

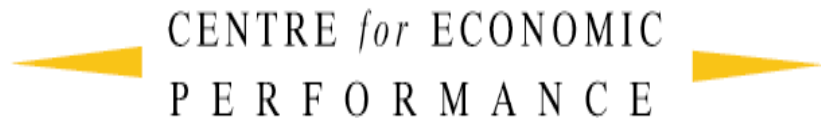
# **Firm Size Distortions and the Productivity Distribution: Evidence from France**

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Cornell October 2nd 2015



# Or..... “Lucas in France”



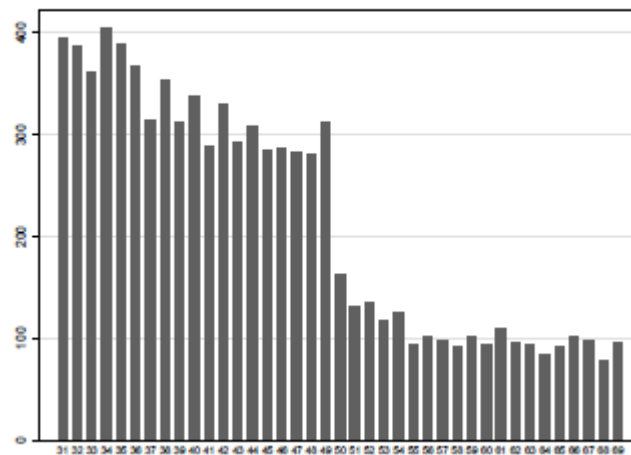
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## Firms in the manufacturing in

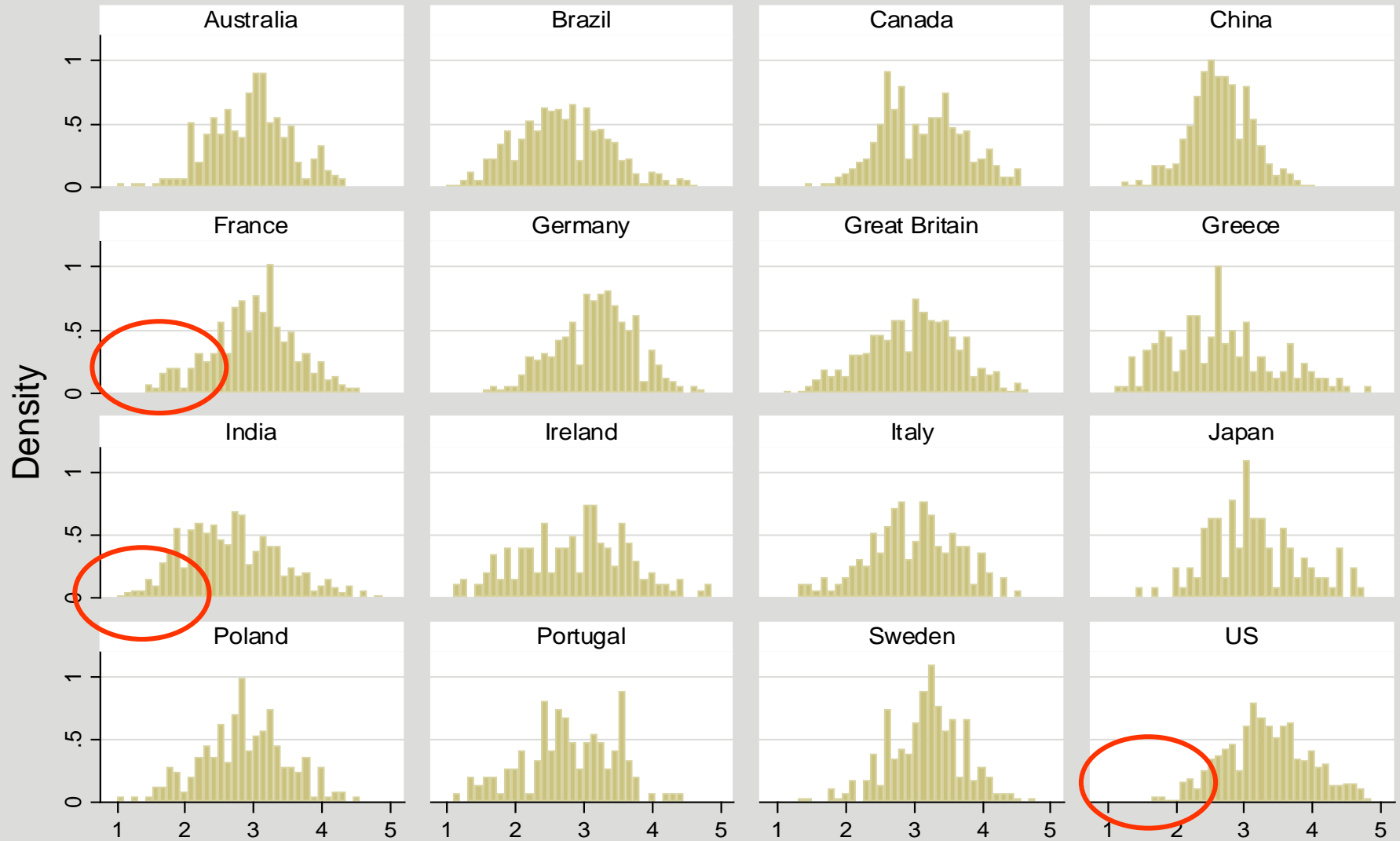
### 1. FICUS



# MOTIVATION

1. **Reallocation:** bigger share of economic activity to more productive/efficient firms. Important in understanding:
  - Aggregate productivity changes over time within countries (e.g. Bailey et al, 1992) & within industries
  - Trade with heterogeneous firms (e.g. Melitz, 2003)
  - Aggregate productivity across countries (Hsieh & Klenow, 2009; Bartelsman, Haltiwanger & Scarpetta, 2013)

# MANAGEMENT QUALITY DISTRIBUTION ACROSS FIRMS WITHIN COUNTRIES (BLOOM & VAN REENEN DATA) TAIL OF VERY BADLY MANAGED FIRMS SMALLEST IN US



**Firm-Level Management Scores (1=worst, 5=Best)**

# MOTIVATION

1. **Reallocation:** bigger share of economic activity to more productive/efficient firms. Important in understanding:
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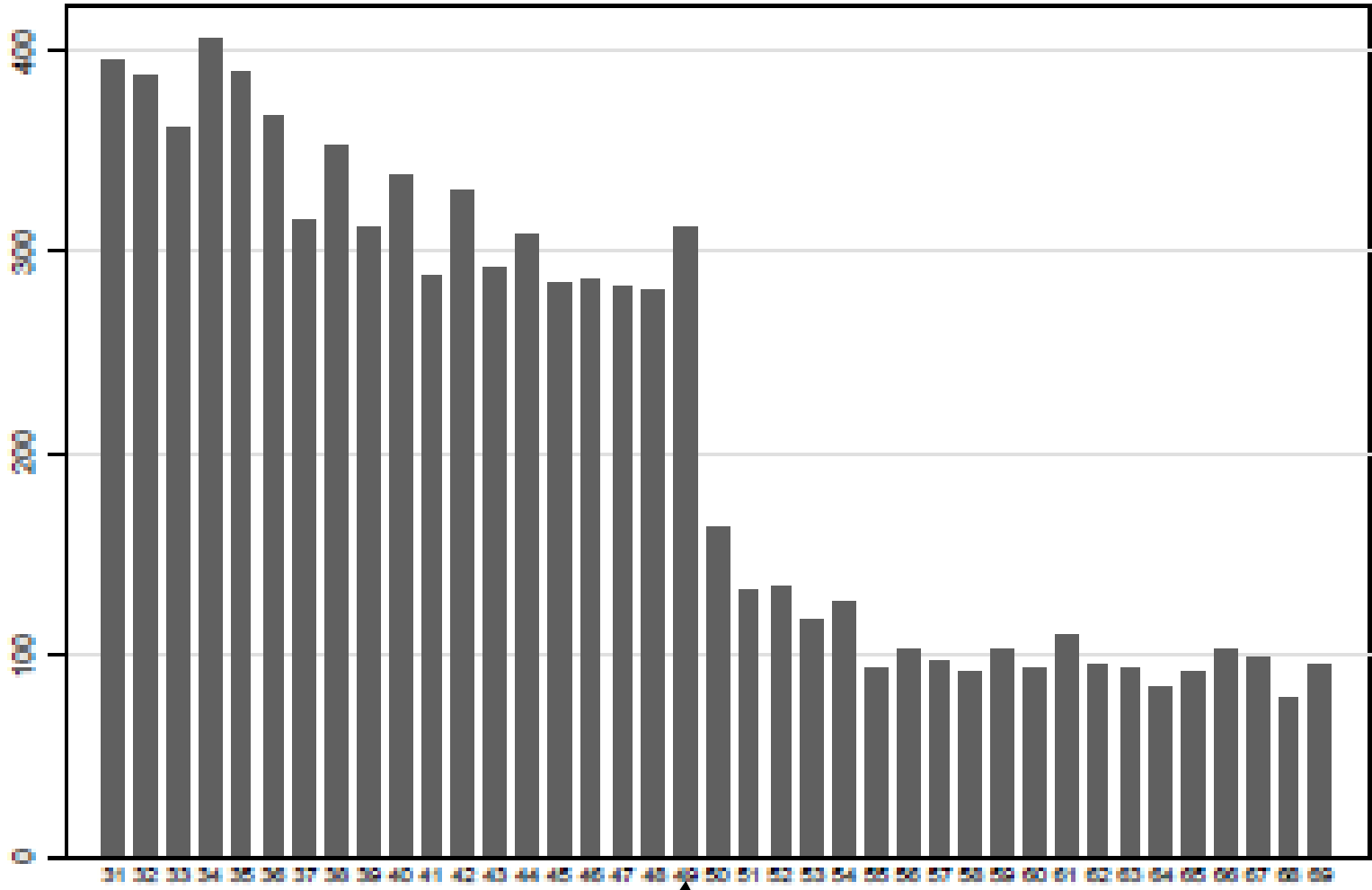
## 2. Labor market regulation

- How do we estimate the cost of labor regulations? Most Employment Protection Indices are crude & legally based
- Our alternative: back out implicit regulatory “tax” using theory & data
  - Labor Reform is hot political issue in EU due to crisis
  - In France regulation increases for firms >50 workers
  - Affordable Care Act penalties for firms >50 workers who don't offer health insurance, but not smaller firms

# SUMMARY

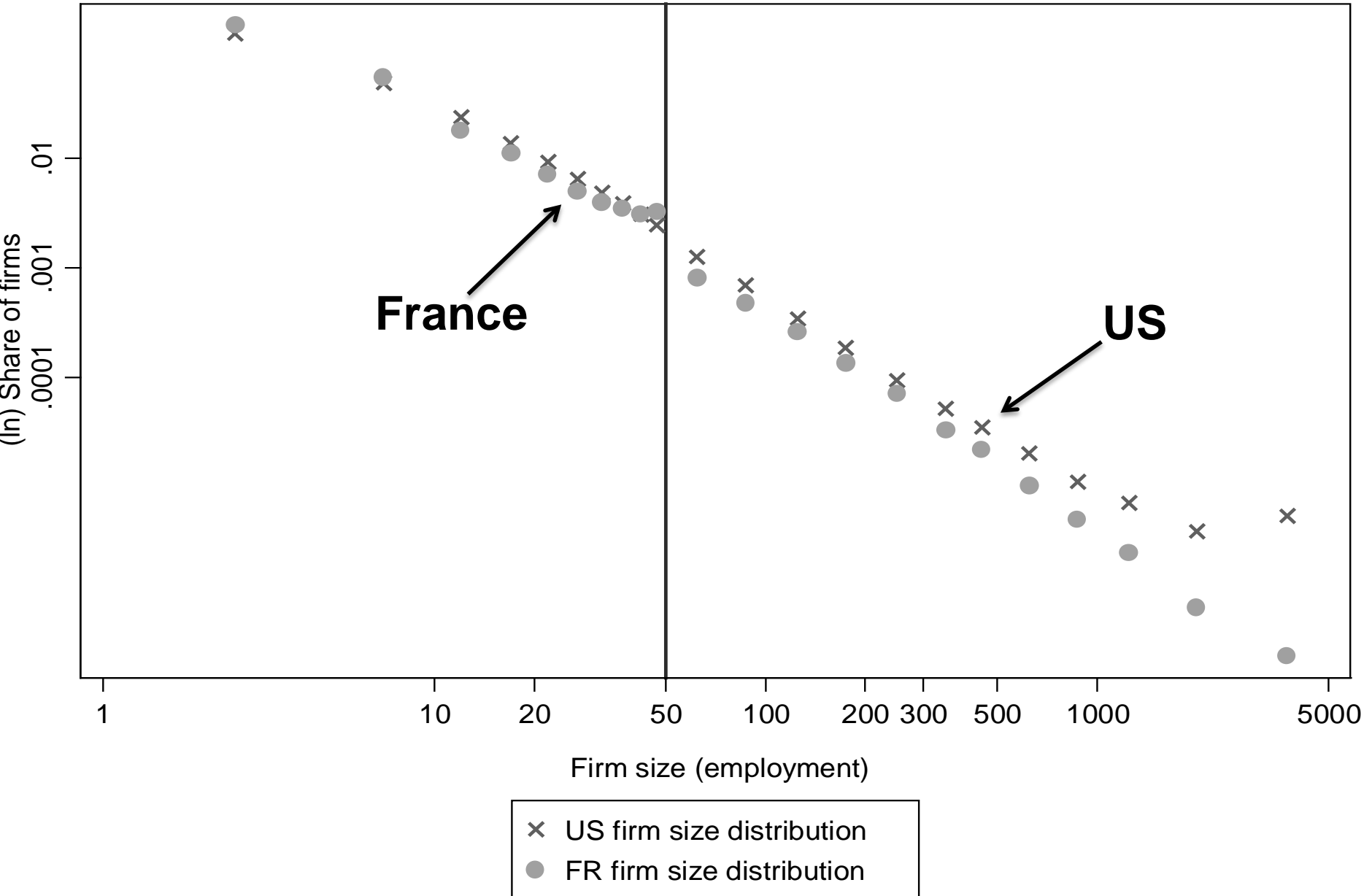
- Focus on major labor regulations in GE setting:
- Method for estimating effects of size-related regulation
  - Extension of Lucas (1978) firm size in GE
  - Exploit discontinuity in size-distribution (“Broken power law”) & theory for structural estimation
- **Findings:**
  - Big distributional effects: workers & large firms lose; small firms gain
  - Welfare costs potentially large: ~1% GDP if real wages fully adjust to regulation; ~5% if real wages downwardly inflexible (US/France contrast?)

# RAW DATA ON NUMBER OF FIRMS BY EACH SIZE CLASS (INTEGER NUMBER OF EMPLOYEES)



Exactly 49 employees

# FIG 1: FIRM SIZE DISTRIBUTION: US DOESN'T HAVE A BREAK AT 49 WORKERS LIKE FRANCE





# WHY THE BREAK AT 49 WORKERS?

- Sharp increase in regulation at 50 workers
  - Creation of “work council” (“comité d’entreprise”)
  - Firm has to offer union representation
  - Health & safety committee
  - Profit sharing scheme
  - Collective dismissal requires “social plan” to facilitate re-employment through training, job search, etc.  
Negotiated/monitored by unions & Labor Ministry
- These costs make firms reluctant to grow: an implicit tax on firm size (e.g. Bentolila & Bertola, 1990)

# EXAMPLES OF RELATED PREVIOUS LITERATURE

- **Lucas model applications**
  - Braguinsky et al (2011); Murphy et al (1991); Guner et al (2006, 2008); Restuccia & Rogerson (2008); Atkeson & Kehoe (2005); Garcia-Santana & Pijoan-Mas (2010); Gourio and Roys (2014); Kaplow(2014)
- **Firm Size Distribution**
  - Gibrat (1931); Axtell (2001); Ramsden & Kiss-Hopal (2000); Giovanni et al (2010); Hernandez-Perez et al (2006)
- **Labor Market Regulation**
  - Kramarz & Michaud (2010); Schivardi and Torrini (2008); Abidoye et al (2009); Ceci-Renaud & Chevallier (2010), Petrin & Sivadassan (2012)
- **Productivity and Firm Size**
  - Hsieh & Klenow (2009); Hsieh & Olken (2014); Bartelsman, Haltiwanger & Scarpetta (2013); European Commission (1996); Banerjee & Duflo (2005); Martin, Harrison & Nataraj (2014)
- **Discontinuities related to tax kinks & notches**
  - Saez (2010); Chetty et al (2011); Kleven et al (2011); Kleven & Wassoum (2012)

# OUTLINE

## 1. Theory: “Lucas in France”

## 2. Empirical Implementation

## 3. Data

## 4. Results

- Main findings
- Robustness/Extensions

# BASELINE THEORY

- One input, one sector a la Lucas (1978)
- Distribution of managerial ability ( $\alpha$ )
- **Ability**: how much an agent can raise a team's output:
  - Manager with ability  $\alpha$  and  $n$  workers produces
$$y = \alpha f(n)$$
  - $f'(n) > 0$ ,  $f''(n) < 0$  from managerial span of control problem (e.g.  $f(n) = n^\theta$ ,  $\theta < 1$ )
  - More able managers run bigger firms

# INDIVIDUAL OPTIMIZATION

- Economy-wide wage,  $w$

- **Profits:**

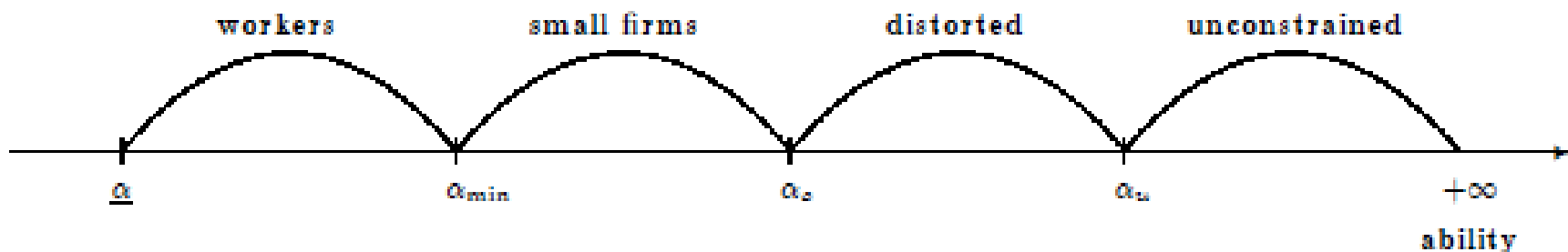
$$\pi(\alpha) = \max_n \begin{cases} \alpha f(n) - wn & \text{if } n \leq N \\ \alpha f(n) - w(N + \tau(n - N)) - F & \text{if } n > N \end{cases}$$

