Identifying and Fixing Resource Misallocation

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What is Aggregate TFP?

Weighted Average of Firm Productivity

Extent of Resource Misallocation

Roadmap:

Measurement of Allocative Efficiency

- Privatization of Chinese State Owned Firms
- Sources of Informality
- Contract Labor in India

Spatial Misallocation

Occupational Misallocation

Measuring Productivity of Heterogenous Firms

Typical Setup: $Y = AK^{\alpha}L^{1-\alpha}$

Thousands of papers focused on measuring α

But there is a deeper problem

Setup is inconsistent with existence of heterogenous firms

$$Y = AL$$

$$MPL = A$$

Also true with more general function

$$Y = AK^{\alpha} L^{1-\alpha}$$

$$MPL = (1-\alpha)A\left(\frac{K}{L}\right)^{\alpha} = W$$

$$MPK = \alpha A\left(\frac{K}{L}\right)^{\alpha-1} = R$$

$$\Rightarrow \frac{K}{L} = \frac{W}{R} \cdot \frac{\alpha}{1-\alpha}$$

MPK and MPL highest in highest A firm

Need a source of diminishing returns

Lucas "Span of Control"

$Y = AL^{\gamma}$ => MC rises with size of firm

$$MPL = \frac{\gamma A}{L^{1-\gamma}} = W$$

$$\frac{Y}{L} = \frac{AL^{\gamma}}{L} = \frac{A}{L^{1-\gamma}} \quad \text{and } L = \left(\frac{\gamma A}{W}\right)^{\frac{1}{1-\gamma}}$$

Downward Sloping Demand Curve

$Y = AL$ and $P = \eta Y^{-\sigma}$

$$P = \frac{\sigma}{\sigma - 1} \cdot \frac{W}{A} \quad \Rightarrow \quad P \cdot MPL = \frac{\sigma}{\sigma - 1} \cdot \frac{W}{A} \cdot A = \frac{\sigma}{\sigma - 1} W$$

Note that $\frac{PY}{L} = P \cdot A = P \cdot MPL$

Efficient equilibrium

PY/L is the same across firms

Differences in A show up as differences in firm size

Differences in PY/L are not differences in A

What do differences in PY/L reflect?

Differences in the marginal product of labor

Suppose $Y = AL$ and $P = \eta Y^{-\sigma}$ but

$$\pi = PY - (1+\tau_L)WL$$

$$=> P = \frac{\sigma}{\sigma - 1} \cdot \frac{W(1+\tau_L)}{A} \text{ and } \frac{PY}{L} = \frac{\sigma}{\sigma - 1} \cdot W(1+\tau_L)$$

Labor Productivity Reflects MPL

High PY/L

=> MPL is high (firm is smaller than optimal)

Low PY/L

=> MPL is high (firm is larger than optimal)

More general setup:

$$Y_i = A_i K_i^{\alpha} L_i^{1-\alpha}$$

$$\pi_i = P_i Y_i - (1+\tau_{Li}) W L_i - (1+\tau_{Ki}) R K_i$$

$$\text{Value of MPL} \propto \frac{P_i Y_i}{L_i} \propto 1 + \tau_{Li}$$

$$\text{Value of MPK} \propto \frac{P_i Y_i}{K_i} \propto 1 + \tau_{Ki}$$

Average MP of K and L (TFPR)

$$\propto \left(\frac{P_i Y_i}{K_i}\right)^{\alpha} \left(\frac{P_i Y_i}{L_i}\right)^{1-\alpha} = \frac{P_i Y_i}{K_i^{\alpha} L_i^{1-\alpha}}$$

$$\propto \left(1+\tau_{Ki}\right)^{\alpha} \left(1+\tau_{Li}\right)^{1-\alpha}$$

This is NOT $A_i = \dfrac{Y_i}{K_i^{\alpha} L_i^{1-\alpha}}$

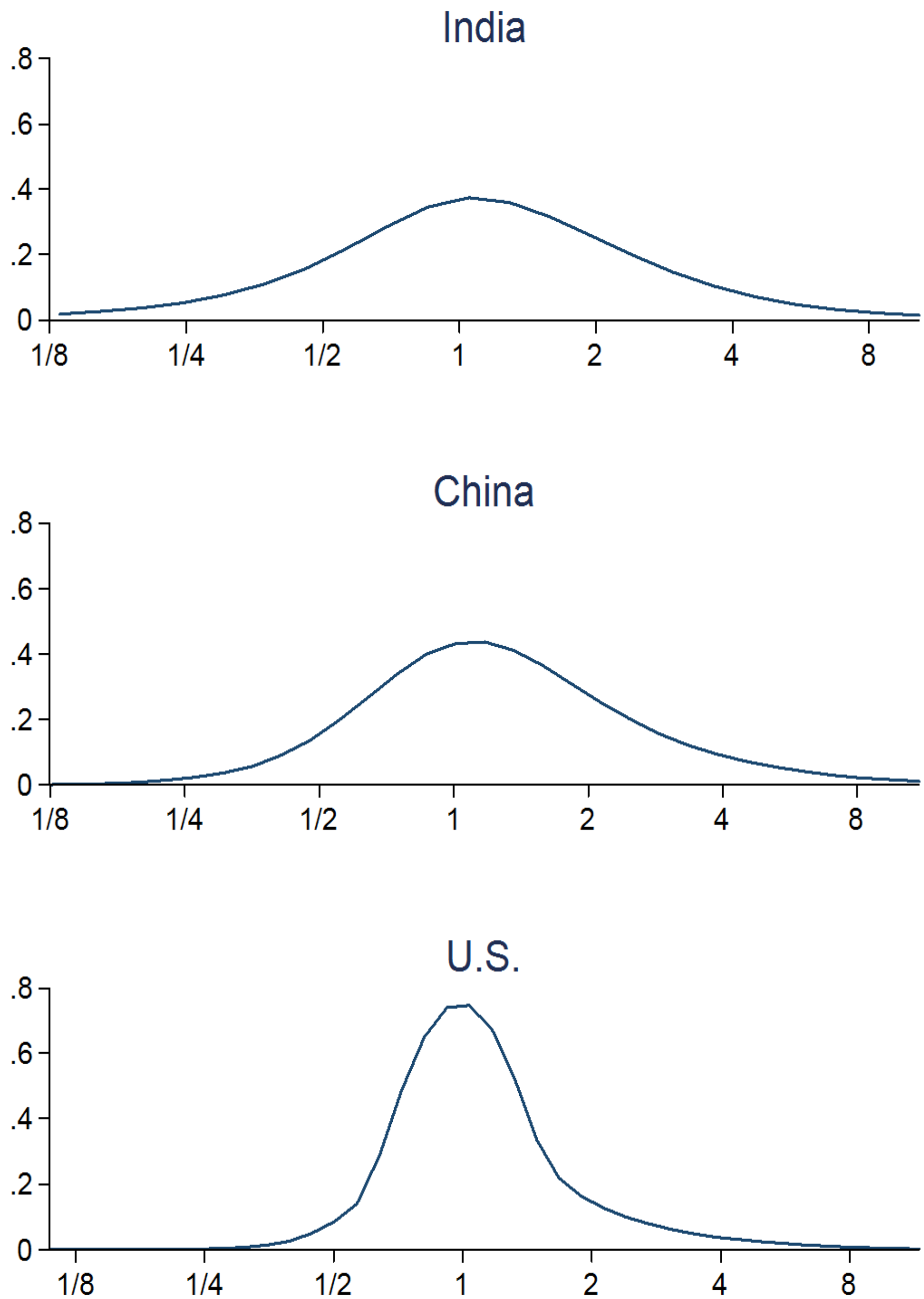
This is extreme:

- Markups could differ

- Fixed costs (e.g., exporting costs)

- Adjustment costs

Figure 2: Distribution of TFPR



Dispersion in Marginal Product of K and L

90-10 Gap

US (1987)	China (1998)	India (1989)
1.97	6.49	8.17

Transformation of State-Owned Firms in China

Small SOEs were closed or privatized

Large SOEs were "corporatized"

