Advanced Development Economics: Business Environment and Firm Performance

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20 October 2009

1 Introduction

- Over the last two decades there have been **radical changes** in economic policy in many developing countries including most of Africa.

- A common factor in these changes has been a transition from economies where government controls were extensive to more open, **market-oriented**, regimes.

- The private sector thus plays a crucial role in the development process, and it is important that this sector performs well. Indeed, the main reason we are interested in understanding the determinants of performance in the private sector is that better performance raises the incomes and the standards of living of people in poor countries.

- In this lecture we have a look at the microeconomics of firms in developing countries.

The research papers underlying the lecture are the following ones:

Bigsten, A., Söderbom, M. (2006), "What Have We Learned from a Decade of Manufacturing Enterprise Surveys in Africa?",World Bank Research Observer, 21(2): 241-65.

Dollar, David, Mary Hallward-Driemeier and Taye Mengistae (2005). "Investment Climate and Firm Performance in Developing Countries," Economic Development and Cultural Change vol. 54, No 1..

Van Biesebroeck, J. "Firm Size Matters: Growth and Productivity Growth in African Manufacturing," Economic Development and Cultural Change, 2005, 53 (3).

The first and the last of these are concerned with African firms whereas the second looks at firms in Asia.

- One good way to make use of these papers when revising for the exam is to refer to them when reading the present notes, in case you need more details or a more complete discussion. In principle, however, if you know and understand the material covered in my lecture notes you should be able to answer my exam question(s). Thus there's no need to read every single letter in the above papers if you are short of time.

2 Business Environment & Firm Performance in Africa

The focus is on the manufacturing sector - two main reasons:

- The manufacturing sector is often perceived to be 'special'
  - Leading edge of "modernization";
  - Creates skilled jobs;
  - Generates technological spillover effects.

- Manufacturing growth not constrained by land (scarce). With high population growth & pressure on land, diversification beyond agriculture is necessary.

Further, manufacturing exports was a key factor in the rapid development of the Asian 'tigers' - can manufacturing in countries that are poor today serve as a similar 'engine of growth'?

- We should remember, however, that Africa's manufacturing sector is relatively small.

[Table: The relative size of manufacturing in Africa & China]

Table 3: Sectoral value added as % of GDP 1975-2007 in SSA and China

	1965	1970	1975	1980	1985	1990	1995	2000	2005	2007
Sub-Saharan Africa										
Agriculture	21.85	19.65	20.02	18.50	18.01	18.83	17.95	16.53	17.00	15.27
Industry	31.02	30.86	32.68	36.84	34.49	32.14	29.15	29.38	31.19	31.98
- manufacturing	17.50	17.86	17.63	16.58	16.47	17.60	15.77	14.52	13.11	14.48
Services	47.14	49.48	47.31	44.64	47.49	49.24	52.91	54.10	51.81	52.88
China										
Agriculture	37.94	35.22	32.40	30.17	28.44	27.12	19.96	15.06	12.59	11.13
Industry	35.09	40.49	45.72	48.22	42.89	41.34	47.18	45.92	47.68	48.50
- manufacturing	29.23	33.75	38.13	40.23	34.73	33.66	33.65	32.12	32.18	-
Services	26.97	24.29	21.88	21.60	28.67	31.54	32.86	39.02	39.72	40.37

Source: WDI 2009

2.1 African manufacturing: An overview of leading issues and findings

Reference: Bigsten and Söderbom (2006).

- Prior to the 1990s, very little data existed on enterprises in Africa. It was clear, however, that manufacturing **did not perform well** in most African countries. In the early 1990s, to get a better idea of why things were going wrong in the manufacturing sector and how to improve them, the World Bank fielded extensive data collection projects in many African countries

- A key objective of these projects was to collect **survey data** on a large number of individual manufacturing firms. A survey would typically cover

hundreds, sometimes thousands, of firms. The data are well suited to statistical analysis. The firms can often be followed over time, enabling researchers to document growth patterns.

- These data has generated a lot of empirical research. A rather general finding is as follows: While most African firms have not fared well during the last decade, some have performed extremely well. There is thus substantial **heterogeneity** in choices and outcomes across firms within countries in Africa.

- Compare & contrast such cases. What drives success? Firm-level data are very useful for this type of analysis.

- Bigsten and Söderbom (2006) survey this line of research, focussing on the business environment and enterprise performance. We're going to have a look at the main results.