- Once employment exceeds  $N=49$  regulation implies implicit taxes: variable cost,  $\tau$  & fixed cost,  $F$
- First order condition at each side of threshold:

$$\alpha f'(n^*) - \bar{\tau}w = 0, \quad \text{with } \begin{cases} \bar{\tau} = 1 & \text{if } n \leq N \\ \bar{\tau} = \tau & \text{if } n > N \end{cases}$$

# EQUILIBRIUM (1/3)

1. Wage level  $w$
2. An allocation  $\mathbf{n}(\alpha)$ : firm size ( $n$ ) function of ability ( $\alpha$ )
3. A triple of cutoffs
  - $\{\alpha_{\text{MIN}}, \alpha_{\text{C}}, \alpha_{\text{U}}\}$



## EQUILIBRIUM (2/3)

1. Labor supply = labor demand
2. No agent wishes to change occupation from manager to worker or to change from unconstrained to constrained
3. The choice of  $n(\alpha)$  for each manager is optimal given their skills  $\alpha$ , taxes  $\tau$ ,  $k$  and wage  $w$   
**“Marginal Manager” at  $\alpha_U$**

# EQUILIBRIUM (3/3)

- Firm size & productivity:

$$n^*(\alpha) = 0 \quad \text{if } \alpha < \alpha_{\min}$$

$$n^*(\alpha) = f'^{-1}\left(\frac{w^*}{\alpha}\right) \quad \text{if } \alpha_{\min} \leq \alpha \leq \alpha_c$$

$$n^*(\alpha) = N \quad \text{if } \alpha_c \leq \alpha < \alpha_u$$

$$n^*(\alpha) = f'^{-1}\left(\frac{\tau w^*}{\alpha}\right) \quad \text{if } \alpha \geq \alpha_u$$

**Workers**

**‘Small Firms’**

**‘Constrained’**

**‘Unconstrained’**



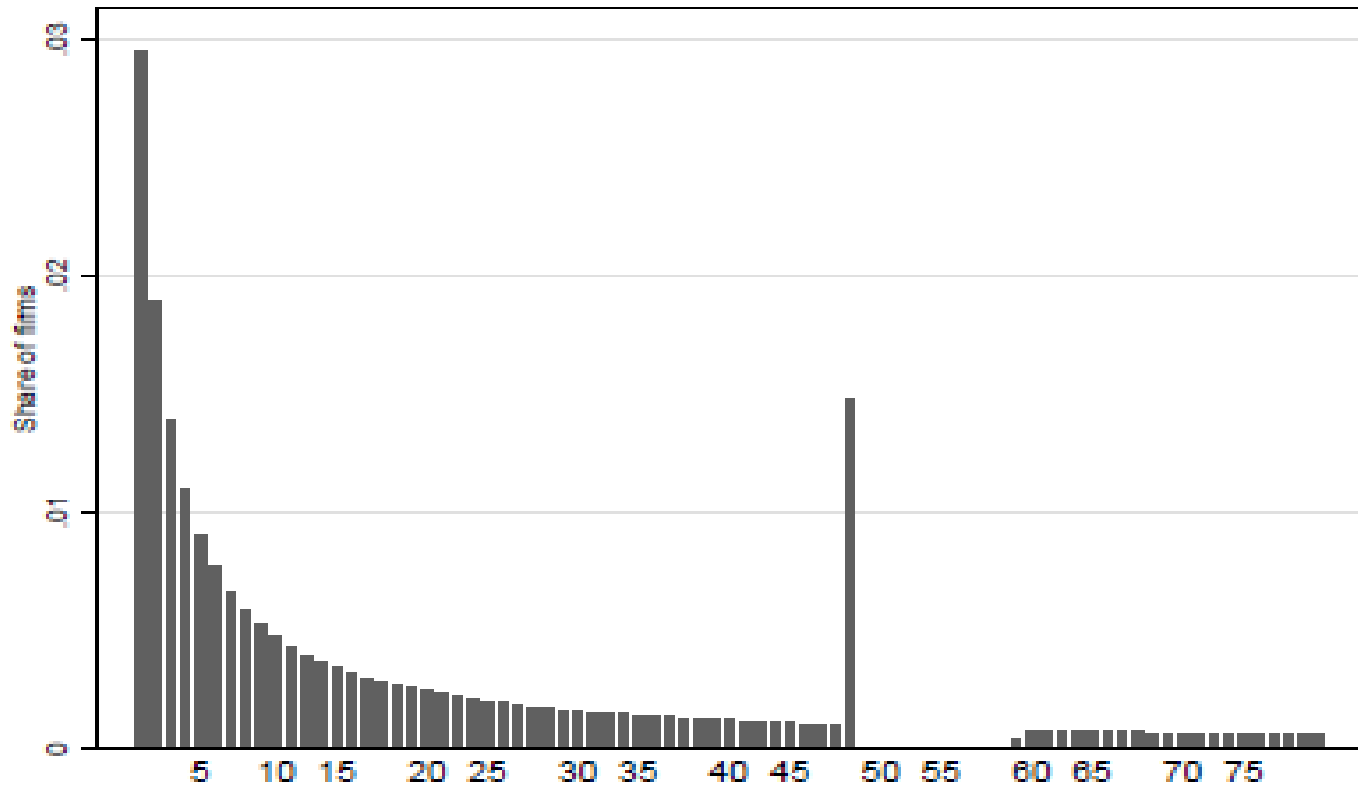
# MANAGERIAL ABILITY DISTRIBUTION

- Following Lucas (1978) assume:
  - The managerial returns to scale function has a constant 'elasticity' form. We assume  $f(n) = n^\theta$
  - A power law in firm size requires a power law in the ability distribution. Assume pdf of ability is:

$$\phi(\alpha) = c_\alpha \cdot \alpha^{-\beta_\alpha}$$

# THEORY: FIRM SIZE DISTRIBUTION (FIG 3A)

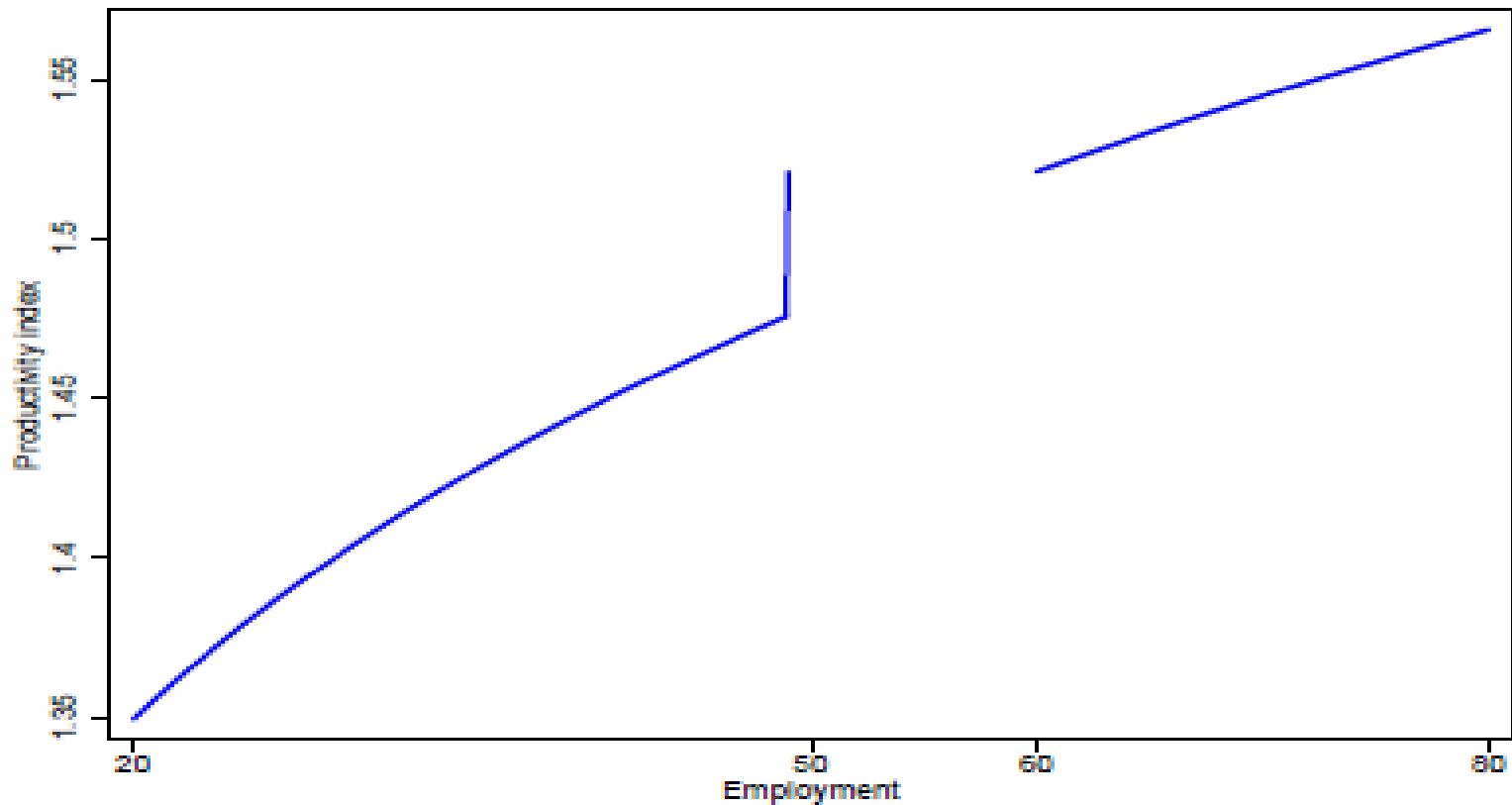
Firm Size Distribution



**Notes:** parameter values are  $\beta_\alpha=1.6$ ,  $\tau=1.01$ ,  $n_u=60$

# THEORY: SIZE AND PRODUCTIVITY (FIG. 3B)

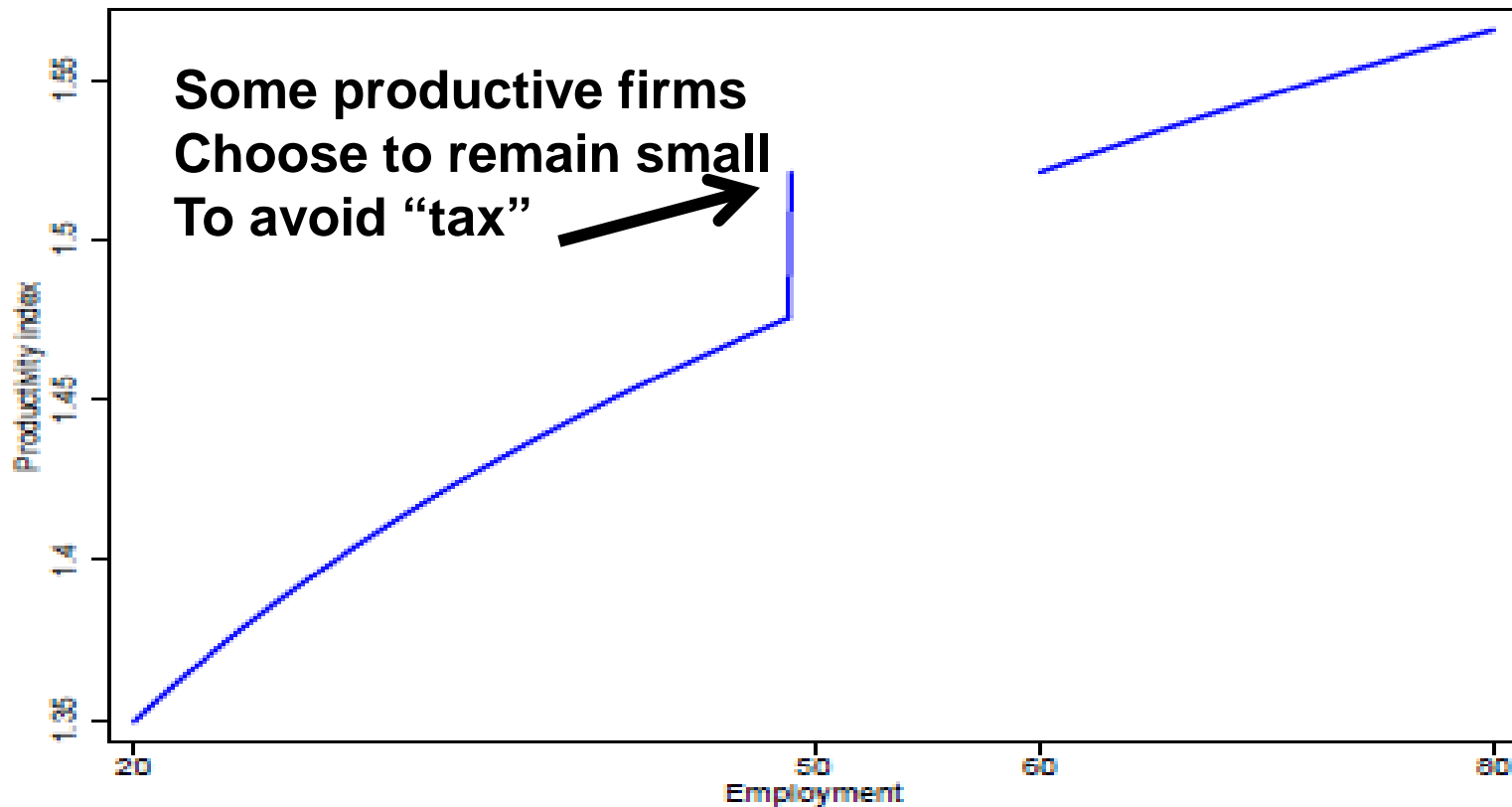
TFP/Size Relation



**Notes:** parameter values are  $\beta_\alpha=1.6$ ,  $\tau=1.01$ ,  $n_u=60$

# THEORY: SIZE AND PRODUCTIVITY (FIG 3B)

TFP/Size Relation



# LABOR REGULATION GENERATES 'TOO MANY' SMALL FIRMS FOR TWO REASONS

- Firms choosing to remain small to avoid the regulation
- Equilibrium wage lower as workers bear some of the incidence of tax
  - This encourages low managerial ability individuals to form firms instead of remaining workers
  - And smaller firms enjoy lower labor costs
- 'Too many' small firms in Europe?
  - Braguinsky, Branstetter & Regateiro (2011) on Portugal
  - European Commission (1996,2006)

# OUTLINE

1. Theory: Lucas in France

**2. Empirical Implementation**

3. Data

4. Results

- Main findings
- Robustness/Extensions

# EMPIRICAL IMPLEMENTATION

- Equilibrium Firm Size Distribution (pdf of  $n^*$ ):

$$\chi^*(n) = \begin{cases} \left(\frac{1-\theta}{\theta}\right)^{1-\beta} (\beta - 1)n^{-\beta} & \text{if } \theta/(1 - \theta) \leq n < N \\ \left(\frac{1-\theta}{\theta}\right)^{1-\beta} (N^{1-\beta} - Tn_u^{1-\beta}) & \text{if } n = N \\ 0 & \text{if } N < n < n_u \\ \left(\frac{1-\theta}{\theta}\right)^{1-\beta} (\beta - 1)Tn^{-\beta} & \text{if } n_u \leq n \end{cases}$$

**Small Firms**  
**“Bulge”**  
**“Valley”**  
**Large Firms**

- $\beta$  = “slope” of power law in firm size =  $\beta_\alpha(1 - \theta) + \theta$
- Tax  $\tau$ , affects shift in ‘intercept’ of power law & size of ‘bulge’ & ‘valley’

$$T = \tau^{-\frac{\beta-1}{1-\theta}}$$

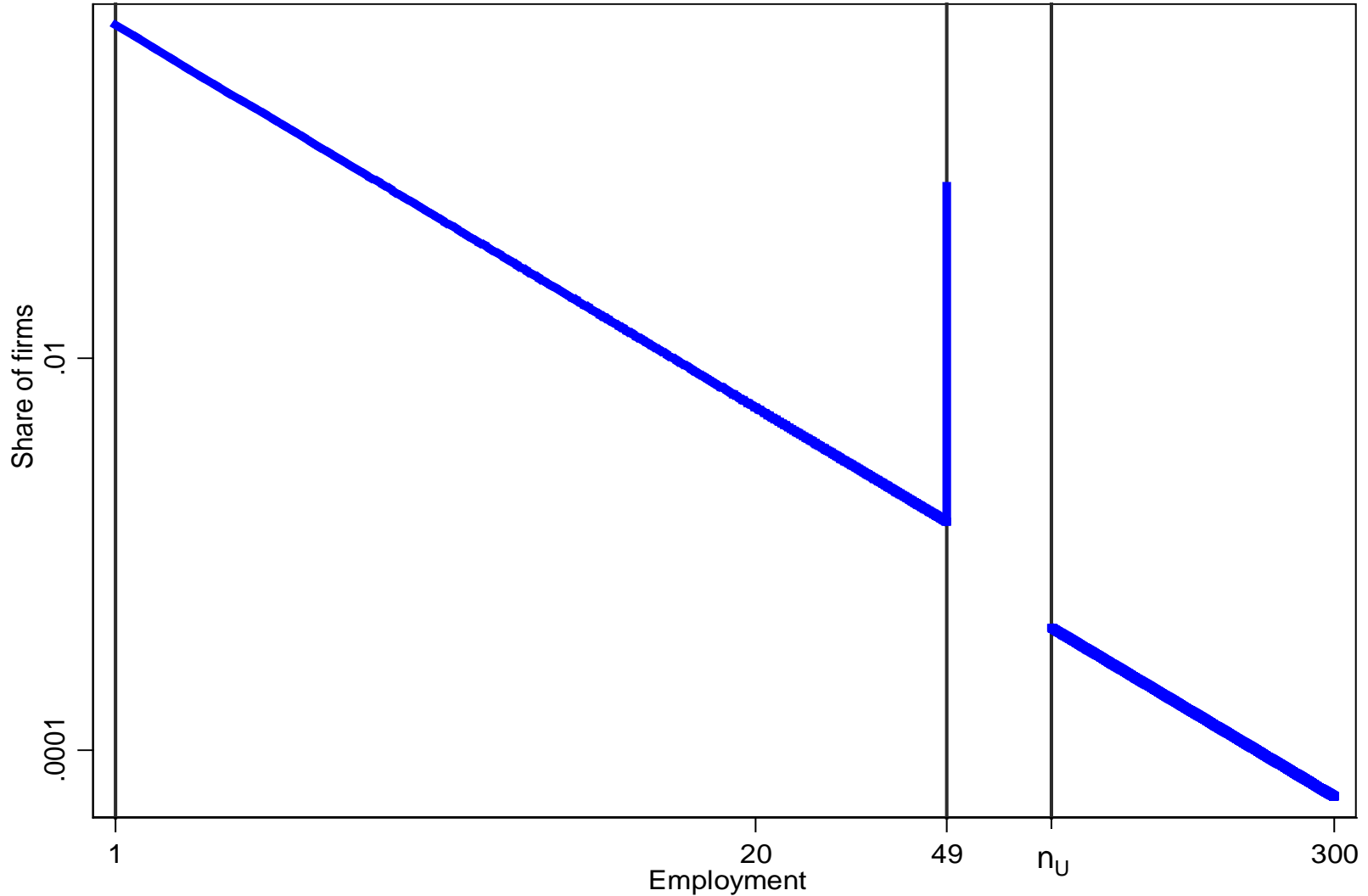
# ECONOMETRICS

- Since we have fully characterized firm size distribution we estimate parameters by straightforward ML to obtain  $\tau$ ,  $\beta$ ,  $n_U$ ,  $\sigma$  and  $F/w$
- ML estimation of broken power law follows physics literature (e.g. Howell, 2002), but we also compare with OLS + structural breaks (e.g. Bai and Perron, 1998)
- Also need estimate of  $\theta$ , returns to scale to identify the implicit tax:

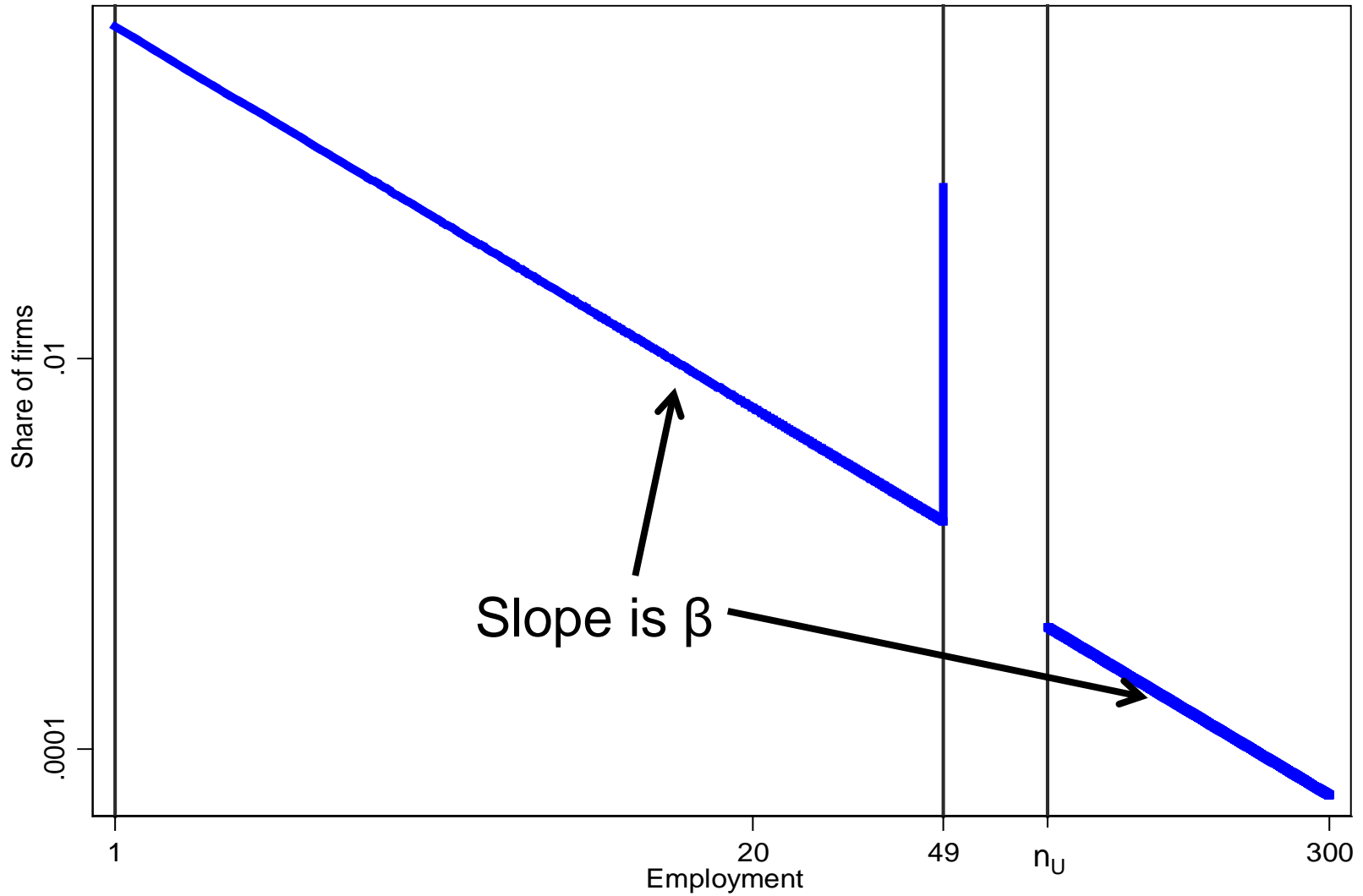
$$T = \tau^{-\frac{\beta-1}{1-\theta}}$$



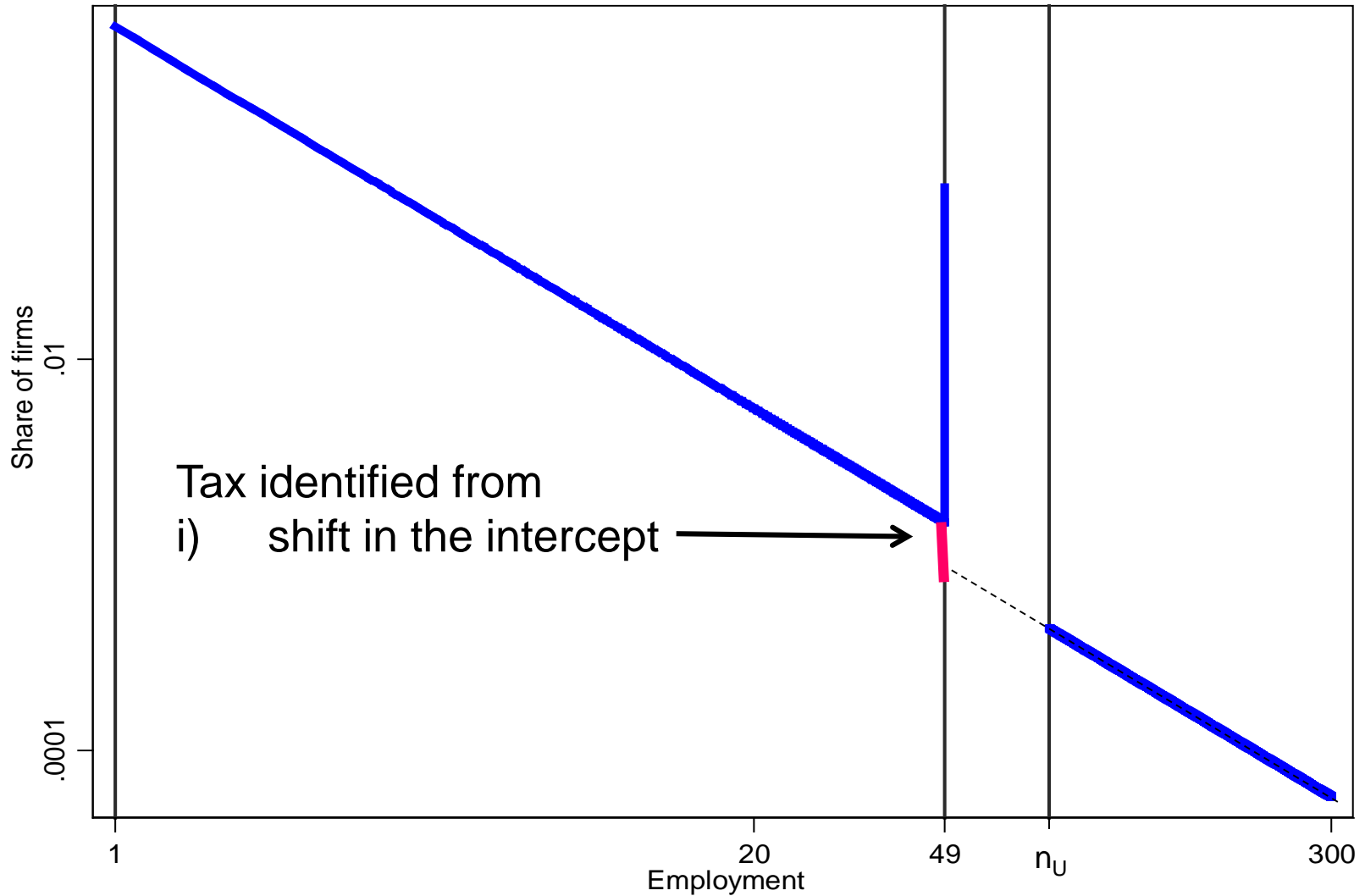
# IDENTIFICATION OF THE TAX (FIRM SIZE POWER LAW IN LOG-LOG SPACE)



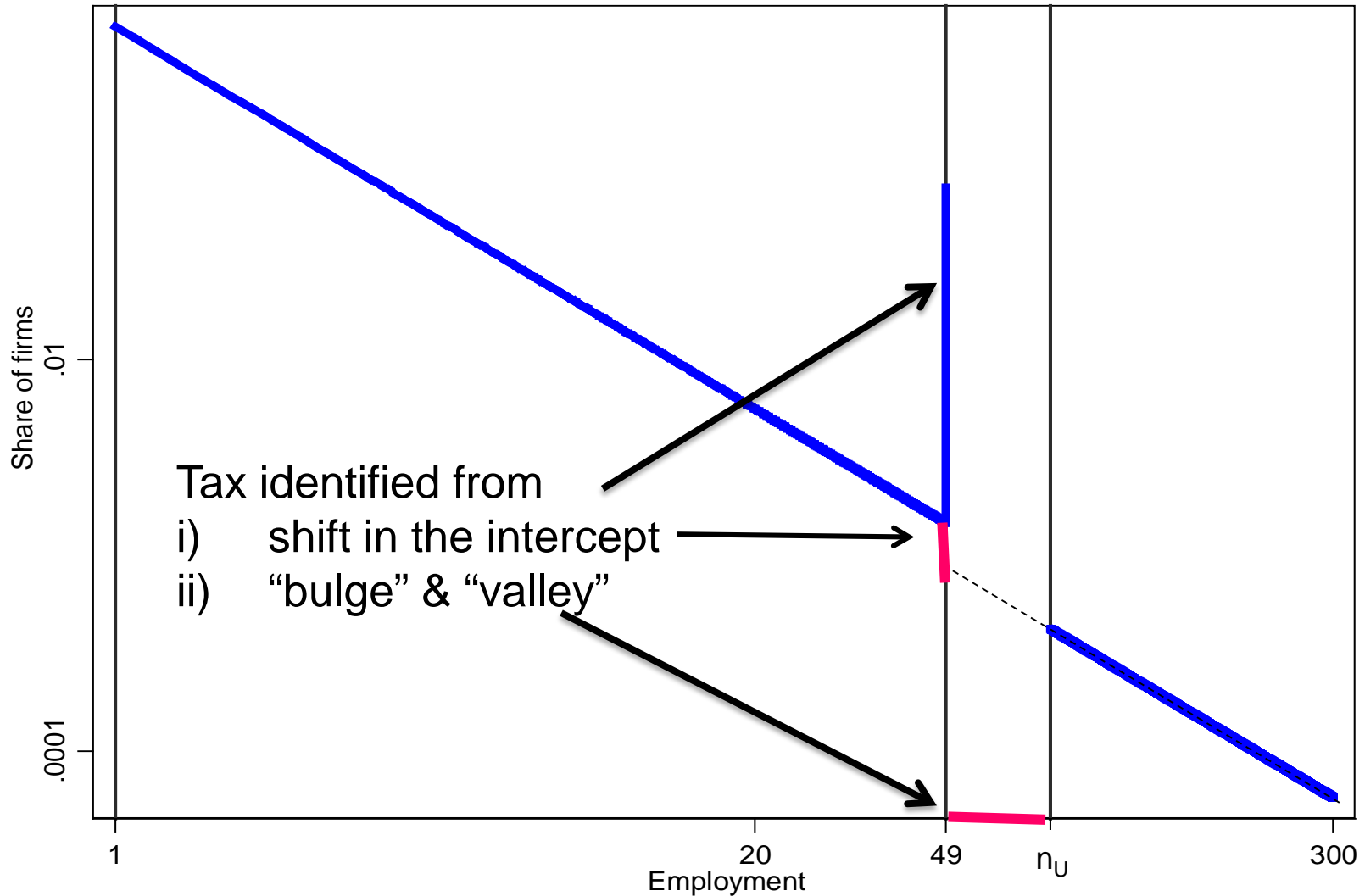
# IDENTIFICATION OF THE TAX



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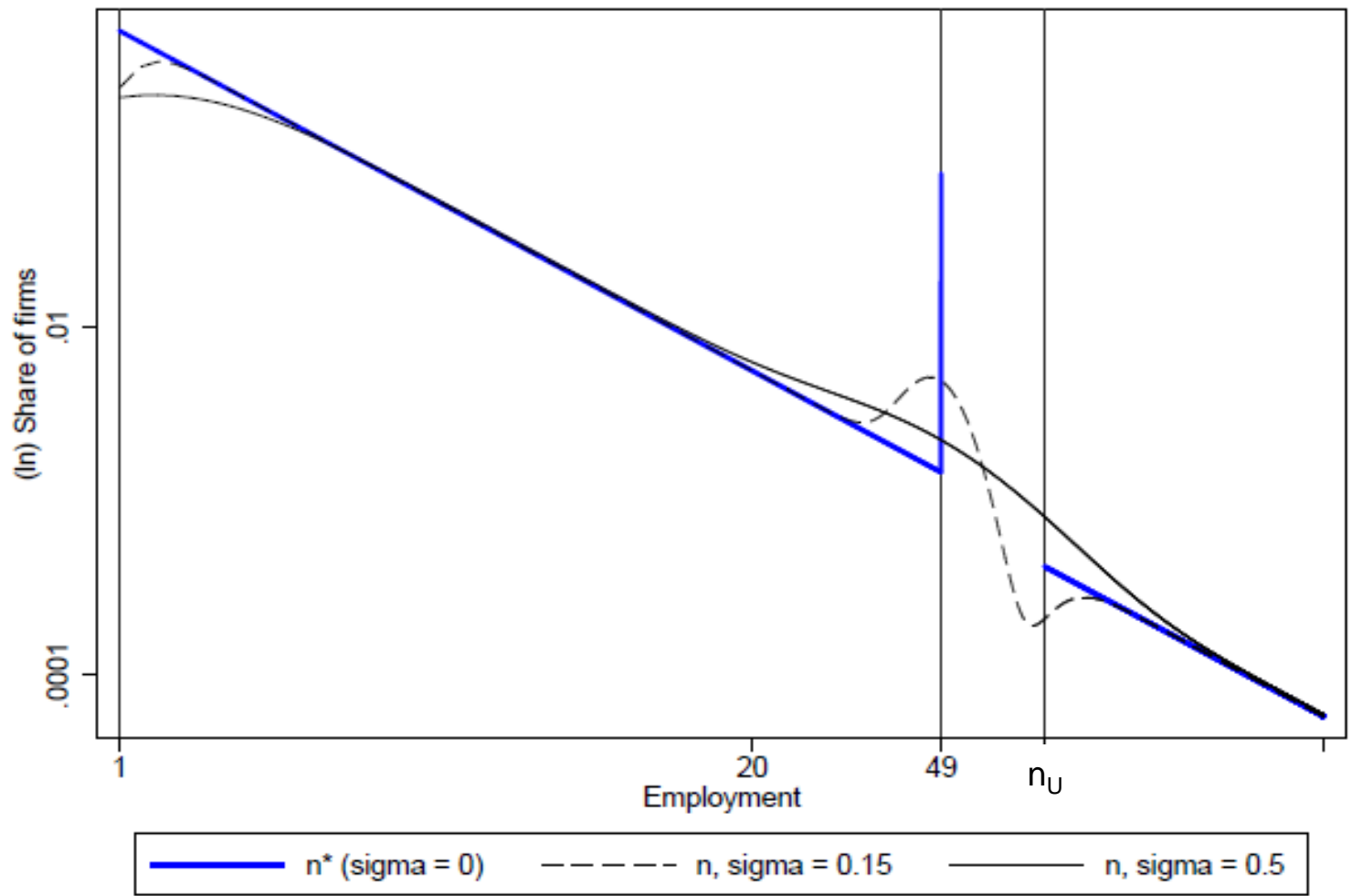