Shanghai Automobile

Publicly Listed in 2000

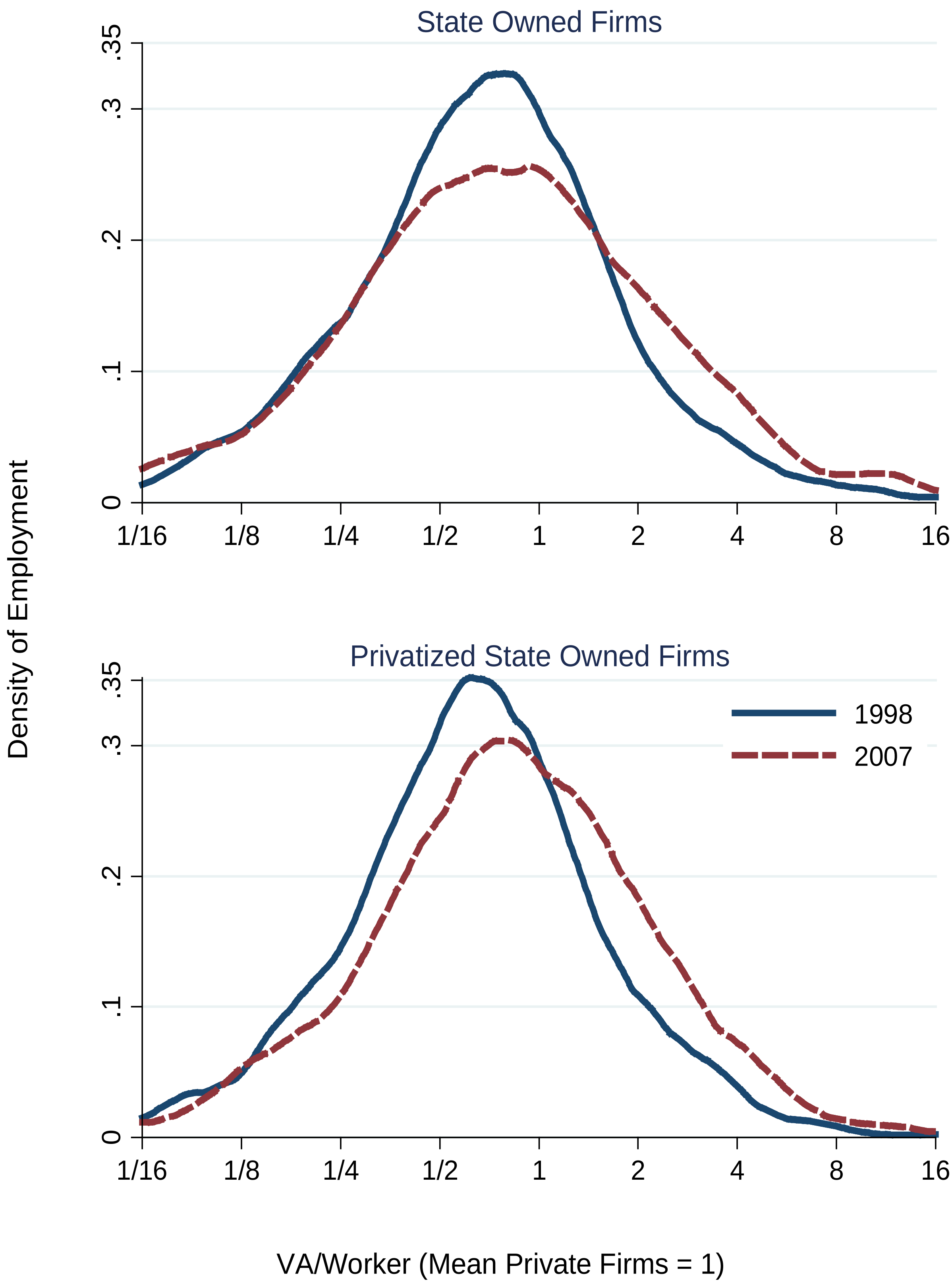
SAIC Group owns 73% of equity of Shanghai Auto

- Group owned by Shanghai Municipal Government

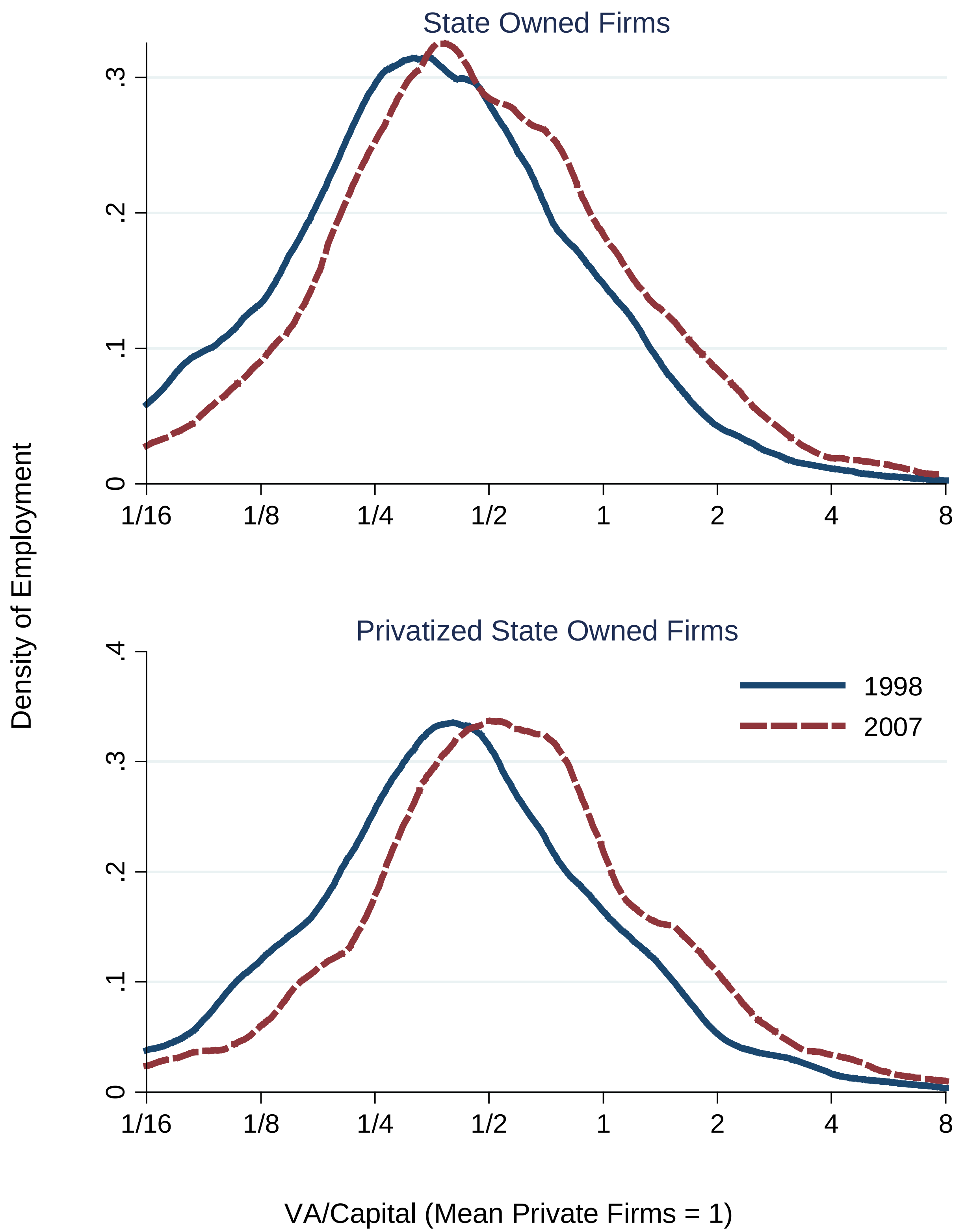
Shanghai Auto also created two new firms:

- Shanghai-GM (owns 50%)
- Shanghai-Volkswagen (owns 50%)

Labor Productivity of Incumbent Firms



Capital Productivity of Incumbent Firms



TFPR: $MPK^{\alpha} MPL^{1-\alpha} = \dfrac{P_i Y_i}{K_i^{\alpha} L_i^{1-\alpha}}$

$$P_i Y_i \propto \frac{A_i^{\sigma-1}}{TFPR_i^{\sigma-1}}$$

Aggregate TFP: $TFP = \left(\sum_i \left[A_i \cdot \frac{\overline{TFPR}}{TFPR_i} \right]^{\sigma-1} \right)^{\frac{1}{\sigma-1}}$

$$\log TFP = \log \overline{A} + \frac{\sigma}{2} \operatorname{var} \log A - \frac{\sigma}{2} \operatorname{var} \log TFPR$$

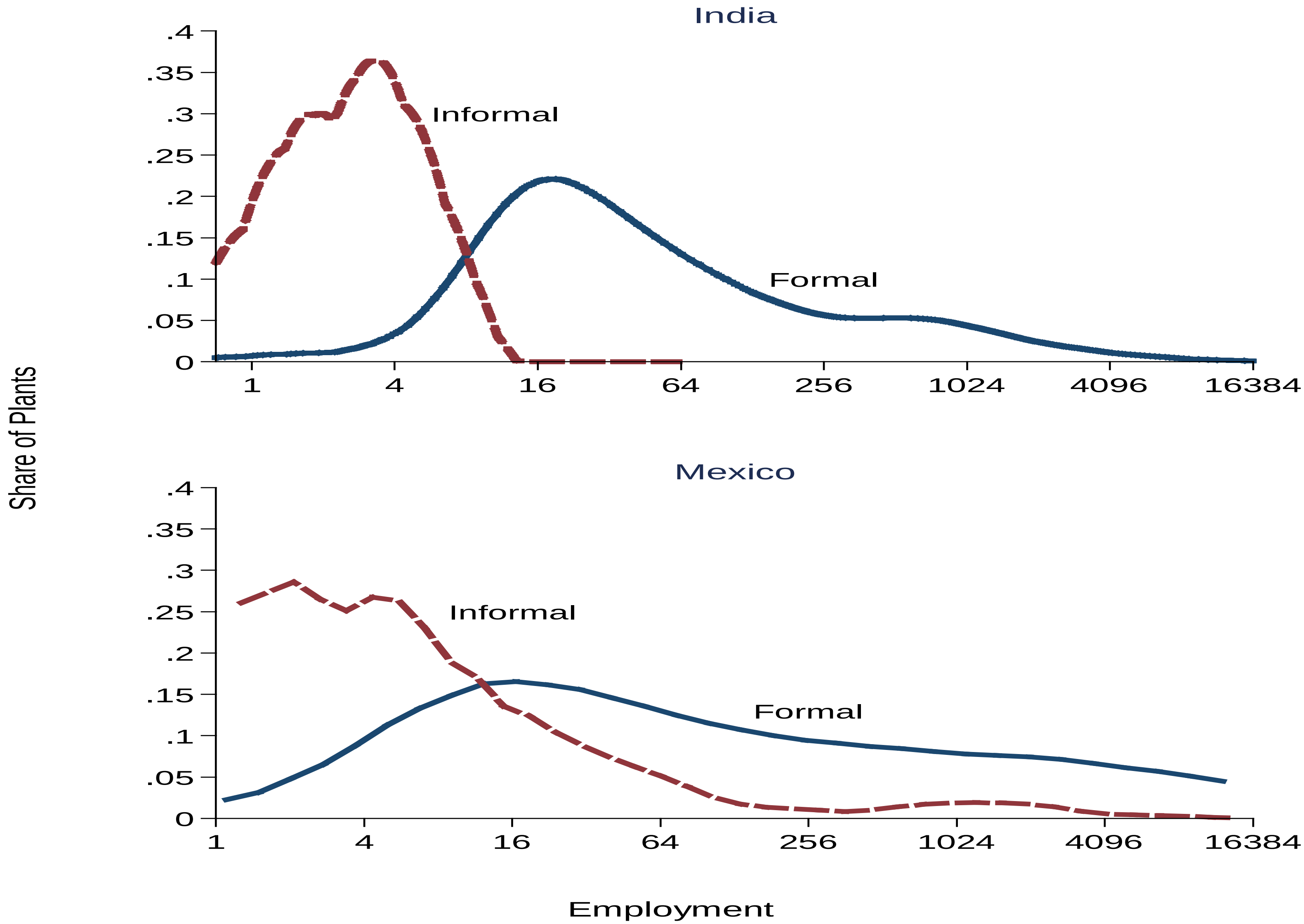
% of Growth from 1998 to 2007 due to:

