intermediation relative to the benchmark economy with a zero tax rate. The effects on output are sizable. When relative financial intermediation is at 10%, a value that is close to the average for the African countries, output per worker declines to 62%, and TFP declines to 90%, of their benchmark values. With low ability to borrow, capital per worker declines and establishments have to operate in less than their optimal scales. This leads to lower output. The decline in capital per worker also lowers the wage and leads to a lower cut-off value for managerial talent. Hence, less talented managers can now enter and the average managerial talent of operating establishments declines and the share of managers increases to roughly four times of that for the US. This leads to misallocation of resources and lowers TFP and output as well as output per establishment. With lower capital per worker and more establishments operated by less talented managers, the average establishment size declines. In addition, managers with low talent but high savings can now buy more capital and operate in larger scales while managers with high talent but low savings cannot acquire enough capital and have to operate in smaller scales. This also causes misallocation and lowers TFP and output.

In the last panel of table 6, we show the effects of the business environment, using the average statistics for the thirty African countries. With a tax rate of 20.0% and relative financial development of 9.2%, output falls to 45% and TFP falls to 72% of U.S. levels. Decreasing the tax rate by one standard deviation to 13.5% raises relative output to 50% and relative TFP to 78%. A one standard deviation improvement in financial development increases relative output to 48% and relative TFP to 75%. However, if we assume a simultaneous one standard deviation decrease in the tax and improvement in financial development, output for Africa increases to 54% and TFP to 81% of US levels. This is a 19.6% increase in output per worker and a 12.8% increase in TFP from their baseline values. While the experiments show large effects of the average tax and the average financial development, we should bear in mind that this is not representative of any particular country, as all establishments are taxed at the same rate. In reality, taxes vary across establishments, a case that is analyzed in the following section.

6.2 Simulation for Eighteen African countries

6.2.1 Aggregate Effects of the Tax and Financial Development

After showing how homogenous taxes and poor financial development affect output and TFP, in this section, we use establishment level taxes and country level financial frictions to simulate the model for 18 Sub-Saharan African countries. In our simulation exercises for each country, it is important that the joint distribution of the tax and productivity preserve the distributional structure in the data. The distributional structure includes, but not limit to, the correlation between the tax and productivity, the statistical properties of the marginal distribution for the tax, and the range of the tax levels.

We approximate the joint distribution of the logarithm of productivity and the tax by the use of a copula.[14] The idea of a copula is as follows: consider a random vector (X_1, X_2) with continuous cumulative distribution functions (CDF), i.e.,: $F_i(x) = P[X_i \leq x]$ are continuous. The random vector $(U_1, U_2) = (F_1(X_1), F_2(X_2))$, obtained by applying the probability integral transformation, is a random vector. The copula of (X_1, X_2) is then defined as the joint cumulative

[14] Sklar's Theorem states that any multivariate joint distribution can be written in terms of univariate marginal distribution functions and a copula which describes the dependence structure between the variables.

distribution function of (U_1, U_2). Using the inverse of the copula, we can generate pseudo-random samples that maintains the distributional structure of (X_1, X_2). Because our data come from a sample of the population of establishments, the constructed copula, called the empirical copula, is an approximation of the true copula. We use the approximate maximum likelihood method from Matlab to generate the copula that fits data the best.

The simulation procedure can be summarized as follows: For each country, an empirical copula is used to construct the joint distribution of taxes and productivity. The inverse of the copula is then used to draw a sample of 100 tax rates corresponding to the 100 grid points representing managerial skills. Finally, the model is simulated, using the given sample of taxes and the country level financial development. The procedure is repeated 50 times, and the average results are reported.

Figure 5 plots the output per worker, TFP, and capital per worker from the model against the data. Each circle represents one country. The straight line is obtained from OLS regression between data and model values. Data on GDP per worker comes from the PWT7.0. Data on TFP is calculated following Hall and Jones (1999) and the aggregate capital is calculated using the perpetual inventory method with investment data. Data on capital per worker is simply derived from the ratio between aggregate capital and the number of workers. The reported values are normalized by the U.S. levels in both the model and the data.

The model's predicted values are highly correlated with the data. The regression coefficient is 0.83 for GDP per worker, is 0.32 for TFP, and is 0.60 for capital per worker. All coefficients are significantly different from zero at the 1% level.

Following Amaral and Quintin (2010), we use $v = 1 - \frac{\sum_i (\hat{y}_i - y_i)}{\sum_i (1 - y_i)}$ as a measure of the dispersion of output captured by the model, where $\hat{y}_i$ is relative income per worker in the model, and y_i is the corresponding value in the data. Using this measure, the model explains 48% of dispersion of income per worker and 47% of dispersion of income per worker for the non-agriculture sector. With only financial development in their model, Amaral and Quintin (2010) can explain one-third of the income variation in their sample, which includes only middle and high income countries. Including the other dimensions of the business environment increases the explanatory power of the model.