2.1.1 The business environment

The business environment = the 'prime suspect' for explaining the poor enterprise performance in Africa. Improving the investment climate is seen as a policy priority for the continent. Leading constraints to doing business, cited by enterprise managers in Africa, are as follows:

- Financing
- Corruption
- Infrastructure

- Inflation

One implication of a poor investment climate is that the cost for services important for manufacturers will be high. We now know that African firms have high indirect costs (transport, logistics, telecommunications, water, electricity, land and buildings, marketing, accounting, security, bribes) compared with firms in Asia and that African firms suffer substantial losses from power outages, crime, shipment losses, and the like.

Risk.

- The African business environment exhibits considerable uncertainty - e.g. with regard to prices (including foreign exchange), demand, customer payment, reliability of infrastructure, and corruption. This is probably harmful for growth; however, investigating the effects of risk empirically is difficult since risk is not easily measured.

  - Fafchamps, Gunning, and Oostendorp (2000) show that Zimbabwean firms respond to risk by increasing their inventories, another example of how risk leads to conservative behavior and additional costs.

  - Pattillo (1998) uses data on entrepreneurs' subjective (or perceived) probability distribution over future demand, to calculate the variance of demand. Using this as a measure of uncertainty, she reports empirical results indicating that uncertainty has a negative effect on investment.

Access to credit. Are African firms constrained by poor access to credit? Data on firms' demand for external funds and on whether firms have had their loan applications approved shed, some light on this.

- Data (for the early and mid 1990s) indicate the demand for formal loans among African manufacturers is **low**: less than 20% of the firms surveyed had applied for a formal loan in the year prior to the survey. Among those applying, the majority of firms obtained loans, but there are large differences by firm size. Loan applications are less common among small firms, and the success rate is lower than among larger firms.

[Table 1 about here]

- Of course, a firm may be credit constrained even if it does not apply for a loan. A firm may expect an application to fail precisely because there are credit constraints and may therefore decide to avoid the transaction costs and not apply. Based on information on **why** firms did not apply for a loan ("did not want a loan", "too costly", "didn't think I'd get one" etc.), three groups of firms are distinguished:
  - those without a demand for credit (55%)
  - those with a demand for credit but constrained (33%)
  - those with a demand for credit and unconstrained (12%)

- Large differences are across firms of different sizes. Close to two-thirds of the micro firms appear constrained, but only 10 percent of the large firms.

About two-thirds of the large firms choose not to participate in the credit market compared with only a third of the micro firms. '

- For a micro firm to have the same chance of getting a loan as a large firm, the micro firm needs to have an average return on fixed capital more than 200 percentage points higher than the large firm.

[Table 2]

Table 1. Formal Credit Market Participation by Firm Size (Percent)

	Micro	*Small*	*Medium*	*Large*	*All*
Did not apply	92	82	80	75	82
Applied and did not receive	6	11	9	5	8
Applied and received	2	7	11	20	10

Source: Bigsten and others (2003):table 2.

Table 2. Credit Constraints by Firm Size (Percent)

	Micro	*Small*	*Medium*	*Large*	*All*
No credit demand	33	50	67	66	55
Demand, but rejected[a]	64	42	21	10	33
Received loan	3	8	12	23	12

[a]Includes firms that suggested that a loan application would be rejected by banks.

Source: Bigsten and others (2003).

Labor and skills. Labor costs and the supply of labor and skills are important for firm performance. Two common results in this area have emerged from the research on the African survey data:

1. Earnings and productivity are positively correlated with workers' education.

2. Wages differ significantly across firms of differing size, even when comparing workers with similar levels of human capital. These results suggest that earnings rise with firm growth.

Combined with the insights from the research on credit and investment, this gives a picture in which small firms have relatively low labor costs but high capital costs; while large firms have relatively high labor costs and low capital

costs. This might explain why the capital-labor ratio is much higher in relatively large firms (note "large" is relative - by international standards, nearly all firms in these samples are small).

Structure of the manufacturing sector A lot of very small and informal firms operate side by side with a small number of large-scale factories. Is this good use of scarce resources, or will there be a deadweight loss due to inefficient resource allocation?

Consider the production function

$$y_i = \alpha l_i + \beta k_i + a_i,$$

where y_i, l_i, k_i denote log output, labour and capital, respectively, and a_i is total factor productivity (TFP). TFP is generally unobserved. If $\alpha + \beta = 1$,we have constant returns to scale; if $\alpha + \beta > 1$ then increasing returns to scale; if $\alpha + \beta < 1$ then decreasing returns to scale.

