Entry Costs Rise with Development

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[1]These views are those of the author and do not necessarily reflect the views of the Federal Reserve System.

Do entry costs rise with development?

Matters for the welfare impact of various policies

No consensus in the literature

In this paper we:

- study mfg. firms in the US, Indonesia, India and China
- find that the PDV of profits per firm increases for successive cohorts as mfg. productivity rises
- infer entry costs rise with development (if free entry condition holds)

Entry costs

Let $c_e(t)$ = the cost of setting up a business in units of real output

Polar case 1: $c_e(t) = c_e$

Polar case 2: $c_e(t) = w(t)\, l_e$

Generalized entry technology

Setting up a business requires 1 unit of an "entry good"

Technology for creating M firms

$$M = A_e \, L_e^{\lambda} \, Y_e^{1-\lambda}$$

Resulting cost of entry

$$c_e \propto \frac{w^{\lambda}}{A_e}$$

No consensus about the labor share of entry costs

All goods $\lambda = 0$	Hopenhayn (1992), Romer (1994), Foster, Haltiwanger and Syverson (2008), Clementi and Palazzo (2015)
All labor $\lambda = 1$	Grossman and Helpman (1991), Melitz (2003), Klette and Kortum (2004), Luttmer (2007), Florin, Ghironi and Melitz (2012)
Agnostic $\lambda = ?$	Rivera-Batiz and Romer (1991), Atkeson and Burstein (2010), Costinot and Rodríguez-Clare (2013)

What we do

Assume free entry condition:

$$c_e = \text{expected PDV of profits}$$

Measure expected PDV of profits using data on mfg. firms and plants in the U.S., India, China and Indonesia.

Use facts to estimate λ in workhorse models

Previous evidence

Countries with higher GDP per capita have fewer establishments per worker in manufacturing

Bento and Restuccia (2015)

No trend in average firm employment in the U.S.

e.g. Laincz and Peretto (2006), Luttmer (2010)

Theoretical properties as wishlist for stylized facts

BGP, stationary firm size distribution

Our contribution: infer entry costs from ex post profits and the free entry condition

This talk

Why are our facts interesting?

Our facts

Interpretation of our facts

Simple models for illustration

- Span-of-control
- Love-of-variety
- Quality ladder growth

Simple models for illustration

- Span-of-control
- Love-of-variety
- Quality ladder growth

Span-of-control model

Firms make homogenous goods: $y = A_y \, l^{\gamma}$, $\gamma < 1$

Entry costs as fixed management costs

Management requires managers and goods (e.g. computers)

Aggregate output under symmetry

$$Y = A_y \, M^{1-\gamma} \, L_y^{\gamma}$$

Equilibrium welfare

$$\ln \frac{C}{L} = constant + \ln w$$

In terms of the exogenous variables

$$\ln w = constant + \frac{\ln A_y}{1-(1-\lambda)(1-\gamma)} + \frac{(1-\gamma)\ln A_e}{1-(1-\lambda)(1-\gamma)}$$

Lower labor share in entry costs (lower λ) $\Longrightarrow$ bigger welfare impact of changes in technology

Intuition: entry multiplier

Steady state in the span-of-control model (at $\ln L = 1, \ln A_e = 1$) :

$$\begin{aligned} \ln w &= \ln A_y + (1-\gamma)\ln M \\ \ln M &= constant + (1-\lambda)\ln w \end{aligned}$$

higher $A_y \rightarrow$ higher $Y/L \rightarrow$ higher M if $\lambda < 1 \rightarrow$ higher $Y/L \rightarrow$ higher M if $\lambda < 1 \rightarrow \cdots$

$$\frac{\partial \ln w}{\partial \ln A_y} = \underbrace{1}_{\text{direct}} + \underbrace{(1-\gamma)\frac{\partial \ln M}{\partial \ln A_y}}_{\text{entry expansion}} = \frac{1}{1-(1-\lambda)(1-\gamma)}$$

Welfare impact depends on λ

Amplification through entry

$$\frac{\text{Impact through entry expansion}}{\text{Direct Impact}} = \frac{1}{1-(1-\lambda)(1-\gamma)} - 1$$

Welfare impact of a 1% increase in A_y

	Amplification	
	$\gamma = 0.67$	$\gamma = 0.8$
$\lambda = 0$	50%	25%
$\lambda = 1$	0%	0%