6.2.2 Comparing the Effects of the Tax and Financial Development

To illustrate the sole effect of taxes and financial frictions, this section conducts two experiments. In the first experiment, we set all taxes to zero but hold the level of financial development at each country's level. This experiment gives the unique effect of financial development. The results are reported in the second column of table 7. In the second experiment, we use the copula to approximate the joint distribution between taxes and productivity in the data as in section 5.3, but financial development is assumed to be at the U.S. level. This experiment gives the unique effect of taxes. The results are reported in the third column of table 7. For comparison purposes, the results with both frictions are reported in the first column. To avoid presenting a messy table, we only report the averages and standard deviations for our sample countries.[15] The following observations from the averages also apply to each country in the sample.

The first observation is that there are no large differences in the effects of the two frictions on TFP. The average decrease in TFP is 10% from the finance channel and is 8% from the tax channel. The second observation is that financial frictions have larger effects on capital per worker. In fact, most of the declines in capital per worker come from the finance channel. The third observation is that the effect of financial development on GDP per worker is much larger than the effect of the tax, a difference that mainly comes from the difference in the capital per worker. Specifically, on average the tax channel leads to a 10% decline of output, while the finance channel leads to a 36% decline. The fourth observation is that the finance channel also accounts for a larger fraction of the dispersion of output. As measured by $v = 1 - \frac{\sum_i (\hat{y}_i - y_i)}{\sum_i (1 - y_i)}$, financial frictions generate a dispersion of 39% in output and taxes generate a dispersion of 11% in output.

We argued above that heterogeneous taxes may lead to a misallocation of resources across establishments. Column three of table 7 demonstrates that this indeed occurs. To see this, note that as the first panel in table 6 illustrates, when the tax is homogenous across establishments, there is no change in the share of managers. However, the third column of table 7 shows that the average share of managers increases by 30% when the tax is heterogenous. This is because

[15] The results for each country are available by request.

the heterogeneous tax leads to a misallocation of resources and thus an increase in the entry of smaller and less productive establishments, which in turn leads to lower TFP and output.

Our model generates little interaction effects between taxes and financial frictions. In reality, there might exists such interaction effects. For example, high crime rates and less developed infrastructure might discourage banks to lend and lead to lower debt to GDP ratio and thus lower output and TFP. However, because we calibrate η to match the debt to GDP ratio, the interaction effects on TFP and output channeled through the debt to GDP ratio are included in our simulations. Other types of interactions that may exist are not included in our model. We view our study as a benchmark in analyzing the effects of taxes and financial frictions on TFP and output in Africa.

6.2.3 Effects of Individual Tax Dimensions

This section explores the contribution of each of the tax dimensions on TFP and output. For this purpose, we perform two sets of simulations. The simulation method is similar to the one employed in the previous section. In the first set of simulations, we set the financial friction at each country's level and approximate the joint distribution between the individual tax dimension and TFP using copulas. The simulation is performed for each tax dimension.[16] The simulated output and TFP are highly correlated with the data for each of the four dimensions. The dispersion measure for output is 43%, 38%, 43%, and 37% for regulation, corruption, infrastructure and crime, respectively. To isolate the effect of each tax dimension from the effect of financial friction, in the second set of simulations, we set the financial friction at the U.S. level and approximate the joint distribution between the individual tax dimension and TFP using copulas for each of the four dimensions. The dispersion measure for output is 5%, 4%, and 3% for regulation, infrastructure and crime respectively while corruption has little contribution on the dispersion of output.

[16]For each simulation, We again include countries with a minimum of 100 establishments with TFP and the simulated tax dimension available.

7 Robustness

7.1 Pareto Distribution for Managerial Ability

In the earlier analysis, we assumed that managerial ability follows a log normal distribution. In this section, we assume that managerial ability follows a Pareto distribution. We recalibrate the model following the same strategy as in section 4. Using the calibrated parameters, we simulate the model for African countries as in section 6.2.1. The model's results for output, TFP and capital per worker are plotted against the data in figure 6. The OLS regression coefficients between the model and the data are all significant at the 1% level. Figure 6 demonstrates that the model's results with the Pareto distribution are similar to that with log normal distribution. The dispersion measure has a value of 60% with the Pareto distribution.

7.2 Alternative Calibration

The analysis so far has relied on the model that is calibrated to the U.S. economy. Alternatively, we can calibrate the economy to an African country and then explore the effects of the tax and financial frictions on output and TFP. This section assess the robustness of the results by calibrating the model economy to Nigeria, the country with the largest sample size in our data.

