Firms and Development

BREAD-IGC Virtual PhD Course

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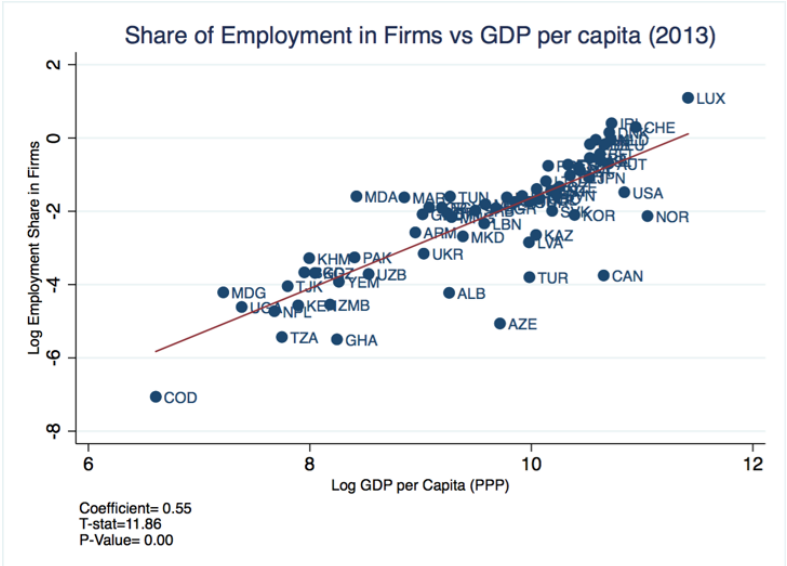
Firms and Development

1. **Introduction to course**
2. Five facts and fictions about firms in developing countries
3. A simple framework to guide the next 7 lectures

Firms and Development

- Big question: why are some countries rich and some countries poor?
- This course:
  - Firms, large and small, provide employment and income for the majority of households in the world—and produce goods and services that constitute a large share of households' budgets—so surely play a huge role
    - Firm-related policies can potentially have large impacts on poverty, growth and development

GDP and private firm employment (5 or more emp.)



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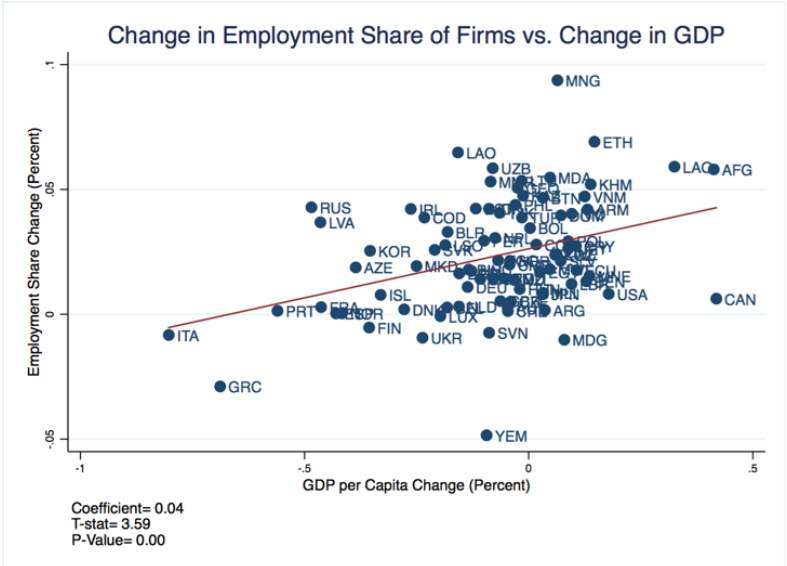

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    - Firm-related policies can potentially have large impacts on poverty, growth and development
  - Can policymakers intervene to grow firms? Should they? And if so how?
    - Recent example of East and South East Asia's rapid growth plus huge expansion of private sector alongside extensive firm-related policy potentially instructive

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- This mini course will explore the evidence from the growing literature on firms and development