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Our method for inferring λ

λ is the elasticity of entry costs wrt real wage

$$c_e \propto \frac{w^{\lambda}}{A_e} \propto \frac{(Y/L)^{\lambda}}{A_e}$$

Measure c_e by assuming zero-profit free entry condition

Document the correlation between $\ln c_e$ and $\ln \frac{Y}{L}$ over time within each country

GMM to estimate λ given $\ln \frac{Y}{L}$ is endogenous to $\ln A_e$

PDV of profits per firm

$$\hat{c}_e(c) = \frac{1}{N_c} \sum_{f=1}^{N_c} \sum_{t=c}^{D_{fc}} (1-\gamma_t) Y_{fc,t} \left(\prod_{s=c+1}^{t} \frac{1}{1+r_s} \right)$$

$Y_{fc,t}$:	real output of firm f from cohort c
$1-\gamma_t$:	profit share t
N_c:	number of firms born in year c
D_{fc}:	year of death of firm f from cohort c
r_t:	real interest rate
t:	calendar year

In the motivating model

$$c_e = \text{PDV of profits per firm} \propto \frac{Y}{M}$$

Data: U.S. Manufacturing

1947-2012

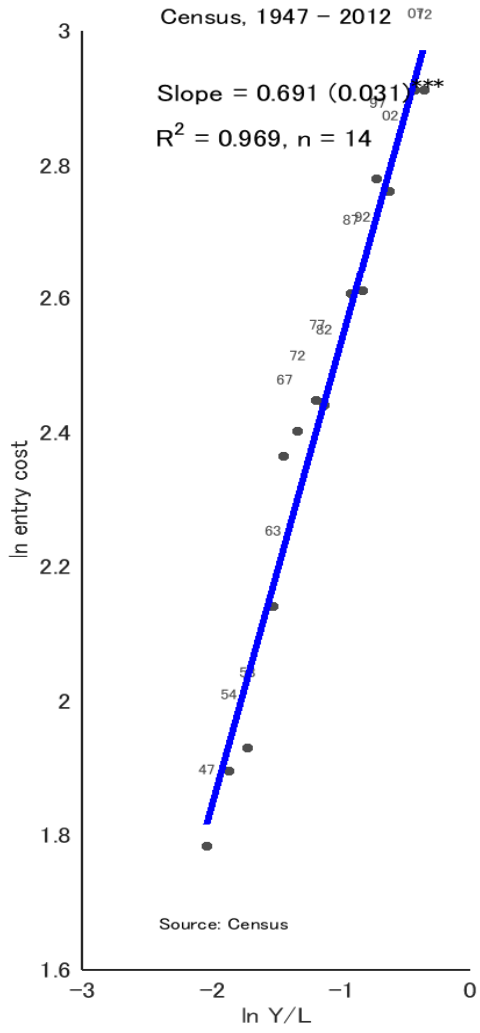
L: Census, ASM, BDS

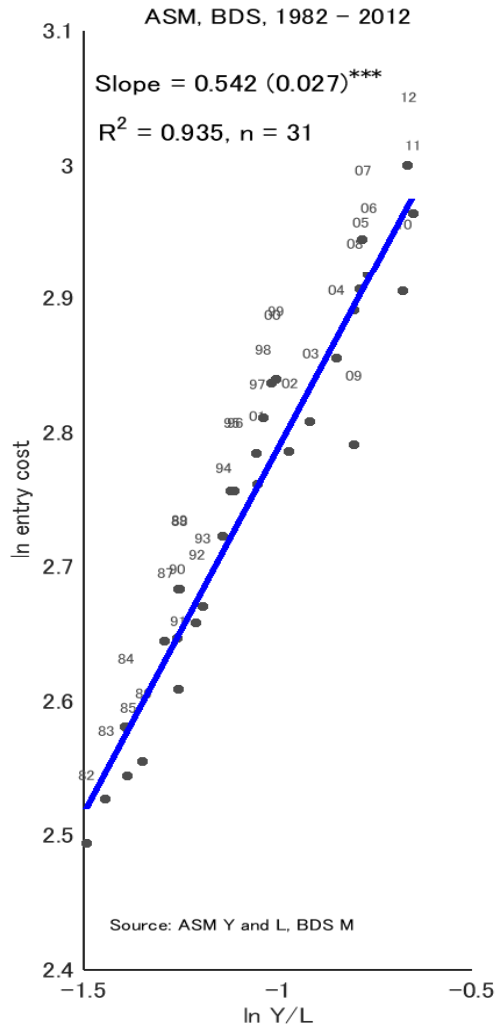
M: Census for available years, ASM/BDS for other years

