The Effects of Labor and Industrial Regulations in India: Evidence from the Plant Size Distribution

Amrit Amirapu and Michael Gechter

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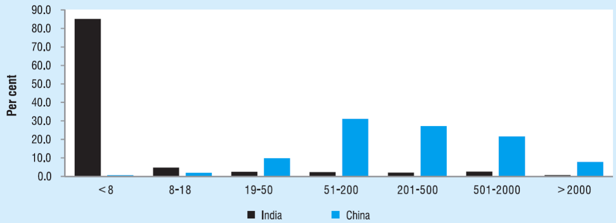

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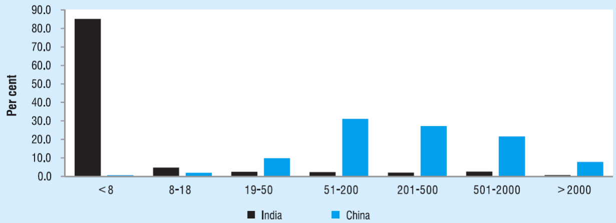

- This could have (ambiguous) implications for:
  - productivity
    - small firms are less productive and pay lower wages (e.g. Hasan and Jandoc, 2012; ADB, 2009)
    - learning/technological growth (Stiglitz)
  - inequality (in either direction)

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    - in particular we model these regulations as producing an increase in the labor costs of firms, and
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    - we attempt to estimate the size of these costs - using distortions in the firm size distribution
  - We document a new phenomenon that may shed insight on the recent "casualisation" of the Indian work force
- Note:
  - Limitations: data; not a welfare analysis
  - Preliminary... a lot to be done... feedback greatly desired...

Outline

Institutional Background

- Size-based regulations:
  - do not apply to firms below a certain size
  - Numerous relevant thresholds (**10**, 20, 50, 100, K = 5 crore)
  - **At 10:** Factories Act, ESI, Payment of Bonus/Gratuities, lots of paperwork, general sense of formality (eg: minimum wages)

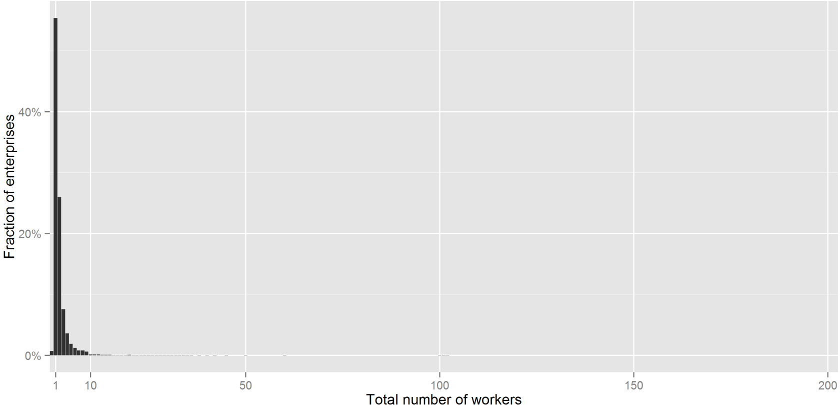
Literature Review

- Regulations and state-level outcomes in India: Besley and Burgess (2004), Bhattacharjea (2006 & 2009), and many many others
  - nearly all focused on IDA,
  - nearly all use (poor) variation in state laws
- Size-based regulations: Garicano, Lelarge and Van Reenen (2013), Gourio and Roys (2013)

Data

- Economic Census of India (1990, 1998, 2005)
  - Intended to be an enumeration of all non-agricultural *enterprises* in India
  - Administered by state statistical offices
  - *Information is self-reported*, not tied to any other interaction with the government
  - very few variables

Distribution of Enterprises By Enterprise Size



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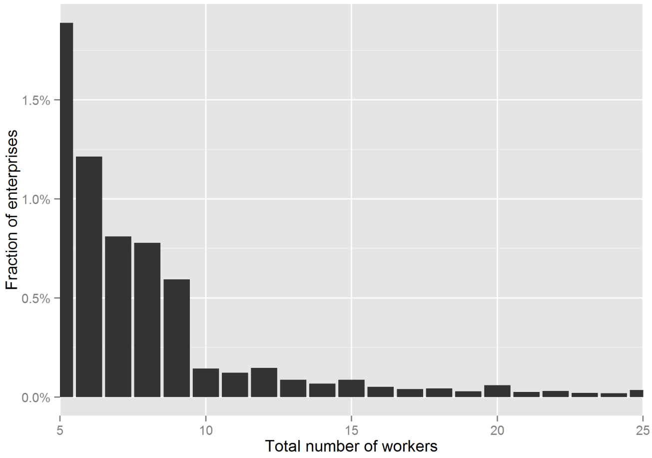

Distribution of Enterprises By Enterprise Size (log-scale)

Distribution of Enterprises By Enterprise Size (log-scale; linear fit)

Interstate Variation

Intertemporal Variation

Possible Explanations?

