

Impact of the Business Environment on Output and Productivity in Africa

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Motivation

- Sub-Saharan Africa is still the least developed region of the world
- One reason: failure to implement institutions and policies favorable to private sector development
- With a poor business environment, there are high share of micro-enterprises with low productivity and employment opportunities
- Labor intensive manufacturing is non-existent or very small in most countries. People move from the rural sector into the informal service sector.

Motivation

- Consequence: low capital stock and aggregate total factor productivity
- Factors affecting capital accumulation and TFP:
 - Investment climate
 - Financial development (Greenwood and Jovanovic (1990), Amaral and Quintin (2009), Levine (2005))
 - Resource misallocation due to policies and institutions (Restuccia and Rogerson (2008), Hsieh and Klenow (2009))
- This paper focuses on the quantitative effects of the business environment on TFP and output in Sub-Saharan Africa

Few Business Environment Indicators

Corruption

	Give gifts	Bribery index	Corruption major constraint
OECD	12.1	3.1	13.9
SSA	34.9	19.2	37.9

Crime

	Theft and vandalism losses	Security costs	Crime major constraint
OECD	0.3	0.8	9.6
SSA	2.7	2.0	28.5

Infrastructure

	Electrical outage and shipping losses	Electricity major constraint	Transportation major constraint
OECD	1.3	16.4	11.3
SSA	8.2	50.3	27.8

Access to Finance

	Firms with a bank loan/line of credit	% of investments financed by banks	Access to finance major constraint
OECD	44.0	21.1	14.6
SSA	22.5	10.0	45.6

Mechanisms

- Focus areas: financial development, regulatory burden, corruption, crime and poor infrastructure.
- The model combines Amaral and Quintin (2009) and Restuccia and Rogerson (2008)
- The five areas of the business environment will enter the model in two ways:
 - Capital is financed from own savings or borrowing. Financial development affects the borrowing limit. Poor financial development lowers firm size and productivity
 - Other areas of the business environment (regulation, corruption, infrastructure and crime) enter as “tax” on output. The tax has a direct effect on TFP and output but also causes misallocation of resources
 - The interaction between the tax and financial constraints can magnify or reduce the effects of misallocation

Model

- Agents are born with managerial talent $z \sim \mu$, which is public information
- They live two periods:
 - First period: supply 1 unit of labor
 - Second period: work or start a business and become manager
- Preferences are given by:

$$U(c_1, c_2) = \log(c_1) + \beta \log(c_2)$$

Managers

- A manager with talent z , produces according to a decreasing return technology:

$$F(k, l) = zk^{\theta}l^{\mu}; \quad \theta + \mu < 1$$

- Two sources of financing for capital: personal savings or external borrowing at the rate r
- Because of the poor business environment, managers lose a fraction τ of output-“tax”:
 - τ is firm specific. Use distribution of losses across firms in a given country

Problem of the manager

- The profit for a manager with ability z , savings s and capital $k = s + d$ is given:

$$\pi(k, z) = \max_l (1 - \tau)zk^\theta l^\mu - wl - k(1 + r)$$

- With perfect financial market, the manager chooses

$$k^* = \operatorname{argmax}(\pi(k, z))$$

- But the financial market is imperfect in the sense that the manager can default on his loan

Problem of managers

- If a manager defaults, he loses a fraction η of his income

$$\begin{aligned}
 V(s, z) &= \max_{b \geq 0} \pi(s + b, z) \\
 \text{s.t. } &\pi(s + b, z) \geq \\
 &(1 - \eta) [\pi(s + b, z) + b(1 + r)]
 \end{aligned}$$

- This implies a borrowing limit:

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

- Lower financial development (low η) and higher “taxes” (poor business environment) all lead to lower borrowing limit, hence to lower capital and output.