Privatization and Exit of SOE: 3.2%

Corporatization of SOE: 13.2%

Informal Workers and Establishments in India and Mexico

	Unpaid Workers		Informal Establishments	
	% Workers	% Establishments	% Workers	% Establishments
India				
1989-90	71.9	94.1	78.9	99.4
2005-06	62.0	90.9	80.5	99.3
Mexico				
1998	10.2	55.0	14.8	75.6
2008	29.7	60.0	30.4	87.1


India
Informal
Formal
Mexico
Informal
Formal
Share of Plants
Employment
.4
.35
.3
.25
.2
.15
.1
.05
0
1
4
16
64
256
1024
4096
16384

Why so Much Informality:

Hernando de Soto’s Answer

Legally register two sewing machine shop in Lima

Two women do paperwork under supervision of lawyer

Six hours per day, five days a week:

300 days and Costs = 32 times average wage, 30 government agencies

The response:

World Bank’s Doing Business Project

Small Firm Registration

Microfinance

Business/Manager Training

Special Tax Regimes

David McKenzie and Christopher Woodruff

Experiment with Registration of Informal Firms in Sri Lanka

Free Registration: **Zero** takeup

Free Registration + 1 month income: 20% takeup

Free Registration + 2 month income: 50% takeup

No Effect on Profit of Formal Registration

Why so Much Informality?

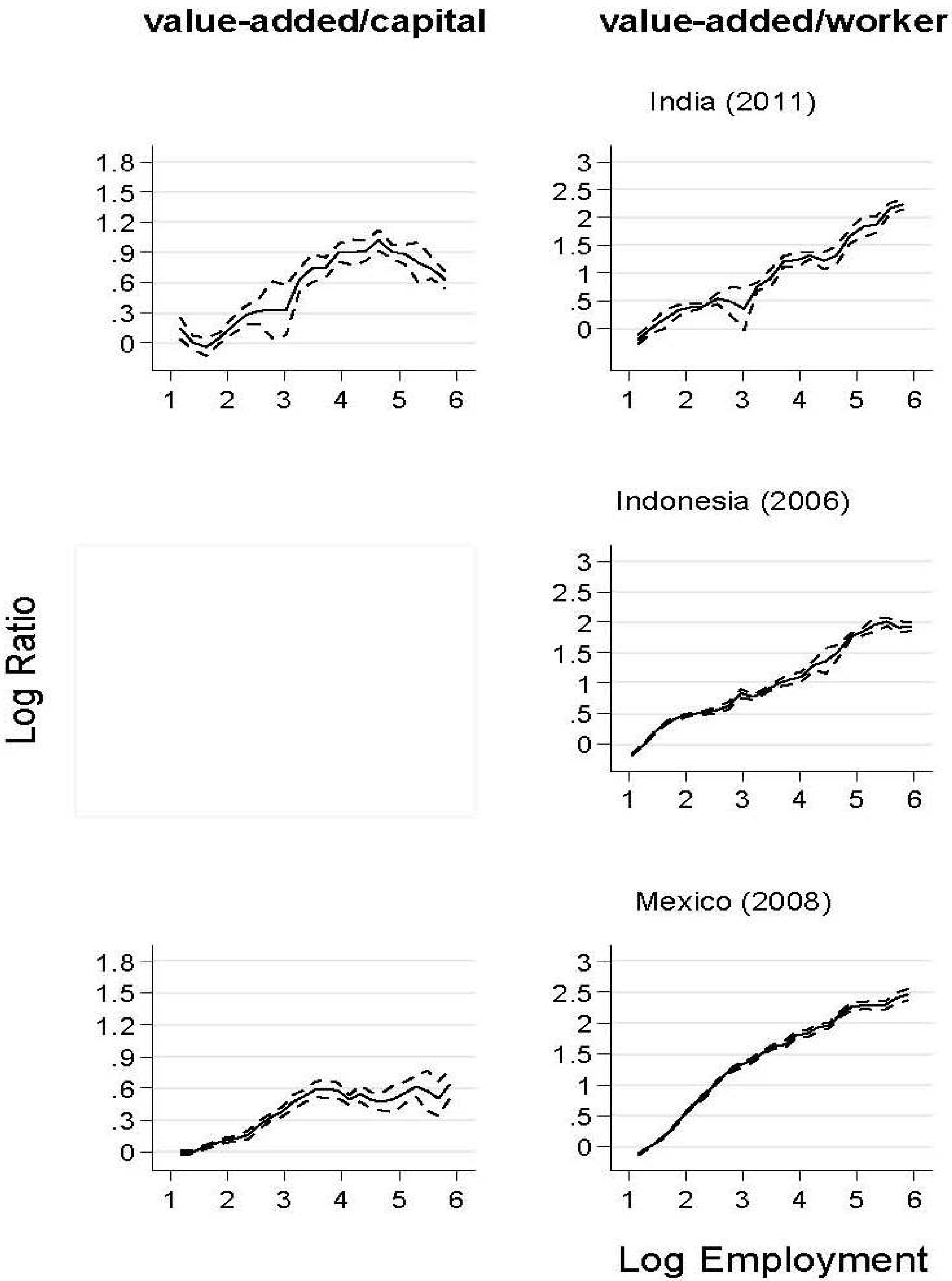
Santiago and McKinsey's Answer:

Formal firms get taxed

Formal firms subject to regulations

Firing Costs in India

Informal firms evade taxes, regulations.


value-added/capital
value-added/worker
India (2011)
Indonesia (2006)
Mexico (2008)
Log Ratio
Log Employment
1.8
1.5
1.2
.9
.6
.3
0
3
2.5
2
1.5
1
.5
0
1 2 3 4 5 6

Industrial Disputes Act

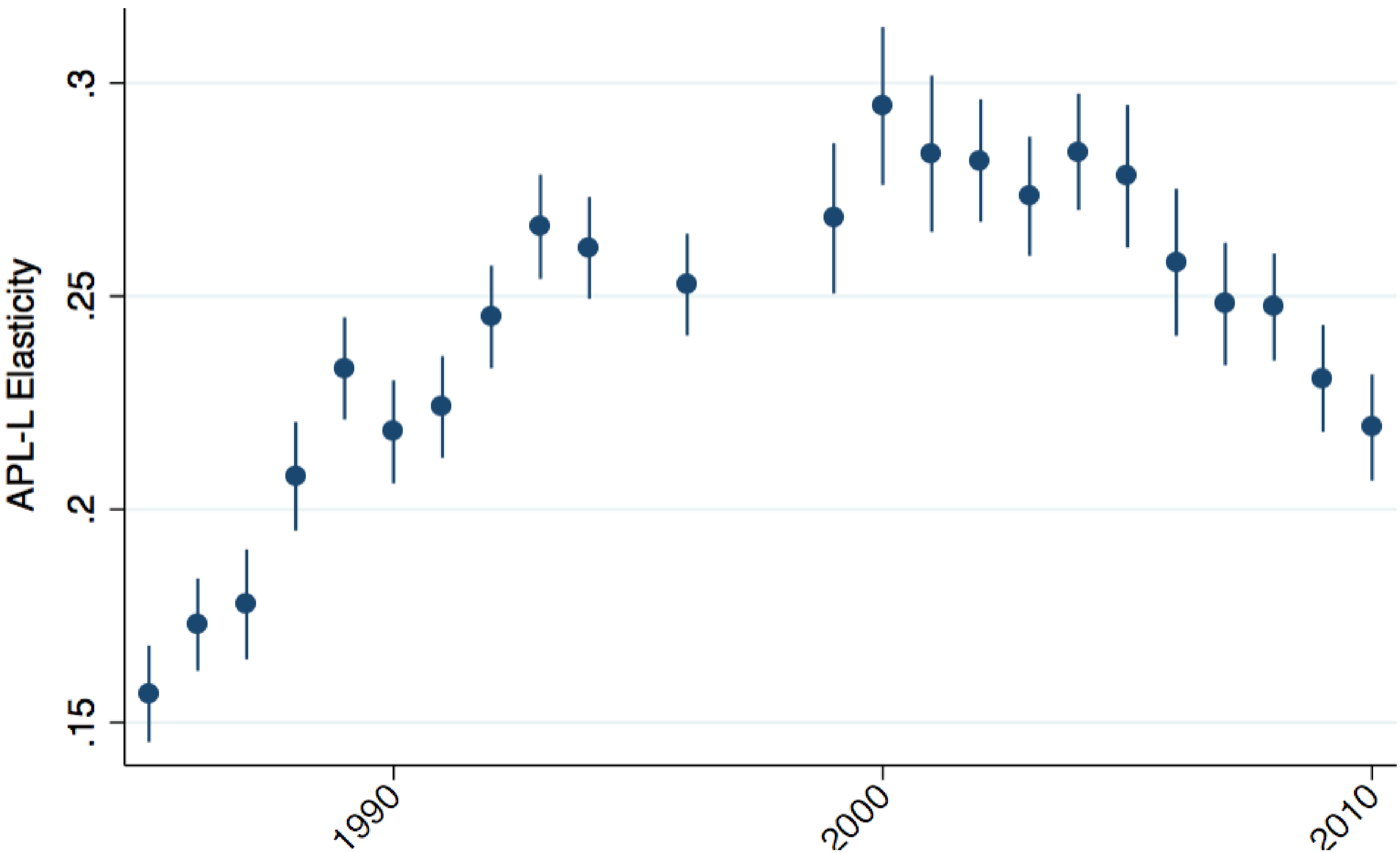
1947: Firms > 100 Workers Cannot Let Workers go