Firms and Development

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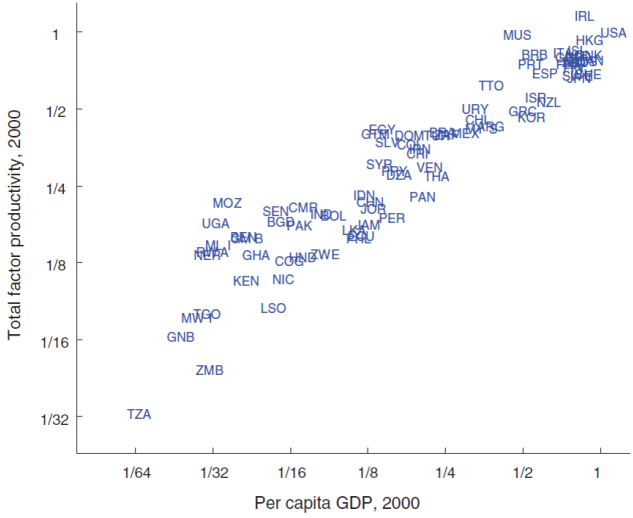
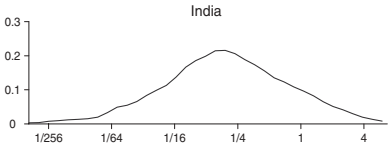
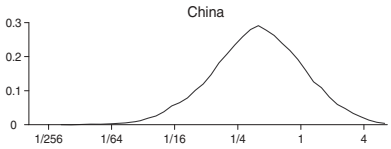
1. Aggregate productivity is low



- Differences in measured inputs explain less than half cross-country differences in GDP pc
  - From Jones and Romer (2010), with $Y = K^{\frac{1}{3}}(AhL)^{\frac{2}{3}}$ where h adjusts for schooling
- But aggregate TFP diff could come from firms being less productive, or from least productive firms accounting for larger share of GDP

2. Technologies and management techniques inside the global frontier





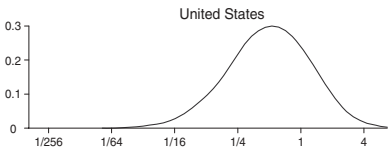


FIGURE I
Distribution of TFPQ

- Measurement difficult
- Distributions of TFPQ for some countries (Hsieh and Klenow 2009)
  - But many thorny issues estimating residuals from production functions across industries and countries

2. Technologies and management techniques inside the global frontier

TABLE 4
MACHINES PER OPERATIVE, c.1910

Country or Region	Average Weekly Wage	Loom-Equivalents per Worker	Index of Machines per Worker	Ring Spindles per Worker	Plain Looms per Worker
New England	$8.8	2.97	1.55	902	8.0
Canada	8.8	2.53	1.41	750	6.0
United States (South)	6.5	2.65	1.44	770	6.0
Britain	5.0	2.04	1.00	625	3.8
Germany	3.8	1.28	0.63	327	2.9
France	3.7	1.11	0.81	500	2.8
Switzerland	3.7	1.40	0.70	450	2.7
Austro-Hungary	2.8	1.24	0.65	403	2.8
Spain	2.7	0.91	0.73	450	2.0
Mexico	2.6	1.15	0.77	540	2.5
Russia	2.4	1.10	0.77	450	2.0
Italy	2.4	0.88	0.76	436	2.0
Portugal	1.72	0.88	0.65	384	2.0
Egypt	1.69	0.81	0.39	240	1.5
Greece	1.38	0.46			
Japan	0.80	0.53	0.52	190	1.6
India	0.78	0.50	0.33	214	1.9
China	0.54	0.48	0.34	168	1.5
Peru		1.17	0.78	391	3.5
Brazil		0.88	0.67	527	3.0

Notes: The United States and Canada used underpick looms and these were somewhat slower than the standard loom used elsewhere. In Brazil and Peru the nominal wages clearly exceeded the real wage greatly, but no price deflator is available.
Sources: See Appendix.

- Measurement difficult
- For single industry, can directly measure output per worker on same machines (Clark 1987)

2. Technologies and management techniques inside the global frontier

Table 17.1 Doffs per Hour, United States, Britain, and India

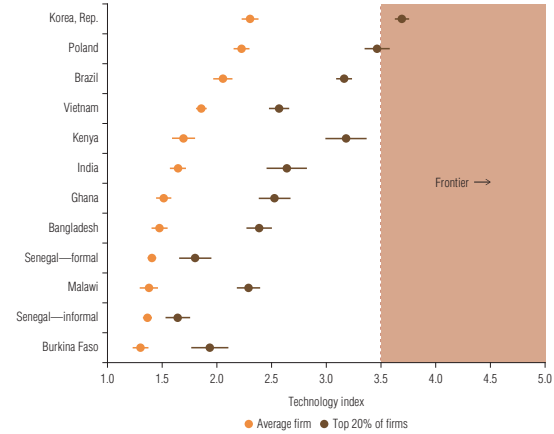
Year	United States	Britain	India
1907	—	—	*102*
1921	*728*	—	*118*
1944–49	770	462	*124*
1959	1,000	—	—
1969	—	600	—
1978	—	—	*160*
1996	—	—	319

Sources: Clark, 1907; Shirras, 1923; Cotton Spinning Productivity Team, 1951; Textile Council, 1969; Ratnam and Rajamanickam, 1980; Doraiswamy, 1983; Rajamanickam and Ranganathan, 1997, 2.
Note: Figures in italics are doffing rates inferred from the number of spindles per doffer or the number of pounds doffed per hour per doffer.