Since there are no studies on the parameter value for returns to scale in African countries, we set it to the same value as for the U.S. and set capital share to be $1/3$ and labor share to be $2/3$ of the returns to scale. We set the interest rate to be 9% which is the average discount rate for African countries from the IMF International Financial Statistics database (IFS). We calibrate the managerial ability distribution to match the establishment distribution in Nigeria while we chose η to match its debt to GDP ratio. Because taxes are positive for establishments in Nigeria, in the calibration we use the copula to approximate the joint distribution between the tax and productivity in the data.

With the calibrated model, we first conduct three experiments. In the first experiment, we set the tax level of Nigeria to zero but keep its level of financial development. This leads to an increase of 20% in output and an increase of 12.7% in TFP. The effects are comparable to those obtained from the calibration to the U.S. economy, where the tax channel alone leads to a

17% decline in Nigerian output and a 13% decline in Nigerian TFP. In the second experiment, we increase financial development to the US level but use the copula to approximate the joint distribution between the tax and productivity in Nigeria. This leads to a doubling of output and an increase of 6.4% in TFP. With the calibration to the U.S. economy, the finance channel alone leads to a decrease of 36% in output and a decrease of 8% in TFP. In the third experiment, we increase the financial development to the US level and set taxes to zero. This increases output by a factor of 2.4 and increases TFP by 20%. This is line with the findings from the calibration to the U.S. economy where incorporating both taxes and financial frictions leads to a 47% decrease in output and a 20% decrease in TFP for Nigeria.

We also simulate the effect of the tax and financial frictions for African countries using the calibrated model as in section 6.2.1. The results are reported in figure 7. Both the model and the data values are normalized by the values for Nigeria. The figure shows that the model results and data values are highly correlated. The OLS regression coefficients between the model and the data are all significant at the 1% level. The dispersion measure for output has a value of 30%.

8 Conclusion and Policy Implications

This paper shows how various dimensions of the business environment affect output and productivity in African countries. We find that the poor business environment discussed in various papers in the literature is quite damaging to African development. Businesses lose large shares of their sales due to government regulations, poor infrastructure, corruption and crime. The implications of these losses are lower aggregate output and lower TFP. Low financial development, measured as intermediated capital relative to output, contributes significantly to the poor economic performance in Africa. It leads to low capital levels and misallocates resources and hence lower output and TFP.

While some improvements in the business environment are costly and will require considerable time to achieve, others can be achieved with little cost, if there is strong political will. For example, the time managers spend dealing with government regulation can be decreased

by simplifying the regulatory environment. Governments can simplify their tax codes, reform labor laws and decrease the number of licenses and inspections required for businesses. Cumbersome regulation system and large bureaucracy encourage bureaucrats and businesses to be involved in corruption, especially if the chances of being caught and punished are low. In addition, reforming the judicial system to make it more efficient in punishing corrupt officials and criminals can decrease levels of corruption and crime.

Improving the quantity and quality of infrastructure has great potential to benefit the long-term development of Africa, but it is costly. Building more roads and railways and generating more electrical power require large investments. To finance such investments, countries must explore new financing mechanisms, such as public-private partnerships, toll roads, licensing access to mineral resources against infrastructure development and so on. In recognition of the huge infrastructure deficit, several African countries in coordination with development partners have taken some of these new financing mechanisms. For instance, a number of countries have traded infrastructure investments by China against mining rights. The African Development Bank is also involved in the design and financing of many infrastructure projects in the continent.

Improving access to credit for businesses is another difficult but necessary ingredient in Africa's long-term development. This can be achieved by changes in banking and financial regulations that encourage more savings, that make resolution of disputes between lenders and borrowers more efficient, and that provide more information to financial institutions on borrowers' backgrounds. Moreover, for finance to play an important role in African economies, costs and interest rate spreads must decrease substantially. Beck et al. (2009) points to some necessary institutional and policy changes for the financial sector.

In summary, this paper points to key institutions and policies that make the business environment in Africa unfriendly and quantifies the effects of these institutions and policies on output and TFP. To achieve their long-term development objectives, African countries must make changes to facilitate a business environment that is friendly to business operation and growth.

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Table 1: Business Environment in Sub-Saharan Africa

	Corruption		
	Percent of firms expected to give gifts to public officials "to get things done"	Bribery index (% of gift or informal payment requests during public transactions)	Percent of firms identifying corruption as a major constraint
OECD	12.1	3.1	13.9
SSA	34.9	19.2	37.9
	Crime		
	Losses due to theft and vandalism (% of annual sales)+ Products shipped that were lost due to theft (% of product values)	Security costs (% of annual sales)	Percent of firms identifying crime, theft and disorder as a major constraint
OECD	0.3	0.8	9.6
SSA	2.7	2.0	28.5
	Infrastructure		
	Losses due to electrical outages (% of annual sales) + Proportion of products lost during shipping (%)	Percent of firms identifying electricity as a major constraint	Percent of firms identifying transportation as a major constraint
OECD	1.3	16.4	11.3
SSA	8.2	50.3	27.8
	Regulation		
	Senior management time spent dealing with the requirements of government regulation (%)	Percent of firms identifying business licensing and permits as a major constraint	Percent of firms identifying tax administration as a major constraint
OECD	4.2	10.8	19.7
SSA	7.7	16.5	27.5
	Access to Finance		
	Percent of firms with a bank loan/line of credit	Proportion of investments financed by banks (%)	Percent of firms identifying access to finance as a major constraint
OECD	44.0	21.1	14.6
SSA	22.5	10.0	45.6