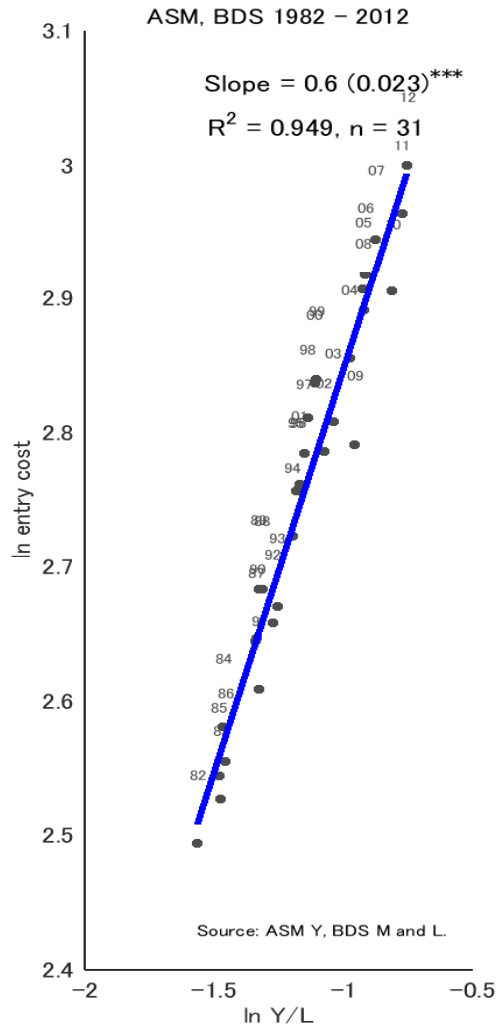
Y: Nominal VA deflated by BEA GDP deflator