- Measurement difficult
- Doffs per hour particularly clean (and stark) measure (Clark 2007)

2. Technologies and management techniques inside the global frontier

FIGURE 2.1 **Estimated Technology Sophistication, by Country: Manufacturing**

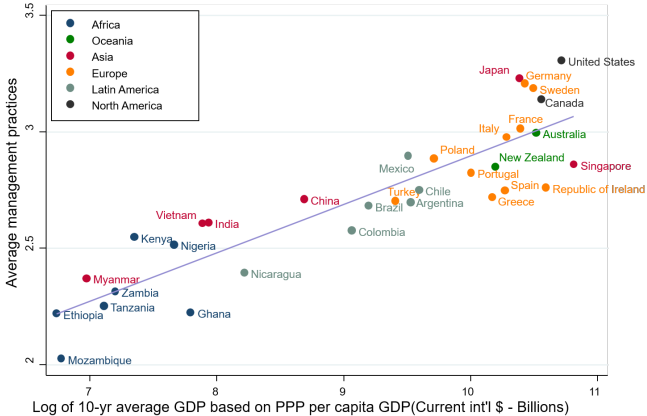


Source: Original figure based on Firm-level Adoption of Technology (FAT) survey data.

Note: The figure plots for each country the average level of technology sophistication of the firm across all business functions (ABF), including general business functions (GBFs) and sector-specific business functions (SBFs). Results are based on ordinary least squares (OLS) estimation using sampling weights and controlling for sector, country, formality, firm size group, and age group.

- Measurement difficult
- Surveys of technology use, e.g. Cirera et al. (2020) for World Bank
- Best firms further behind the frontier, although gaps less pronounced for average firm
- But less sophisticated $\neq$ suboptimal

2. Technologies and management techniques inside the global frontier



- Measurement difficult
- Surveys of management practices (Bloom and Van Reenen, 2010)
- Restrict attention to "vertically ranked" practices, e.g. performance-based pay

3. Input and output markets are distorted

Table 1 Distortions by country income-group and firm type.

	Formal									Informal
	All	Firm Size		Exporter		Importer		Tradable		All
		Small	Large	Yes	No	Yes	No	Yes	No	
Regulation distortion										
Low-income	0.018	0.022	0.015	0.015	0.019	0.018	0.018	0.019	0.015	0.001
Middle-income	0.010	0.011	0.011	0.010	0.011	0.009	0.011	0.010	0.011	0.000
High-income	0.005	0.006	0.003	0.004	0.006	0.004	0.006	0.005	0.004	0.000
Crime distortion										
Low-income	0.135	0.162	0.110	0.152	0.129	0.135	0.134	0.138	0.123	0.015
Middle-income	0.076	0.104	0.064	0.065	0.081	0.063	0.080	0.082	0.066	0.007
High-income	0.048	0.062	0.042	0.041	0.052	0.037	0.051	0.048	0.046	0.002
Markup distortion										
Low-income	0.389	0.392	0.379	0.376	0.393	0.372	0.396	0.414	0.309	0.217
Middle-income	0.364	0.370	0.362	0.367	0.363	0.345	0.371	0.385	0.329	0.209
High-income	0.363	0.332	0.374	0.388	0.346	0.361	0.363	0.356	0.382	0.206
Domestic tax distortion										
Low-income	0.053	0.050	0.050	0.052	0.053	0.025	0.064	0.054	0.049	0.000
Middle-income	0.115	0.112	0.120	0.123	0.112	0.115	0.116	0.114	0.117	0.000
High-income	0.172	0.182	0.169	0.173	0.172	0.186	0.168	0.172	0.172	0.000
Imported input distortion										
Low-income	0.012	0.005	0.018	0.023	0.008	0.042	0.000	0.006	0.031	0.014
Middle-income	0.020	0.007	0.032	0.038	0.012	0.079	0.000	0.003	0.049	0.021
High-income	0.007	0.003	0.010	0.013	0.002	0.028	0.000	0.001	0.023	0.014
Capital distortion										
Low-income	0.207	0.223	0.205	0.218	0.204	0.201	0.210	0.212	0.191	0.269
Middle-income	0.167	0.198	0.153	0.165	0.168	0.160	0.170	0.173	0.156	0.215
High-income	0.142	0.162	0.134	0.140	0.144	0.131	0.145	0.142	0.141	0.182
Labor distortion										
Low-income	0.232	0.219	0.246	0.230	0.233	0.263	0.220	0.231	0.235	0.000
Middle-income	0.240	0.240	0.249	0.249	0.235	0.265	0.231	0.234	0.250	0.000
High-income	0.268	0.237	0.280	0.266	0.270	0.273	0.267	0.271	0.261	0.000
Intermediate input distortion										
Low-income	0.205	0.199	0.211	0.206	0.205	0.211	0.203	0.205	0.205	0.174
Middle-income	0.201	0.198	0.204	0.207	0.198	0.207	0.199	0.200	0.202	0.168
High-income	0.192	0.190	0.192	0.191	0.193	0.195	0.191	0.193	0.189	0.161
Electricity distortion										
Low-income	0.141	0.140	0.145	0.148	0.138	0.143	0.139	0.138	0.148	0.130
Middle-income	0.112	0.114	0.112	0.116	0.110	0.129	0.106	0.106	0.122	0.099
High-income	0.088	0.090	0.085	0.080	0.092	0.103	0.083	0.087	0.090	0.082