- One extreme:
  - Firms curb employment (and thus production) to avoid higher costs
- The other extreme:
  - Firms simply misreport employment (and are in fact relatively unconstrained)

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- The other extreme:
  - Firms simply misreport employment (and are in fact relatively unconstrained)
- Alternative explanations:
  - Firms substitute permanent workers with non-permanent/contract/casual labor
  - Firms substitute labor for capital or higher-skill labor
  - Firms reduce employment through vertical disintegration/outsourcing of inputs

Theory

Based on Garicano, Lelarge and Van Reenen (2013)

- An individual firm's problem:

$$\pi(\alpha) = \max_{n} \alpha f(n) - wn$$

  - output, $y = \alpha f(n)$; $\quad n$: number of workers
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- FOC:

$$\alpha = \frac{w}{f'(n)}$$

- If α has a power law distribution, so will $\chi(n)$.

Theory

Distribution with Size-Based Regulation

- With Size-Based Regulation:

$$\pi(\alpha) = \max_n \alpha f(n) - w\bar{\tau}n - \bar{k}$$

  - $\bar{\tau} = 1, \bar{k} = 0$ if $n \leq N$
  - $\bar{\tau} = \tau, \bar{k} = k$ if $n > N$; $\tau > 1$
- The result is that:
  - $\underline{\alpha} < \alpha < \alpha_1$: Unconstrained managers - choose low n ($<$ N)
  - $\alpha_1 < \alpha < \alpha_2$: Constrained managers - choose n = N and avoid regulation
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  - $\alpha_2 < \alpha < \infty$: Taxed managers - choose high n ($>$ N) and bite the bullet
- Now, adopting specific functional forms:
  - $f(n) = n^{\theta}$ & $\phi(\alpha) = c_{\alpha}\alpha^{-\beta_{\alpha}}$

Theoretical Densities

- And simplifying...

$$log\chi(n) = \begin{cases} logA - \beta log(n) & if \quad n \in [n_{\min}, N) \\ log(\delta_n) & if \quad n = N \\ 0 & if \quad n \in (N, n_u) \\ logA - \beta log(n) - \frac{\beta-1}{1-\theta} log(\tau) & if \quad n \geq n_u \end{cases}$$

- Key things are:
  - 1) power law in n 2) τ enters the log density additively

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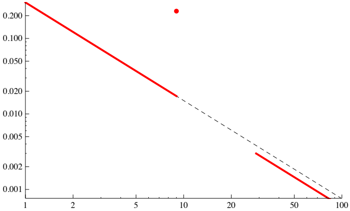
Graphically:



Taking the model to the data

Our estimating equation:

$$\log(\chi(n)) = \alpha - \beta \log(n) + \delta * D,$$
$$D = 1\{n > 9\}$$
$$\hat{\tau} = \exp(\hat{\delta})^{-\frac{1-\theta}{\hat{\beta}-1}}$$

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Which we can take to the data:

ID Assumption & Preliminary "Results"

Main ID Assumptions:

- The distribution of firms is power law - *except* for the effect of the regulation.
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All-India	α	β	δ	θ	τ
	-0.390 (0.0135)	2.155 (0.0404)	-1.147 (0.1338)	0.387 (0.0007)	**0.839** **(0.1725)**

Preliminary Results: Variation by State and Industry

State	τ	Industry	τ
Bihar	1.637	Construction	1.157
	(0.4629)		(0.3782)
Kerala	0.0441	Pub admin, etc	-0.224
	(0.0469)		(0.1247)
UP	1.465	Hotels, restaur.	0.966
	(0.4452)		(0.3610)
WB	2.017	***Manufacturing***	***2.501***
	(1.0039)		(1.0317)
TN	0.286	Wholesale, retail	1.569
	(0.0950)		(0.5851)

An Alternative Explanation: Misreporting (1)

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$$\pi(\alpha) = \max_{n,l} \alpha f(n) - wn - \tau l * 1(l > 9) - F(n,l) * p(n,l)$$