Y/M rises with Y/L

U.S. manufacturing over time







Data: Indonesia Manufacturing

1985-1999, Annual Manufacturing Survey

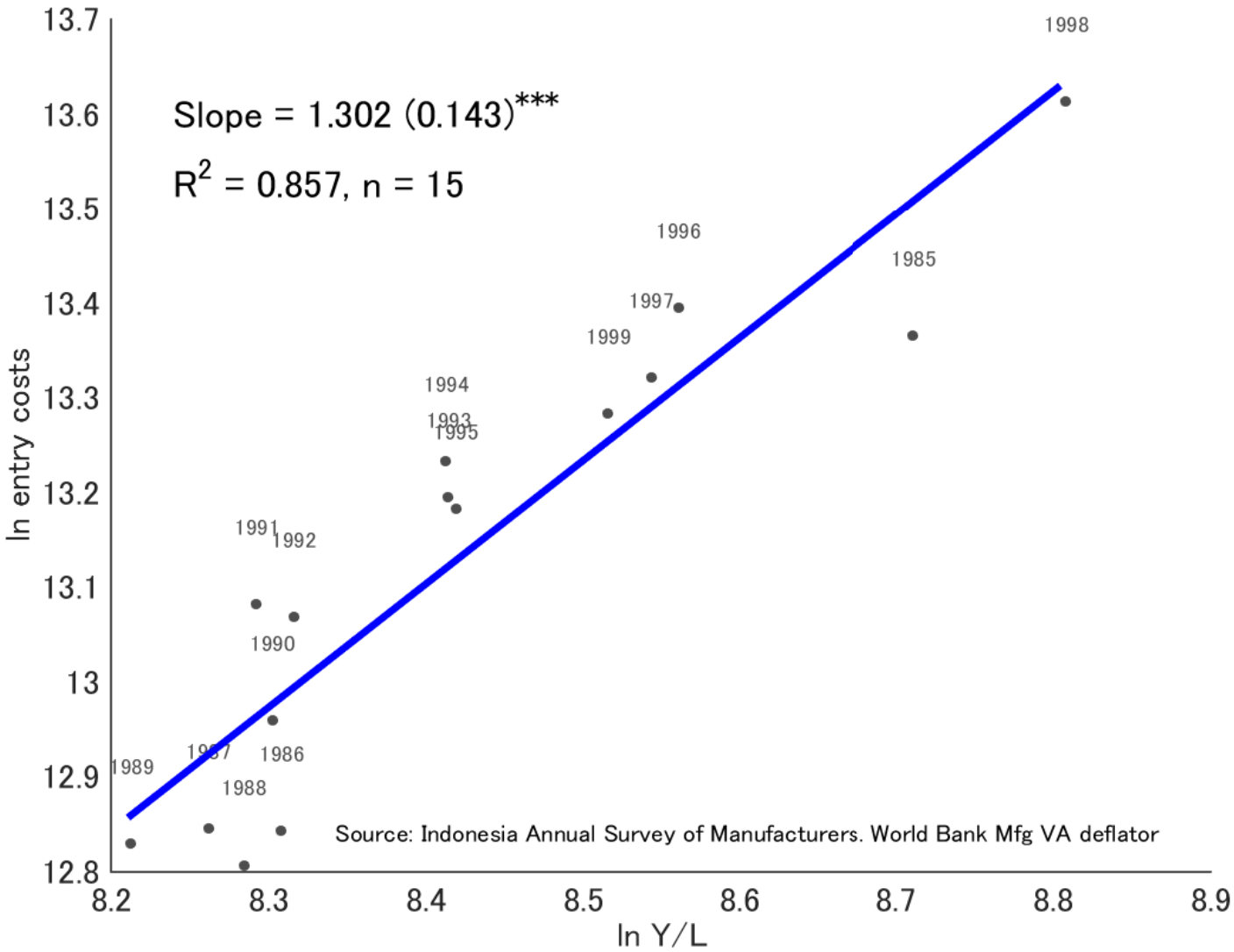
L: Number of production workers

M: Number of establishments

Y: Nominal VA deflated by World Bank mfg VA deflator

Y/M rises with Y/L

Indonesia manufacturing sectors over time



Data: Indian Manufacturing