- Kenyan survey data indicate no significant difference in TFP (a_i) between small informal and small formal African-owned firms. A reallocation of firms from the informal to the formal sector would thus not necessarily affect aggregate productivity.

- Moreover, there is little evidence of increasing returns to scale in Africa's manufacturing sector. Typically, we cannot reject $\mathsf{H}_0 : \alpha + \beta = 1$.

- Nevertheless, there is little investment and little exporting in the informal sector, and so growth in this sector is unlikely to be a source of significant modernization. Further, wages in the informal sector are low, and contributions to tax revenues miniscule. There is therefore a case for policies to encourage the formalization of informal firms.

2.1.2 Enterprise performance

Enterprise growth. Which types of firms grow? Recall that most firms in Africa are very small. How realistic is it to hope that some of these firms will grow and become successful large firms? Will new firms survive and grow?

- A common way of investigating the relationships between growth on the one hand and size and firm age on the other is to run regressions of the growth rate of employment between two periods on the explanatory variables employment and age in the initial period, e.g.

$$\Delta \log L_t = \beta_0 + \beta_1 \log L_{start-up} + \beta_2 \times Age + residual$$

- Several such studies have found a negative relationship between size and growth - i.e. β_1 and β_2 tend to be negative.

- Quite possibly, the modelling framework above is not general enough. A famous paper by Sleuwaegen and Goedhuys (2002), cited in Bigsten & Söderbom, report results indicating that small and large firms have very different growth patterns: high growth tends to be observed mostly among the small and young firms and the large and old firms.

- On firm survival, the data indicate **high exit rates** especially among the smallest firms. We have found that high **productivity** reduces the likelihood of exit for relatively large firms but not for small firms. In other words, being relatively more productive does not prevent firms from going out of business if they are small.

Investment African financial markets are the least developed in the world. One worry is that this may hold back investment - i.e. firms with profitable investment projects may not be able to proceed with the investment because of lack of finance. However if firms have no desire to invest, financial imperfections do not translate into binding constraints, so it's not obvious that financial imperfections always hamper investment.

- Bigsten and others (1999b), cited in Bigsten & Söderbom, test whether investment is sensitive to changes in cash flow among firms observed in the early and mid-1990s in Cameroon, Ghana, Kenya, and Zimbabwe. Why is such an analysis telling us anything about the role of credit constraints? The main idea is that, if it's hard to get credit, then if your own cash-flow increases this improves your ability to finance investment; however, if firms are not credit constrained, then changes to cash-flow won't matter so much for investment.

- The evidence from the data indicates that there is a statistically significant profit effect on investment, which suggests the presence of credit constraints. However, the effect is small: only between \$0.06 and \$0.10 cents of an additional \$1 earned in profits are invested.

- Subsequent research documents a larger profit effect among smaller firms, which is consistent with the notion that credit access is more of a problem for small firms. However, the estimated effect is still rather low (between \$0.11, cents of an additional \$1 earned in profits are invested)

Exports Manufacturing firms in Africa operate in small domestic markets. To expand production, firms may have to orient part of their production toward exporting. Important questions:

- What factors prevent African firms from entering export markets? An important factor determining whether a firm participates in the export market is the level of entry barriers. An indirect test for entry barriers is based on the following idea. With high entry barriers, it is costly for non-exporters to become exporters; but firms that have been exporters in the past can continue to supply the international market at relatively low cost. That is, once you have entered the exports market, you are likely to remain an exporter for some time, if entry costs are high. In the African data, few firms change export status over time, suggesting that entry costs are indeed high.

- Are there any benefits, other than market enlargement, associated with exporting? In particular, is there any evidence that firms become more productive as a result of exporting, perhaps because of contacts with foreign customers or exposure to international competition?

- In most datasets, exporting is concentrated amongst the more productive firms - i.e. exports and productivity positively correlated.

- In the literature there are two **hypotheses** with regard to the relation between exporting and productivity:

  - **self-selection**: more efficient firms choose to export (causality from efficiency to exporting)

  - **learning-by-exporting**: firms become more efficient as a result of exporting (causality from exporting to efficiency)

- The two hypotheses are not mutually exclusive. Most studies for high and middle income countries have found evidence supporting the self-selection hypothesis but not learning-by exporting.