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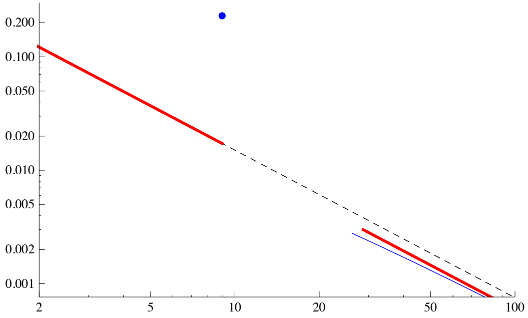
- May be reasonable to assume that the expected cost of misreporting [$F * p$] is an increasing, convex function of misreporting [$n - l$].
- I.e.: $F * \frac{(n-l)^2}{100}$, or $F(n-l) * \frac{(n-l)}{100}$

An Alternative Explanation: Misreporting (2)

- If the expected cost of misreporting $[F * p]$ is an increasing, strictly convex function of misreporting $[n - l]$, e.g.:

$$\pi(\alpha) = \max_{n,l} \alpha n^{\theta} - wn - \tau l * 1(l > 9) - F * \frac{(n-l)^2}{100}$$

- $\psi(l) \to \chi(n)$ for large l, n.
  - I.e.: This kind of misreporting cannot cause the observed 'downshift' *
  - more convex -> "faster" convergence -> lower bias



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- For sufficiently convex misreporting penalties, the bias in estimating *tau* will be minimal.
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- Under other assumptions, the bias may be significant.
- Similar conclusions may hold if we amend the model to allow for:
  - substitution with capital, skilled labor or casual/contract labour

Further Issues: Explaining Interstate Variation

Interstate Variation

Table 2: Correlates of Tau table

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	tau	tau	tau	tau	tau	tau	tau
ln_strikes	-0.0936						
	(0.117)						
ln_workers_involved_strikes		0.0651					
		(0.0613)					
ln_mandays_lost_strikes			0.0760				
			(0.0752)				
ln_lockouts				0.216			
				(0.190)			
ln_workers_involved_lockouts					0.0908		
					(0.190)		
ln_mandays_lost_lockouts						0.169	
						(0.134)	
ln_lle_index_2005							-0.547
							(0.470)
Constant	0.883**	0.0391	-0.158	0.519	0.217	-1.168	3.819
	(0.269)	(0.633)	(0.857)	(0.455)	(1.567)	(1.697)	(2.685)
Observations	18	18	18	8	8	8	18

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Interstate Variation

Table 1: Correlates of Tau table

	(1) tau	(2) tau	(3) tau	(4) tau	(5) tau	(6) tau	(7) tau
ln_factory_inspections_fa	0.0430						
	(0.0661)						
ln_convictions_fa		0.0949					
		(0.0641)					
ln_inspections_mtwa			0.0999*				
			(0.0419)				
ln_cases_filed_mtwa				0.0796			
				(0.0950)			
ln_convictions_mtwa					0.0968		
					(0.0673)		
ln_min_wages_minimum						1.027*	
						(0.402)	
ln_min_wage_maximum							0.0811
							(0.338)
Constant	0.378	0.329	0.0182	0.447	0.310	-4.024*	0.330
	(0.468)	(0.364)	(0.280)	(0.377)	(0.268)	(1.862)	(1.677)
Observations	13	8	18	13	10	34	34

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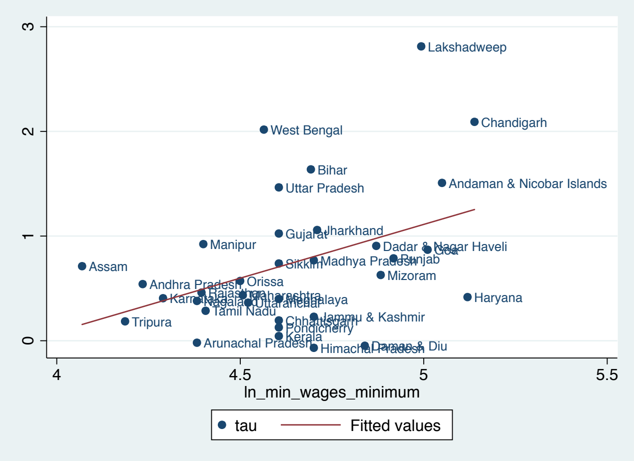
Interstate Variation