- Poorly functioning K markets, onerous L regulations, contracting frictions etc. distort firm's input use
- But also distortions on output markets (markups? taxes?)
- Atkin and Donaldson (2022) measure (via heroic assumptions) wedges between buyer price and seller cost using WB enterprise surveys

3. Input markets are distorted

TABLE II

Input Mix and Court Congestion (Fact 2)

	Dependent variable: $\frac{x_j^R}{x_j^R + x_j^H}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Avg age of civil HC cases	−0.00547*	−0.00621**	−0.00530*	−0.0144**	−0.0146**	−0.0167**
	(0.0022)	(0.0023)	(0.0024)	(0.0044)	(0.0044)	(0.0045)
Log district GDP/capita		−0.00389	−0.00384		−0.00912^{+}	−0.00980^{+}
		(0.0045)	(0.0046)		(0.0051)	(0.0051)
State controls			Yes			Yes
Five-digit industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	OLS	IV	IV	IV
R^2	0.441	0.446	0.449	0.441	0.446	0.449
Observations	225,590	204,031	199,339	225,590	204,031	199,339

- Contracting frictions and poor institutions limit firm-to-firm trade
- In Indian states with more-congested courts, intermediate input bundles are tilted toward standardized intermediate inputs (Boehm and Oberfield 2020)

3. Output markets are distorted

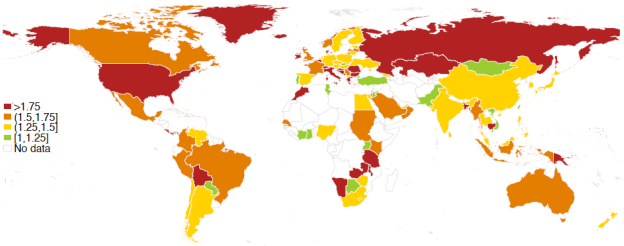
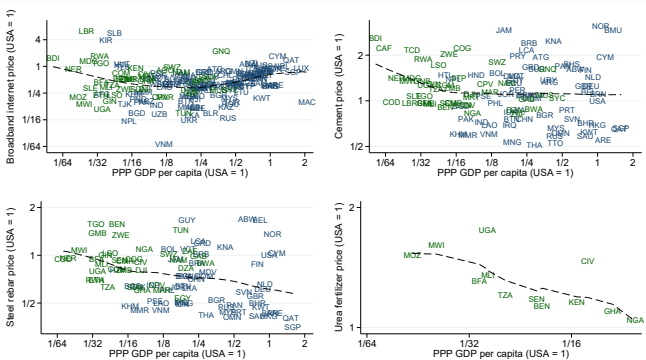


Figure 6: Markup by Country in 2016

- Lack of competition?
- Markup estimates using global datasets all over the place (DeLoecker and Eeckhout 2021)

3. Output markets are distorted



- Lack of competition?
- Leone, Macchiavello and Reed (2022) show prices of important inputs are higher (not lower) in poorest countries
  - But is this higher markups or costs?
  - And if markups, is this uncompetitive conduct/barriers to entry or small market size?