Problem of Young agents

- The problem of young agents is as follows:

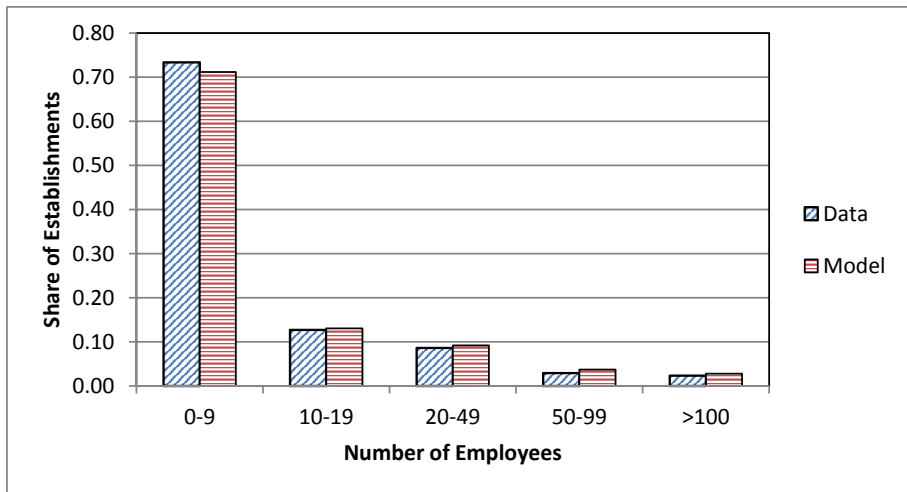
$$\begin{aligned}
 & \max_{c_1, c_2, s} && \log(c_1) + \beta \log(c_2) \\
 \text{s.t: } & c_1 + s &= & w \\
 & c_2 &= & s(1 + r) + \max(w, V(s, z; w, r, \tau))
 \end{aligned}$$

- Implies that there is an ability threshold (\underline{z}) below which agents become workers and above which agents become managers.

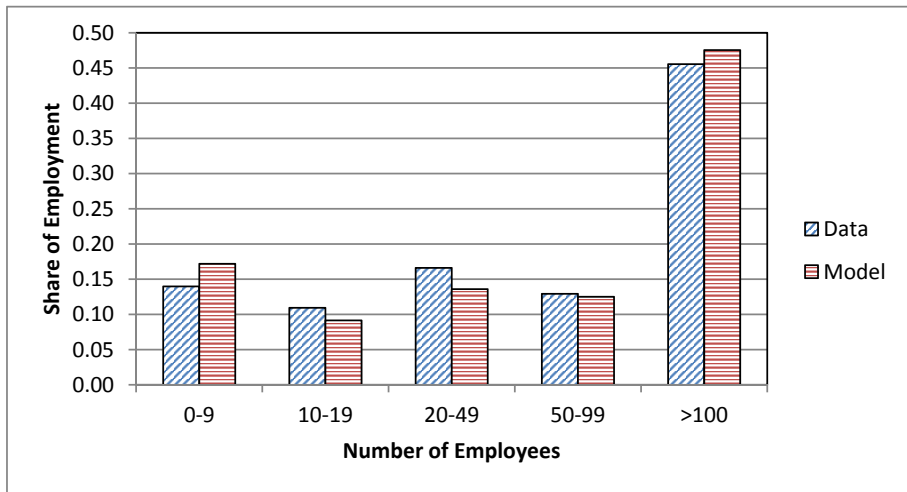
Calibration

- The model is calibrated to the US economy
- Follows Amaral and Quintin (2009)-Most parameter values are standard
- Model's period is 20 years
- For η , we target the ratio of intermediated capital to GDP, which is 2.2 for the US.
- Managerial talent follows log normal distribution and we target size distribution of firms as in the 2007 US census data

Distribution of establishments by employment levels-Model vs. Data



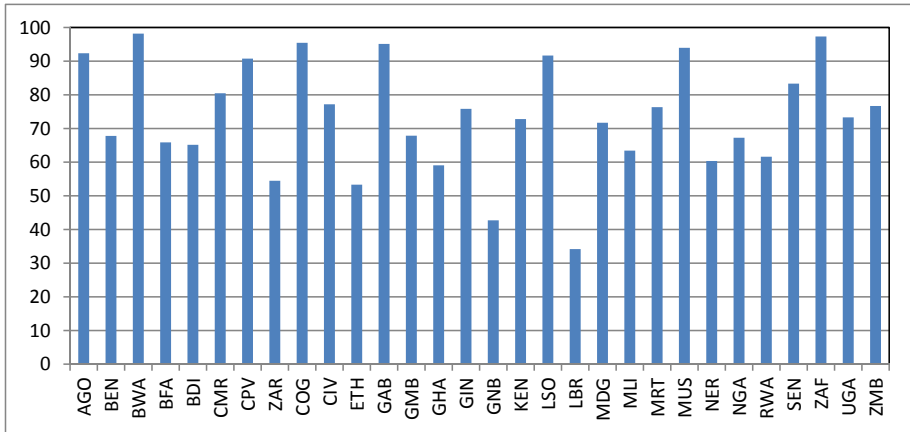
Distribution of employment-Model vs. Data