# IDENTIFICATION OF THE REGULATORY TAX



**Note:** Fixed cost of regulation ( $F$ ) only affects bulge & valley & not shift in intercept

# FIG 4: THEORETICAL FIRM SIZE DISTRIBUTION (WITH MEASUREMENT ERROR, $\sigma$ )

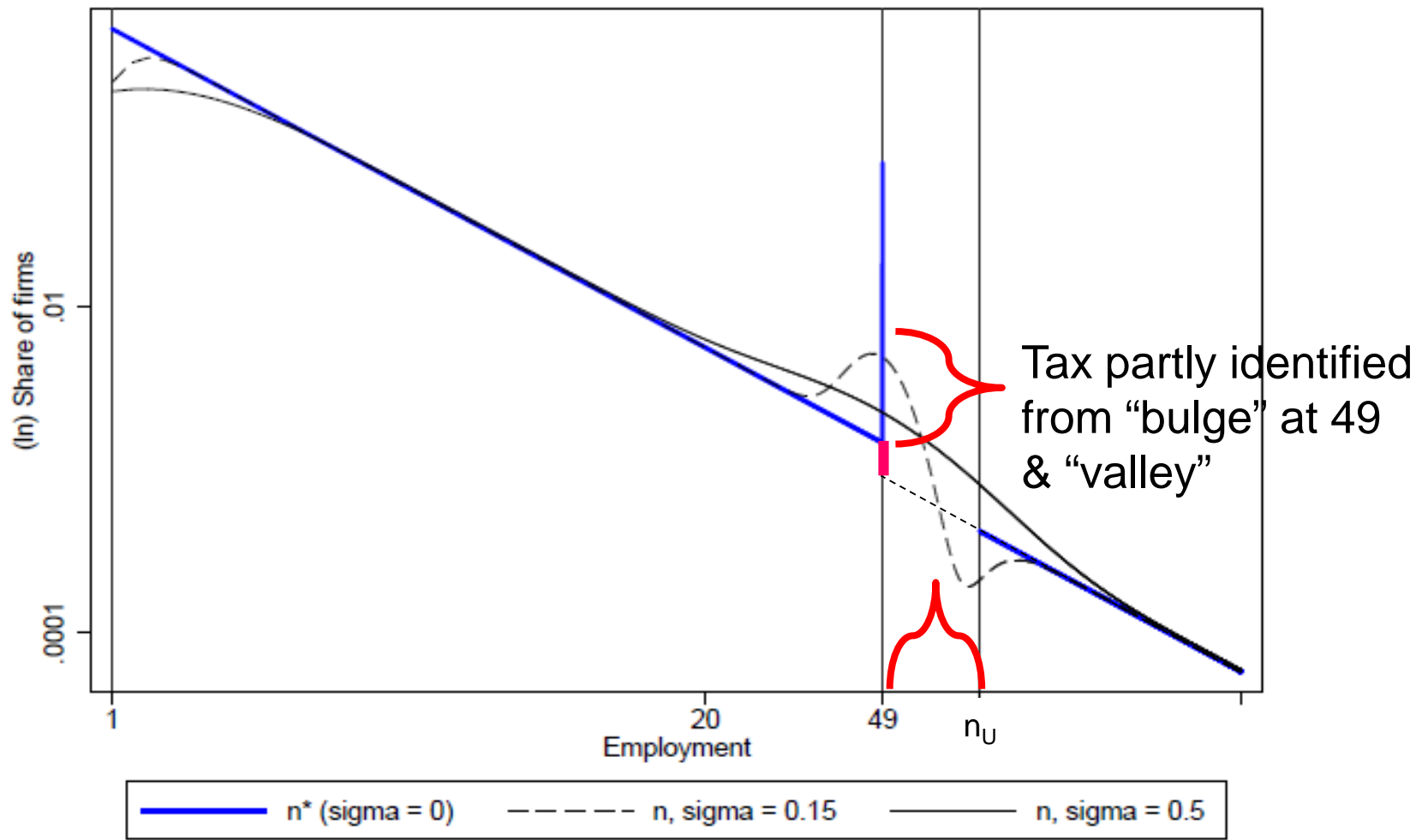


# EMPIRICAL IMPLEMENTATION

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# OUTLINE

1. Theory: Lucas in France

2. Empirical Implementation

**3. Data**

4. Results

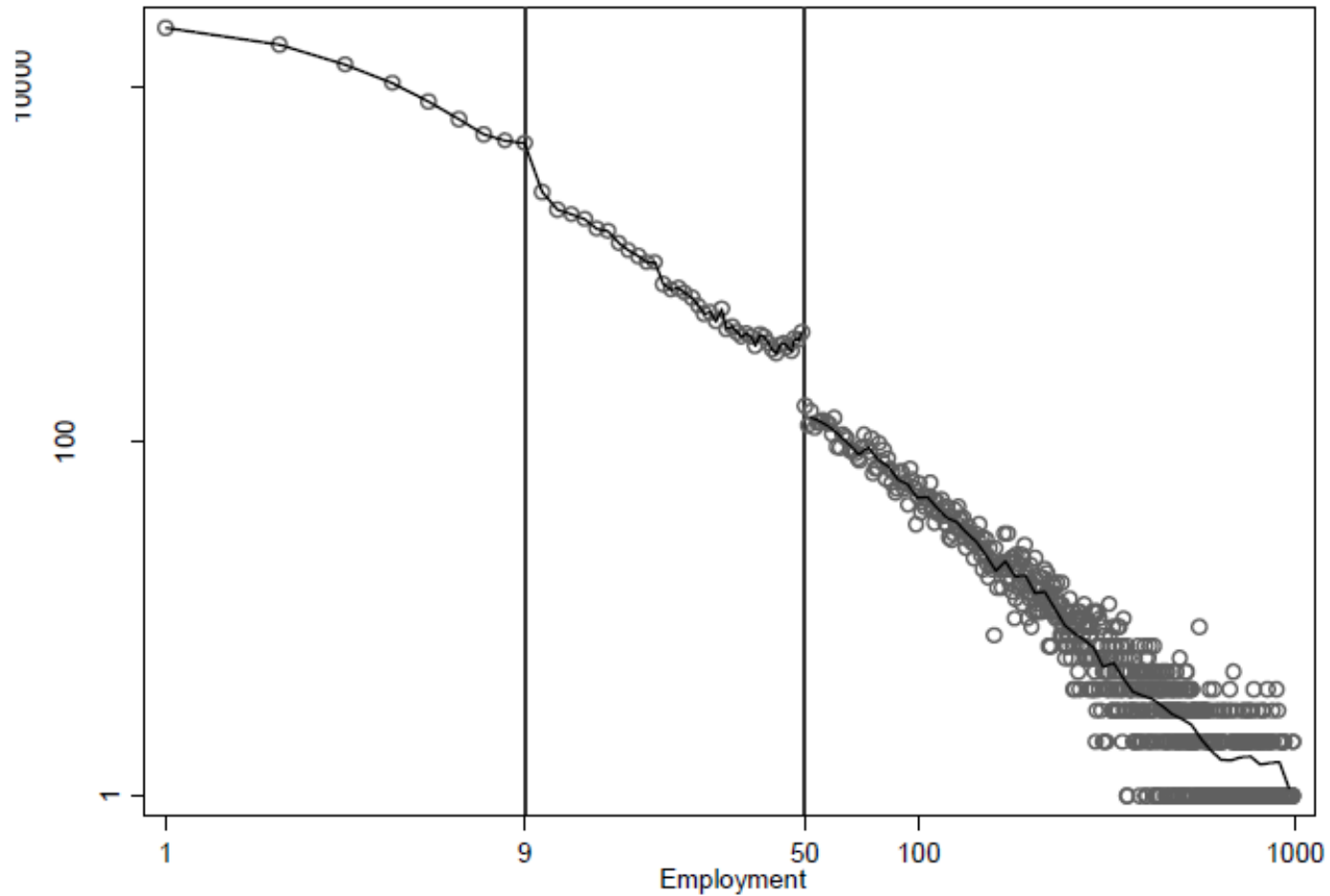
- Main findings
- Robustness/Extensions

# DATA

- Universe of French firms between 1995 - 2007
  - Mandatory fiscal returns of all French firms ("FICUS")
  - DADS (for some extra info on workers, e.g. hours, skills)
  - This is the administrative unit that the main law pertains to.
- FICUS has balance sheet information on value added, labor, capital, investment, wage bills, materials, 4 digit industry, etc.
  - Use this to calculate TFP via several methods (Levinsohn-Petrin, Olley Pakes, Solow residual, etc.)

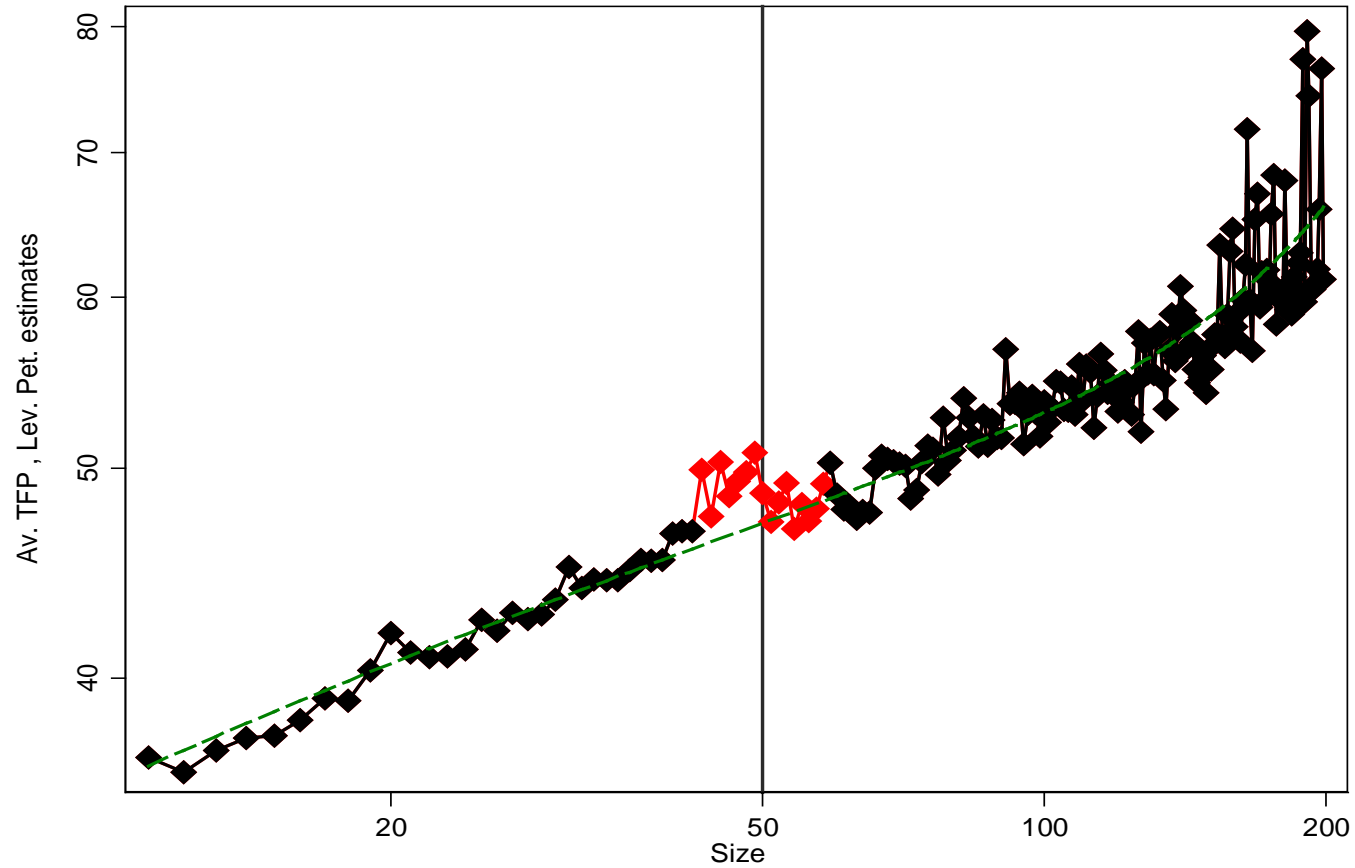


# FIG 5A: EMPIRICAL FIRM SIZE DISTRIBUTION – SLOPE, BULGE, VALLEY & INTERCEPT SHIFT



**Note:** Another regulatory break at 10 so focus on firms between 10 and 1000. Consider second threshold at 10 in Extensions

**FIG 6: TFP & SIZE RELATIONSHIP: CONSISTENT WITH THEORY THERE IS A BULGE IN TFP AROUND THE REGULATORY THRESHOLD**



# OUTLINE

1. Theory: Lucas in France
2. Empirical Implementation
3. Data

## **4. Results**

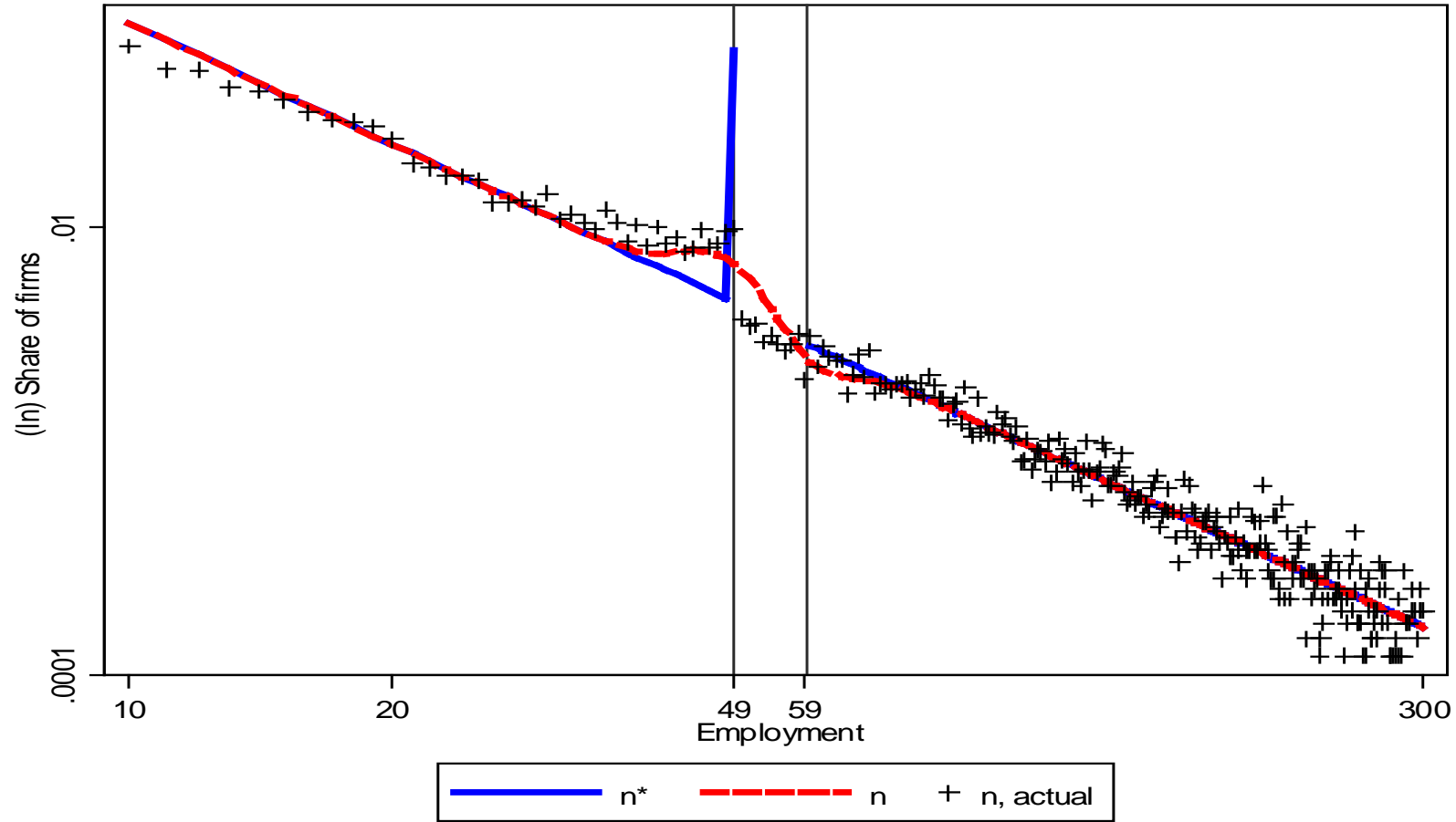
- **Main findings**
- Robustness/Extensions

**TABLE 1: ML ESTIMATES OF PARAMETERS**

$\theta$ , Returns to Scale	0.8 (Basu-Fernald)	0.85 (Atkeson-Kehoe)	$\theta=0.5$ (Hsieh-K)	$\theta=0.9$
$\tau-1$ , Implicit variable tax	0.023 (0.008)	0.017 (0.006)	0.059 (0.021)	0.007 (0.001)
$\beta$ , power law	1.800 (0.054)	1.800 (0.054)	1.800 (0.054)	1.813 (0.051)
$n_u$ , upper emp. cutoff	59.271 (2.051)	59.265 (2.026)	59.271 (2.052)	52.985 (0.317)
$\sigma$ , msremnt. error	0.121 (0.033)	0.121 (0.032)	0.121 (0.033)	0.041 (0.003)
F/w, Fixed cost of tax	0.196 (0.075)	0.146 (0.055)	0.517 (0.206)	0.016 (0.002)

**Notes:** 57,008 (manufacturing size 10-1,000) in year 2000; estimates by ML with standard errors clustered at the 4 digit industry level.

# FIG 7 FIRM SIZE DISTRIBUTION: ACTUAL AND FITTED



Notes: Baseline specification Table 1 column (1).

# TABLE 2 COMPARISON OF ACTUAL DATA WITH ESTIMATES OF OUTPUT (NOT USED IN ESTIMATION)

(Actual data)	Firms having 10 to 48 workers	Firms having 49 to 59 workers	Firms having 60 to 10,000 workers	Total
Distribution of firms (actual)	0.761	0.042	0.197	1
Distribution of firms (predicted)	0.758 (0.002)	0.046 (0.009)	0.196 (0.016)	1
Distribution of employment (actual)	0.300	0.040	0.660	1
Distribution of employment (predicted) $n=n^*[\alpha].e^\varepsilon; \sigma_\varepsilon = 0.121$	0.276 (0.021)	0.042 (0.008)	0.682 (0.023)	1
Distribution of output (actual)	0.249	0.035	0.716	1
Distribution of output (predicted) $y = \alpha.n^\theta = \alpha. (n^*[\alpha])^\theta .e^{\theta\varepsilon}, \sigma_\varepsilon = 0.121$	0.272 [0.230;0.314]	0.041 [0.025;0.057]	0.686 [0.640;0.732]	1

# TABLE 3 WELFARE & DISTRIBUTION

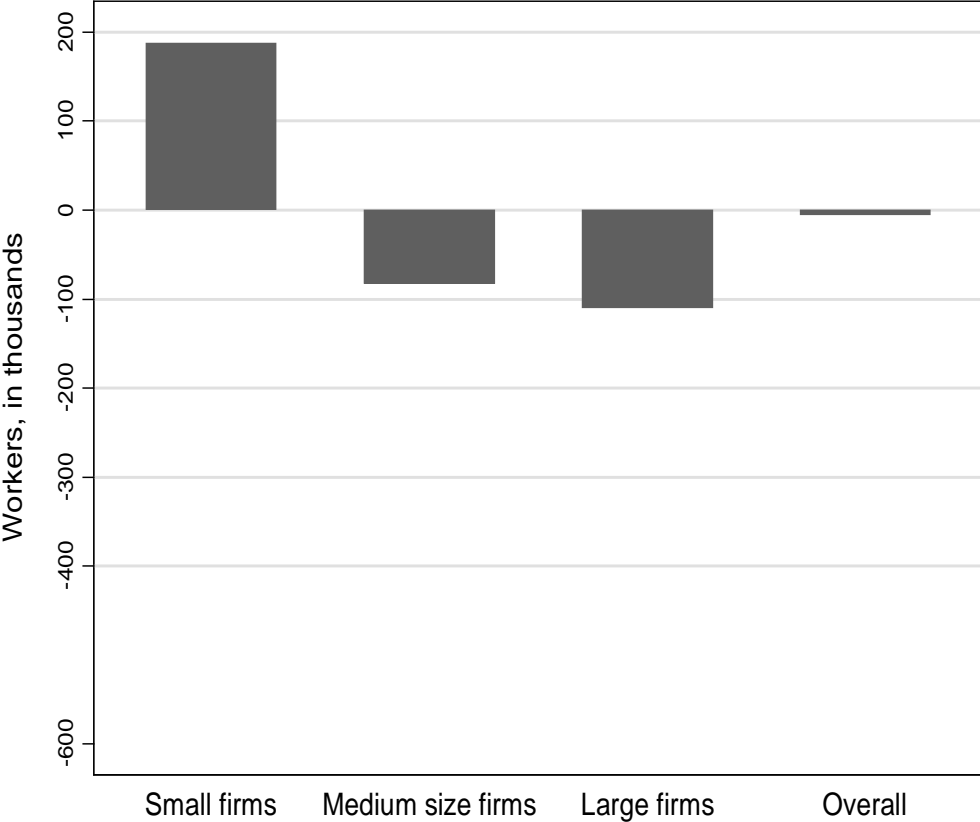
(Regulated Economy – Unregulated Economy)	FULL WAGE ADJUST
Unemployment rate	0%
Percentage of firms avoiding the regulation	2.920%
Percentage of firms above the regulatory threshold	10.387%
Change in labor costs (wage reduction), Small firms (below 49)	-1.792%
Change in labor costs (wage reduction but tax increase), Large firms (above 49)	0.502%
Excess entry by small firms (percent increase in number of firms)	7.184%
Increase in size of small firms	8.958%
Increase in size of large firms	-2.512%
Annual welfare loss (as % of GDP):	
Implicit Tax	1.304%
Output loss	<u>0.022%</u>
<b>Total (implicit tax + output loss)</b>	<b>1.326%</b>
Winners and losers:	
<i>Change in expected wage for those in labor force</i>	-1.792%
Av. gain by entering entrepreneurs of small firms	2.667%
Average profit gain by small unconstrained firms	7.167%
Average profit gain by firms constrained at 49	6.061%
<i>Change in profit for large firms</i>	-1.159%