4. Distortions are size dependent

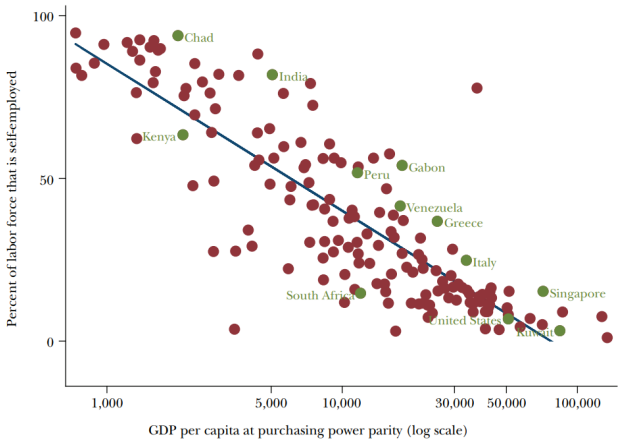
TABLE 1
DISTRIBUTION OF EMPLOYMENT SHARES ACROSS PLANT SIZES

	Numbers of Workers					
	1–4	5–9	10–19	20–49	50–99	>99
United States, 1992[a]	1.3	2.6	4.6	10.4	11.6	69.4
Mexico, 1993[b]	13.8	4.5	5.0	8.6	9.0	59.1
Indonesia, 1986[c]	44.2	17.3			38.5	
S. Korea, 1973[d]	7.9		22.0		70.1	
S. Korea, 1988[e]		12		27		61
Taiwan, 1971[c]		29.1			70.8	
Taiwan, 1986[f]		20		29		51
India, 1971[g]	42		20		38	
Tanzania, 1967[g]	56		7		37	
Ghana, 1970[g]	84		1		15	
Kenya, 1969[g]	49		10		41	
Sierra Leone, 1974[g]	90		5		5	
Indonesia, 1977[g]	77		7		16	
Zambia, 1985[g]	83		1		16	
Honduras, 1979[g]	68		8		24	
Thailand, 1978[g]	58		11		31	
Philippines, 1974[g]	66		5		29	
Nigeria, 1972[g]	59		26		15	
Jamaica, 1978[g]	35		16		49	
Colombia, 1973[g]	52		13		35	
Korea, 1975[g]	40		7		53	

- Tybout (2000) documents a "missing middle" in developing countries
  - Regulatory barriers and distortions retard all but smallest firms
  - Biggest firms also benefit from cheap credit/subsidies etc.
- Size dependencies important as determine what types of firms policies should target

4. Distortions are size dependent

Figure 4
Self-Employment and GDP per Capita in 2013

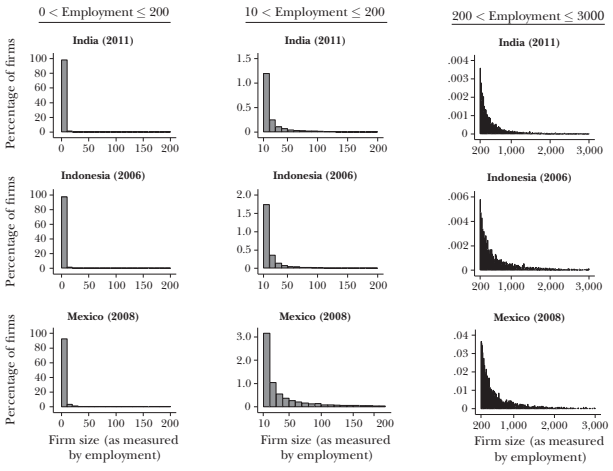


- Why so many small informal firms? La Porta & Shleifer (2014) offer three views:
  - Romantic: small firms held back by capital and regulation distortions
  - Parasite: small (informal) firms very unproductive but avoid tax/regulation, crowd out productive
  - Dual economy: two sectors, traditional sector source of subsistence not growth

4. Distortions are size dependent

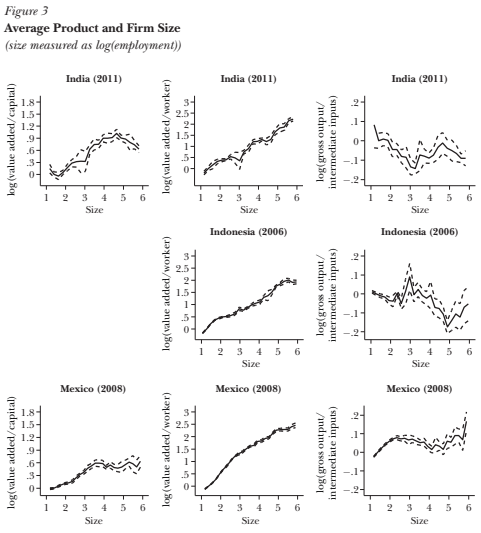
Figure 1

Distribution of Firm Size as Measured by Number of Workers



- Hsieh and Olken (2014) find no evidence for missing middle using relatively comprehensive firm-level data for Mexico, Indonesia and India

4. Distortions are size dependent



- Hsieh and Olken (2014) also find big firms have higher APK, APL
  - Inconsistent with small firms facing largest constraints (romantic view)?
  - Or dual economy where big would have lower APK?