Tau Against Lowest Minimum Wage



Further Issues: Explaining Intertemporal Variation

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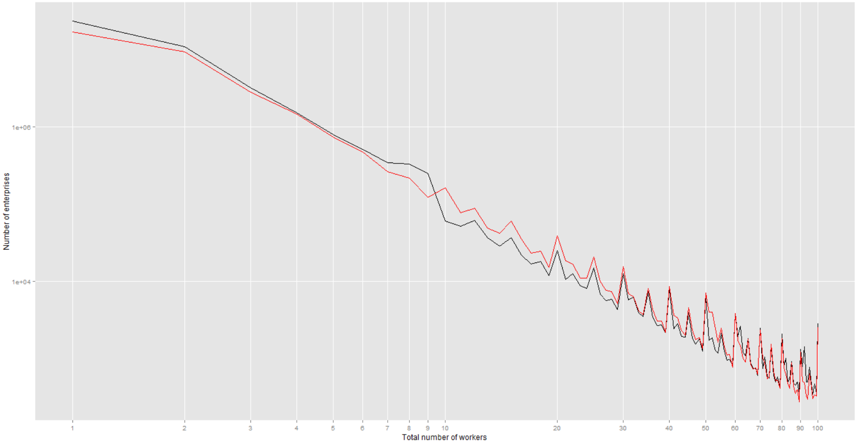
Frequency by enterprise size (Overlaying EC Waves)

Black = 2005 EC; Red = 1998 EC



Intertemporal Variation

Possible "economic" explanations

- Some suggestive facts:
  - significant decrease in organized employment over the time period.
    - 1997 - 2004, 1.8 million jobs lost (6.3% of org sector)[1]
  - significant increase in casual and contract labor (at least in registered manuf):
    - 1990 - 12%; 1998 - 15.5%; 2005 - 26.8%[2]
- But it could also be...
  - Change in organizational form (eg: more subcontracting/disintegration)?
  - Entry of small firms between 98 and 2005, coupled with exit of larger sized firms?
  - Anything else?

---

[1] 1.2 million in org manuf sector (18% of jobs) [Nagaraj, 2007]

[2] [Sundar, 2012; Maiti, 2013]

Intertemporal Variation

Possible "statistical" explanations

- Change in cost of misreporting or the benefit of reporting accurately?
  - dilution of powers of ministry of factories in 2000?
- In 2005 EC, an extra burden placed on enumerators for enterprises > 10 - the address slip
  - enumerators were paid extra in some states (Bihar, Tamil Nadu - not WB or MH)
  - some evidence that this is not an issue (from Post Enumeration Checks in WB and Tamil Nadu, anyway)
  - can't explain the downshift
  - similar downshift doesn't appear in other waves of the EC

Conclusion

- We observe a distortion in the size distribution of Indian enterprises arising between the period 1998-2005
  - *largest in the manufacturing sector.*
- We suspect that these distortions have something to do with size-based industrial regulations.
  - eg: perhaps they arise due to an interaction between these regulations and an increase in the use and availability of contract labor
- Following Garicano et al. (2013) we translate the size of the distortion into economic costs - under the assumption that the distortions are *not* caused by misreporting or other types of adjustment.
  - Under this assumption, employing 10 or more workers results in an 84% (average) increase in the cost of labor.
  - Given the caveats above, this is likely an upper bound.

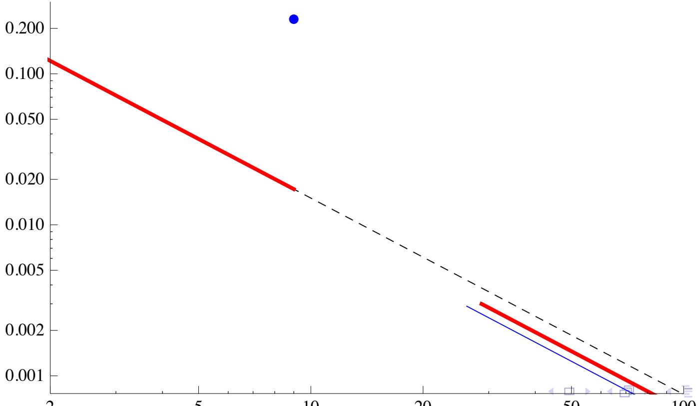
Thank you!