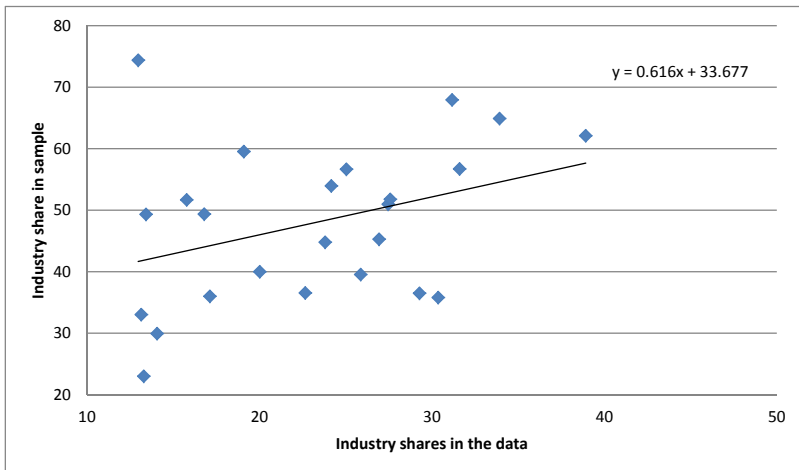
Data

- 30 countries in Sub-Saharan Africa
- Data from the Penn World Table 7.0, the World Bank Enterprise Surveys (ES) and the World Bank Global Development Finance Database
- Worry that Africa consist mostly of agricultural economies-Not the case in terms on output shares (see figure)
- The ES survey focus on firms in industry and services with proportional representation of industry-correlation between shares of firms in industry from the sample and data is 0.35 after the elimination of few outliers (Angola, Nigeria, Gabon, Botswana)

Shares of Non-Agriculture in Value Added



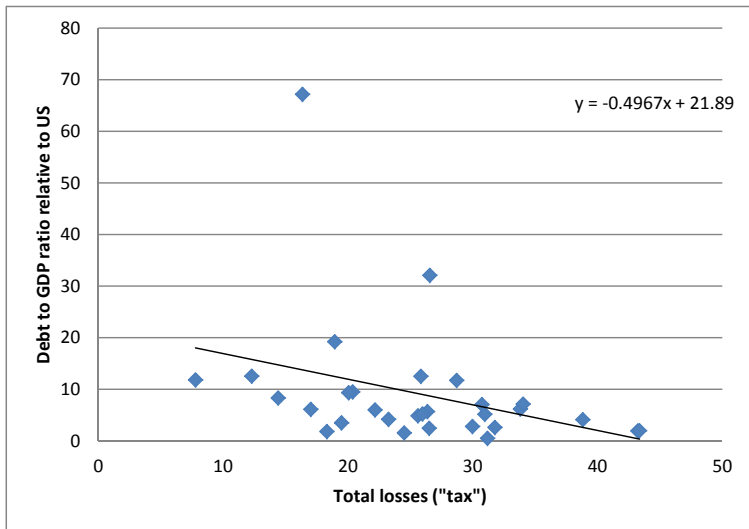
Share of Industry in Sample vs Share of Industry Value Added



Data

- **Regulation** = average time managers spend dealing with government regulation
- **Crime** = percentage of sales lost due to theft, robbery, vandalism and arson, the % of sales paid for security, and the percentage of products shipped to domestic markets lost due to theft
- **Infrastructure** = percentage of sales lost due to power outages and the percentage of shipment lost during transit
- **Corruption** = informal payments as a percentage of sales
- **Financial intermediation** = average domestic credit to the private sector as a percentage of GDP for the years 2000-2005.
- The correlation among areas are of the expected signs

Cross-country losses and debt to GDP ratio



Summary Statistics

	Mean	Std. Deviation
Regulation	5.5	2.3
Crime	9.7	4.0
Infrastructure	7.1	3.4
Corruption	3.5	2.5
Total "Tax"	25.6	8.85
Finance rel. US	9.2	12.6
Finance w/out South Africa	7.2%	6.3%