No change in IDA

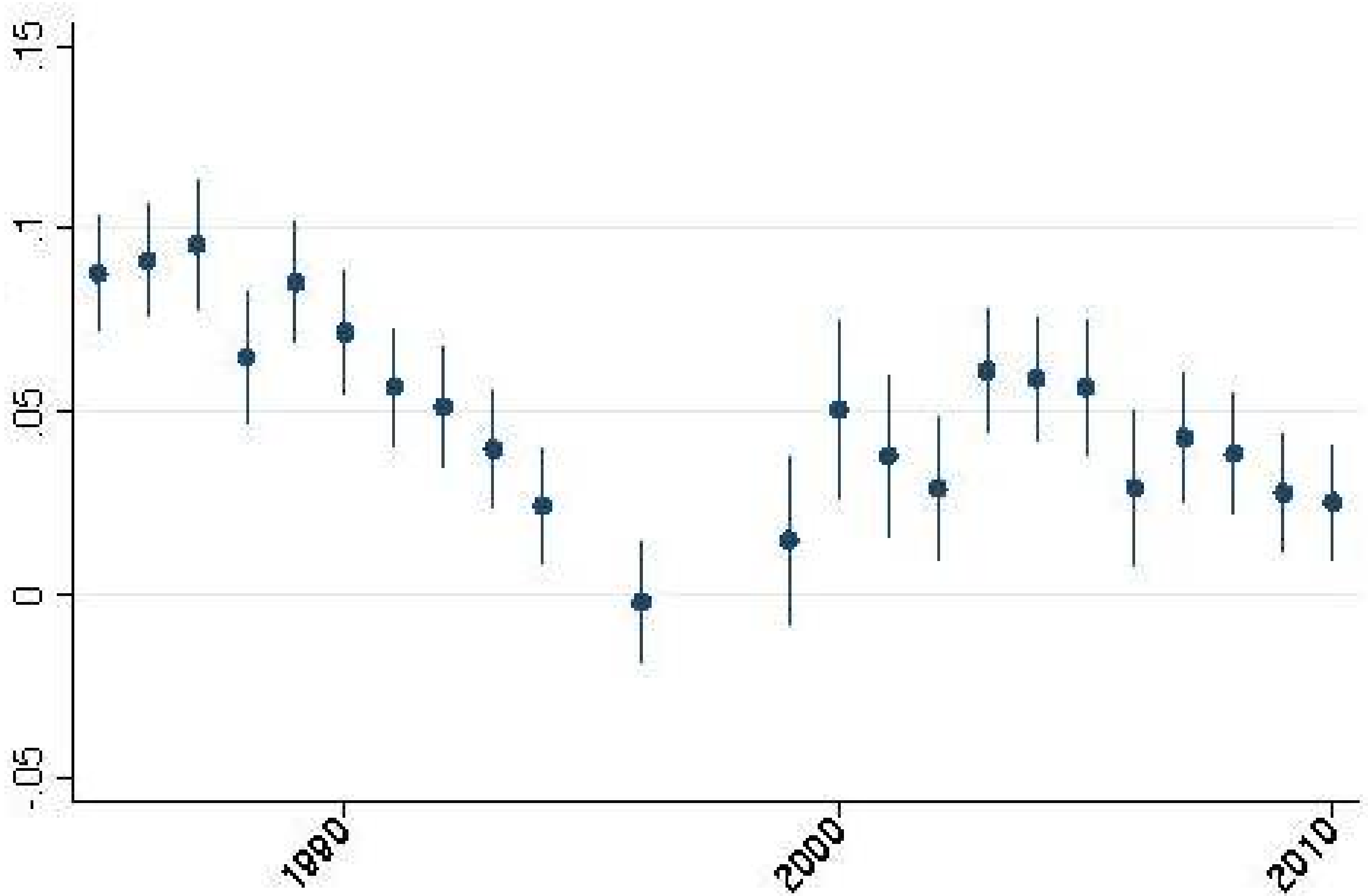
Licensing Laws

Mostly Dismantled by mid 1990s

Elasticity of Labor Productivity (Y/L) with respect to Employment



Elasticity of Productivity of Capital with respect to Employment



TeamLease

Founded in 1997

99,000 Workers, 1100 administrative staff

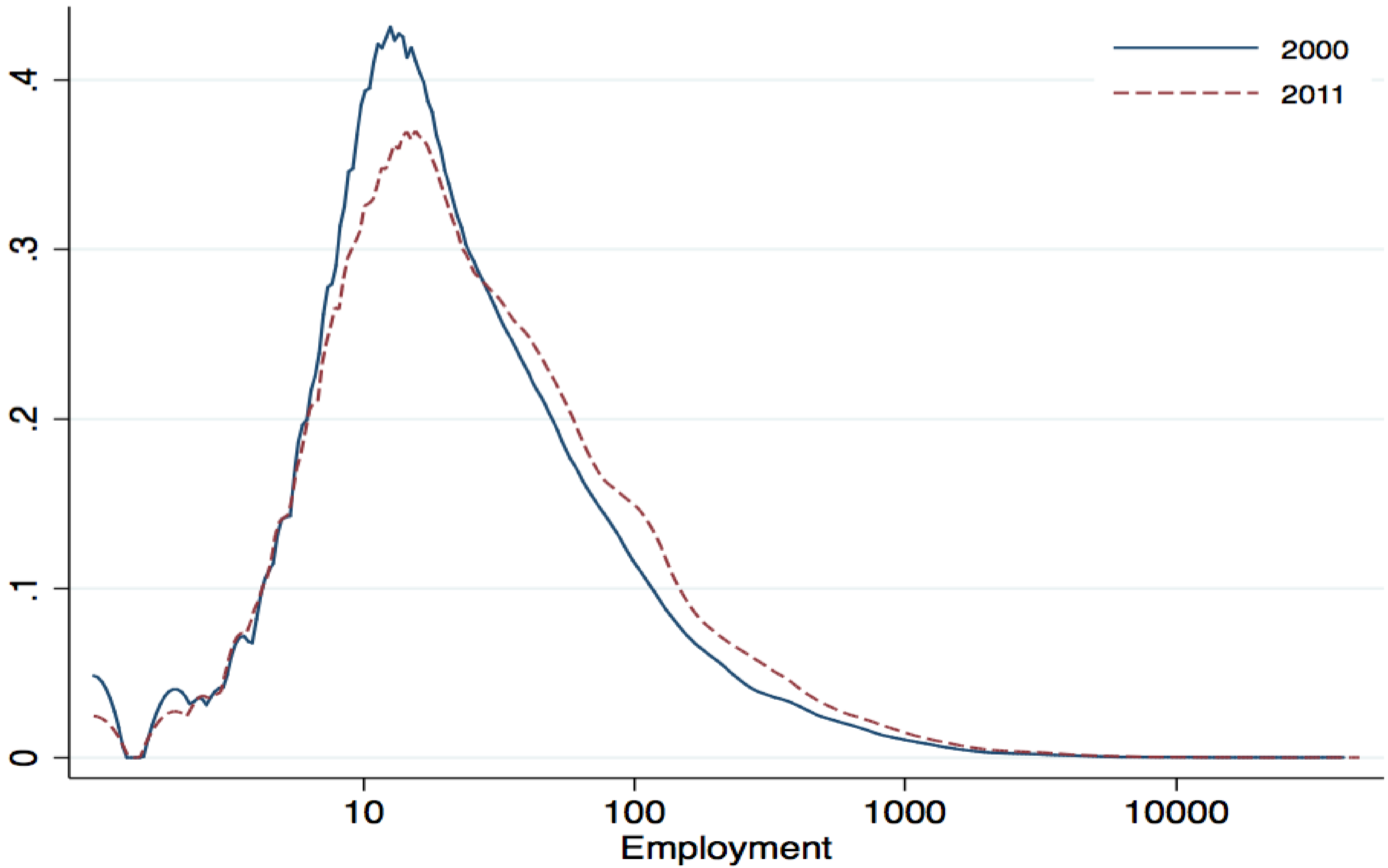
1,200 clients, mostly service sector (83 workers per client)

One-year contract, one-month notice

Complies with IDA, pays payroll tax (but other labor contractors may not)

