

Strict Duality and Overlapping Productivity Distributions between Formal and Informal Firms

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Motivation

- Paper was originally motivated by strict interpretation of the dual view of economic development
 - Lewis (1954), Todaro and Harris (1970), etc.
- More recent work by La Porta and Shleifer (2008,2014) has underscored this view.
- The underlying narrative is that formal firms are separate and distinct from informal firms..
- However, among 124,000 formal sector firms, over 50% report competing against informal firm.

Motivation

- Seminal work by Rauch (1991) showed that there was a strict size dualism between formal and informal firms.
- Newer work show overlaps in firm size and productivity distributions: Taymaz (2009), Hsieh and Klenow (2010), Nataraj (2011), Busso et al. (2012), Meghir et al. (2015), and Ulyssea (2017).

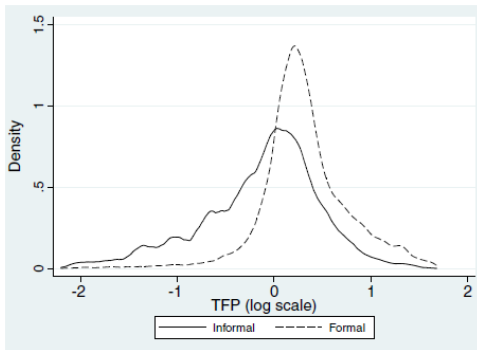


Figure: Nataraj(2011)

Research Question

- ① How can we explain informal firms that are (systematically) more productive than formal firms?
- ② How much inter-industry competition is there?

Contribution

- We offer an alternative and/or additional explanation for the overlap from Meghir et al. (2015) and Ulyssa (2017).
- Our explanation predicts a greater degree of overlap in the aggregate (overlaps) than within-industries (duality?) - a prediction we test using Indian manufacturing data.
- We create a multi-industry and multi-sector models that closely parallels the familiar Melitz (2003) framework.

Intuition

- Two industries: H and L have the same registration costs
- Industry H has a slightly higher fixed cost of production
- Cut-off productivity levels in H for formal and informal will be greater than L
- As long as the difference in fixed costs is not too large then for some levels of productivity, firms may be formal in L and informal in H.

Data

- We further motivate our model with a couple of stylized facts.
- World Enterprise Survey conducted by the World Bank
- Surveys conducted from 2006 to mid-2016
- Covers 140 countries and over 124,000 establishment observations
- Caveat: Formal establishments that are larger than 5 employees
- We use two measures of firm competition and reported firm size

Competition

Stylized Fact 1

A significant proportion of formal sector establishments compete with informal firms in developing countries.

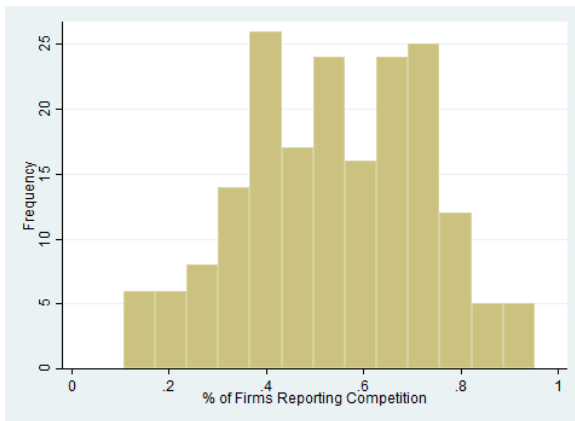


Figure: Country-Level Means

Competition and Firm Size

Stylized Fact 2

There is an inverse relationship between firm size and whether a formal establishment competes with informal firms.

Table: Competition and Firm Size within Strata Means

Size Category	Mean
Small (<20)	55.6%
Medium (20-99)	49.2%
Large(100+)	42.4%
Total	50.9%

Model

- Our theoretical model follows Melitz (2003) with several notable exceptions.
 - Formal/Informal Decision (incentives and costs)
 - Multi-Industry (separate fixed costs)
 - Households (preference for formal goods)
 - Labor market (higher formal sector wage rate)
 - Government (taxes and enforces)
- For the Pareto distribution we are able to analytically derive the cut-offs for firms to produce and whether they choose to be formal or informal across industries.