- But now some evidence that learning-by-exporting holds for Africa - i.e. firms become more productive as a result of exporting.

- This suggests that active policies encouraging exports may help African firms to become more competitive.

- But then the high entry costs are problematic. Reducing these will help firms access a larger market, and may even result in learning-by-exporting effects on productivity.

2.1.3 Summary & Conclusions in Bigsten & Söderbom

Four main findings:

1. Investment in new equipment has remained low. Lack of credit appears not to be the main reason; high risk and low demand are more important factors. Caveat: Credit more important for the very smallest firms.

2. Manufactured exports from Africa remains low. Costs of entering the exports market appear high, and unless these can be reduced, we think chances are small that this will change in the foreseeable future.

3. Being exposed to international competition through exporting raises productivity.

4. Firm performance is hampered by poorly integrated domestic markets for labor and capital. Small firms face relatively low labour costs and high capital costs; large firms face high labour costs and low capital costs.

3 Firm Size, Growth and Productivity Growth

Reference: Van Biesebroeck (2005).

- The paper by Van Biesebroeck (2005) summarizes some important insights regarding the connections between firm size and growth in employment and productivity in African manufacturing.

- The paper makes use of firm-level survey data collected in Burundi, Cameroon, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Tanzania, Zambia, and Zimbabwe between 1992 and 1995. Around 200 firms per country & year, short panels, 4 sub-sectors, wide size range, wide range of variables. .

[Table 1 here]

Industry has small employment share, larger GDP share

Most surveyed firms are very small. And note that large firms are overrepresented in these samples.

TABLE 1
SUMMARY STATISTICS

	Aggregate Economy (1995)				Sample (First Wave of Interviews; Year Differs by Country)							
			Share of Industry			Employment per Firm			Frequency by Size Class			
	Pop. (mil)	GDP/ Capita (PPP)	In LF*	In GDP	Coverage of GDP†	Mean	Median	Number of Firms	Micro (≤5)	Small (6–24)	Medium (25–99)	Large (≥100)
Ethiopia	56.4	450	.02	.10	.79	155	10	217	.29	.42	.14	.15
Burundi	6.3	630	.03	.18	.65	61	12	120	.34	.28	.27	.11
Tanzania	29.6	640	.05	.17	.31	91	12	213	.23	.39	.21	.17
Zambia	9.0	930	.09	.40	.12	85	23	211	.20	.29	.32	.19
Kenya	26.7	1,380	.07	.17	.17	95	22	222	.28	.24	.27	.21
Côte d'Ivoire	14.0	1,580	.10	.20	.52	168	18	235	.30	.25	.25	.20
Ghana	17.1	1,990	.13	.16	.14	57	16	192	.23	.37	.25	.15
Zimbabwe	11.0	2,030	.08	.36	.26	292	90	199	.05	.25	.23	.47
Cameroon	13.3	2,110	.09	.23	.63	162	22	210	.17	.40	.26	.17

Source. World Bank (1997a), World Bank (1997b), and calculations based on RPED surveys.
* Share of labor force in 1990.
† Total sample value added (VA) as percentage of manufacturing GDP.

3.1 Productivity

Two productivity measures are used in the analysis:

- Labour productivity, defined:

$$LP = \frac{\text{value-added}}{\text{number of employees}}$$

- Total factor productivity, defined:

$$TFP = \frac{Y}{L^{s_l} K^{(1-s_L)}},$$

where Y is value-added, L is labour, K is physical capital (measured as the replacement value of plant & equipment), and s_L is the wage share

in value added. Notice that this is essentially the same approach as that often adopted in the macro literature.

- Key result: "In Africa, size is unusually important for success" (Van Biesebroeck, 2005, p.554).
  - Old firms have somewhat higher labour productivity than young firms.
  - Large firms have (much) higher labour productivity than small ones.
  - But differences in TFP are typically small and statistically insignificant across age and size groups.

[Discuss figures 1-2 in Van Biesebroeck here]

Firm age and productivity

Figure 1. Productivity density and distribution by age group

- Old firms higher labour productivity than young firms
- No obvious differences across age groups in total factor productivity.
- Implication: Old firms have more capital per worker. They also have more human capital per worker (schooling, experience).