1980-2004, Annual Survey of Industries

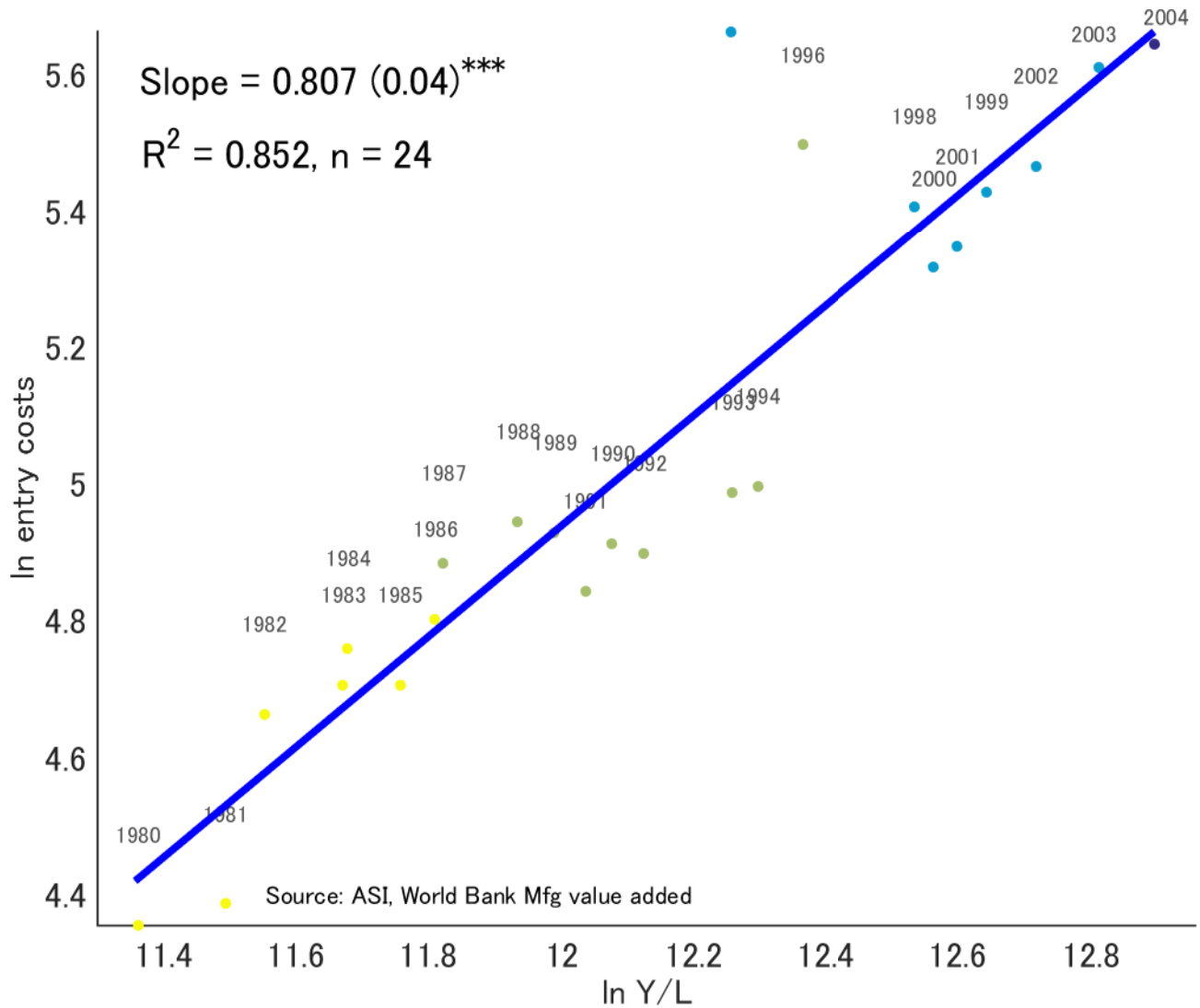
L: Number of production workers

M: Number of establishments

Y: Nominal VA deflated by World Bank mfg VA deflator

Y/M rises with Y/L

Indian manufacturing over time, ASI



Data: Chinese Manufacturing

1998-2007, Surveys of Industrial Production

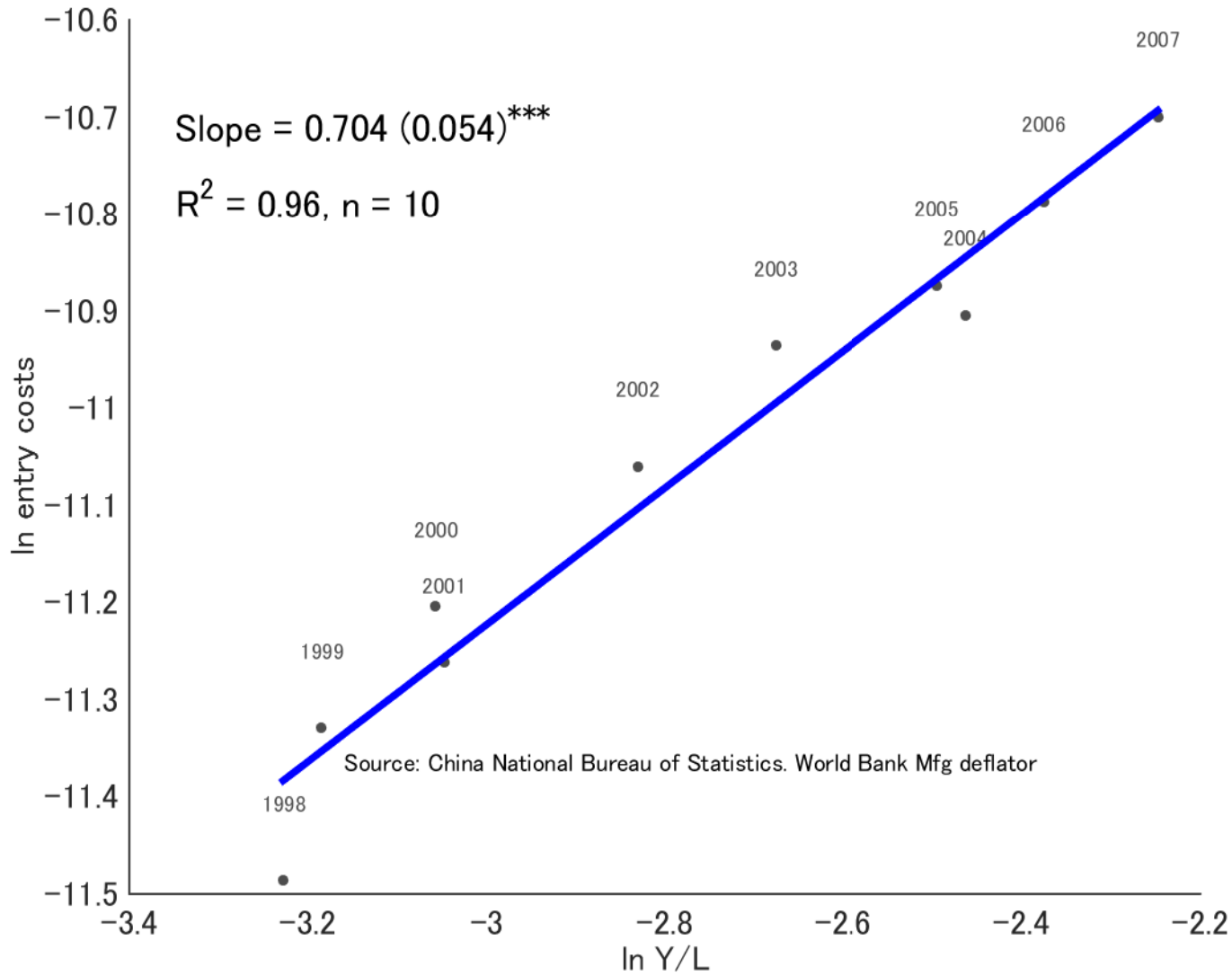
L: Number of production workers

M: Number of establishments

Y: Nominal VA deflated by World Bank mfg VA deflator

Y/M rises with Y/L

Chinese manufacturing over time



More general model

Assuming constant

- post entry growth rate
- exit rate
- discount rate
- markup

$$c_e = \text{PDV of profits per firm} \propto \left(\frac{Y}{M}\right)_{entrants}$$