Correlation Coefficients

	regula- tion	crime	infras- tructure	corrup- tion	finance	logGDP
regulation	1.00	0.18	0.15	0.43	-0.06	-0.15
crime		1.00	0.45	0.20	-0.26	-0.32
infrastructure			1.00	0.36	-0.30	-0.43
corruption				1.00	-0.31	-0.42
finance					1.00	0.53

Note: Based on a larger sample of 123 countries

Experiments

Relative to benchmark								
	GDP worker	TFP	K/Y	Size	Z_cut	\bar{Z}	Mgrs	Output/es
Taxes								
10%	0.86	0.90	1.00	1.00	1.00	1.00	1.00	0.86
20%	0.73	0.80	1.00	1.00	1.00	1.00	1.00	0.73
30%	0.61	0.70	1.00	1.00	1.00	1.00	1.00	0.61
40%	0.49	0.60	1.00	1.00	1.00	1.00	1.00	0.49
Finance Relative to the benchmark								
40%	0.75	1.00	0.45	0.55	0.87	0.89	1.88	0.40
20%	0.65	0.95	0.33	0.36	0.78	0.81	3.01	0.21
10%	0.59	0.89	0.29	0.28	0.71	0.76	4.11	0.14
5%	0.56	0.86	0.28	0.25	0.68	0.73	4.79	0.12

Experiments-Average Africa

	Relative to benchmark							
	GDP worker	TFP	K/Y	Size	Z_cut	\bar{Z}	Mgrs	Output/e
Averages for Africa								
Mean fin and tax	0.38	0.66	0.28	0.28	0.71	0.76	4.11	0.09
Lower tax 1 std. dev.	0.44	0.74	0.28	0.28	0.71	0.76	4.11	0.11
Increase fin. 1 std. dev.	0.41	0.69	0.31	0.32	0.75	0.78	3.52	0.12
Improve both	0.48	0.77	0.31	0.32	0.75	0.78	3.52	0.14

Channels

- Financial constraint:
 - Lower capital and capital to output ratio
 - Lower the wage, which lowers the cut-off to become a manager. More people enter including less efficient ones. Average efficiency and average size of firms decline.
 - Misallocation of resources-more inefficient managers using capital-aggregate TFP declines

- Homogenous tax:
 - Part of output is thrown away because of the tax, so TFP and GDP decline
 - The declines in TFP get amplified through lower use of capital

Firm-specific taxes

- Heterogenous taxes can lead to misallocation of resources depending on the correlation with productivity
- For each country, compute the total tax for each firm in the sample
- Needs to draw a sample of 100 tax rates corresponding to the managerial talent grid points
- Issue: what type of sampling to use?
- Use sales/worker as firm's productivity
- Use empirical copula to fit the joint distribution between productivity and the tax
- use the inverse of the distribution to draw 100 taxes that keep the correlation structure between tax and productivity
- Simulate the model 100 times for each country and show the average outcomes

Results for 30 African Countries

- GDP per worker drops by 20 to 58 percentage points
- TFP drops by 7 to 29 percentage points
- Reasons:
 - Lower skill cut-off for entrants: 62 to 91% of the US
 - More firms: 1.7 to 6.5 times more than the US
 - Lower average skill for managers: 68 to 92% of the US
 - Low capital to output ratio: 25 to 75% of the US
 - Lower average firm size: 19 to 66% of the US
 - Lower output per establishment: 7 to 52% of the US

Model Success: Output dispersion

- Measure of the dispersion of output captured by the model

$$v = 1 - \frac{\sum_i (\hat{y}_i - y_i)}{\sum_i (1 - y_i)}$$

- \hat{y}_i is relative income per capita in the model and y_i the corresponding value from the data
- We find: $v = 54\%$
- Big improvement from Amaral and Quintin (2009) which captured a 1/3 of output dispersion for their sample

Misallocation from taxes and interaction effects

- If more productive firms are taxed higher, then it can hurt average productivity
- Compare model outcomes for: $(\tau, \eta) = (0, \eta_i)$ vs baseline model
- We find that the tax lowers the cut-off and the average of managerial talent for most countries.
- So for these countries there is amplification of the misallocation
- The change in average managerial talent vary between 0 and 7%
- For Benin and Burkina Faso, the interaction reduces the misallocation