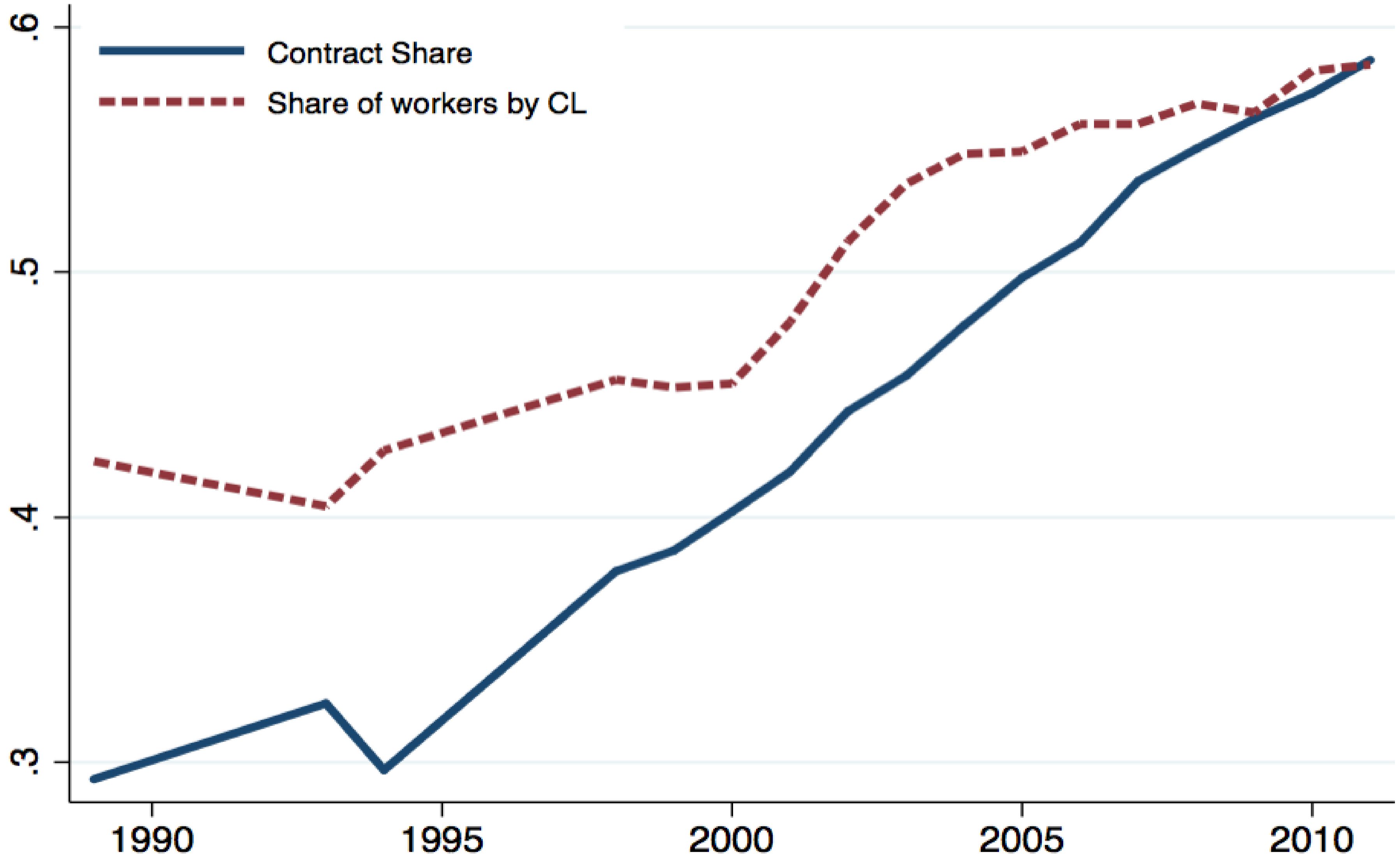
Based in Mumbai, 8 branches

Right Tail of Firm Size Distribution Has Thickened



	2000	2010
Share of Plants > 100 Workers	11%	15%
Employment Share Plants > 100 Workers	63%	70%

Large Firms (> 100 Workers) Use More Contract Labor



Spatial Misallocation

Large Differences in Economic Activity Across Cities

Local Labor Demand (TFP)

Labor Supply (Amenities, Housing Prices)

But workers can move between cities and indifferent between “good” and “bad” cities (in equilibrium)

Effect of Local TFP/Amenities/Housing Prices on Aggregate Welfare and Output

Suppose housing supply is inelastic in cities with TFP growth.

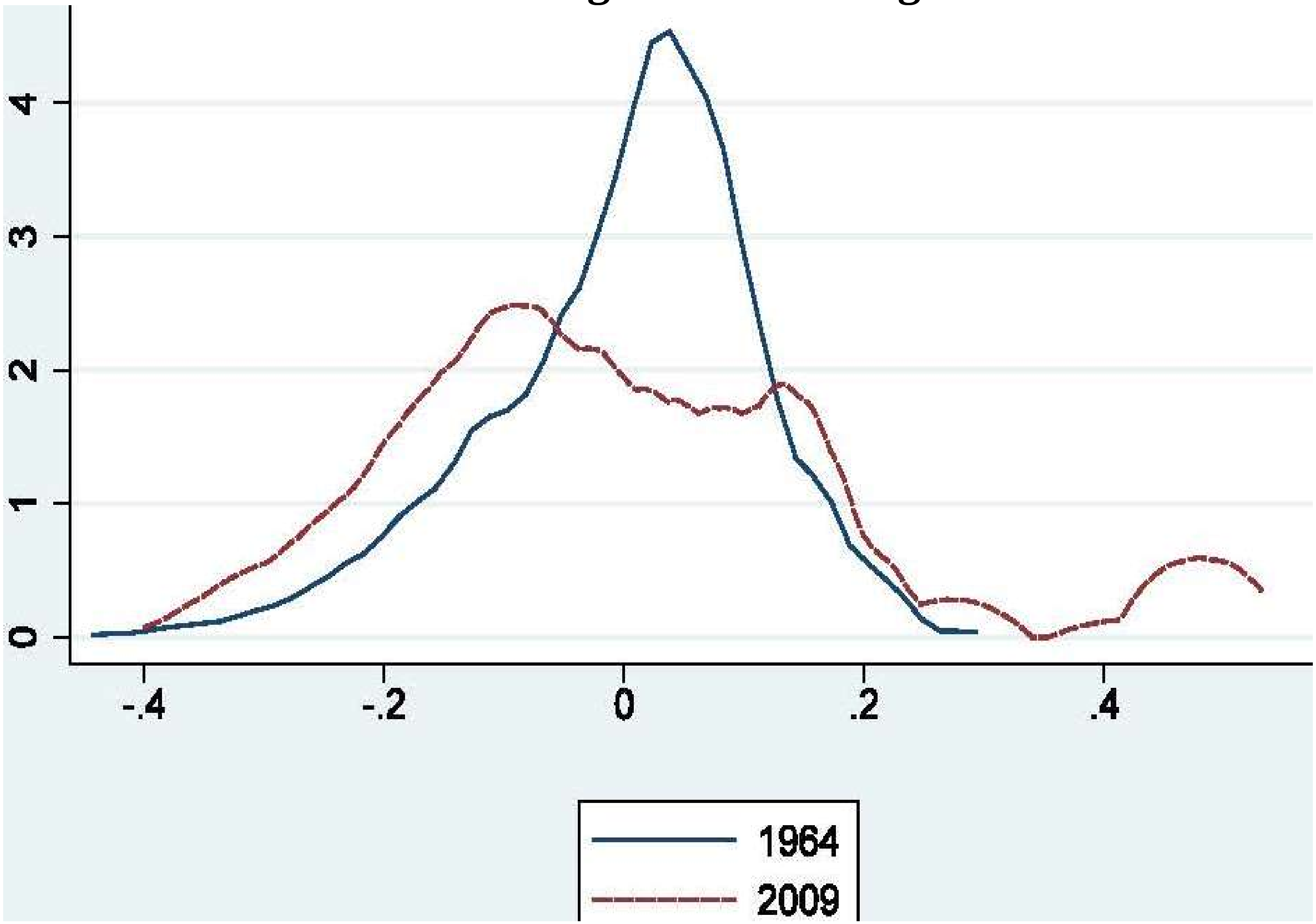
TFP => Higher Housing Prices

Rosen-Roback => High TFP cities are also Wage Cities

High TFP cities are also cities where MP of Labor is high

High Wage is equilibrium: Workers do not want to move to high TFP/high MP city

Distribution of Average Residual Wage in 220 Cities



Rosen-Roback

Local Output: $$Y_i = A_i K_i^{\eta} L_i^{\alpha}$$

A_i: Local TFP

Welfare (Indirect Utility): $$V = \frac{W_i Z_i}{P_i^{\beta}}$$

Z_i : Amenities

P_i: Rental Price of Housing

Partial Equilibrium

Labor Productivity: $$\frac{Y_i}{L_i} \propto W_i = \frac{VP_i^{\beta}}{Z_i}$$

City Size: $$L_i \propto \left(\frac{A_i}{W_i^{1-\eta}}\right)^{\frac{1}{1-\alpha-\eta}} = \left(\frac{A_i Z_i^{1-\eta}}{P_i^{\beta(1-\eta)}}\right)^{\frac{1}{1-\alpha-\eta}}$$

Housing Price: $P_i = L_i^{\gamma_i}$ $$\Rightarrow W_i \propto \left(\frac{A_i^{\gamma_i \beta}}{Z_i^{1-\eta-\alpha}}\right)^{\frac{1}{(1-\eta)(1+\gamma_i\beta)-\alpha}}$$

General Equilibrium

Aggregate Welfare: $V \propto Y \cdot \sum_i L_i \cdot \frac{Z_i}{P_i^{\beta}}$

$$Y = \sum_i Y_i = \left(\sum_i A_i^{\frac{1}{1-\alpha-\eta}} \left(\frac{\overline{W}}{W_i} \right)^{\frac{1-\eta}{1-\alpha-\eta}} \right)^{\frac{1-\alpha-\eta}{1-\eta}}$$

$\overline{W} = \sum_i L_i W_i$: employment-weighted average wage

Welfare = Average local TFP + Average Amenities/Prices - Wage Dispersion

Aggregate Effect of Increase in Local TFP (New York, SF, South)

Average Local TFP

Average Housing Prices increase (depending on housing supply elasticity)

W_i Dispersion

Increase Dispersion if high wage city (by a lot if housing supply inelastic) (New York, SF)

Decrease Dispersion if low wage city and housing prices don't increase by "too much" (South)

Aggregate Effect of *Decrease* in Local TFP (Rust Belt Cities)

Average Local TFP Falls

Glaeser-Gyourko: Housing Supply Inelastic in Declining Cities

Average Housing Prices (across all cities) Fall

W_i Dispersion

Decrease Dispersion if wages are "very high"

Increase Dispersion if wages are not "too high"

Aggregate Effect of Improvement in Local Amenities

Value of Good Weather, Consumer Amenities, Good Public Schools

Average Amenities Improves

W_i Dispersion

Decrease Dispersion if high wage city (New York, SF)

Increase Dispersion if low wage city (South)

Standard Deviation of Log Average Wage Across 220 Cities

	1964	**2009**
Average Wage	0.132	0.205
Average *Residual* Wage	0.109	0.189

Convergence in Occupational Choice since 1960

Women vs. Men

Blacks vs. White

Percent of White Men in Select Occupations

	1960	2006-2008
Doctors	94	63
Lawyers	96	61
Managers	86	57

What were they doing in 1960?