Note: The numbers in the table are simple averages across firms and countries derived from the custom query of ES webpage. The OECD includes 9 countries (Czech Republic, Germany, Greece, Hungary, Ireland, Korea, Portugal, Slovak and Spain) and SSA includes 39 countries.

Table 2: Correlation Coefficients

	log GDP per capita
regulation	-0.15
crime	-0.32
infrastructure	-0.43
corruption	-0.42
finance	0.53

Note: The sample consists of 123 countries mostly from developing countries and Eastern Europe. The Business environment data is from the custom query of ES webpage.

Table 3: Parameter Values

β	α	μ	r	η_{US}	g_{mean}	g_{std}
0.4565	0.2833	0.5667	1.1911	0.50	-1.9958	0.4123

Table 4: Business Environment Statistics for Africa

country	sample size	obs. for tfp	regu-lation	corrup-tion	crime	infras-tructure	”tax”	Fin./ US(%)
AGO	421	172	7.3	2.9	5.3	4.6	20.0	6.7
BDI	270	90	5.8	4.6	4.5	9.0	23.8	8.6
BEN	150	39	5.8	4.6	5.1	4.1	19.6	10.2
BFA	371	34	6.0	0.4	3.5	2.9	12.9	8.8
BWA	337	108	5.0	0.9	5.5	2.5	14.0	12.2
CIV	503	115	1.9	9.6	6.8	6.2	24.4	8.2
CMR	347	82	5.4	2.5	5.0	4.9	17.8	5.6
COG	135	19	5.2	7.6	8.5	11.2	32.5	1.8
CPV	148	43	5.6	0.0	4.7	4.9	15.3	25.0
ETH	357	283	3.8	0.7	1.2	1.0	6.7	10.8
GAB	139	117	3.9	5.4	6.7	2.7	18.6	4.9
GHA	613	371	3.6	1.9	7.9	6.5	19.9	7.5
GIN	223	100	2.9	4.9	12.3	11.8	31.9	2.7
GMB	174	28	5.8	3.8	7.7	9.7	27.1	6.6
GNB	155	43	3.1	3.7	2.8	4.5	14.2	2.0
KEN	757	492	6.3	2.7	1.3	6.5	16.8	14.8
LBR	150	128	6.8	4.3	7.1	4.4	22.6	5.5
LSO	136	125	4.2	4.5	9.6	4.7	23.0	5.6
MDG	355	141	12.0	8.5	5.4	7.9	33.8	5.5
MLI	619	301	2.4	1.2	3.5	2.3	9.3	9.1
MRT	230	78	5.3	3.9	5.5	2.4	17.2	12.9
MUS	381	117	6.5	7.1	5.4	2.3	21.3	40.8
NER	137	43	13.0	1.9	6.2	3.3	24.4	5.1
NGA	2387	1391	6.5	1.9	6.9	10.0	25.3	12.7
RWA	212	47	5.3	2.2	4.9	7.2	19.6	5.8
SEN	625	259	3.4	1.3	3.3	5.5	13.4	12.2
UGA	557	267	5.3	3.6	6.3	8.8	24.0	6.1
ZAF	1056	679	5.9	0.7	3.8	2.3	12.8	79.4
ZAR	340	149	6.1	5.0	6.4	7.0	24.4	2.8
ZMB	603	302	4.7	1.0	5.0	3.9	14.7	5.8
Mean	429.6	205.4	5.5	3.4	5.6	5.5	20.0	11.5
Stddev	431.7	269.6	2.3	2.5	2.3	2.9	6.6	14.9

Note: The table shows the overall averages of regulation, corruption, crime, infrastructure and their total for each country. The last column shows the debt to GDP ratio relative to the US.