4. Distortions are size dependent

Figure 4
Distribution of Indian Firm Size and Labor Regulations
(size as measured by employment)

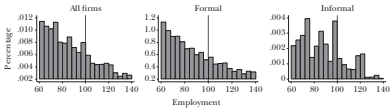


Figure 5
Distribution of Indonesian Firm Size and the VAT Threshold

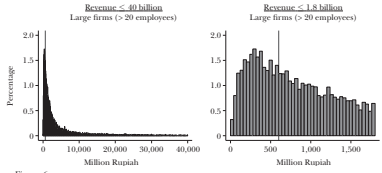
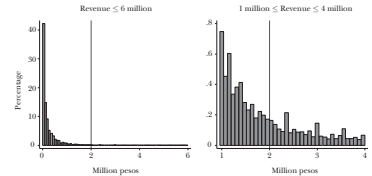
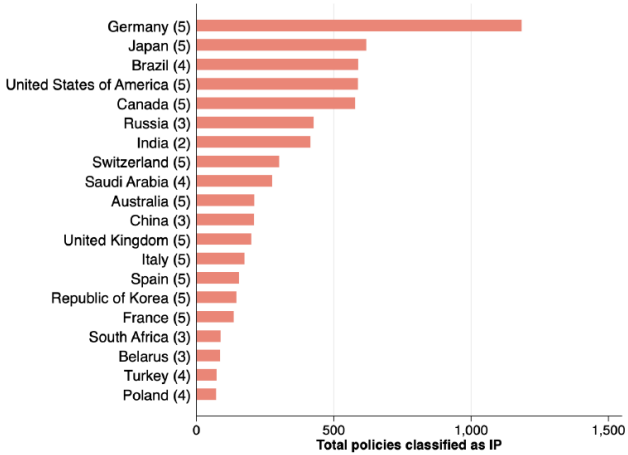


Figure 6
Distribution of Mexican Firm Size and the Simplified Tax Regime Threshold



- Hsieh and Olken (2014) also find limited evidence of discontinuities at regulatory notches (parasite view?)
  - Indian labor regulation threshold
  - Indonesian VAT threshold
  - Mexican simplified tax regime threshold

5. Picking winners doesn't work



(a) Number of IP policies

- "Washington Consensus" (Krueger, Bhagwati, Balassa etc.): while justified in theory, too hard to identify winners, too subject to capture
- Rodrik (2008, 2012): doesn't stop us doing education, health policy etc., and evidence mixed, difficult to infer causality
- What is (more) clear is that everyone is doing it (Juhász et al. 2022)

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3. **A simple framework to guide the next 7 lectures**

Environment

- Now develop a conceptual/organizing framework for thinking about the material covered in the coming lectures
- Set of goods i enter "national utility" (so NB: this is shamelessly ignoring distributional considerations)

$$U = U(\mathbf{Q})$$

- Each produced by a firm using the common technology (i.e. single-product firms, but nothing that follows hinges on this)

$$Q_i = F(\mathbf{x}_i, A_i) \equiv \max_{t \in A_i} \widetilde{F}(\mathbf{x}_i, t)$$

- Aggregate (i.e. nationwide) input constraints (for each type of input, m)

$$\sum_i x_{im} \leq X_m$$

What is captured/implied by: $Q_i = F(\mathbf{x}_i, A_i) \equiv \max_{t \in A_i} \widetilde{F}(\mathbf{x}_i, t)$?

- "Technique" (t) is *costlessly* chosen over
  - but firm is constrained to use techniques within (exogenously given) set A_i
  - holds $\mathbf{x}_i$ constant—think "if I'm going to use 1000 hours of labor, how best can I produce my output?"
- "Technology" $F(\cdot, A_i)$ is a mapping from inputs ($\mathbf{x}_i$) into output (Q_i)
  - shape of $F(\cdot, A_i)$ not restricted (flexible RTS; het. across firms; etc.)
  - expansion in A_i strictly improves Q_i that is feasible for given $\mathbf{x}_i$
  - how will/should the firm use (i.e. put $\mathbf{x}_i$ into) its technology? Good question (more below)! But it's a separate question from what the technology *is*.
- What distinguishes technique (t) from inputs ($\mathbf{x}_i$)?
  - techniques are free (to the firm, and possibly also to the nation)
  - but inputs are probably not free to the firm, and definitely are not free to the nation (assuming $\sum_i x_{im} \leq X_m$ constraint binds)
  - inputs (presumably) respond to prices; techniques (and technology...both $F(\cdot, A_i)$ and A_i) do not