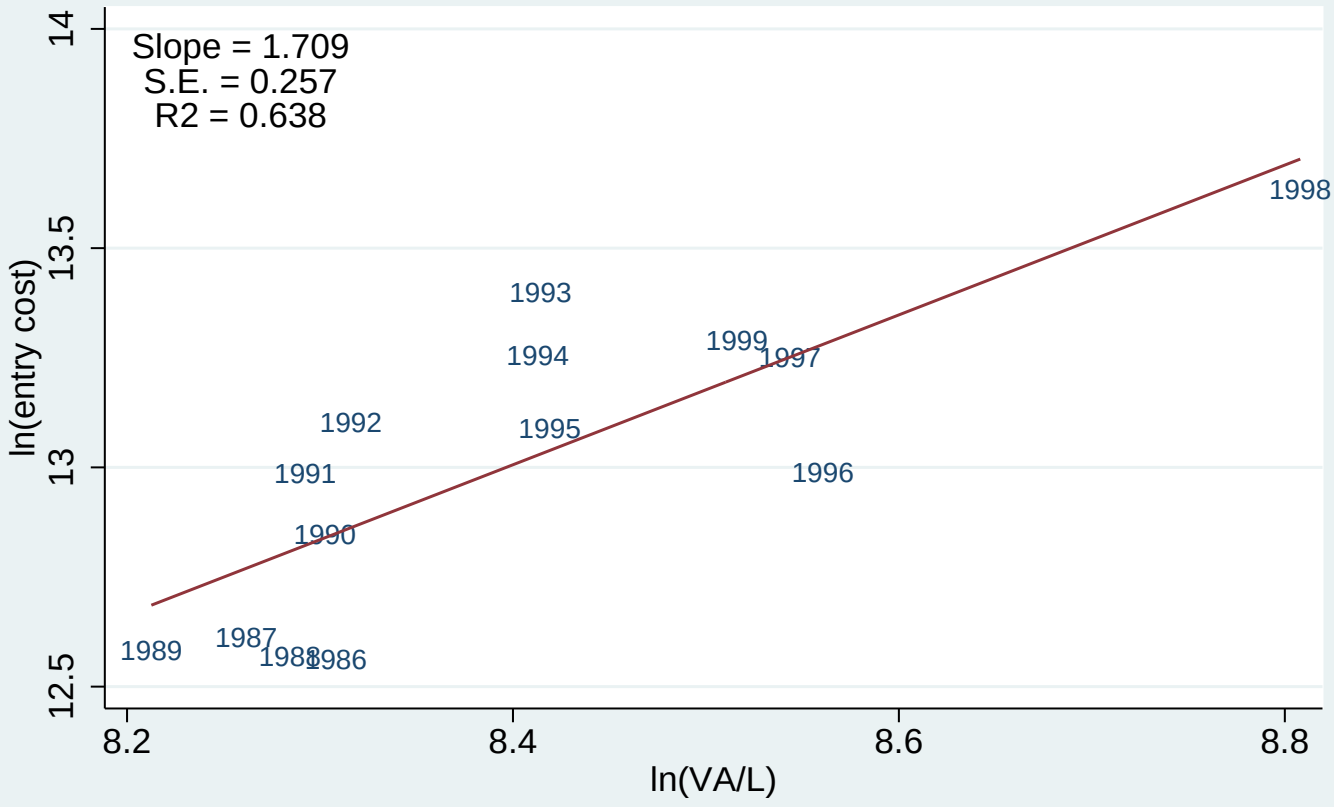
Indonesia

- real value added per establishment of *entrants* increases strongly with real value added per worker
- no trend in post-entry growth rate
- no trend in exit rate by age
- no strong trend in markup

Suggests PDV of profits per firm ↑ with development

Entrant size vs development

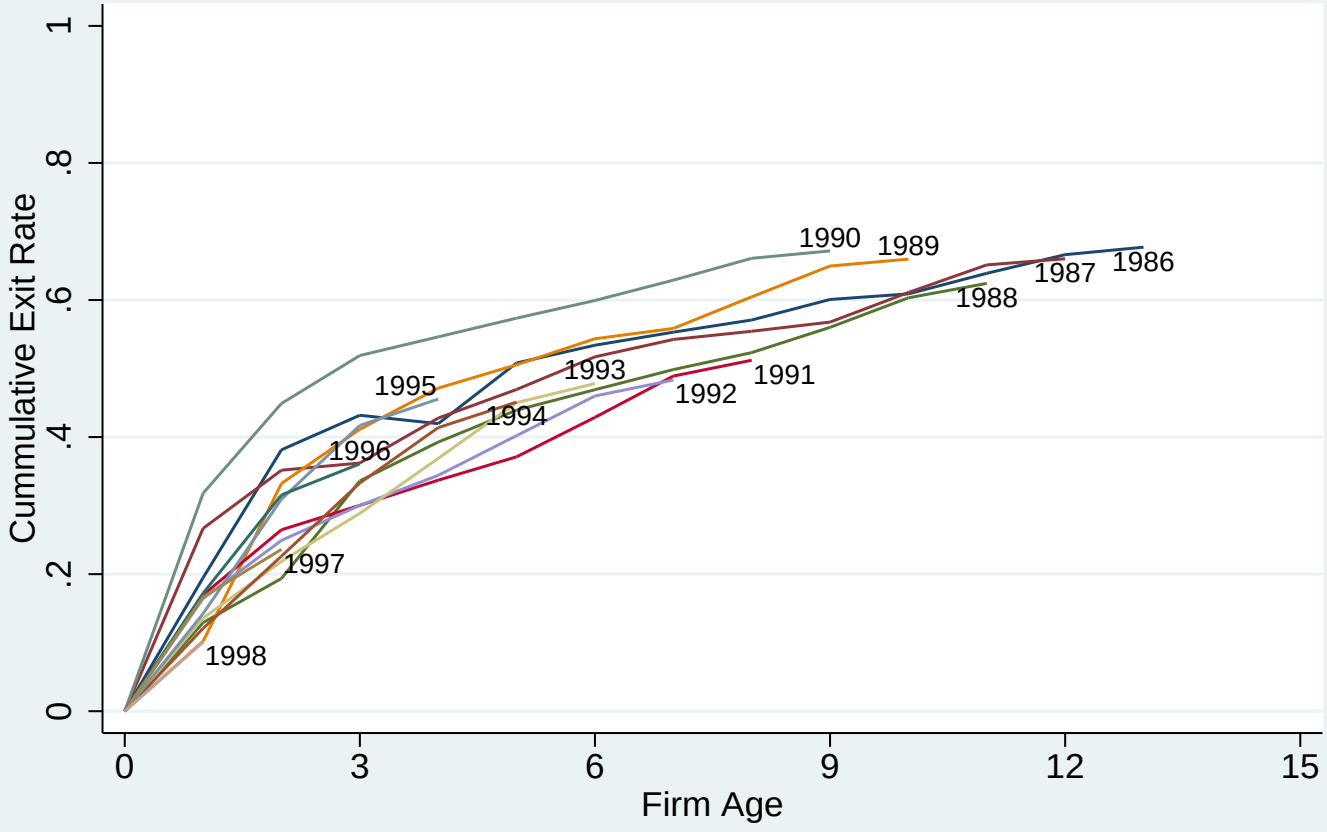
Indonesia manufacturing over time



N = 14
Note: entry cost is measured by entrant value added per plant.
VA is the total value added in a year deflated by World Bank manufacturing VA deflators.
Reported standard errors are robust.