Table 5: Correlation Between TFP and Tax

Country	Output	Tax	Regulation	Corruption	Crime	Infrastructure	Tax Expediture
AGO	0.68^{***}	0.13^{*}	0.02	0.13^{*}	0.22	0.1	0.17^{**}
BWA	0.94^{***}	-0.04	0.06	-0.09	-0.16	-0.11	0.3^{***}
CIV	0.93^{***}	0.08	0.45^{***}	-0.2	-0.42^{**}	-0.31^{**}	0.34^{***}
ETH	0.82^{***}	-0.12^{**}	-0.02	-0.11^{*}	-0.35^{***}	-0.07	0.12^{**}
GHA	0.88^{***}	0.09^{*}	-0.01	0.12^{**}	0.05	0.08	0.17^{***}
GIN	0.84^{***}	-0.05	-0.07	-0.06	-0.24	-0.03	0.18^{*}
KEN	0.92^{***}	-0.11^{**}	0.11^{**}	-0.14^{***}	-0.15^{***}	-0.15^{***}	0.38^{***}
LBR	0.95^{***}	0.32^{***}	0.35^{***}	0.08	0.07	-0.03	0.29^{***}
LSO	0.93^{***}	-0.19^{**}	-0.12	0.23	-0.52^{***}	-0.02	0.3^{***}
MDG	0.86^{***}	0.18^{**}	0.16^{*}	0.22	-0.11	0.04	0.38^{***}
MLI	0.92^{***}	0.13^{**}	0.06	0.20^{***}	0.18	-0.04	0.31^{***}
MUS	0.88^{***}	-0.01	0.04	-0.48	-0.25	-0.17	0.21^{**}
NGA	0.82^{***}	-0.05^{*}	-0.08^{***}	-0.02	0.08	-0.03	0.22^{***}
SEN	0.89^{***}	-0.07	0.05	0.05	-0.15	-0.22^{***}	0.34^{***}
UGA	0.9^{***}	0.18^{***}	0.27^{***}	0.19^{***}	-0.13	0.05	0.43^{***}
ZAF	0.88^{***}	0.15^{***}	0.14^{***}	-0.07^{*}	0.05	-0.01	0.34^{***}
ZAR	0.9^{***}	0.03	0.07	0.1	-0.32^{*}	0.02	0.18^{**}
ZMB	0.9^{***}	-0.07	0.04	-0.2^{***}	0	-0.19^{***}	0.18^{***}

Note: The values in the table show the correlation coefficients in the data. The stars indicate significance level..

Table 6: Benchmark Experiments

	Relative to benchmark							
	GDP worker	TFP	K/L	Size	*Z_cut*	*Z_avge*	Share of man-agers	Output per est.
	Taxes							
10%	0.86	0.90	0.86	1.00	1.00	1.00	1.00	0.86
20%	0.73	0.80	0.73	1.00	1.00	1.00	1.00	0.73
30%	0.61	0.70	0.61	1.00	1.00	1.00	1.00	0.61
40%	0.49	0.60	0.49	1.00	1.00	1.00	1.00	0.49
	Finance Relative to the benchmark							
40%	0.78	0.99	0.35	0.49	0.85	0.87	2.16	0.36
20%	0.67	0.95	0.21	0.35	0.77	0.81	3.16	0.21
10%	0.62	0.90	0.17	0.28	0.72	0.77	4.10	0.15
5%	0.59	0.88	0.15	0.27	0.71	0.75	4.44	0.13
	Averages for Africa							
Mean finance and tax	0.45	0.72	0.12	0.28	0.72	0.77	4.10	0.11
Decrease tax by 1 std. dev.	0.50	0.78	0.14	0.28	0.72	0.77	4.10	0.12
Increase finance by 1 std. dev.	0.48	0.75	0.15	0.33	0.76	0.80	3.46	0.14
Improve both	0.54	0.81	0.16	0.33	0.76	0.80	3.46	0.16

Table 7: Individual Effects of Tax and Financial Friction

		Finance and Tax	Finance only	Tax only
	Average	0.56	0.64	0.90
Y	Std dev	0.09	0.09	0.04
	Average	0.82	0.90	0.92
TFP	Std dev	0.06	0.04	0.03
	Average	0.18	0.28	0.93
K/L	Std dev	0.13	0.13	0.03
	Average	4.84	3.97	1.30
Share of managers	Std dev	1.29	0.91	0.24
Dispersion explained by model		48%	39%	11%

Note: The values in the table show the summary statistics of the simulation for 18 countries. The values are relative to the benchmark economy (US). .