Firm size and productivity

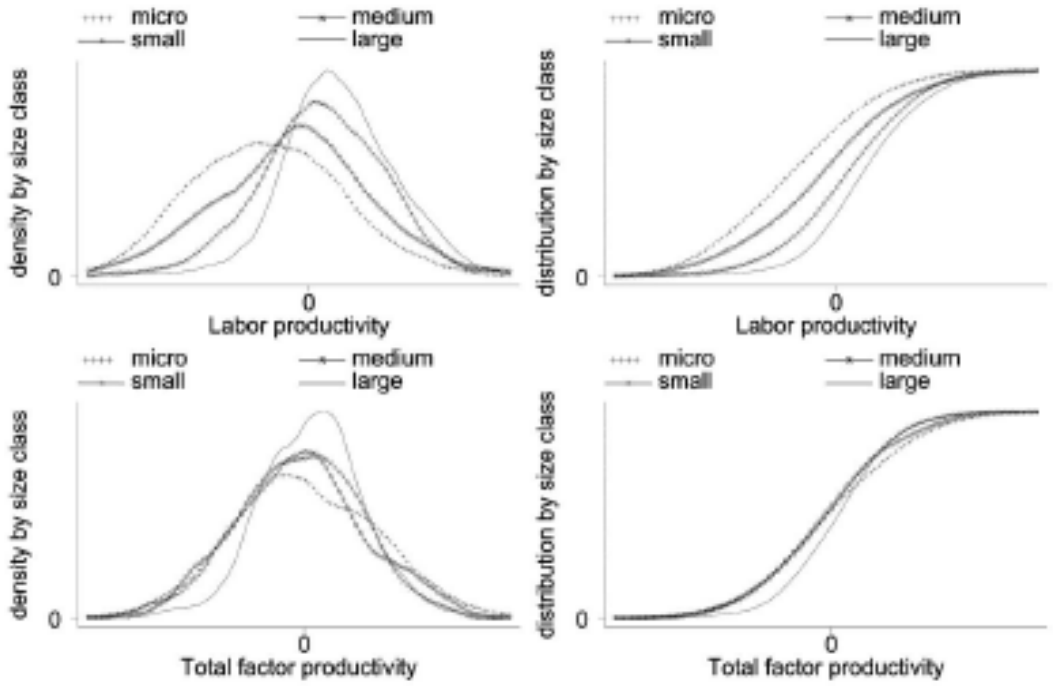

Figure 2. Productivity density and distribution by size class

- Large firms have much higher labour productivity than small firms
- Much smaller differences across size groups in total factor productivity.
- Implication: Large firms have more capital per worker. They also have more human capital per worker (schooling, experience)

3.2 Firm growth

- Recall: heterogeneity in performance across firms - some firms do very well, others pretty badly. Are there any systematic differences in the characteristics of such heterogeneous firms? Can we "predict" what type of firm is likely to grow, for example?

- Table 5 in Van Biesebroeck shows results from OLS regressions in which growth in size and productivity are modelled as functions of firm age, size, ownership, the capital-labour ratio, investment, location, exporting.....

[Discuss Table 5]

TABLE 5

CHARACTERISTICS CORRELATED WITH GROWTH RATES

	Size		Productivity	
	Employment	Value Added	LP	TFP
Textiles/garments sector	.0057	−.0018	−.0057	−.0824
	(.0122)	(.0269)	(.0278)	(.0936)
Wood/furniture sector	.0291**	.0181	−.0069	−.1057
	(.0128)	(.0282)	(.0292)	(.0960)
Metal working sector	.0211*	.0020	−.0102	−.0877
	(.0125)	(.0274)	(.0284)	(.0915)
Located in capital city	.0131	−.0199	−.0313	−.0222
	(.0095)	(.0207)	(.0214)	(.0672)
Young firm	.0976***	.1055***	.0026	−.0131
	(.0095)	(.0209)	(.0216)	(.0725)
Medium/large firm	.0944***	.0224	−.0773***	.2659***
	(.0105)	(.0231)	(.0239)	(.0800)
Exporter	−.0118	.0487*	.0565**	.1277
	(.0121)	(.0263)	(.0272)	(.0900)
(Partially) foreign owned	−.0181	.0534*	.0714***	.0596
	(.0128)	(.0282)	(.0292)	(.0961)
(Partially) state owned	−.0715***	−.0488	.0130	−.1361
	(.0172)	(.0382)	(.0395)	(.1421)
Formal training program	.0243*	.0414	.0193	.0368
	(.0136)	(.0294)	(.0305)	(.0940)
Introduced new technology	.0021	.0260	.0242	.0919
	(.0106)	(.0232)	(.0241)	(.0797)
High K/L ratio	−.0776***	−.0283	.0504**	−.6507***
	(.0096)	(.0209)	(.0216)	(.0694)
Occasional investments	.0528***	.0667***	.0204	−.1508*
	(.0112)	(.0251)	(.0260)	(.0896)
Yearly investments	.0897***	.1373***	.0559	−.0541
	(.0219)	(.0476)	(.0493)	(.1619)
Constant	−.0809***	−.1625***	−.0847*	−.1784
	(.0198)	(.0436)	(.0451)	(.1446)
Number of observations	7,389	6,229	6,229	1,891
Adjusted R^2	.078	.057	.030	.320