White Women:

58% in Nursing, Teaching, Sales, Secretaries, Food Preparation

White Men: 17% (Mostly Sales)

Black Men: 54% in Freight/Stock Handlers, Motor Vehicle Operators, Machine Operators, Farm, Janitorial and Personal Services

White Men: 29%

Occupational convergence driven by deep social changes

- Labor market discrimination
  - Sandra Day O’Connor couldn’t find job in 1952
- Human capital market discrimination
  - Princeton did not admit women until 1970s
- Social preferences

Occupational convergence suggests less misallocation of talent today

Questions:

How much better is talent allocated across professions today?

How much does better allocation matter for

- Wage gaps?
- Aggregate productivity?

How much did different social forces matter?

Our approach:

Roy model of occupational choice with frictions
+ general equilibrium

Minimum Setup

Each person gets a skill draw ε_i in N occupations

w_i: Return to unit of skill in occupation i

Labor Market Friction: $Wage_{ig} = (1 - \tau_{ig}^{W}) \cdot w_i \cdot \varepsilon_i$

Occupational Choice: Pick $\max\limits_{i} \left\{ (1 - \tau_{ig}^{W}) \cdot w_i \cdot \varepsilon_i \right\}$

Distributional Assumption

$\varepsilon_i \sim$ iid Frechet with dispersion parameter θ

Ex-ante probability person from group g chooses sector i

$$p_{ig} = \frac{\left(w_i \cdot (1-\tau_{ig}^{W})\right)^{\theta}}{\sum_k \left(w_k \cdot (1-\tau_{kg}^{W})\right)^{\theta}}$$

Average Wage

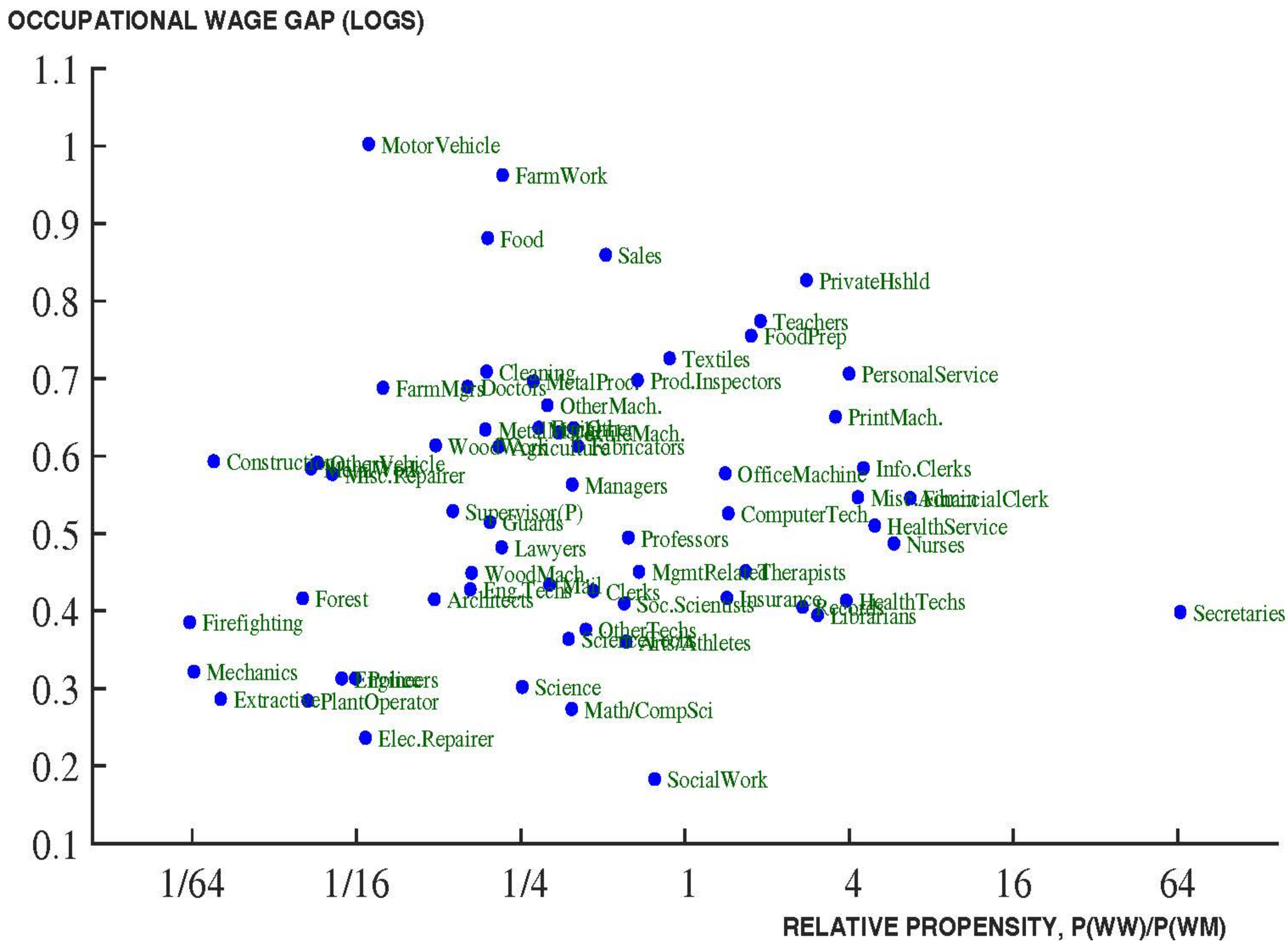
$$\overline{Wage}_{ig} = \left(1-\tau_{ig}^{w}\right) w_i \bar{\varepsilon}_{ig}$$

Average quality of group *g* in *i*: $\bar{\varepsilon}_{ig} = p_{ig}^{-\theta}$

Average quality falls when more people enter

$$\overline{Wage}_{g} = \left(\sum_{i} \left(w_i \cdot \left(1-\tau_{ig}^{w}\right)\right)^{\theta} \right)^{\frac{1}{\theta}}$$

Same wage in all occupations



OCCUPATIONAL WAGE GAP (LOGS)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
1/64
1/16
1/4
1
4
16
64
RELATIVE PROPENSITY, P(WW)/P(WM)
MotorVehicle
FarmWork
Food
Sales
PrivateHshld
Teachers
FoodPrep
Textiles
Cleaning
FarmMgrs
Doctors
MetalProc
Prod.Inspectors
PersonalService
OtherMach.
PrintMach.
Fabricators
Construction
OtherVehicle
Misc.Repairer
OfficeMachine
Info.Clerks
Managers
FinancialClerk
Supervisor(P)
Guards
ComputerTech.
HealthService
Professors
Nurses
Lawyers
WoodMach.
MgmtRelated
Therapists
Forest
Architects
Eng.Techs
Mail
Clerks
Soc.Scientists
Insurance
Records
HealthTechs
Librarians
Secretaries
Firefighting
OtherTechs
Arts/Athletes
Mechanics
Engineers
Police
Science
Extractive
PlantOperator
Math/CompSci
Elec.Repairer
SocialWork

Aggregate Output

$$Y = \sum_g \sum_i w_i \bar{\varepsilon}_{ig} = \sum_g \frac{\overline{Wage}_g}{1 - \bar{\tau}_{ig}^w}$$

$$= \sum_g \left(\sum_i \left(w_i \cdot \frac{\left(1 - \tau_{ig}^w\right)}{1 - \bar{\tau}_{ig}^w} \right)^{\theta} \right)^{\frac{1}{\theta}}$$