# TABLE 3 WELFARE & DISTRIBUTION

(Regulated Economy – Unregulated Economy)	FULL WAGE ADJUST	PARTIALLY FLEXIBLE (50%)	FULLY RIGID
Unemployment rate	0%	4.373%	8.541%
Percentage of firms avoiding the regulation	2.920%	2.818%	2.712%
Percentage of firms above the regulatory threshold	10.387%	10.021%	9.670%
Change in labor costs (wage reduction), Small firms (below 49)	-1.792%	-0.894%	0
Change in labor costs (wage reduction but tax increase), Large firms (above 49)	0.502%	1.400%	2.321%
Excess entry by small firms (percent increase in number of firms)	7.184%	7.171%	7.158%
Increase in size of small firms	8.958%	4.472%	0
Increase in size of large firms	-2.512%	-6.998%	-11.470%
Annual welfare loss (as % of GDP):			
Implicit Tax	1.304%	1.301%	1.308%
Output loss	<u>0.022%</u>	<u>3.599%</u>	<u>7.165%</u>
<b>Total (implicit tax + output loss)</b>	<b>1.326%</b>	<b>4.900%</b>	<b>8.463%</b>
Winners and losers:			
<i>Change in expected wage for those in labor force</i>	-1.792%	-0.894%	-8.928%
Av. gain by entering entrepreneurs of small firms	2.667%	-0.913%	4.484%
Average profit gain by small unconstrained firms	7.167%	3.578%	0
Average profit gain by firms constrained at 49	6.061%	2.472%	-1.105%
<i>Change in profit for large firms</i>	-1.159%	-4.748%	-8.326%

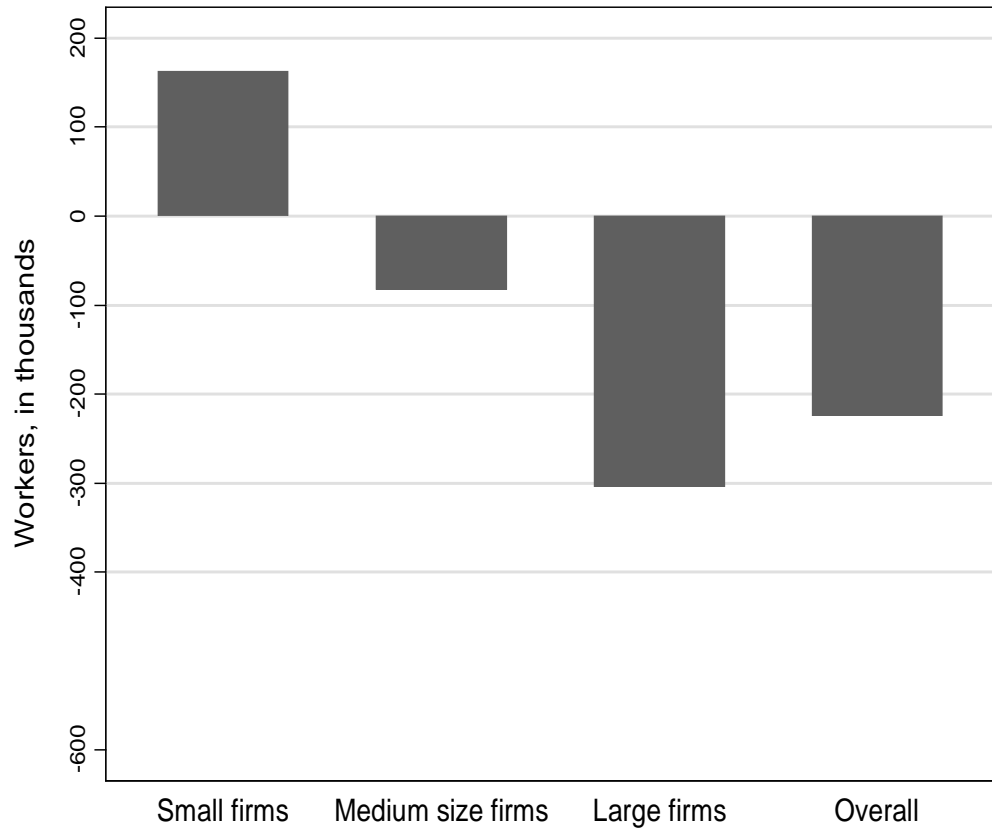


# TABLE 10 JOB CHANGES BY TYPE OF AGENT: FULLY FLEXIBLE REAL WAGES

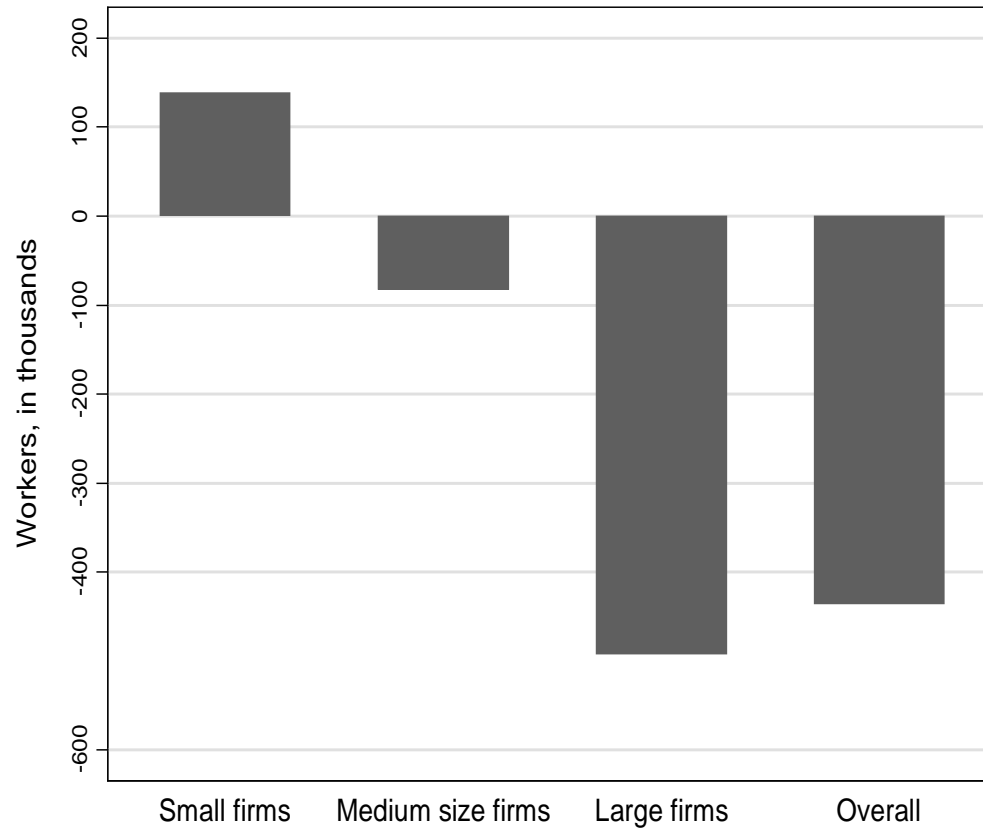


**Under 50 employees      50-59 employees      60+ employees**

**TABLE 10: JOB CHANGES BY TYPE OF AGENT:  
PARTIALLY FLEXIBLE (50%) REAL WAGES**

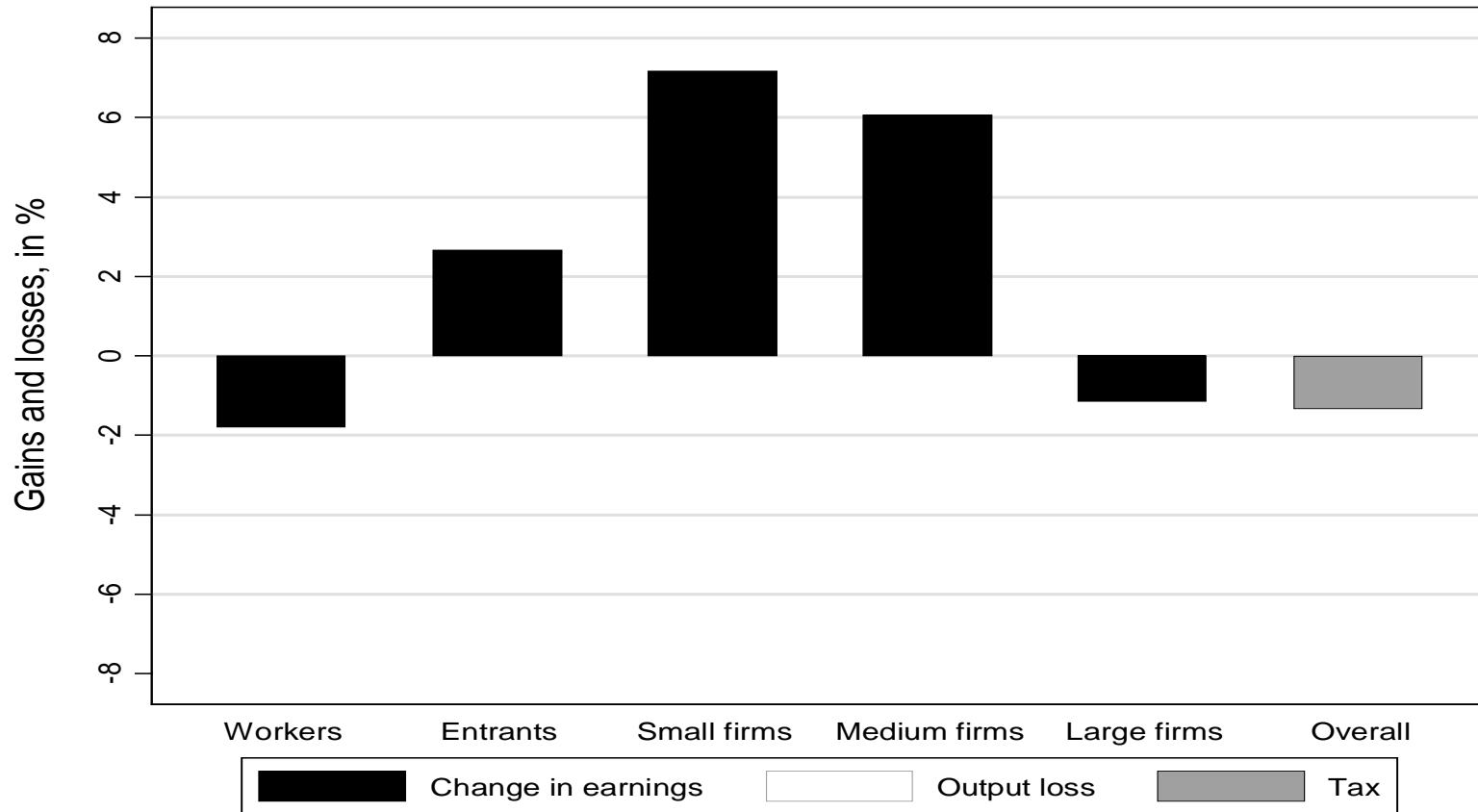


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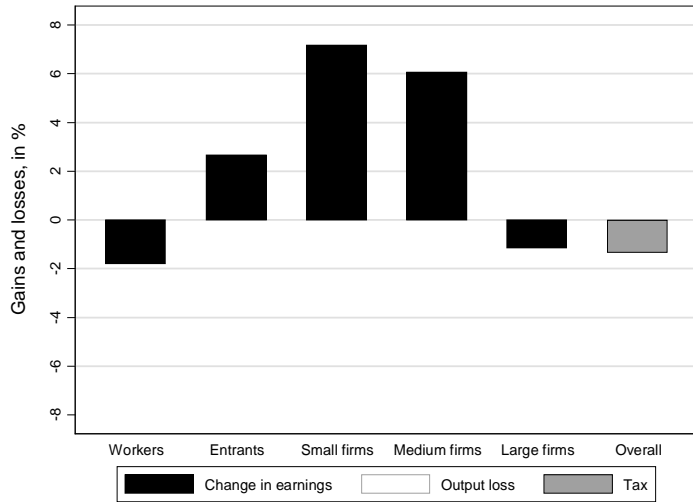
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## Fully Flexible Real Wages

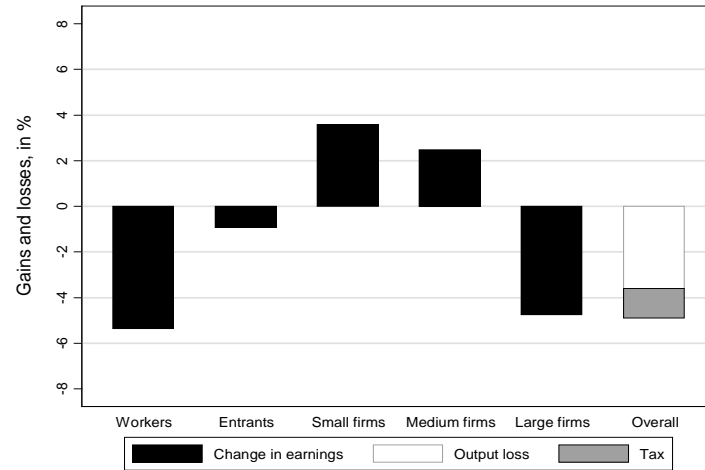


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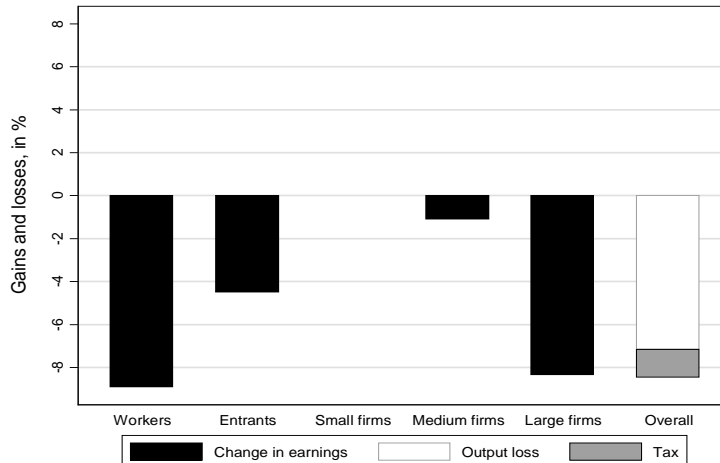
## Fully Flexible Real Wages



## Partially Flexible Real Wages



## Inflexible Real Wages



# WELFARE & DISTRIBUTION: SUMMARY

- With flexible wages welfare loss small (~1% of GDP)
  - Ranking of firm size by managerial ability stable (Hopenhayn, 2014)
- But big distributional change
  - Workers lose as they bear cost of regulation through lower wages
  - Large firms lose as lower wages do not fully offset regulation costs
  - Small Firms gain from lower costs & more entrepreneurs
- With inflexible wages (unions, minimum wages, etc.) much bigger welfare costs due to unemployment
  - For partially inflexible ~5%
  - Similar pattern of redistribution

# OUTLINE

1. Theory: Lucas in France
2. Empirical Implementation
3. Data

## **4. Results**

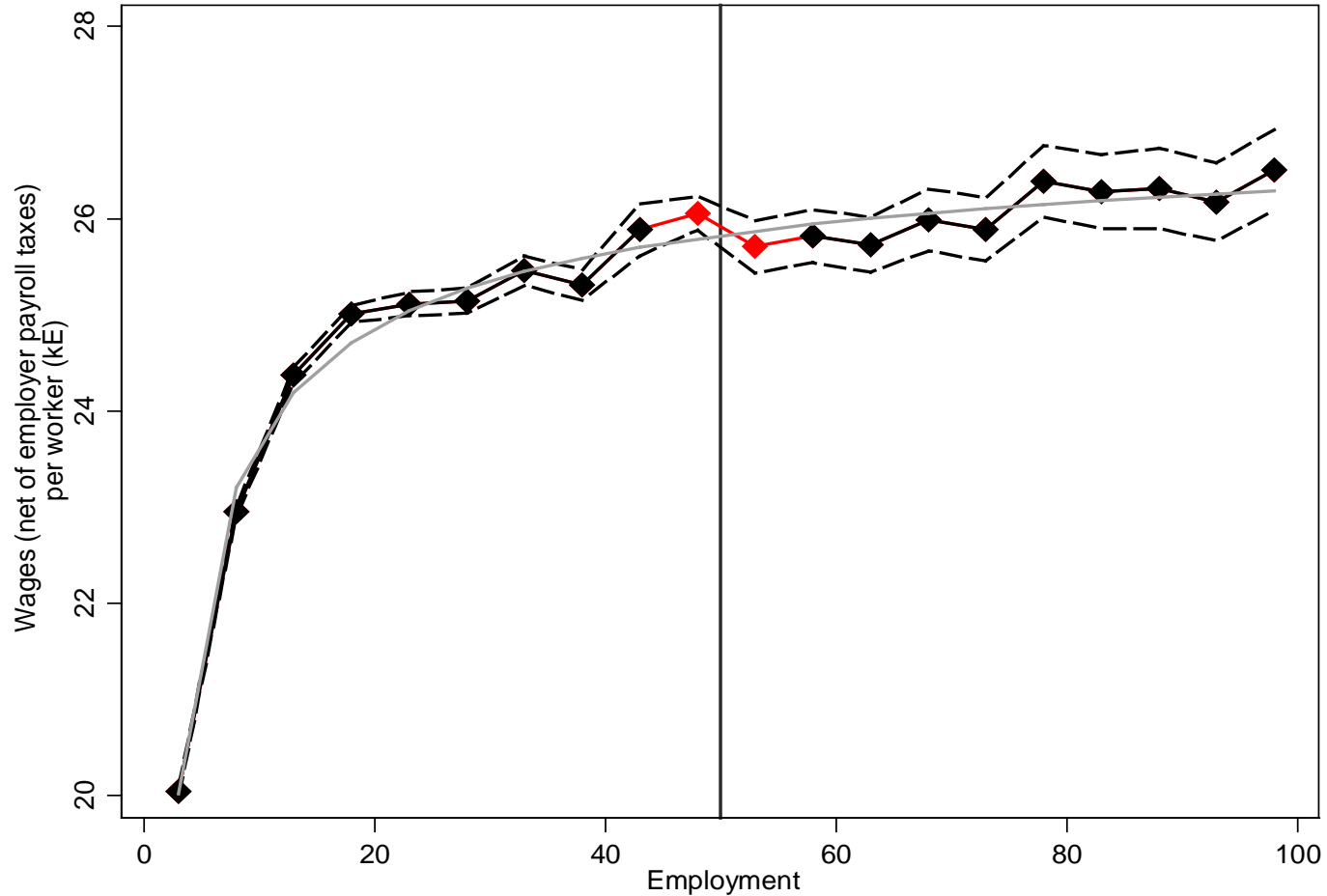
- Main findings
- **Robustness/Extensions**