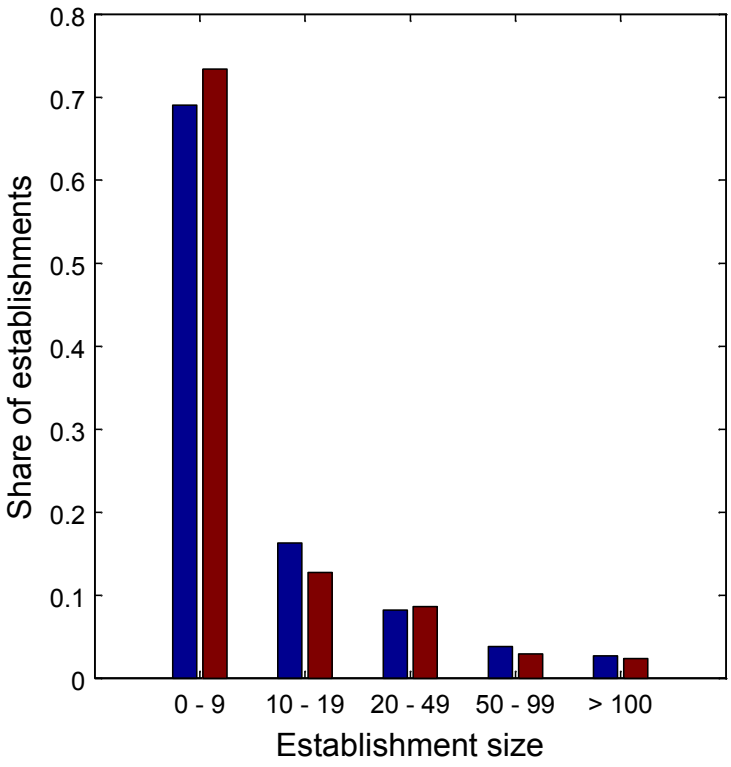


Figure 1: Distribution of establishments by employment levels: Model vs. Data

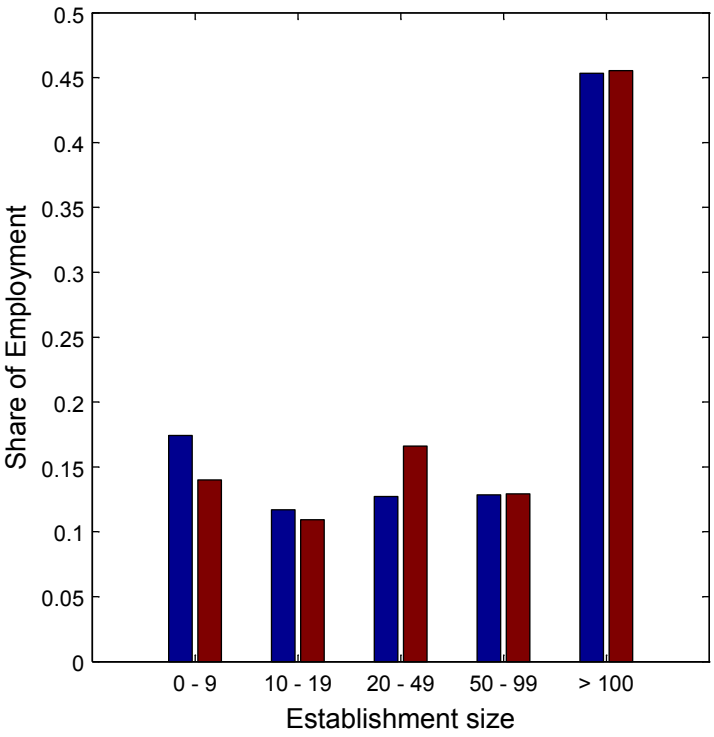


Figure 2: Distribution of employment: Model vs. Data

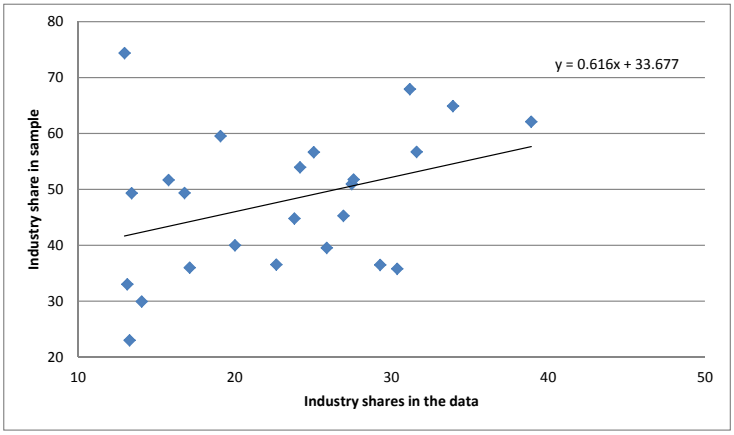


Figure 3: Share of Industry in Sample vs Share of Industry Value Added

Note: The figure plots for each country the industry share of value added from WDI online against the shares in the sample. The survey includes a question about the main sector of activity.