Mean has no effect on output

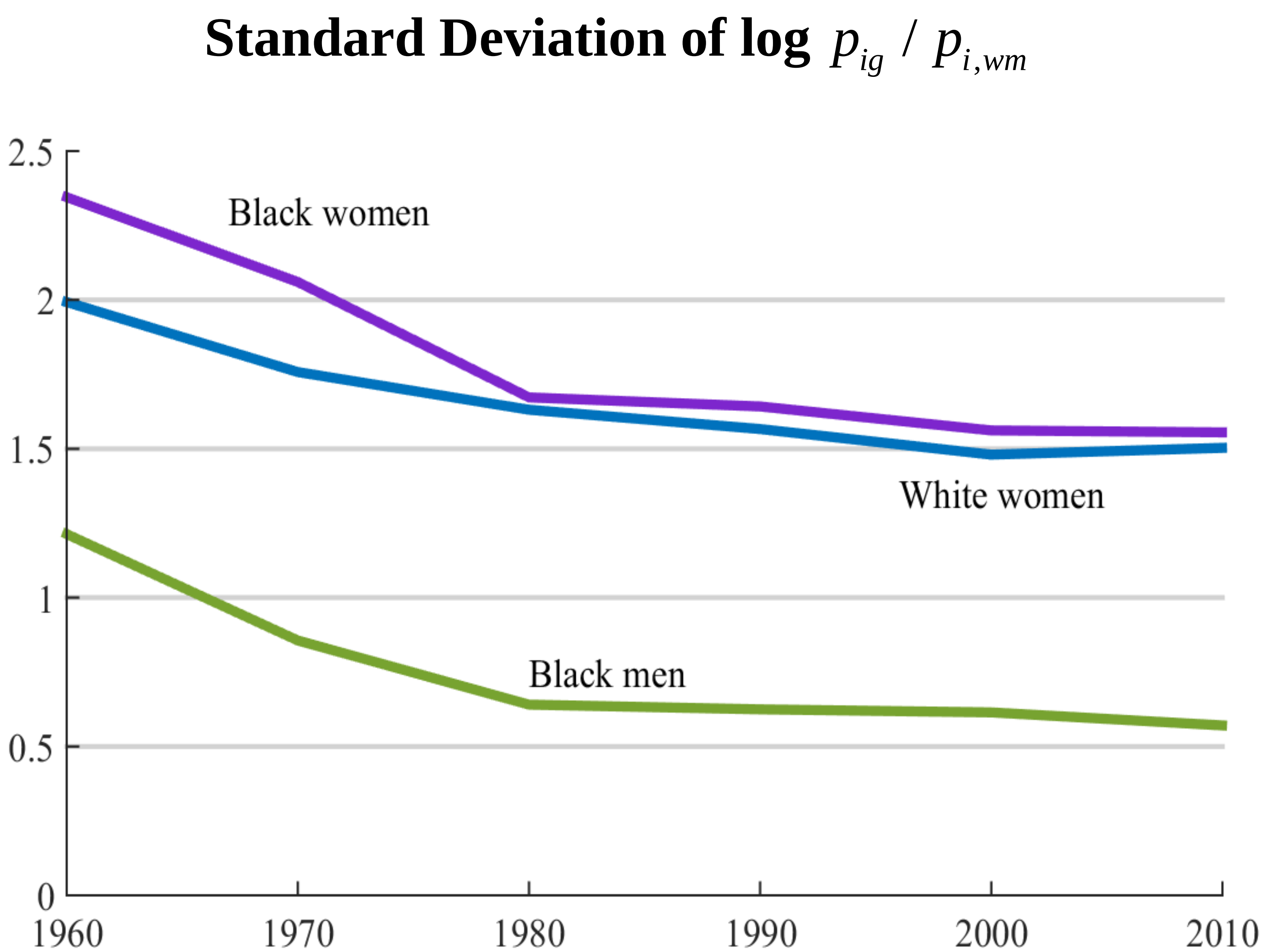
Only dispersion matters for output

Inference:

$$\frac{p_{ig}}{p_{i,wm}} = \left(\frac{1-\tau_{i,wm}^{w}}{1-\tau_{ig}^{w}}\right)^{\theta}\left(\frac{\overline{Wage}_{wm}}{\overline{Wage}_{g}}\right)^{\theta}$$

Normalize $\tau_{i,wm}^{w} = 0$

$$1-\tau_{ig}^{w} = \left(\frac{p_{ig}}{p_{i,wm}}\right)^{-1/\theta}\frac{\overline{Wage}_{wm}}{\overline{Wage}_{g}}$$


Standard Deviation of log $p_{ig} / p_{i,wm}$
2.5
2
1.5
1
0.5
0
1960
1970
1980
1990
2000
2010
Black women
White women
Black men

Preferences vs. Labor Market Frictions

$$\text{Pick } \max_i \left\{ z_{ig} \cdot (1-\tau_{ig}^W) \cdot w_i \cdot \varepsilon_i \right\}$$

$$p_{ig} = \frac{\left(w_i \cdot z_{ig} \cdot (1-\tau_{ig}^W)\right)^\theta}{\sum_k \left(w_k \cdot z_{kg} \cdot (1-\tau_{kg}^W)\right)^\theta}$$

$$\overline{Wage}_{ig} = z_{ig}^{-1} \left(\sum_k \left(w_k \cdot z_{kg} \left(1-\tau_{kg}^w\right)\right)^\theta \right)^{\frac{1}{\theta}}$$

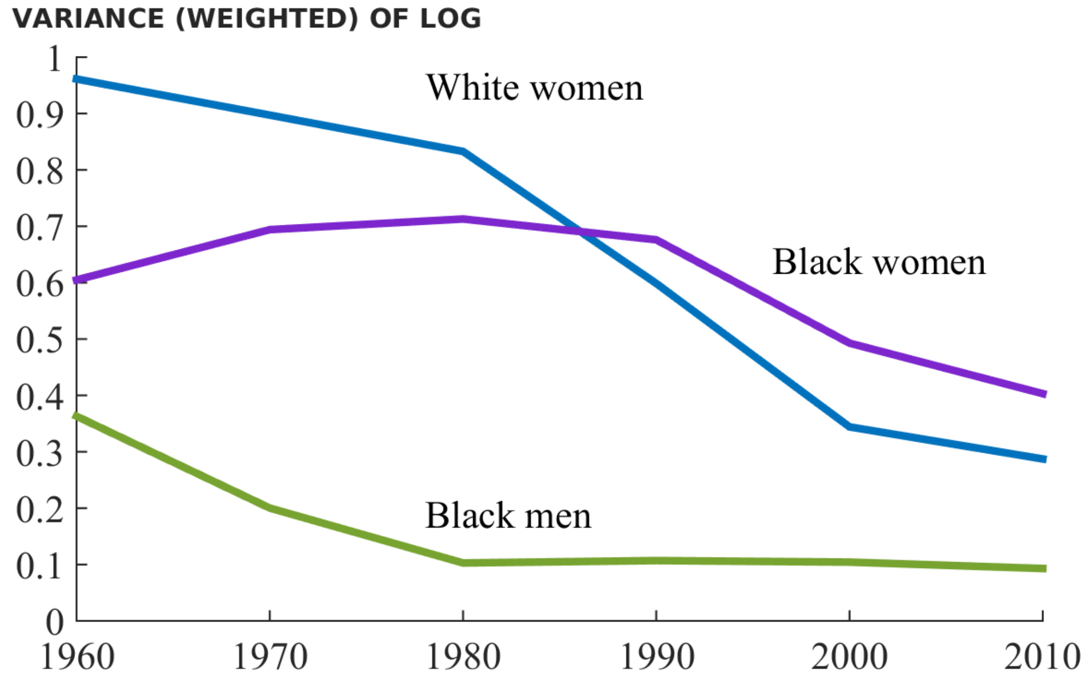
Inference in model with z_{ig} and τ_{ig}

$\overline{Wage}_{ig} \propto z_{ig}^{-1}$ => Wage gaps across occupations reflect z_{ig}

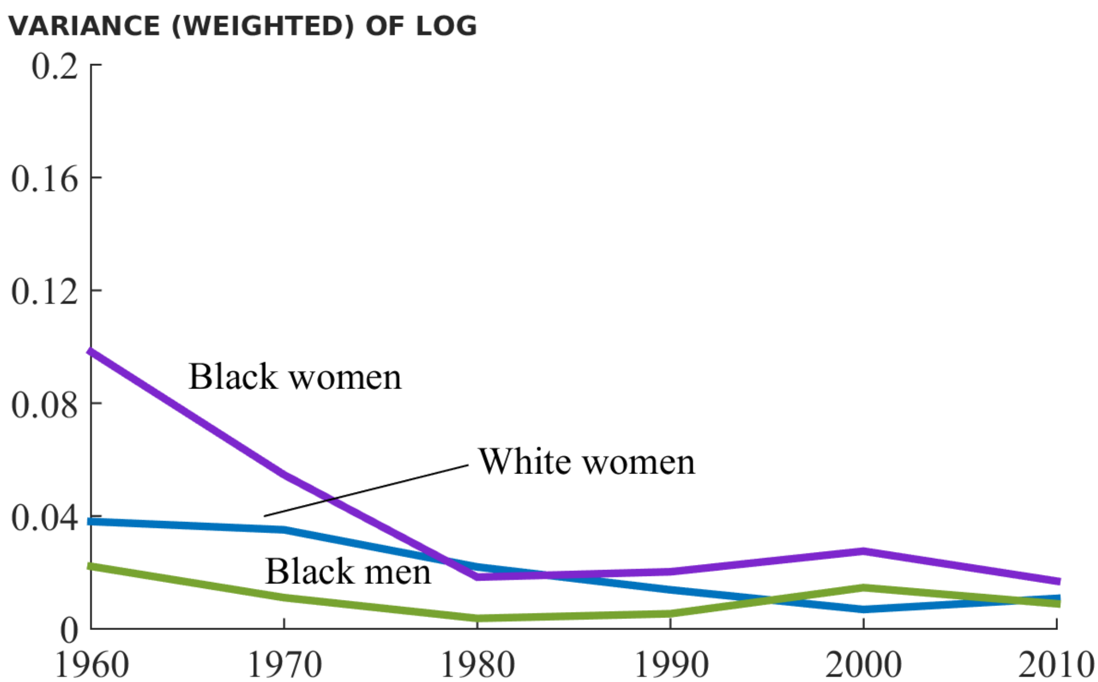
$1-\tau_{ig}^{w} = \left(\dfrac{p_{ig}}{p_{i,wm}}\right)^{-1/\theta} \dfrac{\overline{Wage}_{i,wm}}{\overline{Wage}_{ig}}$ still measures $1-\tau_{ig}^{w}$

(note we now use sector specific wage gap)