# EXTENSIONS & ROBUSTNESS

- **Do workers benefit from the “mandated benefit” & take lower wages (Lazear, 1990; Summers, 1989)?**
  - Not in our data
- Big firms pretending to be small?
- Other margins of adjustment (e.g. capital)
- Dynamics (another explanations for the “Valley”)
- Industry Heterogeneity
- Alternative calculations based on MRPL a la Hsieh-Klenow (2009)
- Allow for another discontinuity at size=10



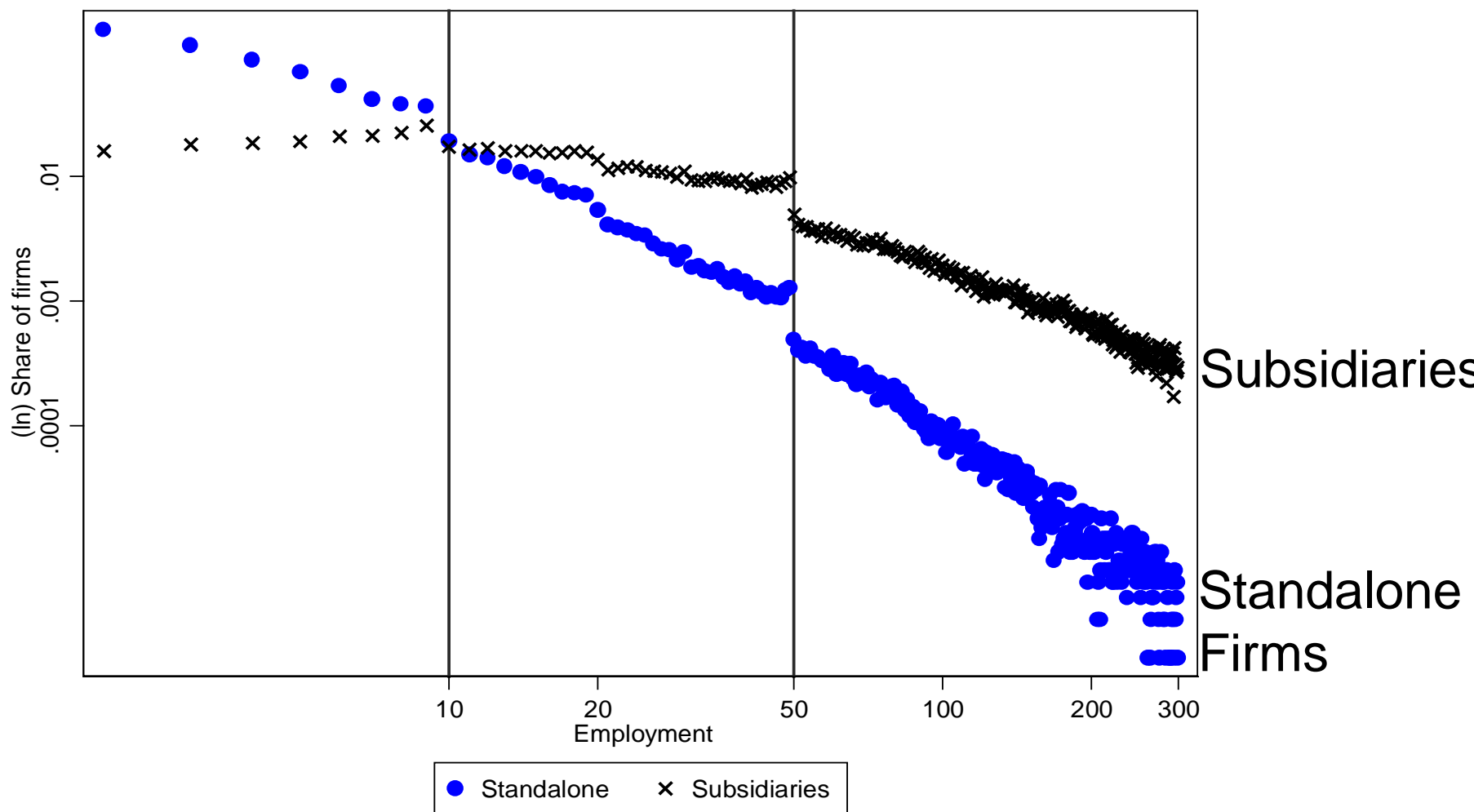
# FIG 11: NO EVIDENCE THAT WORKERS ARE ACCEPTING LOWER WAGES IN RETURN FOR TOUGHER REGULATION



# EXTENSIONS & ROBUSTNESS

- Workers benefit from “insurance” & take lower wages?
- **Big firms pretending to be small?**
  - **See effects for standalone firms as well as those part of business groups**
  - **Misreporting**
- Other margins of adjustment (e.g. capital)
- Dynamics (another explanations for the “Valley”)
- Industry Heterogeneity
- Alternative calculations based on MRPL a la Hsieh-Klenow (2009)
- Allow for another discontinuity at size=10
- Robustness – other datasets; different years

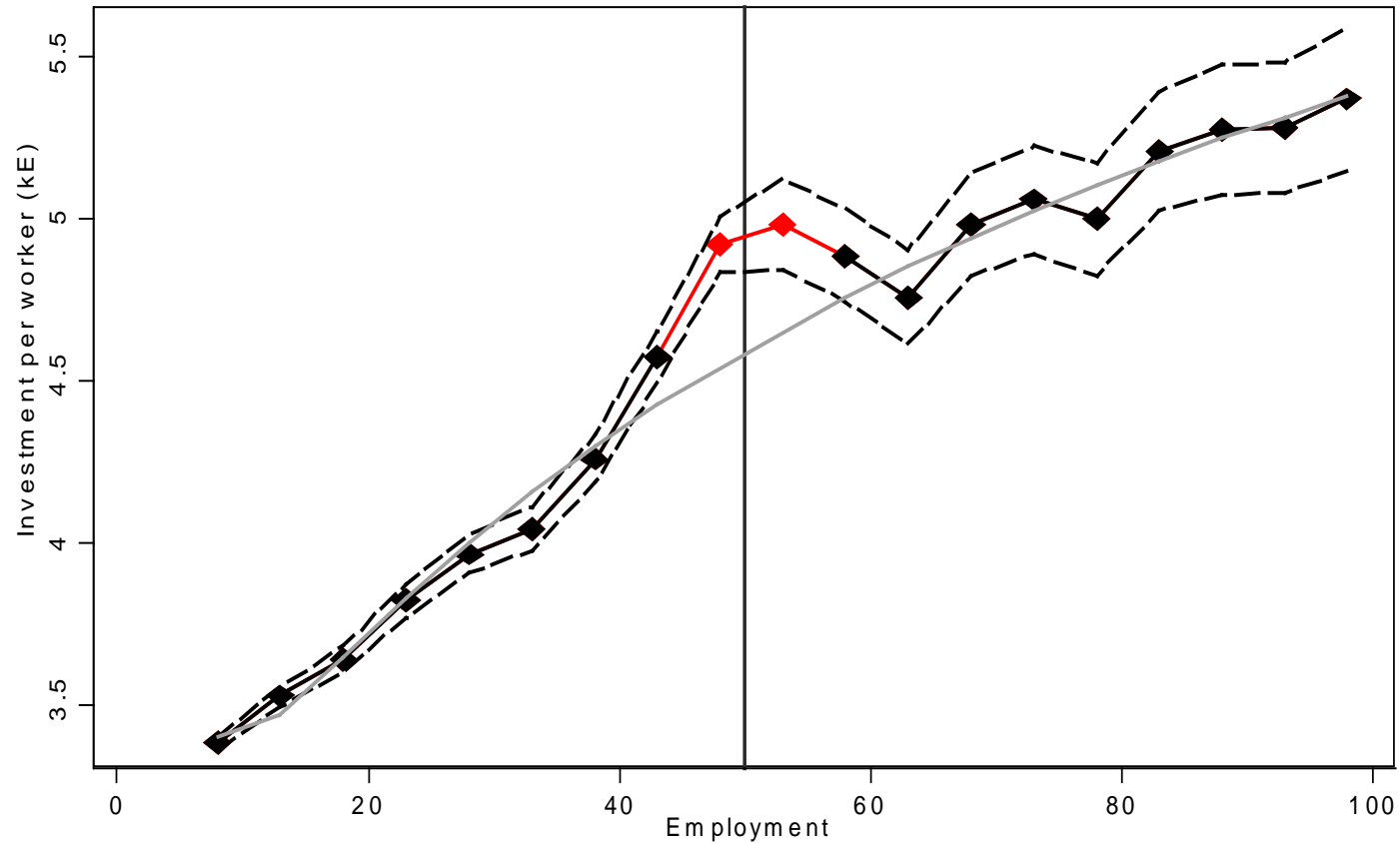
# RESULTS NOT DRIVEN BY BIG BUSINESS GROUPS PRETENDING TO BE SMALL (FIG A4)



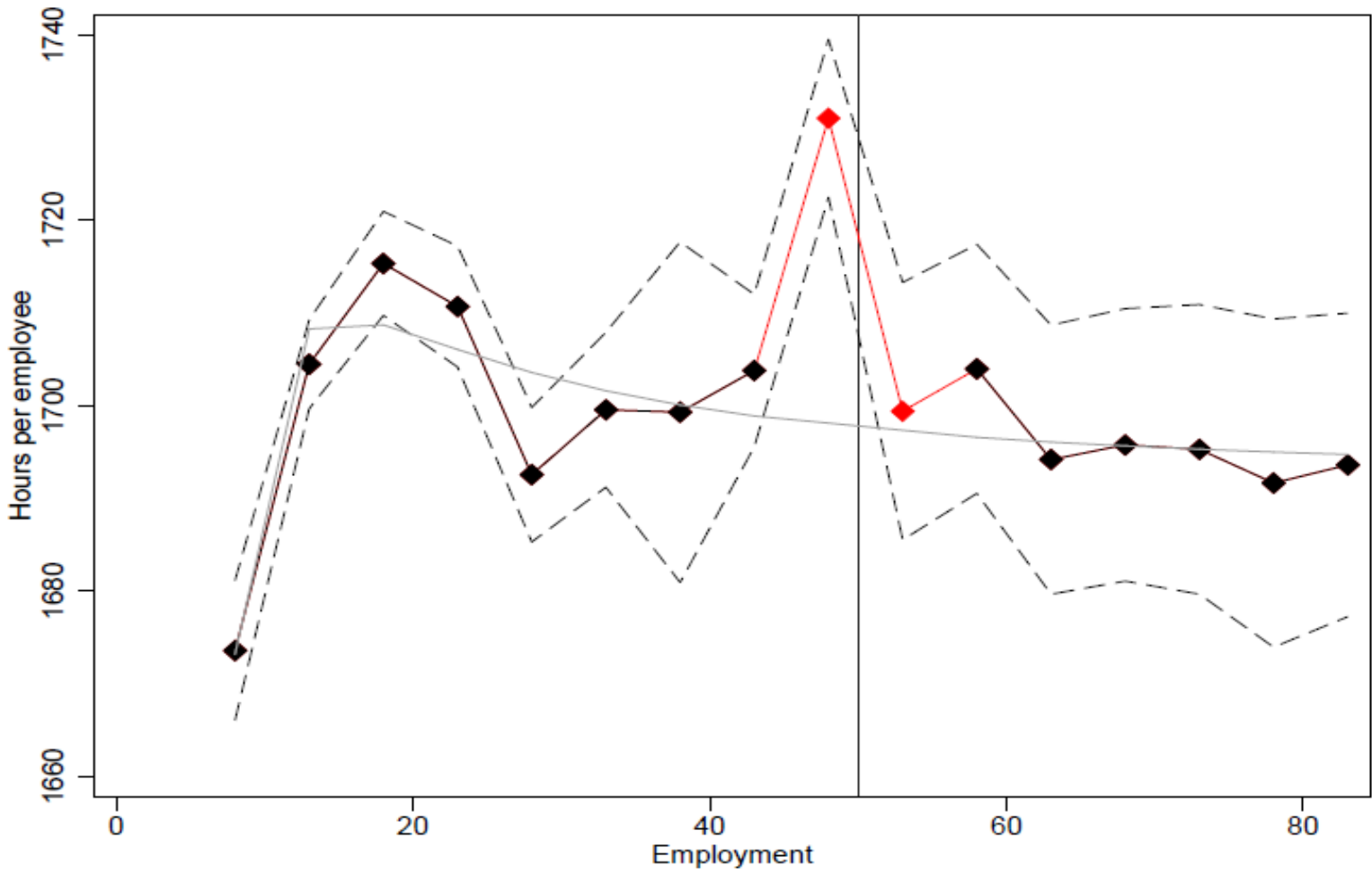
# EXTENSIONS & ROBUSTNESS

- Workers benefit from “insurance” & take lower wages?
- Big firms pretending to be small?
  - See effects for standalone firms as well as those part of business groups
  - Misreporting
- **Other margins of adjustment (e.g. capital)**
- Dynamics (another explanations for the “Valley”)
- Industry Heterogeneity
- Alternative calculations based on MRPL a la Hsieh-Klenow (2009)
- Allow for another discontinuity at size=10
- Robustness

# FIG 12 - OTHER ADJUSTMENTS AROUND THE THRESHOLD: MORE INVESTMENT PER WORKER



# FIG A6 - OTHER ADJUSTMENTS AROUND THE THRESHOLD: MORE HOURS PER WORKER

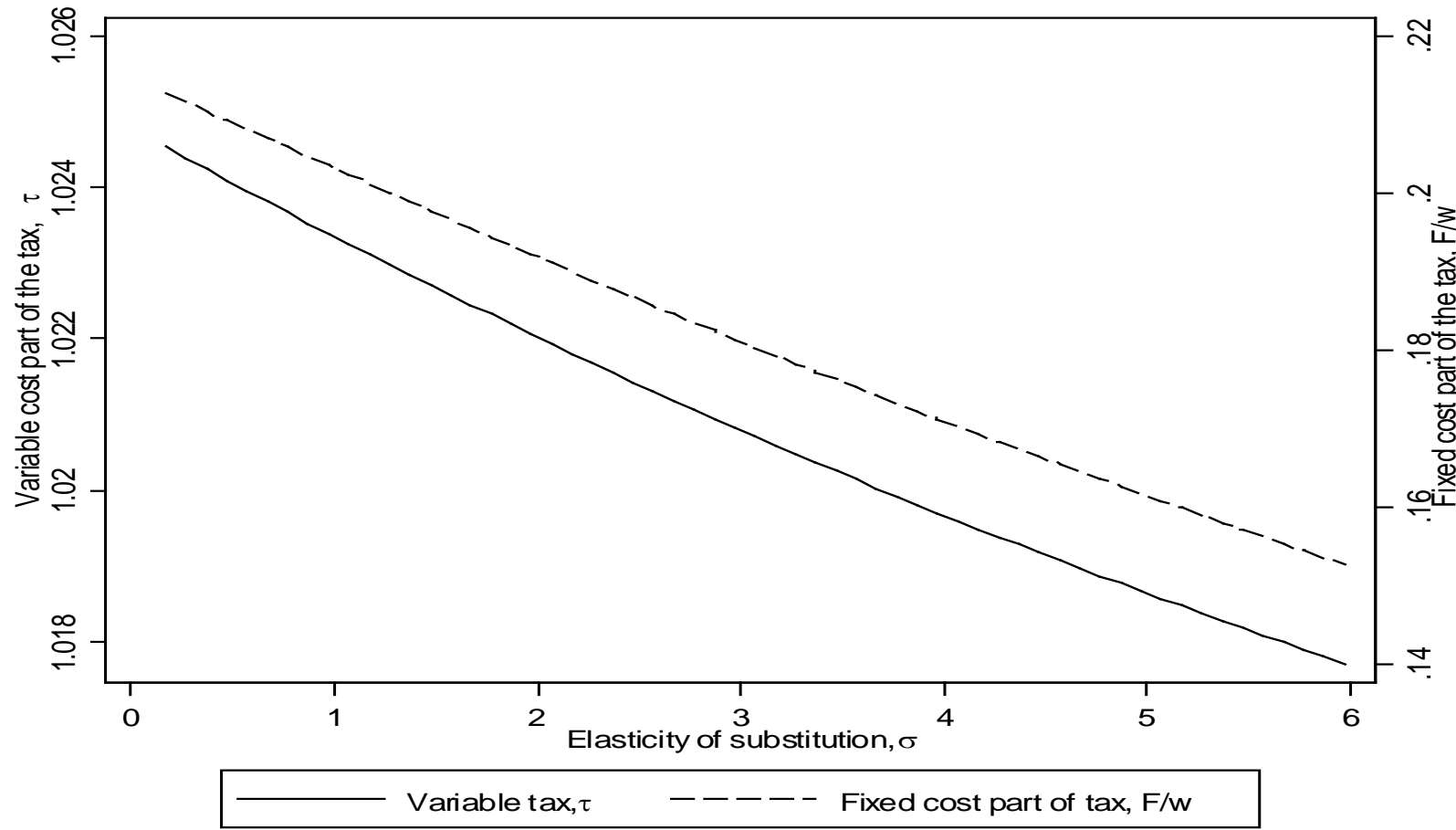


## EXTENSIONS: Other margins of adjustment

- Substitution reduces costs to firms, but still distortion unless perfect substitutes
- Our good predictions on output (Table 3) suggest these other margins of substitution are not first order
- Implement a formal extension to CES production function:

$$\alpha f(n,k) = \alpha (\lambda_1 n^\rho + \lambda_2 k^\rho)^{\theta/\rho}$$

# FIG 13 – ALLOWING FOR CAPITAL-LABOR SUBSTITUTION DOESN'T CHANGE MAIN RESULTS



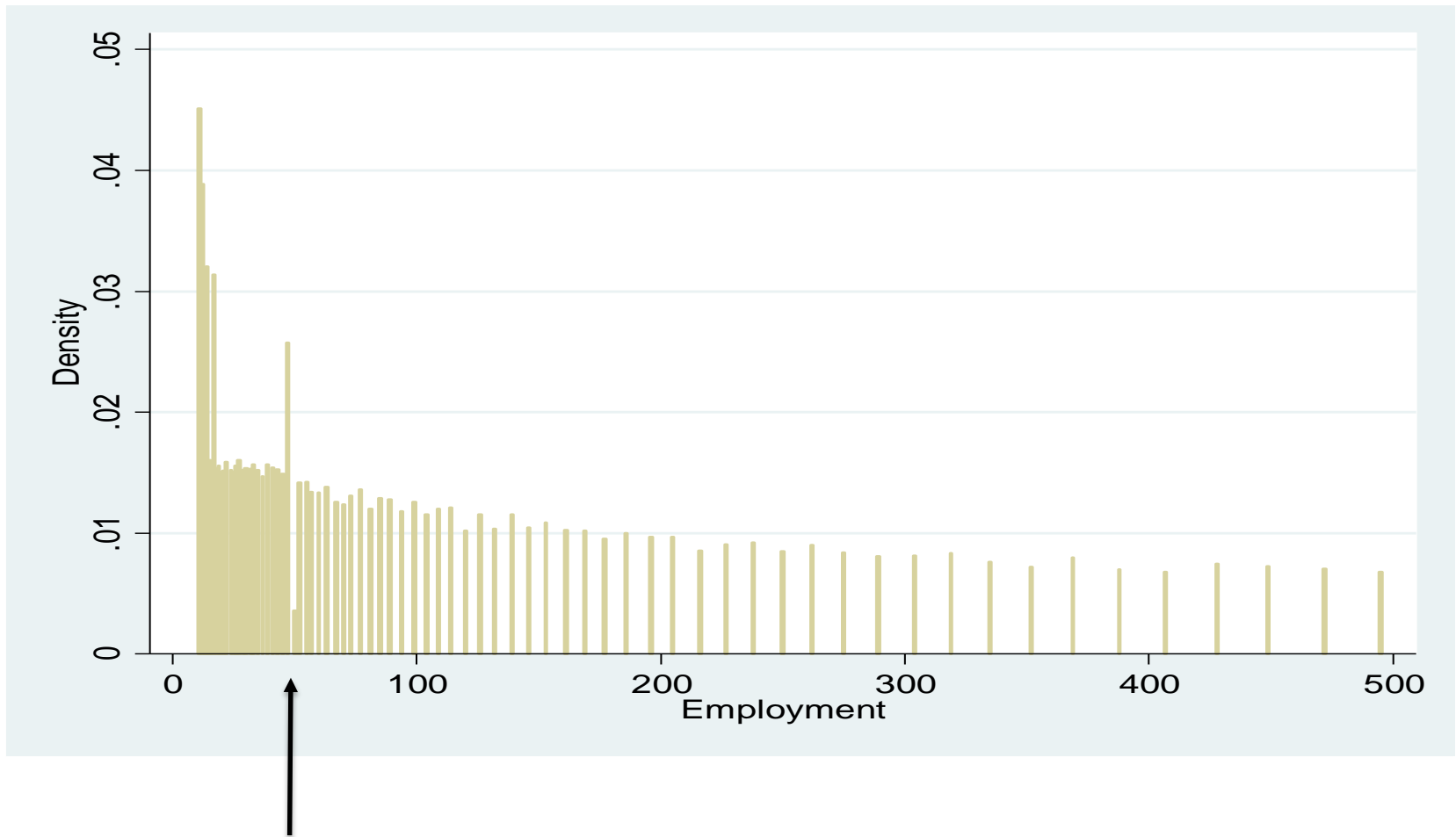
**Note:** Welfare losses similar (see Fig 14). For example for elasticity of sub=1; falls from 1.3% to 1% of GDP.



## EXTENSIONS: Dynamics

- Positive mass in valley to right of threshold could be due to adjustment costs (not just measurement error)
- Consider much more general model:
  - Initial draw of TFP & then random shocks each period (AR(1) with 0.95 persistence)
  - Labor & Capital with quadratic adjustment costs
  - Numerically simulate model
- Use value function iteration to calculate policy correspondences
- Draw 20,000 firms & run for 100 years. Distribution settles down after ~50 years so just use last 25 years to characterize long-run employment distribution

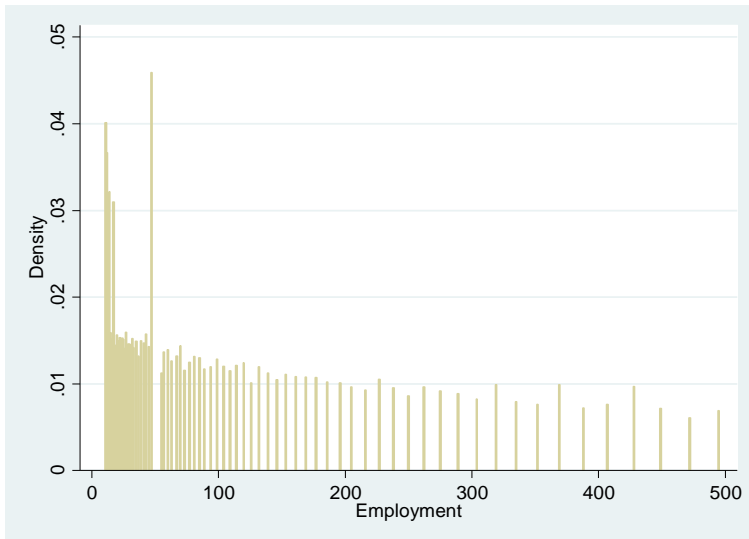
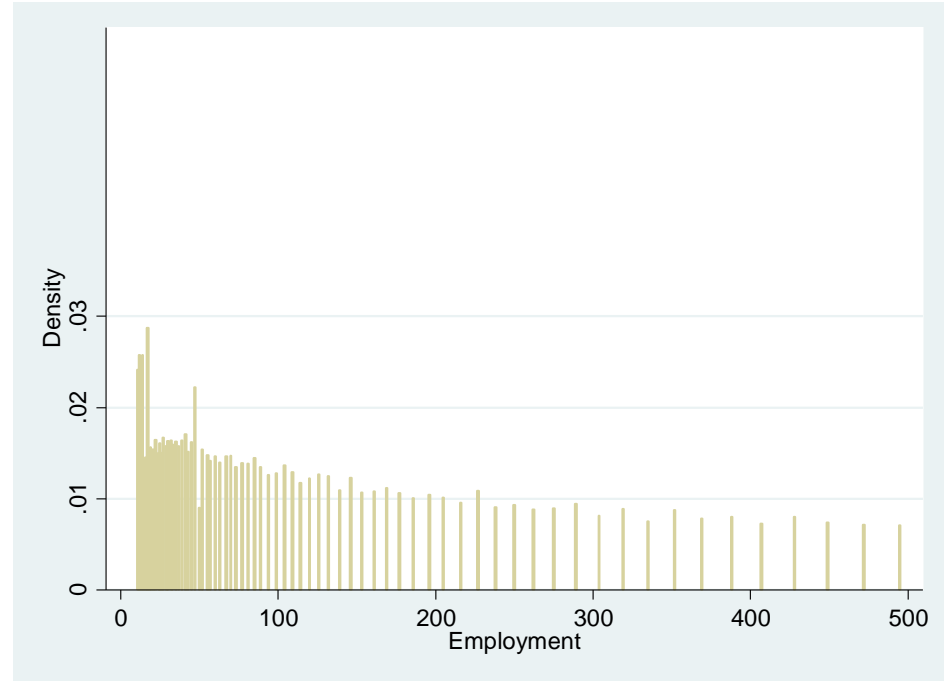
**Figure 16: Baseline calibration of steady state firm employment size distribution generates similar picture as static model**



**Positive mass in valley are firms moving in & out**

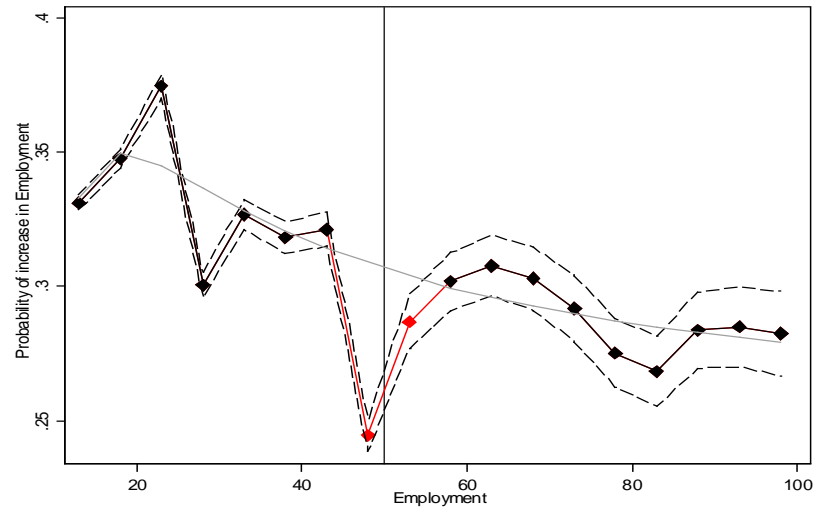
# Figure 17: As adjustment costs increase valley is “smoothed out”

**A. Adjustment costs increased (2x higher)**

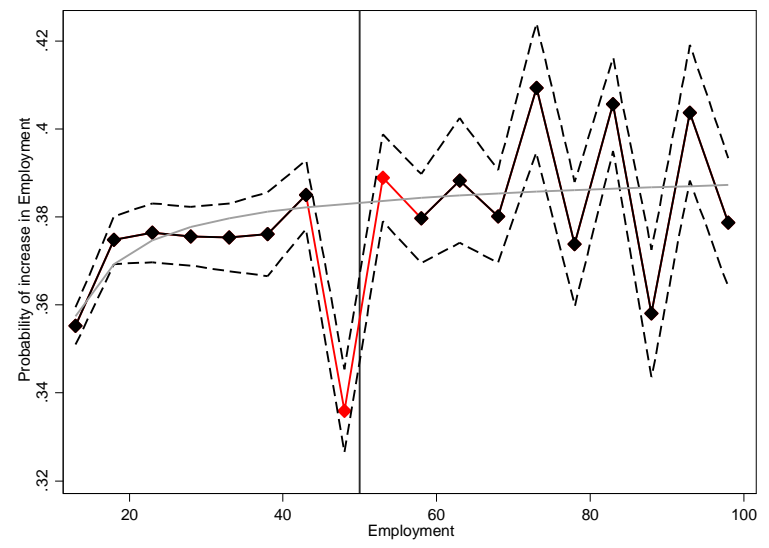


**B. Adjustment costs lower (~10% of baseline)**

# FIG 18: PROPORTION OF FIRMS GROWING DROPS TO LEFT OF THRESHOLD



A. Actual data



B. Simulated data

# CONCLUSIONS

- Simple method for quantifying effect of size-related regulations & explains qualitative features of data
- Big changes in distribution: workers & large firms lose but smaller firms win
- Small losses under 1% GDP if real wages perfectly downwards flexible, but ~5% if partially inflexible wages
- **Some Next Steps:**
  - Re-calculate regulatory tax based on dynamic model
  - Let TFP be influenced by endogenous innovation decisions (e.g. increased penalty of growing may reduce investment incentives)
  - Build in other size-related regulations
  - Other settings for methodology: ACA?

Back Up

## Mapping between alternative formulations of fixed cost of regulation

$$\pi(\alpha) = \max_n \begin{cases} \alpha f(n) - wn & \text{if } n \leq N \\ \alpha f(n) - w(N + \tau(n - N)) - F & \text{if } n > N \end{cases}$$

If we changed regulatory costs for firms above threshold from:

$$wN + (n - N)\tau + F'$$

To the alternative where costs are on all workers

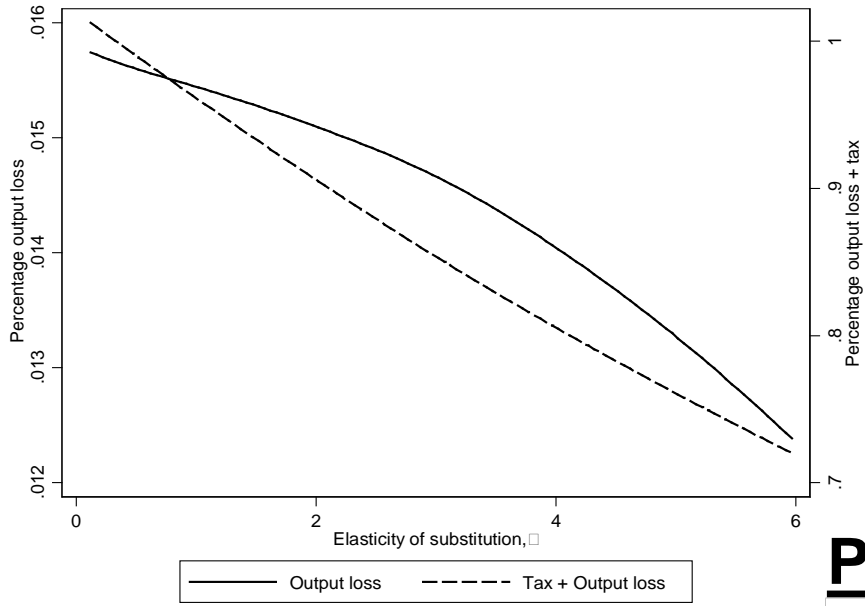
$$w\tau'n + F'$$

Then this is simply a re-mapping of estimates of costs:

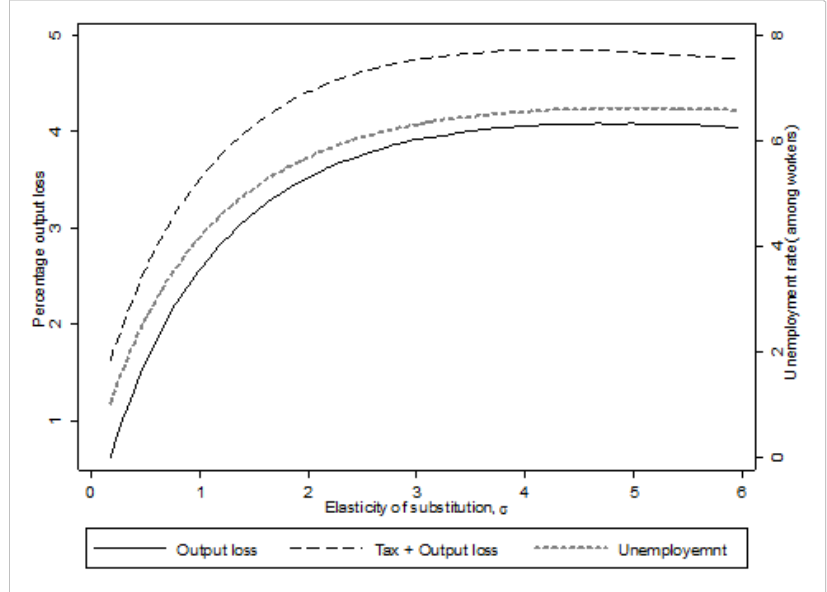
$$\begin{aligned} \tau &= \tau'; \\ F &= F' + (\tau' - 1)wn \end{aligned}$$