Further comments about $Q_i = F(\mathbf{x}_i, A_i)$

- What does A_i capture?
  - Embodies the constraints the firm can do nothing about (even by changing $\mathbf{x}_i$)
  - Laws of physics; limits of scientific knowledge
  - But also in more reduced-form manner:
    - ignorance: limits to the firm's own knowledge that it can do nothing about
    - mistakes/irrationality: "deliberate" use of inferior set of techniques
- What does $\mathbf{x}_i$ capture? Everything that uses up costly resources (since $\sum_i x_{im} \leq X_m$). (Think broadly...)
  - Usual stuff
    - capital, labor (time/effort), human capital, managers
    - materials, intermediates
  - And more
    - R&D, search, marketing/advertising, transport costs
    - Dynamics (just let $\mathbf{x}_i$ include inputs at different time periods); hence phenomena like hiring/firing costs, training, adjustment costs, learning by doing...

How does this relate to development?

- *Best* we could do with this economic environment:

$$\max_{\mathbf{Q}} U(\mathbf{Q}) \quad s.t. \quad Q_i \leq F(\mathbf{x}_i, A_i) \ \ \forall i, \quad \sum_i x_{im} = X_m \ \ \forall m, \quad x_{im} \geq 0 \ \ \forall i, m$$

- (That is: which firms *should* be relatively large, use relatively more capital, shut down, etc.?)

- Achieved at allocation $(\mathbf{Q}^*, \{\mathbf{x}_i^*\}_i)$, which displays characteristics:

$$\frac{\partial U(\mathbf{Q}^*)}{\partial Q_i} \frac{\partial F(\mathbf{x}_i^*, A_i)}{\partial x_{im}} = \lambda_m^* > 0 \quad \forall i, m \ \ with \ \ x_{im}^* > 0$$

$$\frac{\partial U(\mathbf{Q}^*)}{\partial Q_i} \frac{\partial F(\mathbf{x}_i^*, A_i)}{\partial x_{im}} < \lambda_m^* \quad \forall i, m \ \ with \ \ x_{im}^* = 0$$

How does this relate to development?

- Never mind the best allocation. What *actually* happens*?* Suppose
  - economy has *some* actual allocation denoted $(\overline{\mathbf{Q}}, \{\overline{\mathbf{x}}_i\}_i)$, and has $\sum_i \overline{x}_{im} = X_m \ \ \forall m$
  - and households pay $\overline{p}_i$ and choose $\overline{\mathbf{Q}}$ such that $\overline{p}_i \propto \frac{\partial U(\overline{\mathbf{Q}})}{\partial Q_i}$
- Then associated with actual allocation $\{\overline{\mathbf{x}}_i\}_i$ and $\overline{p}_i$, whatever values they take, can define

$$\overline{p}_i \frac{\partial F(\overline{\mathbf{x}}_i, A_i)}{\partial x_{im}} \equiv VMPX_{im}$$

- Why "VMPX"?
  - $V =$ "value": $\overline{p}_i$ captures many crucial features like product differentiation, quality, diminishing marginal utility
  - $M =$ "marginal": captures usefulness of x_{im} on the margin; very different from *average* product $VAPX_{im} \equiv \frac{\overline{p}_i \overline{Q}_i}{\overline{x}_{im}}$ (i.e. could reasonably expect either $corr(VMPX, VAPX) > 0$ or < 0)
  - NB: $VMPX_{im} \equiv \overline{p}_i \frac{\partial F(\overline{\mathbf{x}}_i, A_i)}{\partial x_{im}}$ is almost never the same thing as $MRPX_{im} \equiv \frac{\partial (p_i F(\overline{\mathbf{x}}_i, A_i))}{\partial x_{im}}$ (though $MRPX_{im} \propto VMPX_{im}$ under monop. comp. with CES prefs.).