Assumptions

- We make three assumption regarding the fixed costs of entry:

$$f_i^I \leq f_i^F \quad (1)$$

$$f_{i-1}^S \leq f_i^S \quad (2)$$

$$\frac{f_i^F}{f_i^I} \leq \frac{f_{i-1}^F}{f_{i-1}^I} \quad (3)$$

- We also assume:

$$\xi_{i-1} \geq \xi_i \quad (4)$$

Proposition 1

Proposition 1

Suppose that a given industry is mixed in that it has both formal and informal firms. If the underlying distribution of firm productivities is Pareto with minimum value k and shape parameter α , then the zero profit condition is horizontal with respect to ϕ^ , and it is given by:*

$$\bar{r} = \left(\frac{\alpha}{1 + \alpha - \sigma} \right) \left[\hat{F}_I^{-1-\alpha+\sigma} + w^I \left(\frac{\xi}{w^I} \right)^\sigma (1 - \hat{F}_I^{-1-\alpha+\sigma}) \right] \sigma f^I \left(\frac{\xi}{w^I} \right)^{-\sigma} \quad (\text{ZPC}) \quad (5)$$

The free entry condition is upward sloping with respect to ϕ^ and is given by:*

$$\bar{r} = \left[\hat{F}_I^{-1-\alpha+\sigma} + w^I \left(\frac{\xi}{w^I} \right)^\sigma (1 - \hat{F}_I^{-1-\alpha+\sigma}) \right] \sigma \left[\left(\frac{\phi^*}{k} \right)^\alpha \left(\frac{f^e}{\bar{F}_I} \right) + f^I \left(\frac{\xi}{w^I} \right)^{-\sigma} \right] \quad (\text{FE}) \quad (6)$$

Proposition 2

Proposition 2

Suppose that we have two industries that share the same fixed costs, revenues, and tax rates, but they differ in their probability of closing and fining informal firms. In the first industry $\mu = 1$ such that there are no informal firms (\mathcal{F}). In the second industry $\mu < 1$ such that there are both formal and informal firms within the industry (\mathcal{I}). Under such conditions, each of the following is true:

- ① $\phi_{\mathcal{I}}^* < \phi_{\mathcal{F}}^* < \bar{\phi}_{\mathcal{I}}$
- ② $\bar{r}_{\mathcal{I}} < \bar{r}_{\mathcal{F}}$
- ③ $M_{\mathcal{I}} > M_{\mathcal{F}}$
- ④ $M_{\mathcal{I}}^F < M_{\mathcal{F}}^F$

Proposition 4

Proposition 4

Assume that industries are ordered from lowest fixed costs of operation to highest, such that $f_{i-1}^s < f_i^s, \forall i$ and $s \in \{I, F\}$. Under such conditions, the following are true:

- ① $\phi_{i-1}^* < \phi_i^*$
- ② $\bar{r}_{i-1} < \bar{r}_i$
- ③ $\frac{M_{i-1}^F}{M_{i-1}} < \frac{M_i^F}{M_i}$
- ④ *If $\left(\frac{f_i^I}{f_j^I} \frac{\bar{F}_i}{\bar{F}_j}\right)^{\frac{1}{\alpha}} \neq \frac{\hat{F}_i}{\hat{F}_j}$ for some $\{i, j\}$, then there is an overlap between the informal and formal sectors across industries.*

Overlapping Productivity

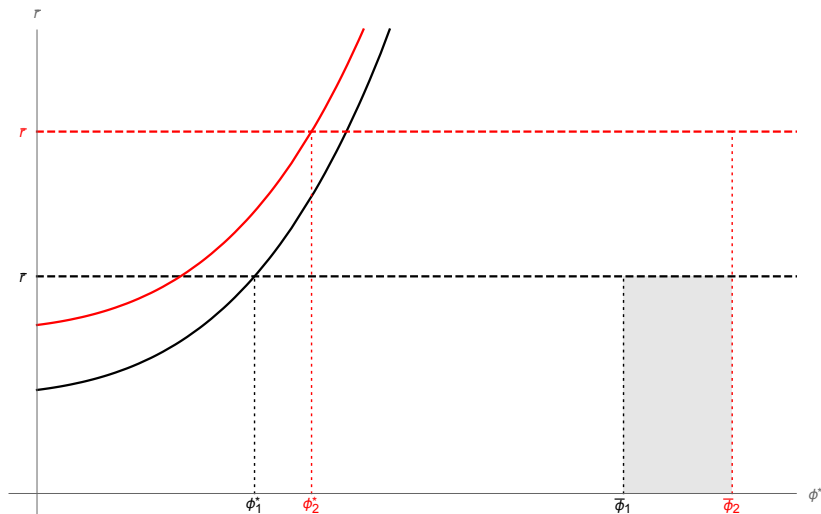


Figure: Overlapping Productivity

Empirical Test

- The model predicts that there should be greater overlap across industries than within industries