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

- **Large** firms have relatively high employment growth rates, but no difference in value-added growth. This is in marked contrast with the literature based on other countries – suggests divergence in size. Large firms remain large.
- **Young** firms have relatively high growth rates in employment & value-added

3.3 Conclusions

- The presence of many micro and small firms in developing countries has often led researchers and multinational institutions to emphasize the development of smaller firms.

- However, the results in this article illustrate the superior performance of large firms.

- Firms employing 100 or more workers are shown to be more productive and more likely to survive (I have not discussed firm survival - see paper for details).

- This is in line with results for more developed countries.

- In addition, large firms also grow more rapidly and improve productivity faster, conditional on other covariates or on previous performance.

- Large firms remain large, and more productive firms remain at the top of the distribution.

- Smaller and less productive firms have a very hard time advancing in the size or productivity distribution.

- Micro and small firms make a positive contribution to aggregate labor productivity growth, however the evolution of aggregate productivity growth is largely determined by the performance of large firms.

4 The Impact of the Investment Climate on Performance: Evidence for Asian Firms

Reference: Dollar, David, Mary Hallward-Driemeier and Taye Mengistae (2005). "Investment Climate and Firm Performance in Developing Countries," Economic Development and Cultural Change vol. 54, No 1.

- Following Dollar et al. (2005), we define the investment climate as "the institutional, policy, and regulatory environment in which firms operate - factors that influence the link from sowing to reaping". This concept is thus closely related to the macroeconomic literature on 'institutions' or 'social infrastructure'.

- A common view amongst economists is that many of the problems faced by firms in developing countries can be linked to the nature of the business environments, or the "investment climate", in which the firms operate. For example, it is sometimes argued that the poor investment climate in Africa results in high transaction costs and particularly disadvantages the manufacturing sector, because manufacturers are intensive users of investment climate services.

- The paper by Dollar, Hallward-Driemeier and Mengistae (2005; from now on referred to as Dollar et al., 2005) investigates how poor investment climate services impact firm performance in Bangladesh, China, India and Pakistan.

Main investment climate indicators.

- Days to clear customs (imports)
- Days to clear customs (exports)
- Power loss (% of sales)
- Days for phone line
- Proportion of firms with overdraft facility

From now on, I'll refer to these as IC indicators. Dollar et all show that there are statistically significant differences across countries and across locations within countries in many of the indicators. Customs clearance is faster in China than in Bangladesh, and faster in Bangladesh than in Pakistan. Overall, China looks the best of the four countries using many of the measures (fast customs clearance, fast access to new phone lines, and few power outages)

[Table I in Dollar et al]

TABLE 1
INVESTMENT CLIMATE INDICATORS IN FOUR COUNTRIES

	Sample Means				
	Bangladesh	China	India	Pakistan	SE
Inspections per year	18.6	28.10	7.99	32.7	.74
	(997)	(1,304)	(1,937)	(957)	
Management time dealing with regulations	4.2	7.8	14.41	10.1	.15
	(985)	(1,456)	(1,667)	(963)	
Unofficial payments (% sales)	2.5	2.5		2.2	.048
	(933)	(348)		(957)	
Days to clear customs (imports)[a]	11.7	7.9	9.06	17.2	.34
	(559)	(434)	(337)	(125)	
Days to clear customs (exports)[a]	8.84	5.41	6.55	9.72	.24
	(446)	(434)	(485)	(194)	
Power loss (% sales)[a]	3.29	1.99	8.70	5.42	.11
	(924)	(1,500)	(1,786)	(963)	
Days for phone line[a]	129.7	15.62	35.5	41.84	1.44
	(277)	(1,454)	(643)	(927)	
Have own generator (%)	71.1	27.3	61.0	42.1	.9
	(999)	(1,500)	(1,930)	(965)	
Have own well (%)	55			44.1	1.3
	(990)			(945)	
Share with overdraft facility[a]	.66	.18	.57	.23	.007
	(975)	(1,500)	(1,982)	(965)	
Share with bank loan	70	44	12	19.8	1.2
	(984)	(1,500)	(1,993)	(965)	
Days to clear a check	2.9	4.3	10.9	1.9	.14
	(947)	(1,492)	(1,539)	(929)	