Graphically

- Case 2:

$$\pi(\alpha) = \max_{n,l} \alpha n^{\theta} - wn - \tau l * 1(l > 9) - F * (n-l) * \frac{(n-l)}{l}$$

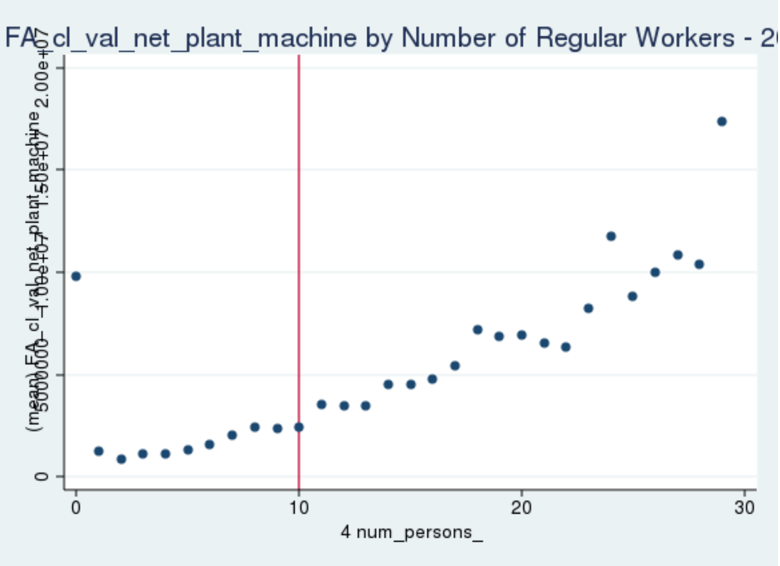
- Dashed: no tax;
- Red line: true distribution $\chi(n)$
- Blue line: reported distribution $\psi(l)$



Distribution of Enterprises By Enterprise Size (log-scale; nonparametric fit)

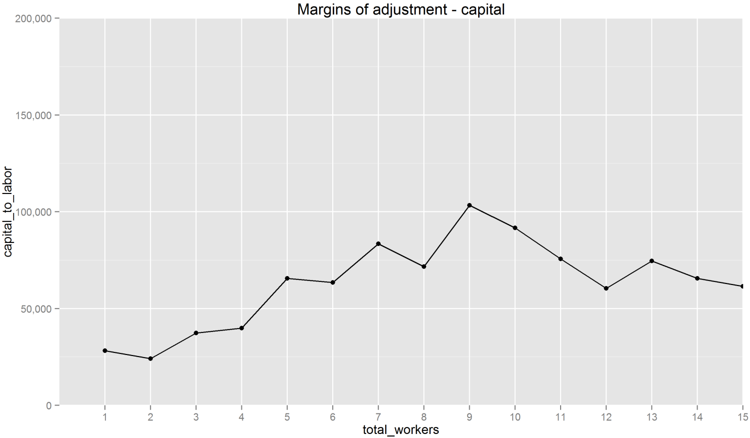
Other Margins of Adjustment

(i.e. other than employment) - ASI



Other Margins of Adjustment

From the NSSO - by hired workers



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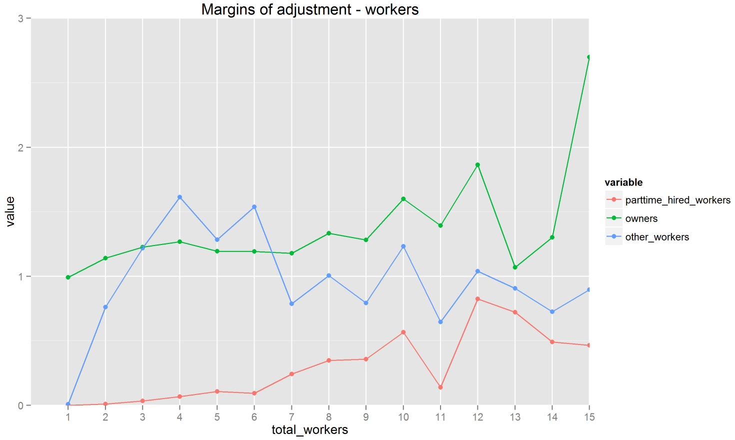