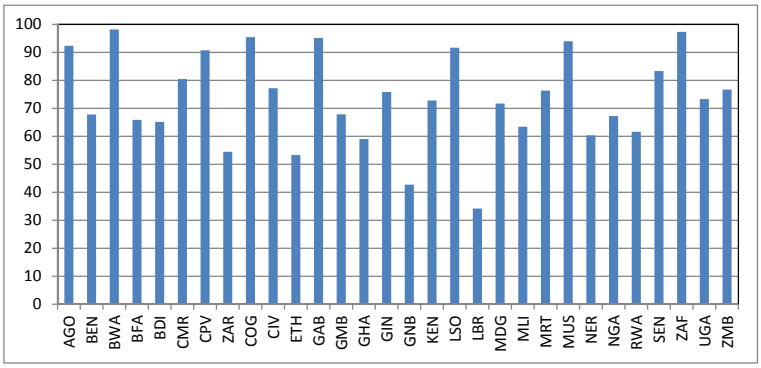
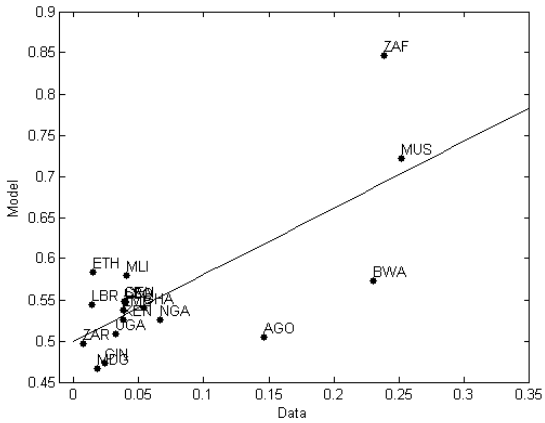
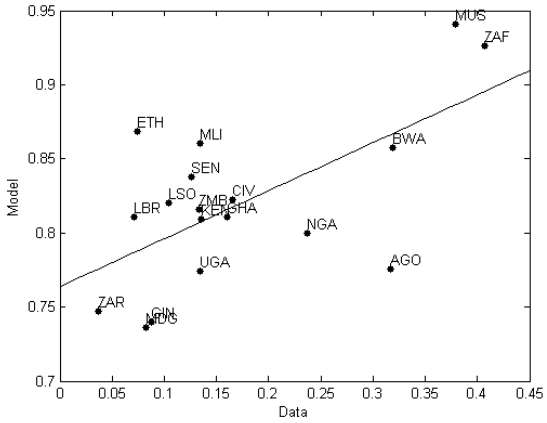


Figure 4: Shares of Non-Agriculture in Value Added

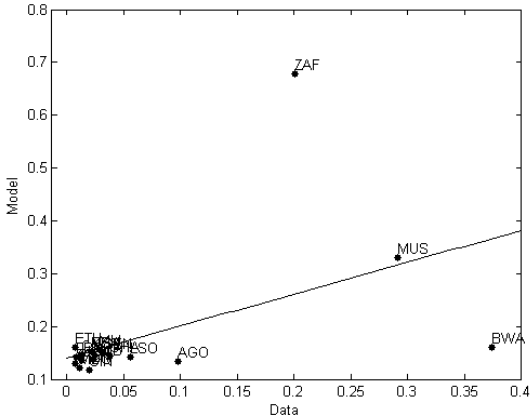
Figure 5: The Effects of Tax and Financial Frictions



(a) GDP per Worker



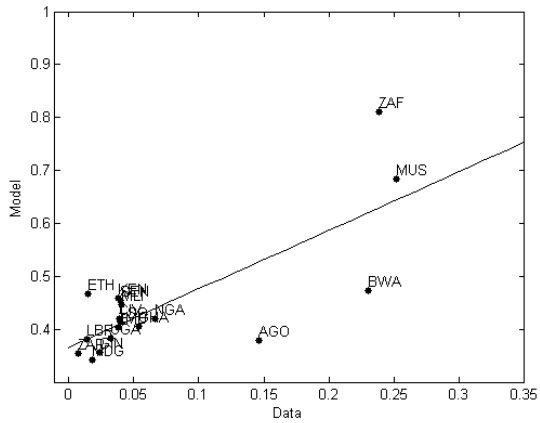
(b) TFP



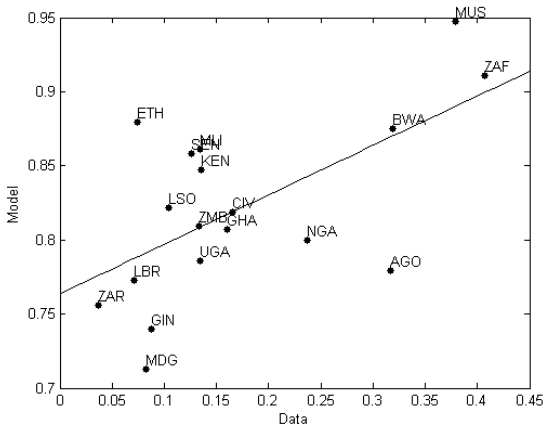
(c) Capital Per Worker

Note: The figure plots GDP per worker, TFP, and capital per worker from the data against the model predictions. Each circle represents one country.