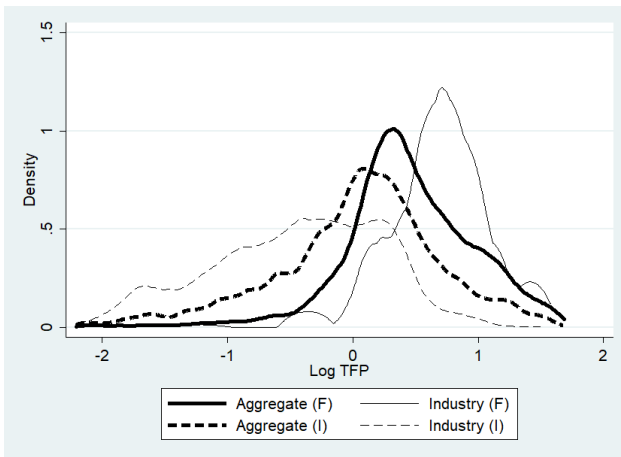


Figure: Aggregate vs. Industry Overlaps

Empirical Test

- We use Indian manufacturing establishment data.
- Data includes three snapshots of formal and informal firms in India.
- We calculate two-sample Kolmogorov-Smirnov test statistics (K-S statistics):

$$D = \max(D_{upper}, D_{lower}), \quad (7)$$

$$D_{upper} = |\max_{\phi} \{F(\phi) - I(\phi)\}| \quad (8)$$

$$D_{lower} = |\min_{\phi} \{F(\phi) - I(\phi)\}|. \quad (9)$$

Empirical Test

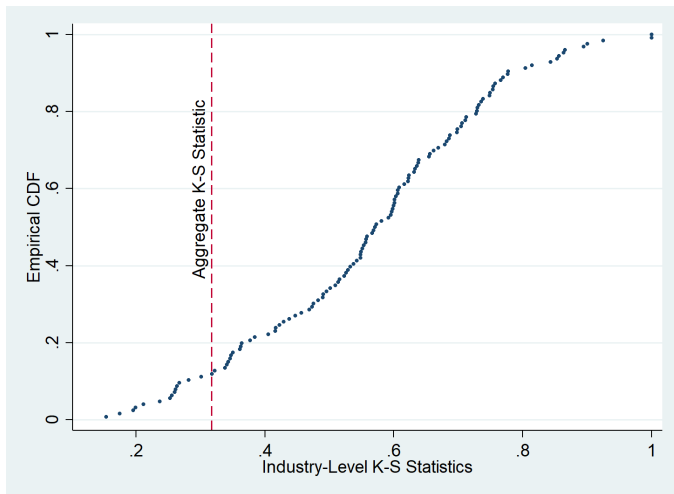


Figure: K-S Statistics across Industries

Conclusions

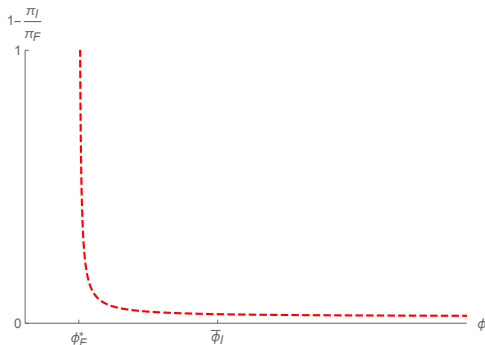
- We develop a model that offers an alternative explanation for why there is overlaps in productivity in the aggregate.
- Maintains “fuzzy” dualism within sector - consistent with models like Rauch (1991).
- We see our explanation as complementary to Meghir et al. (2015) and Ulyssea (2017).
- The model also reflects our stylized facts:
 - Under very general parameters, our industries contain both formal and informal firms.
 - Larger firms “compete” less (lose less profits and operate in industries with less informality).
- The paper encourages a more nuanced view of competition between formal and informal firms.

Proposition 3

Proposition 3

The percentage of profit lost due to informality is declining in firm productivity.

$$PPL(\phi) = \frac{\pi_F^F(\phi) - \pi_I^F(\phi)}{\pi_F^F(\phi)} \quad (10)$$



K-S Stat with Industry Size

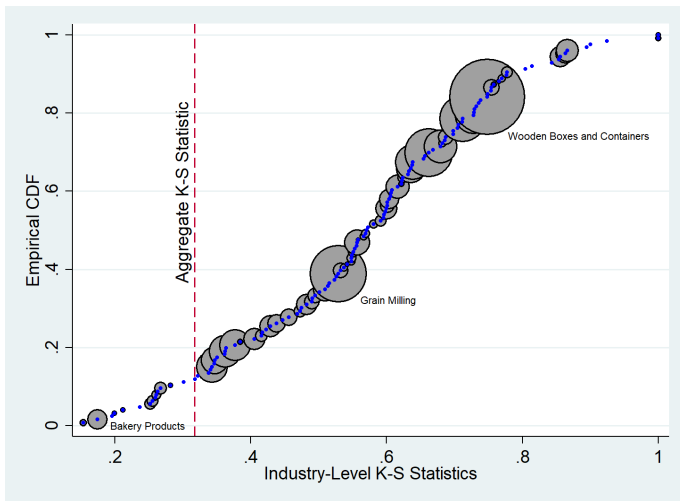


Figure: K-S Statistics across Industries