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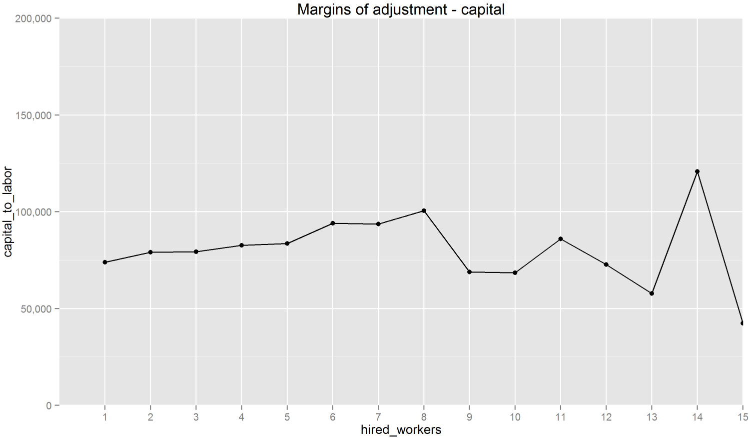

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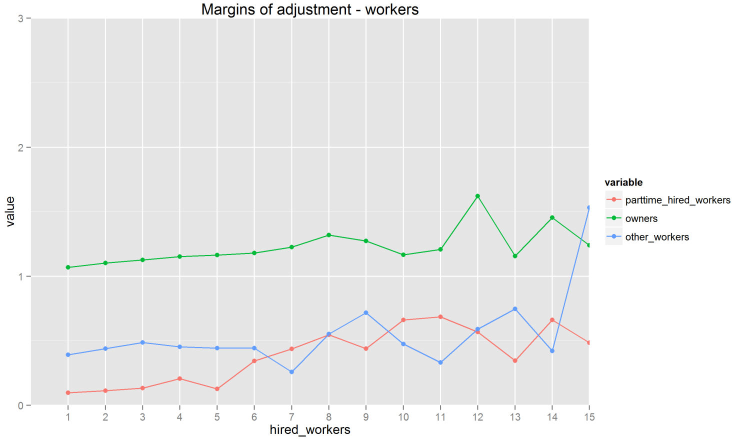
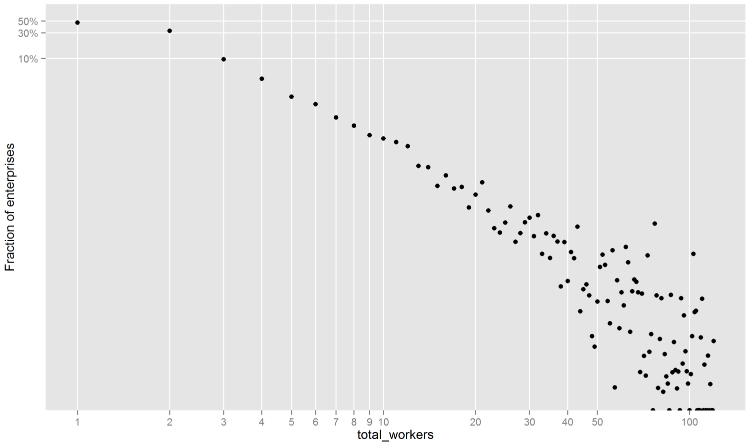


Firm Size Distribution in Other Datasets

2005 NSSO



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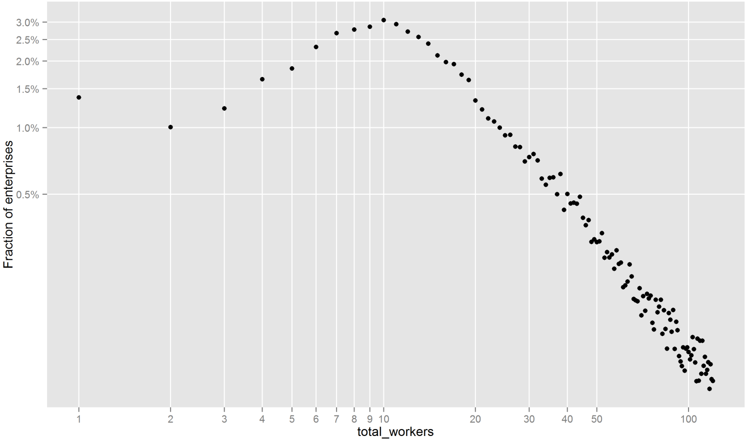
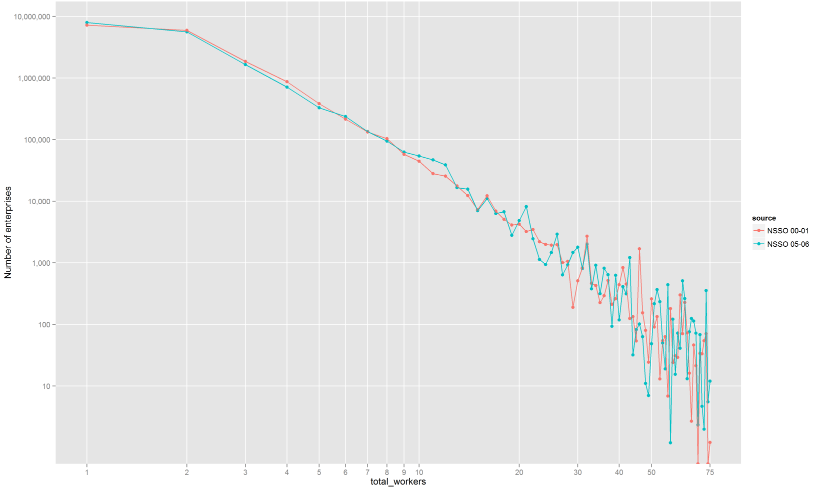