# FIG 14 WELFARE LOSSES IN THE CES MODEL

## Panel A: Fully flexible wages

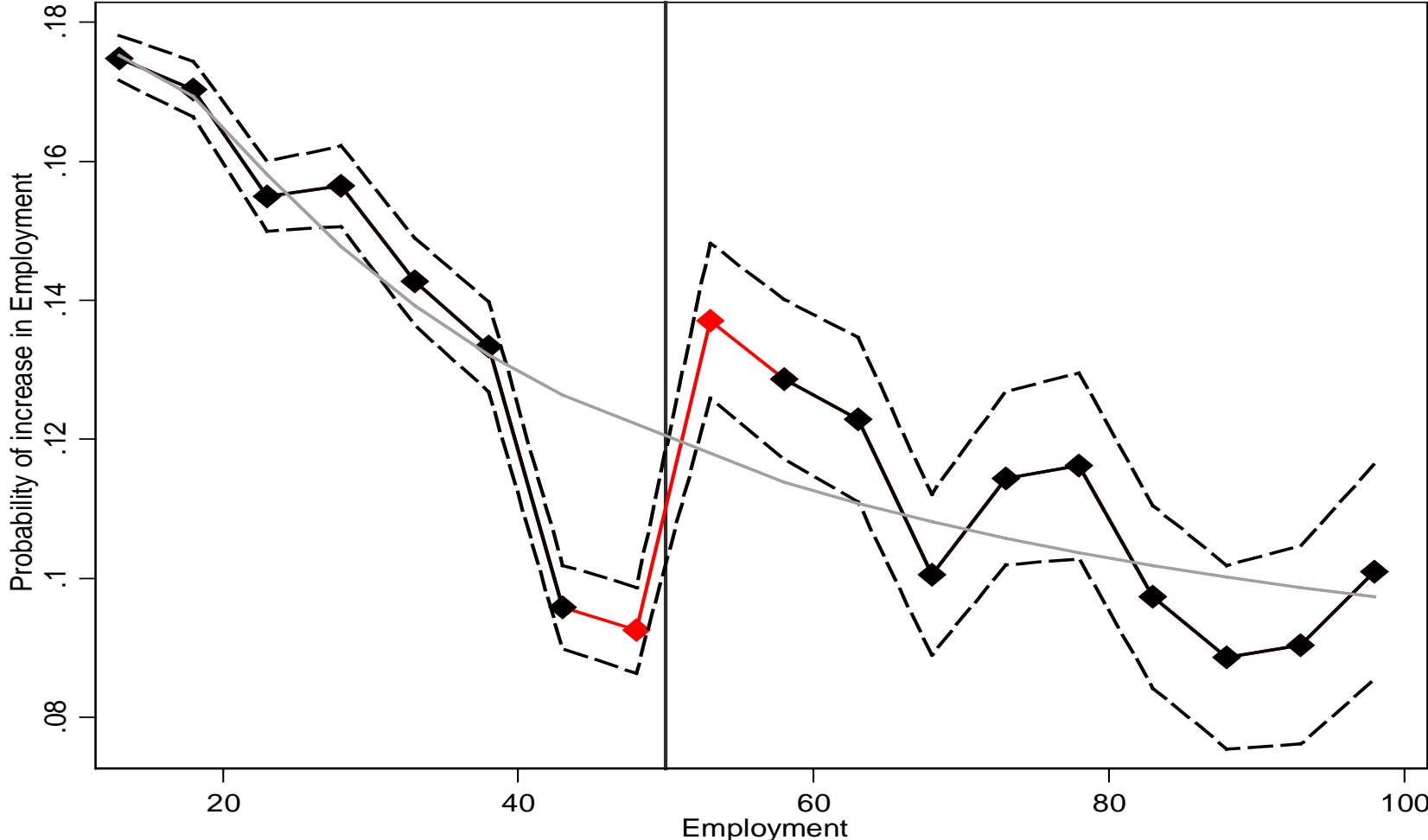


## Panel B: Fully rigid wages

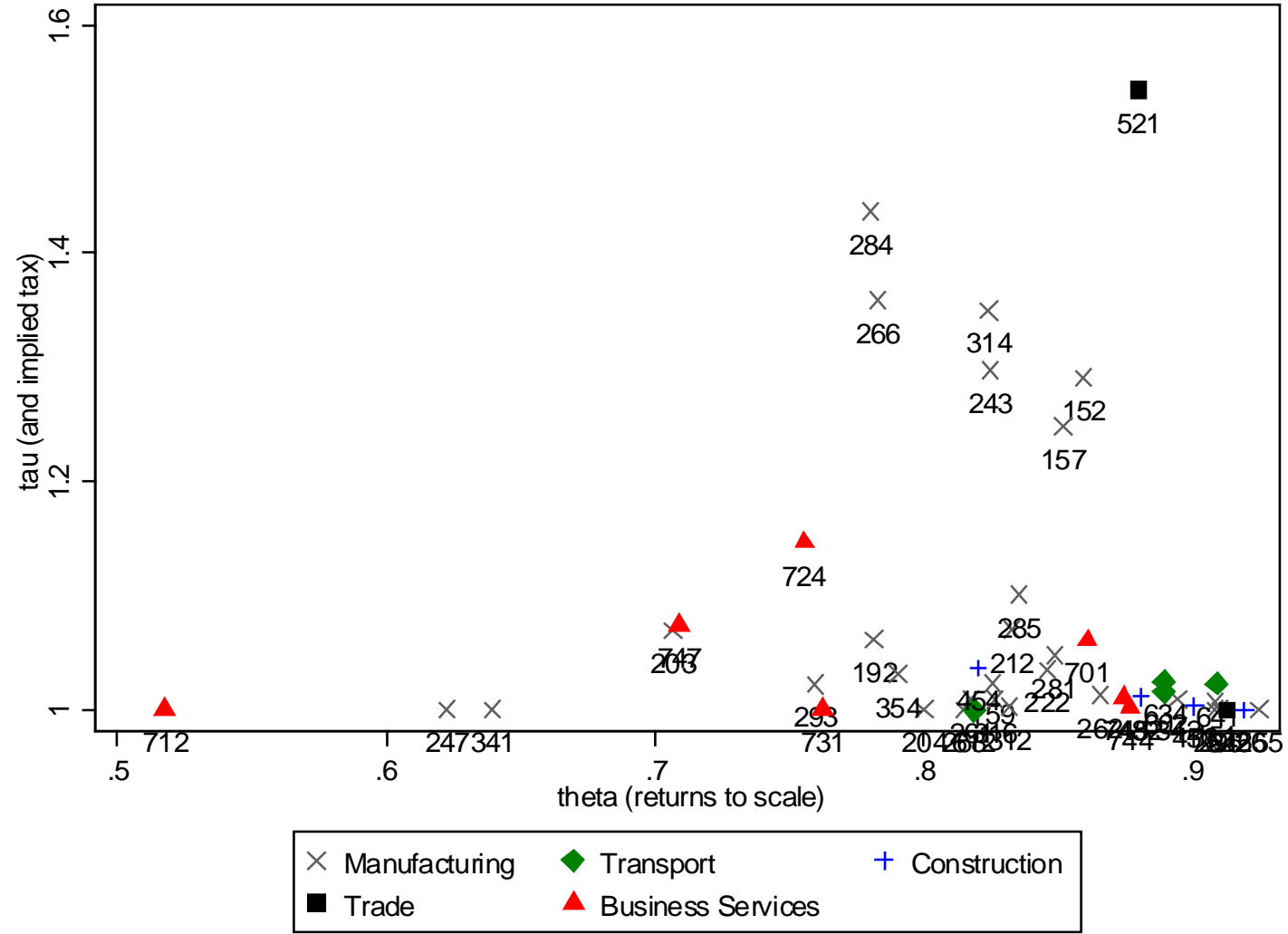




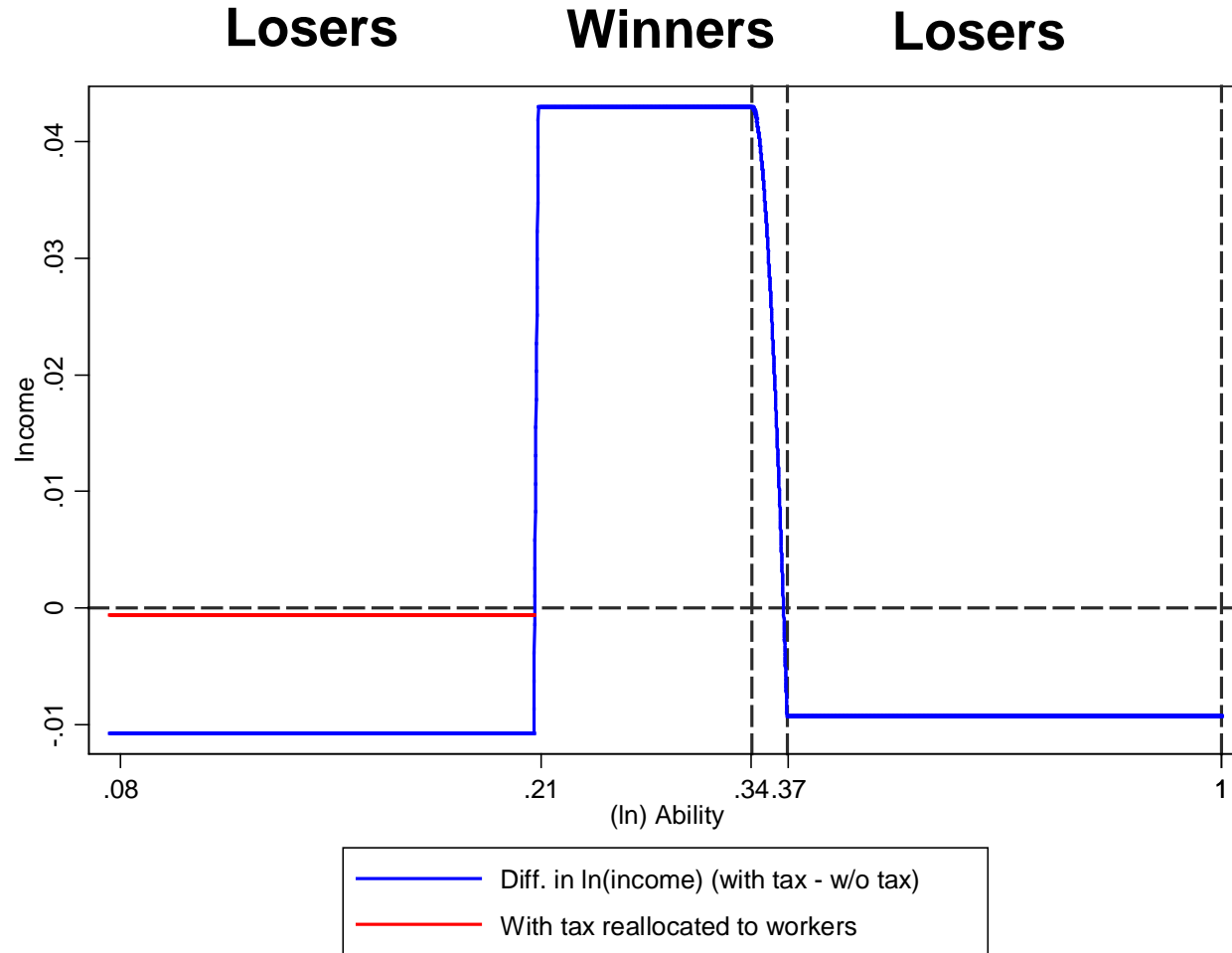
# FIG 16B PROPORTION OF FIRMS SHRINKING BY MORE THAN 10%



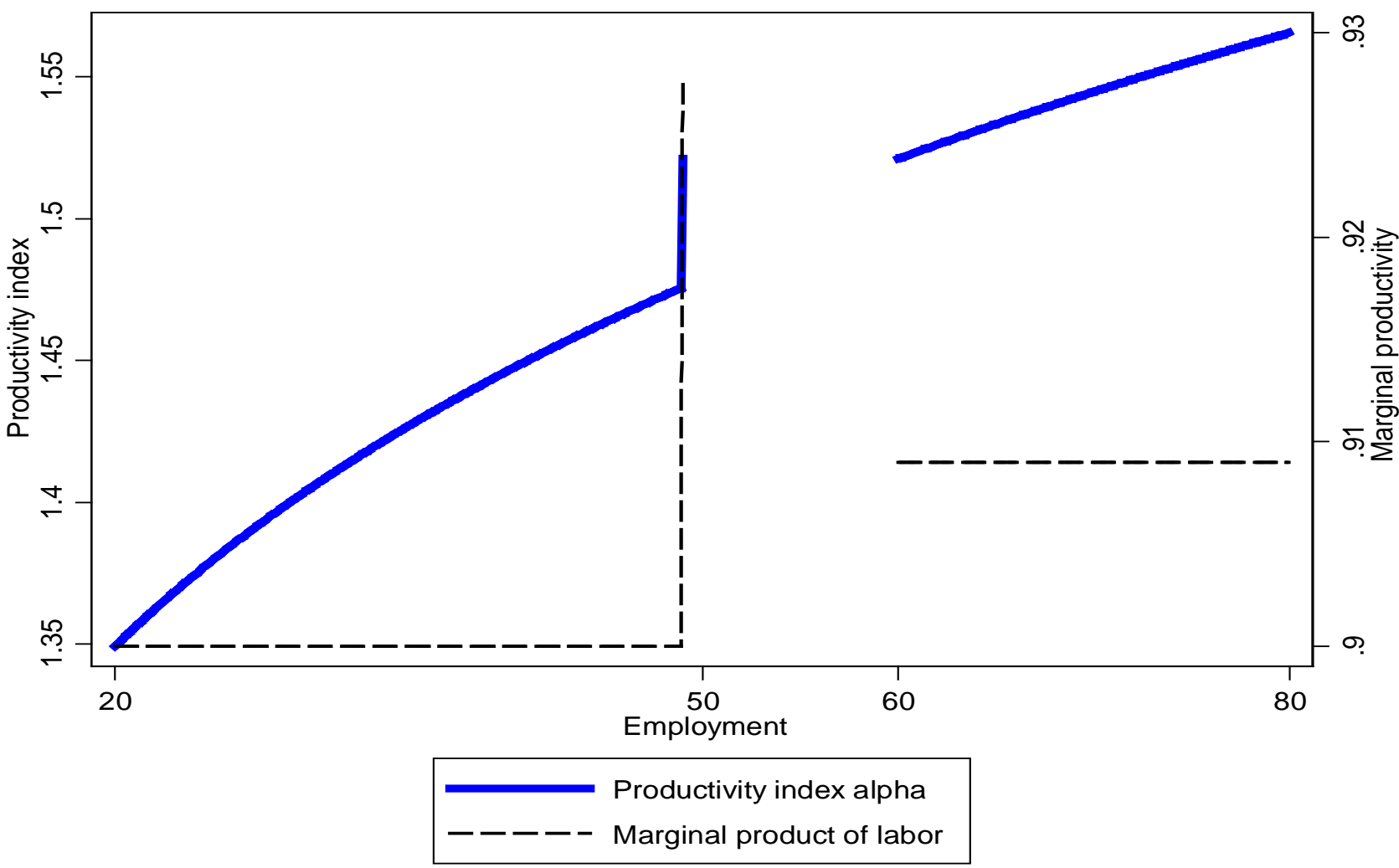
# FIG A1 HETEROGENEITY OF THE ESTIMATES ACROSS DIFFERENT THREE DIGIT INDUSTRIES



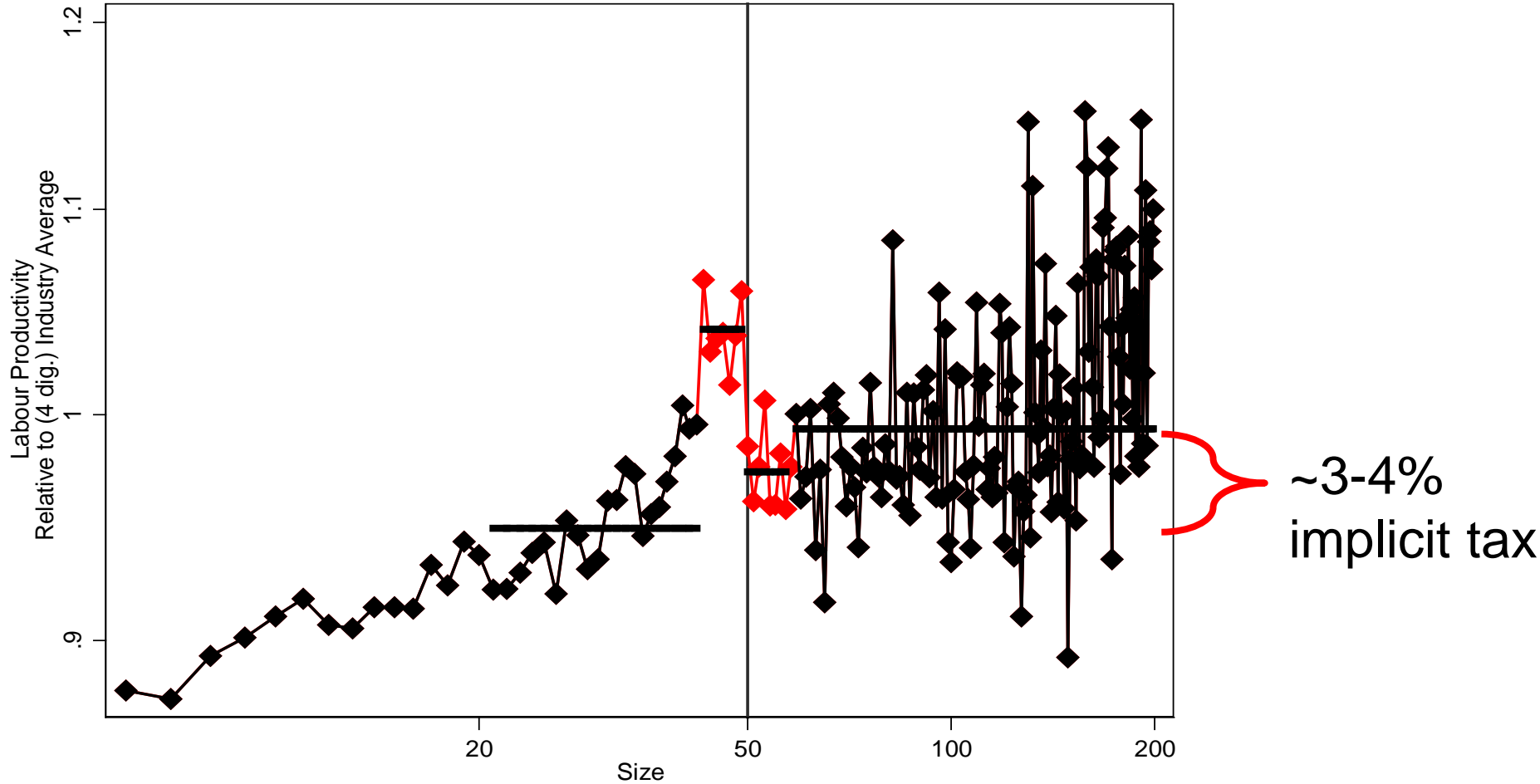
# DISTRIBUTIONAL EFFECTS OF REGULATION ACROSS AGENTS



# COMPARISON WITH HSHIEH-KLENOW APPROACH: MARGINAL REVENUE PRODUCTIVITY OF LABOR



# FIG A3: MRPL SUGGESTS A TAX OF 3-4% (SAME AS MAIN RESULTS WHEN WE USE H-K $\theta=.5$ )



**Note:** This is data on value added per worker relative to the four digit industry average

# EXTENSIONS

- **Industry heterogeneity**
  - Some heterogeneity (e.g. Table 5 over)
  - Estimate separately for more disaggregated industries (Tab A4)
  - Sensible heterogeneity, e.g. higher implicit tax when labor a larger share of total value added

# TABLE A2: INDUSTRY HETEROGENEITY

Experiment	Manufactur ing	Transport	Construct- ion	Wholesale & Dist.	Business Services
$\beta$ , power law	1.800 (0.054)	1.857 (0.098)	2.345 (0.122)	2.129 (0.085)	1.972 (0.079)
$n_u$ , upper emp. cutoff	59.271 (2.051)	62.139 (4.134)	56.916 (1.869)	55.863 (3.057)	53.370 (1.333)
$\sigma$ , msremnt. error	0.121 (0.033)	0.150 (0.053)	0.083 (0.022)	0.072 (0.035)	0.045 (0.015)
$\tau$ , Implicit variable tax	0.023 (0.008)	0.035 (0.007)	0.020 (0.005)	0.026 (0.010)	0.008 (0.002)
$F/w$ , Fixed cost	0.196 (0.075)	0.315 (0.186)	0.119 (0.054)	0.091 (0.079)	0.037 (0.022)
Obs	41,067	10,907	23,506	41,071	30,125

**Notes:** Size 10-1,000 employees; estimates by ML with standard errors clustered at the 4 digit level; returns to scale = 0.8; year 2000

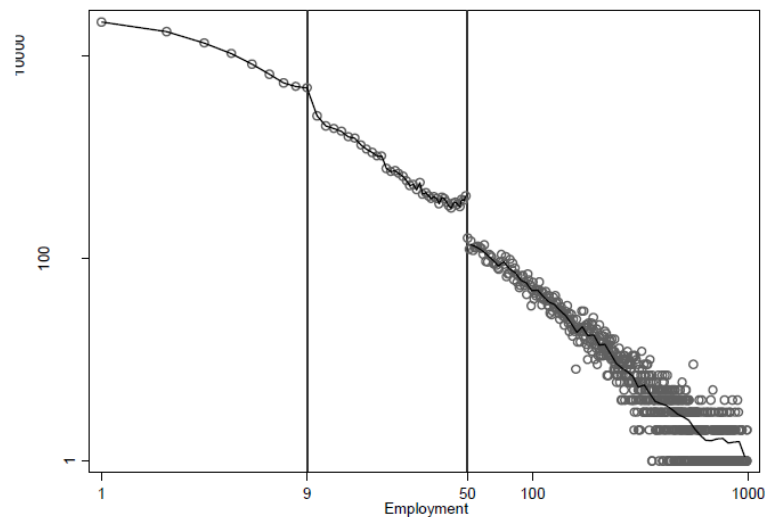
# EXTENSIONS

- Hsieh-Klenow (2009) approach
  - Calculate marginal revenue productivity near threshold
  - How much does this change between “constrained” firms and “unconstrained” firms?
- Issues with approach
  - Those on immediate sides of threshold not comparable
  - Measuring MRP non-trivial (e.g. overhead labor)
- Nevertheless, find broadly consistent results (Tab A2, A3)
  - Regulatory tax 3-4% (so bigger than our baseline estimates)



# GENERALIZE MODEL TO ALSO ALLOW FOR REGULATION AT SIZE = 10

- Extend method to allow for an additional variable & fixed cost after 10 employees (recall smaller discontinuity here)
- Estimate variable cost  $\approx 0$ . Fixed cost at 10 is about 10% of fixed cost at 50 employees (Table A3)
- Welfare loss from 10 is 0.06% of GDP (compared to 1% at 50) under the flexible wage case (0.3% vs. 5% under the rigid wage case (Table A4).



# OTHER ROBUSTNESS

- Estimate on other datasets (DADs in Tab A5)
- Estimate on different years between 1995 and 2007 (Table A1)
  - Taxes pretty stable (variable 1.7% to 2.3%; fixed 15.2% to 23.3%)
- Alternative assumptions over upper bound of firm size distribution