Conclusion

- The business environment have large quantitative effects
- Financial constraints lowers output and TFP through lower capital to output ratio, lower firm size and misallocation of resources
- The taxes have a direct effect on output and TFP but they also lower capital and interact with the financial constraint to increase misallocation for most countries.
- Overall the model explains about 54% of the variation in relative income for the sample

Policy Recommendations

- The poor business environment is very damaging for Africa
- Small improvements can have sizable effects
- Simplify regulation. While, in Canada it takes 2 procedures to start a business, it takes 18 in Uganda
- Improve accountability of civil servants, reform the judicial system
- Protect private property
- Need to improve the infrastructure-Look for alternative financing schemes
- Develop the financial system-crucial role for government-ways to include the informal sector (which is large in most African countries) in the banking and financial system

Results for 30 African Countries

Country	GDP worker	TFP	K/Y	Size	Z_cut	\bar{Z}	Managers	Output/est.
AGO	0.43	0.73	0.27	0.20	0.64	0.69	6.03	0.07
BEN	0.49	0.79	0.29	0.28	0.71	0.76	4.11	0.12
BWA	0.52	0.83	0.29	0.25	0.69	0.74	4.68	0.11
BFA	0.53	0.82	0.29	0.25	0.69	0.74	4.66	0.11
BDI	0.50	0.78	0.31	0.22	0.65	0.71	5.58	0.09
CMR	0.46	0.76	0.27	0.22	0.66	0.71	5.47	0.09
CPV	0.56	0.87	0.32	0.34	0.76	0.79	3.48	0.17
ZAR	0.42	0.72	0.25	0.21	0.64	0.70	5.89	0.07
COG	0.44	0.72	0.28	0.19	0.62	0.68	6.45	0.07
CIV	0.50	0.79	0.28	0.22	0.66	0.71	5.38	0.09
ETH	0.54	0.86	0.29	0.31	0.74	0.78	3.71	0.15
GAB	0.51	0.80	0.28	0.22	0.66	0.71	5.45	0.09
GMB	0.48	0.78	0.28	0.24	0.67	0.72	5.19	0.10
GHA	0.49	0.78	0.28	0.22	0.65	0.71	5.50	0.09
GIN	0.42	0.72	0.26	0.20	0.64	0.70	5.97	0.07
GNB	0.47	0.77	0.27	0.23	0.67	0.72	5.19	0.09

Results for 30 African Countries

Country	GDP worker	TFP	K/Y	Size	Z_cut	\bar{Z}	Managers	Output/est.
KEN	0.50	0.79	0.30	0.25	0.69	0.73	4.76	0.11
LSO	0.47	0.78	0.26	0.23	0.67	0.72	5.07	0.09
LBR	0.49	0.79	0.27	0.22	0.66	0.71	5.43	0.09
MDG	0.43	0.71	0.28	0.20	0.64	0.70	5.98	0.07
MLI	0.53	0.84	0.28	0.26	0.70	0.74	4.46	0.12
MRT	0.52	0.83	0.29	0.27	0.71	0.75	4.29	0.12
MUS	0.64	0.90	0.41	0.37	0.78	0.82	2.95	0.22
NER	0.43	0.74	0.25	0.25	0.68	0.73	4.93	0.09
NGA	0.46	0.75	0.28	0.23	0.67	0.72	5.26	0.09
RWA	0.44	0.74	0.26	0.23	0.66	0.72	5.37	0.09
SEN	0.52	0.82	0.29	0.25	0.69	0.74	4.59	0.11
ZAF	0.80	0.93	0.70	0.66	0.91	0.92	1.57	0.52
UGA	0.44	0.74	0.26	0.21	0.65	0.71	5.59	0.08
ZMB	0.47	0.77	0.27	0.24	0.68	0.73	4.99	0.10

Calibration

- The model is calibrated to the US economy
- Follows Amaral and Quintin (2009)-Most values are standard
- Model's period is 20 years
- $r = 1.04^{20} - 1$ and $\beta = \left(\frac{1}{1.04}\right)^{20}$
- Return to scale factor 0.85, capital share 1/3
- For η , we target the ratio of intermediated capital to GDP, which is 2.2 for the US.

Calibration

- Managerial talent follows log normal distribution and we target size distribution of firms as in the 2007 US census data
 - Maximum firm size = 10,000
 - 73% of establishments have less than 10 employees
 - 2.3% of firms have more than 100 employees
 - Average employment level is 15.65