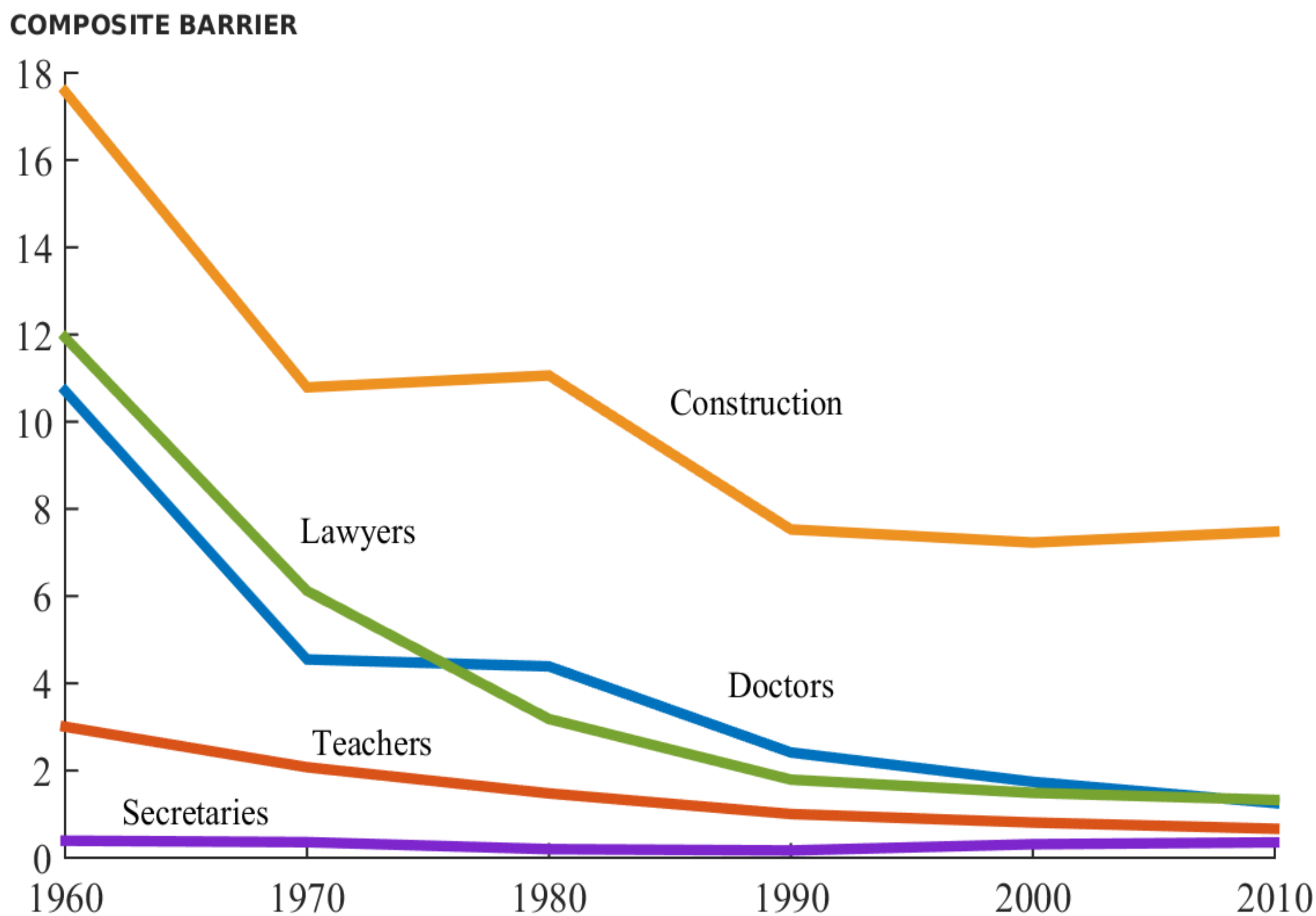
Variance log $1-\tau_{ig}^{w}$



Variance log z_{ig}



$(1-\tau_{ig}^{w})^{-1}$ **for White Women in Select Occupations**



Labor Market vs. Human Capital Distortions

Human capital ${e_{ig}}^{\eta}$ with cost $e_{ig}(1+\tau_{ig}^{h})$

Consumption: $C = (1-\tau_{ig}^{w})w_i\varepsilon_i {e_{ig}}^{\eta} - e_{ig}(1+\tau_{ig}^{h})$

⇨ $C^* = (1-\eta)(1-\tau_{ig}^{w})w_i\varepsilon_i {e_{ig}^{*}}^{\eta}$ where $e_{ig}^{*} = \left(\frac{(1-\tau_{ig}^{w})}{(1+\tau_{ig}^{h})^{\eta}} \cdot w_i\varepsilon_i\right)^{\frac{1}{1-\eta}}$

Choose $\max_i \left\{(1-\tau_{ig}^{w})w_i\varepsilon_i {e_{ig}^{*}}^{\eta}\right\}$

⇨ Occupational Choice: $p_{ig} = \dfrac{\left(w_i \cdot \frac{(1-\tau_{ig}^{w})}{(1+\tau_{ig}^{h})^{\eta}}\right)^{\theta}}{\sum_k \left(w_k \cdot \frac{(1-\tau_{kg}^{w})}{(1+\tau_{kg}^{h})^{\eta}}\right)^{\theta}}$

Labor Market vs. Human Capital Frictions: Identification

$$\left(\frac{p_{ig}}{p_{i,wm}}\right)^{-1/\theta}\frac{\overline{Wage}_{i,wm}}{\overline{Wage}_{ig}}\ \text{measures}\ \frac{(1-\tau^{w}_{ig})}{(1+\tau^{h}_{ig})^{\eta}}$$

Assume e^{*}_{ig} is fixed after it is chosen

$$\Rightarrow\quad \frac{\overline{Wage}_{ig}(\mathrm{t+1})}{\overline{Wage}_{ig}(\mathrm{t})}=\frac{w_i(t+1)}{w_i(\mathrm{t})}\cdot\frac{(1-\tau^{w}_{ig}(\mathrm{t+1}))}{(1-\tau^{w}_{ig}(\mathrm{t}))}$$

Wage growth relative to men isolates change in $(1-\tau^{w}_{ig})$

Labor Market vs. Human Capital Frictions: Identification

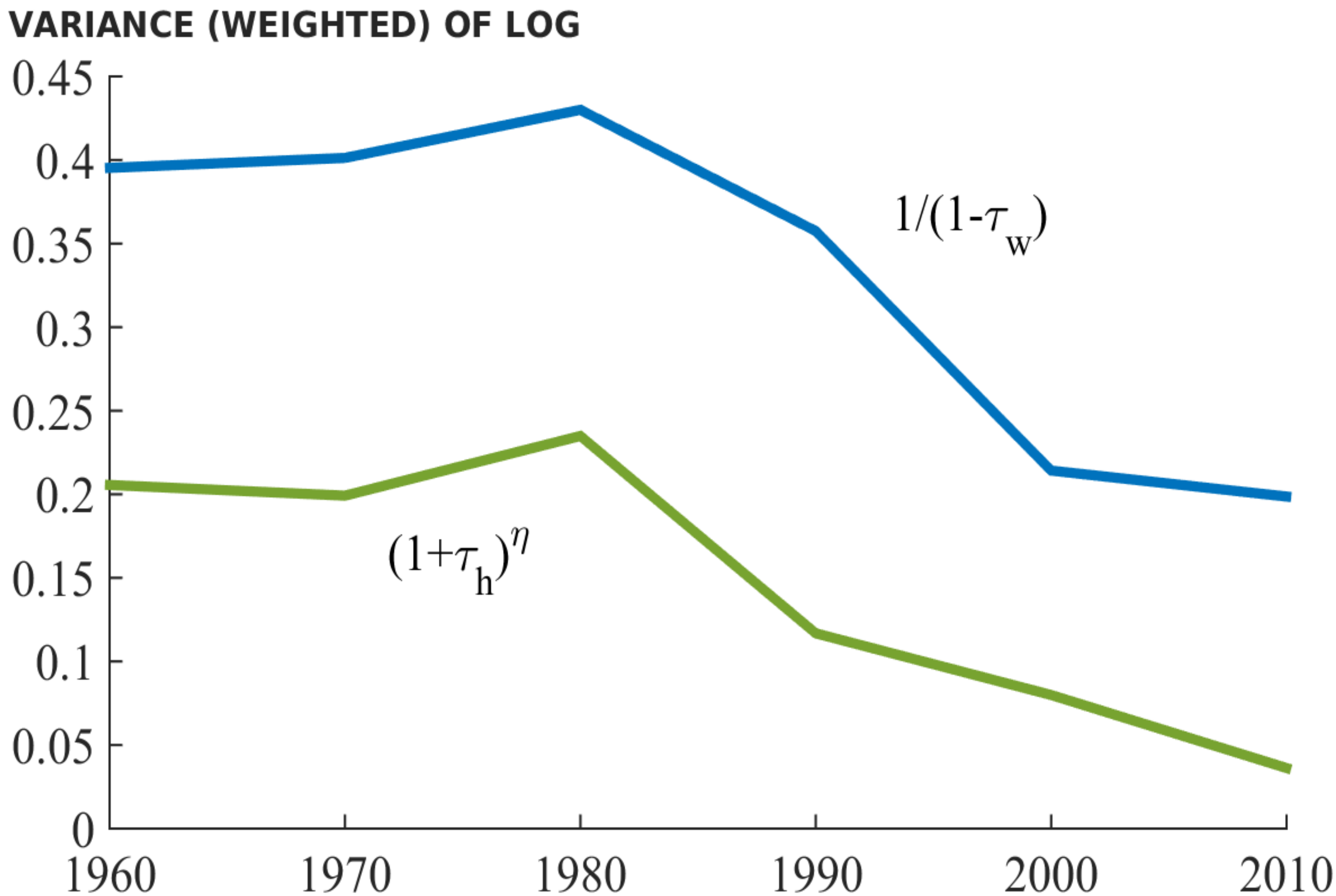
We have:

1) $\Delta(1-\tau_{ig}^{w})$ (from wage growth relative to men)

2) $\dfrac{(1-\tau_{ig}^{w})}{(1+\tau_{ig}^{h})^{\eta}}$ of young at t and t+1 (from occupational shares)

⇨ Back out $\Delta(1+\tau_{ig}^{h})^{\eta}$ as the residual

Variance of log $(1+\tau_{ig}^{h})^{\eta}$ and log $(1-\tau_{ig}^{w})$ for White Women



Contribution to Growth from 1960 to 2010:

τ^w, τ^h, z **:**	**27.2%**
τ^w, τ^h only:	**26.7%**
τ^h only:	**24.5%**
τ^w only:	**5.7%**