Note. Number of observations are in parentheses.

[a] One of the five important indicators on which we focus.

Research strategy. Investigate how variation in the IC indicators (averaged by sector and location) correlate with

- Total factor productivity (TFP)
- Factor prices
- Growth of output, capital and employment.

4.1 The impact of the investment climate on productivity

Main idea: Bureaucratic harassment, power outages, and so on, result in less value added being produced from the same capital and labor. Can learn about the effects of these problems by comparing outcomes in environments across which the investment climate differs.

The starting point is to estimate a Cobb-Douglas production function for a sample of firms in the garments sector in the four countries. Based on this, the authors estimate TFP and then go on to explain variation in TFP with the investment climate variables. Let's have a look at the different steps involved.

4.1.1 The production function

Technology is specified (see p.11 in the paper) as Cobb-Douglas:

$$y_{it} = \alpha_0 + \alpha_L l_{it} + \alpha_K k_{it} + \alpha_m m_{it} + \omega_{it} + \varepsilon_{it}, \tag{1}$$

where y_{it} denotes log gross output; l_{it} is log employment; k_{it} is log physical capital (equipment); m_{it} is log materials; $\omega_{it} + \varepsilon_{it}$ is unobserved total factor productivity (TFP), where ω_{it} is persistent and ε_{it} is transitory with no impact on firm decisions. The subscripts i, t index firms and time periods, respectively (each firm is observed more than once). All financial variables are expressed in real US$.

It follows from the above definition that TFP can be written

$$TFP_{it} = y_{it} - \alpha_L l_{it} - \alpha_K k_{it} - \alpha_m m_{it}, \tag{2}$$

and so if we knew the parameters $\alpha_L, \alpha_K, \alpha_m$ we could calculate TFP. Of course we don't know these parameters, but we can estimate them by applying some suitable regression technique to eq (1).

Consider using ordinary least squares to estimate (1). Would this work?

As you probably remember, OLS will not give consistent and unbiased estimates if the explanatory variables are correlated with the error term. Because TFP is unobserved, the term $\omega_{it} + \varepsilon_{it}$ will inevitably go into the error term. Might $\omega_{it} + \varepsilon_{it}$ be correlated with labor, capital or material inputs? Yes, economic theory suggests this might well happen. Suppose firms choose labour input so as to maximize profits, for example:

$$\max_L R = P \cdot Y - W \cdot L \tag{3}$$

where W is the wage rate and P the unit output price. Assuming that both prices are exogenous, the first-order condition for optimal labour is

$$P\left(\frac{\partial Y_i}{\partial L_i}\right) = W. \tag{4}$$

In this model, everything else equal, firms with high TFP will choose more labor - hence l_{it} is correlated with the error term in (1).

The authors discuss this and their proposed solution to the problem on pp. 13-14. They end up adopting a procedure developed by Levinsohn and Petrin (2003; LP). We now know, however, that this method is not very robust. So please ignore the LP methods and the associated results when reading this paper. Focus instead on the generalized least squares (GLS) random effects results (GLS is very similar to OLS so don't worry if you have not heard of GLS; note that, just like the OLS estimator, GLS will not work if inputs are

correlated with the error term). GLS estimates of the production function parameters are shown in Table 2.