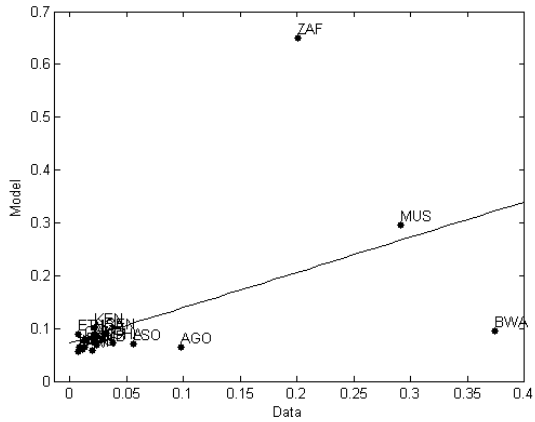
Figure 6: Pareto Distribution



(a) GDP per Worker



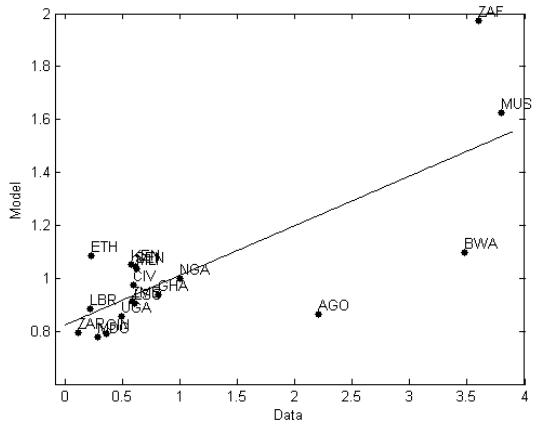
(b) TFP



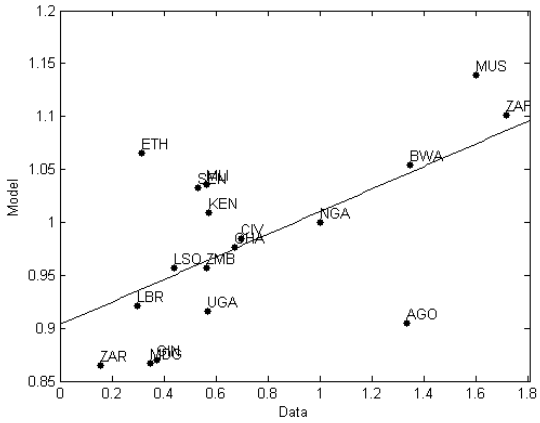
(c) Capital Per Worker

Note: The figure plots GDP per worker, TFP, and capital per worker from the data against the model predictions. Each circle represents one country.

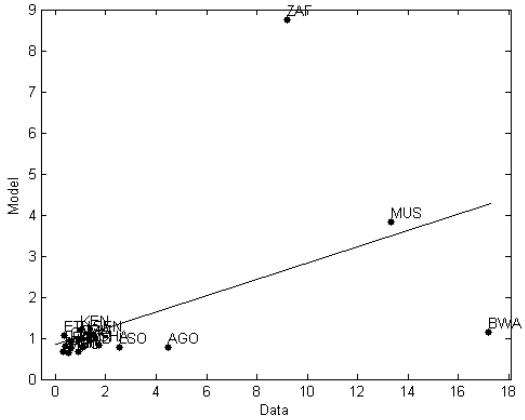
Figure 7: Calibration to Nigeria



(a) GDP per Worker

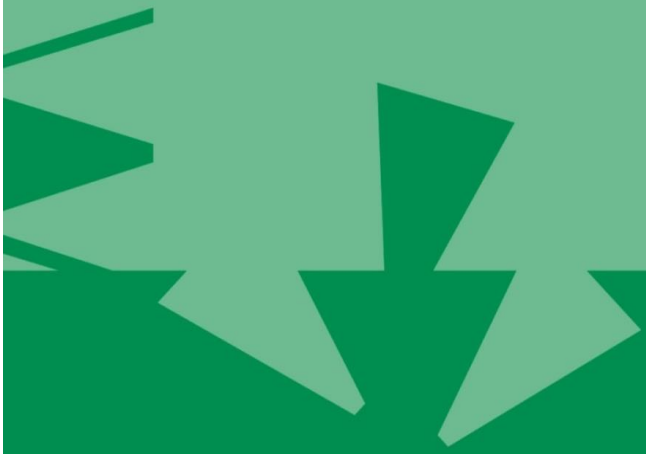


(b) TFP



(c) Capital Per Worker

Note: The figure plots GDP per worker, TFP, and capital per worker from the data against the model predictions. Each circle represents one country.



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