Firm Size Distribution in Other Datasets

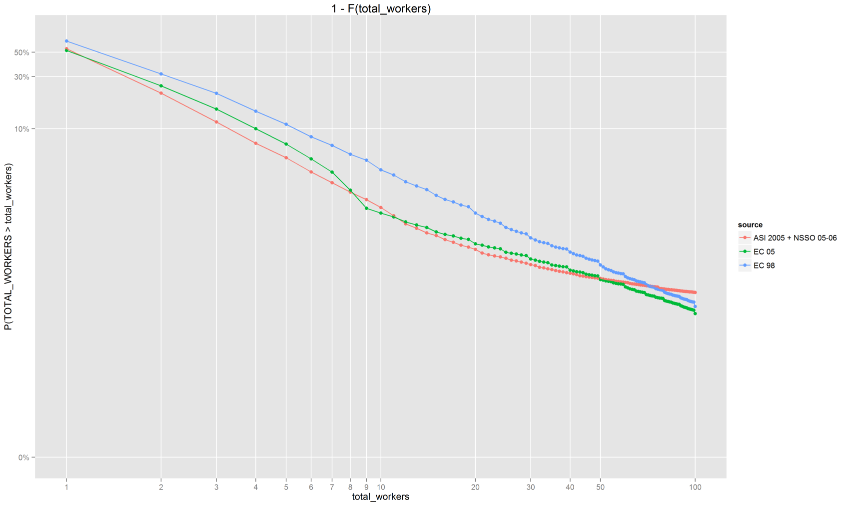
MSME coming soon...

Intertemporal Variation -Other Datasets?

NSSO Unorganized Manufacturing Surveys

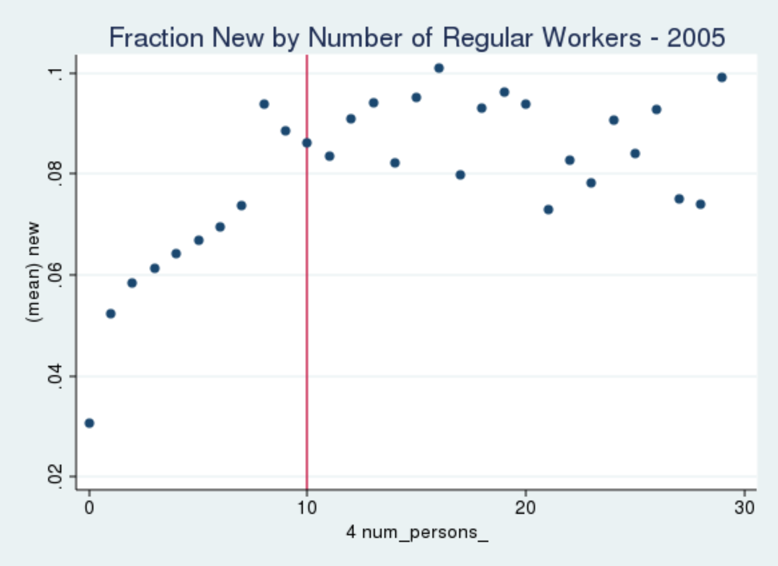


Intertemporal Variation



Intertemporal Variation

Entry - ASI



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Modelling Misreporting

- The result:
  - $\underline{\alpha} < \alpha < \alpha_1$: Unconstrained managers - *choose* $n \leq N$ *&* $l = n$
  - $\alpha_1 < \alpha < \alpha_2$: Misreporting managers - *choose* $l = N$ *but* $n > N$ *(to skirt the regulation)*
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- In case 1: $l = n - \frac{50}{F}\tau$
- In case 2: $l = n * (\frac{1}{\sqrt{\frac{\tau}{F} - 1}})$