[Table 2 here]

Focus on these

(ignore this column)

TABLE 2

ESTIMATING PRODUCTION FUNCTION FOR GARMENT FIRMS

	GLS Estimates				Levinsohn and Petrin (2000) Estimates
	(1)	(2)	(3)	(4)	(5)
Log (labor)	.647	.653	.636	.621	.59
	(30.29)***	(29.96)***	(11.81)***	(11.73)***	
Log (capital)	.258	.240	.250	.246	.36
	(13.96)***	(12.56)***	(9.11)***	(9.01)***	
Log (average schooling of workforce)		.022		.026	.023
		(2.77)***		(3.09)***	
China × log (labor)			−.019	.134	
			(.19)	(.86)	
India × log (labor)			.106	.128	
			(1.42)	(1.62)	
Pakistan × log (labor)			−.047	−.072	
			(.55)	(.83)	
China × log (capital)			.017	−.060	
			(.38)	(.90)	
India × log (capital)			−.036	−.049	
			(1.17)	(1.60)	
Pakistan × log (capital)			.025	.029	
			(.74)	(.86)	
Constant	6.238	6.265	6.354	6.334	
	(32.36)***	(28.62)***	(29.05)***	(25.86)***	
Observations	2,082	1,887	2,082	1,887	1,882
No. of firms	775	697	775	697	694

Note. GLS = generalized least squares. Dependent variable: log of annual value added. Absolute value of *z*-statistics in parentheses.
*** Significant at 1%.

4.1.2 Explaining TFP

- Based on the production function estimates, the authors calculate TFP using the formula in (2). Armed with their TFP estimates, the authors go on to model TFP as a function of the investment climate variables in a second step:

$$TFP_{it} = \boldsymbol{\delta}' \mathbf{X}_{it} + u_{it}$$

  Results are shown in Table 3

[Discuss Table 3]

Table 3: Explaining productivity in the garments industry

	Dependent Variable: TFP for Garments Firms Based on GLS Estimation of Production Function Parameters: All Firms	
	(1)	(2)
Log (custom days–export)	−.042	.034
	(.61)	(.41)
Log (custom days–import)	−.218	−.062
	(1.43)	(.38)
Log (power loss)	−.371	−.566
	(2.86)***	(3.77)***
Log (days to get phone)	−.161	.010
	(2.01)**	(.08)
Log (overdraft facility)	.103	.055
	(1.19)	(.58)
Log (distance from market)	.542	.239
	(2.34)**	(.54)
Log (distance from port)	.016	.006
	(1.62)	(.55)
Log (population)	.005	.030
	(.12)	(.75)
Bangladesh		−.328
		(1.50)
China		−.287
		(.70)
India		.232
		(2.03)**
Constant	3.207	4.557
	(1.78)*	(1.17)
Year dummies	Yes	Yes
Observations	1,961	1,961
No. of firms	714	714
χ^2	10.78	17.01
Prob > χ^2	.0559	.0045

Note this is is the left part of Table 3, shown on p. 16 in the Dollar et al paper (I am cutting out the results based on the LP procedure since flawed).

- How interpret point estimates?
- How interpret ”absolute z-values”?
- What does ”year dummies: Yes” mean?
- What might Prob>χ^2 mean?
- What’s the difference between (1) and (2), really?

Note: GLS = Generalized Least Squares. Absolute z-values in parentheses. Significance at 1%, 5%, 10% level is indicated by ***, ** and *, respectively.

4.2 Effects on factor rewards and growth

Factor rewards. The second empirical component of the paper is to link the IC indicators to factor rewards: wages and returns on capital.

The basic idea: greater factor productivity implies higher factor rewards, and so good IC should be associated with relatively high wages and returns on capital.

- Results for wages in Table 4: Power loss is found to have a negative effect; the other IC coefficients are typically insignificant or significant with the 'wrong' sign (customs days for exports).

- Results for returns on capital in Table 5: Customs clearance time for exports negative and significant; phone delays positive ('wrong') and significant. The rest largely insignificant.

Growth. The final empirical component is to link the IC variables to growth of output, capital and employment. The results are quite mixed. In the output growth regression, for instance, export customs delays, power losses and overdraft facilities have significant coefficients with the expected signs. However, delays in getting phone lines has a positive coefficient.

4.3 Summarizing the authors' conclusions

- Investment climate matters for the level of productivity, wages, profit rates, and the growth rates of output, employment, and capital stock at the firm level.

- These results as consistent with the larger literature on the importance of institutions and policies for economic growth.

- For productivity and profitability, power outages and customs delays are the most serious bottlenecks. This suggests that the government's role in providing a good regulatory framework for infrastructure is important.

- Measures of governance and corruption do not explain differences in outcomes across the locations. Hence the authors tentatively conclude that the government's role in providing a framework for very specific services that firms need seems more important than general issues of governance and corruption.