Misallocation and wedges

- Since the best allocation displays $VMPX_{im} = \lambda_m^*$, all other (i.e. inferior) allocations display *misallocation*:

$$\exists i, m: \quad VMPX_{im} \neq \lambda_m^*$$

- Sometimes this is expressed as

$$"Wedge"_{im} \equiv VMPX_{im}/\lambda_m^* \neq 1$$

- Why might misallocation happen? Market failures (i.e. departures from First Welfare Theorem), such as:
  - Taxes, subsidies, regulations
  - Corruption, bribes, expropriation
  - Asymmetric information (e.g. credit constraints)
  - Incomplete contracts; missing markets
  - Market power (e.g. oligopoly, oligopsony in labor and materials markets)
  - Pure externalities (knowledge spillovers, pollution)
  - Irrational firms (don't choose profit-maximizing $\mathbf{x}_i$), e.g. due to agency problems
  - ...*Bottom line:* firm i effectively pays more/less for x_m than some other"$-i$" does.

Low aggregate productivity: only 2 sources...

- *Misallocation*: Nation's $\{X_m\}_m$ being used in the wrong way—dispersion in wedges (i.e. VMPX) across firms i within any given m
  - Must be generating revenues/rents for *someone* (e.g. if supplier of x_{im} gets w_m per unit sold, firm i is generating rents of $Q_i \cdot (VMPX_{im}/w_m - 1)$—could be collecting them as profits in case of a markup, or generating tax revenue in case of a tax, etc.)
  - Could in principle be fixed with (balanced) tax/subsidy scheme, but always to enact some reallocation of inputs (i.e. need some some $\Delta x_{jm} < 0$ to get $\Delta x_{im} > 0$)
- *Bad technology*: Nation's firms have inferior $\{A_i\}_i$
  - Could potentially be improved for free, and/or in non-rival way (e.g. may be no constraint on aggregate improvements in A_i)
  - Often changes exogenously: foreign firms teach domestic firms (FDI spillovers), hurricanes happen, etc.
  - But some policies may improve A_i (perhaps at a cost to govt.): e.g. build infrastructure, remove red tape
- *Bottom line:* Improving A_i is usually a good thing for the nation. But whether raising x_{im} is good or bad for the nation is very unclear (hinges on whether $VMPX_{im}$ relatively high or not).

Caveats: above treatment glosses over...

- *Endogenous* $\{X_m\}_m$ (since have been discussing aggregate productivity)
  - Natural to expect X_m to respond (positively) to aggregate productivity
- *Input-output linkages*
  - As soon as some inputs are produced elastically (whether by a "household" or by upstream firms) then double-marginalization (i.e when two sellers in a chain have a wedge $\neq 1$, even if it's the same wedge) is inefficient
  - General condition (Baqaee-Farhi, 2020 *QJE*) under non-IRTS: all "paths" from any fixed factor to final consumption have the same "cumulative" wedges (i.e. same amount of double-marginalization).
- *Pure externalities* (e.g. pollution, knowledge spillovers, etc.)
  - Can treat these wlog if model multi-product firms
  - May also want actions of some firm "$-i$" to affect A_i directly
- *Extensive margin concerns*
  - With IRTS technologies, $VMPX_{im} = constant_m$ among active firm-inputs (ie $\forall$ $x_{im} > 0$) is only a necessary condition for efficiency
  - Set of firm-inputs that are active may not coincide with optimum even if see $VMPX_{im} = constant_m$ among active firm-inputs

What lies ahead (a rough categorization)

- **Lectures 2&3: "Upgrading" (Verhoogen), "Management/Training" (Cai)**
  - A_i: improving knowledge about good techniques; knowledge spillovers
  - Illuminating the t's inside the $\max_{t \in A_i} \widetilde{F}(\mathbf{x}_i, t)$—that is, the strategies firms can pursue to use best techniques available to them (per unit inputs), and how changes in inputs available can make new techniques optimal
- **Lecture 4: "Misallocation" (Klenow)**
  - Measuring wedges, quantifying their effects on aggregate productivity
- **Lectures 5-7: "Capital/Labor Distortions" (McKenzie & Woodruff), "Contracts" (Macchiavello), "Competition" (Bergquist)**
  - Measuring, diagnosing, and fixing wedges in input and product markets
- **Lecture 8: "Industrial Policy" (Juhasz)**
  - Mix of policies that aim to improve misallocation and/or bad technology

Important topics (and areas for research) that may not get full treatment

- Interaction between Devo-firms and other fields: International (Trade, Finance, Multinationals), Industrial Organization, Public Finance, Environmental, Labor, Urban, Fluctuations Macro, Household Econ, Behavioral, Political Economy...

- Other objectives than aggregate productivity
  - Distributional aspects (e.g. if care about labor more than other factors then would be concerned with relative labor intensity of firms, not just their wedges and A_i)
  - Self-employment offers more than just profits (less/more risky? more flexible work arrangements?)
  - Raising government revenue to fund public goods (when firms may be easiest entities to tax)

- Informal vs formal firms (and informal vs formal inputs inside formal firms)