Model 1 Implications - Densities

- Then $log\chi(n) =$
$$\begin{cases} logA - \beta log(n) & if \quad n \in [n_{\min}, 9) \\ log[\xi(n)] & if \quad n \in [9, n_m(\alpha_2)] \\ 0 & if \quad n \in (n_m(\alpha_2), n_t(\alpha_2)) \\ logA'(\tau) - \beta log(n) & if \quad n \geq n_t(\alpha_2) \end{cases}$$

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- Then $log\psi(l) =$

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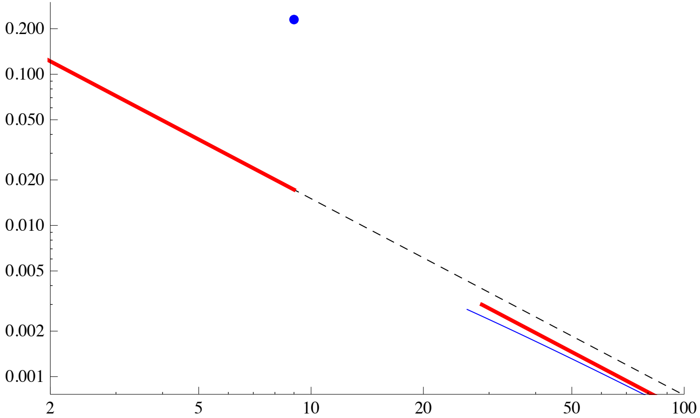
Model 1 Implications - Densities

- Then $log\chi(n) =$
$$\begin{cases} logA - \beta log(n) & if \quad n \in [n_{\min}, 9) \\ log[\xi(n)] & if \quad n \in [9, n_m(\alpha_2)] \\ 0 & if \quad n \in (n_m(\alpha_2), n_t(\alpha_2)) \\ logA'(\tau) - \beta log(n) & if \quad n \geq n_t(\alpha_2) \end{cases}$$
- Then $log\psi(l) =$
$$\begin{cases} logA - \beta log(l) & if \quad l \in [l_{\min}, 9) \\ log(\delta_l) & if \quad l = 9 \\ 0 & if \quad n \in (9, l_t(\alpha_2)) \\ logA'(\tau) - \beta log(l + \frac{50}{F}\tau) & if \quad l \geq l_t(\alpha_2) \end{cases}$$
- Key things are:
  - The presence of 'bunching' and 'valleys' can be explained entirely by this kind of misreporting (δ_l)
  - The 'downshift' cannot: $\psi(l) \to \chi(n)$ for large l,n.

Graphically

- Dashed: no tax;
- Red line: true distribution $\chi(n)$
- Blue line: reported distribution $\psi(I)$



Model 2 Implications - Densities

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- Key things are:
  - Again, there is a downshift in the distribution of $\chi(n)$ after 10,
  - But now there is an additional downshift in the distribution of $\psi(l)$, so that any estimate based on $\psi(l)$ will overestimate the true effect.

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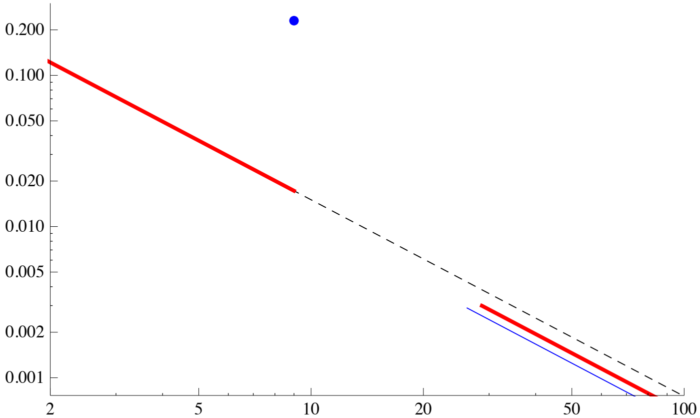

Theory: Last Words

- If there is the "right kind" of misreporting, the estimates above may be upwardly biased.
- Still, there are costs to misreporting (informalization, tax avoidance), but these may be difficult to measure.
- Same with the other stories (contracting, outsourcing, etc)...

Sources of Finance by size

No finance, govt finance and private finance