Cumulative exit rate

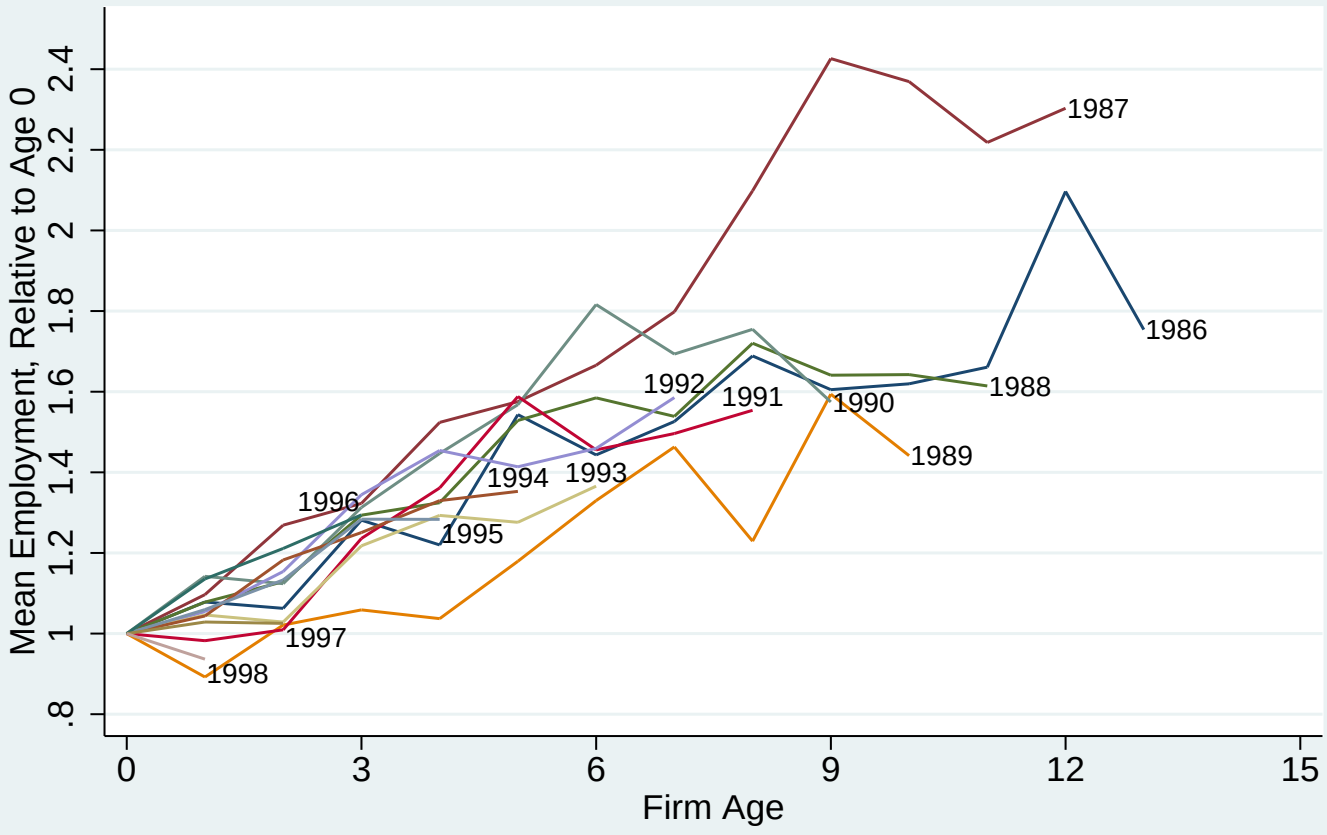
Indonesia manufacturing over time



Note: Firm age is the number of years since the first year a firm was surveyed. Cumulative exit rate is defined as the percent of firms within a cohort that were not surveyed in a given year. The 1985 cohort is excluded as it cannot be accurately identified due to data limitations.

Survivor growth rate

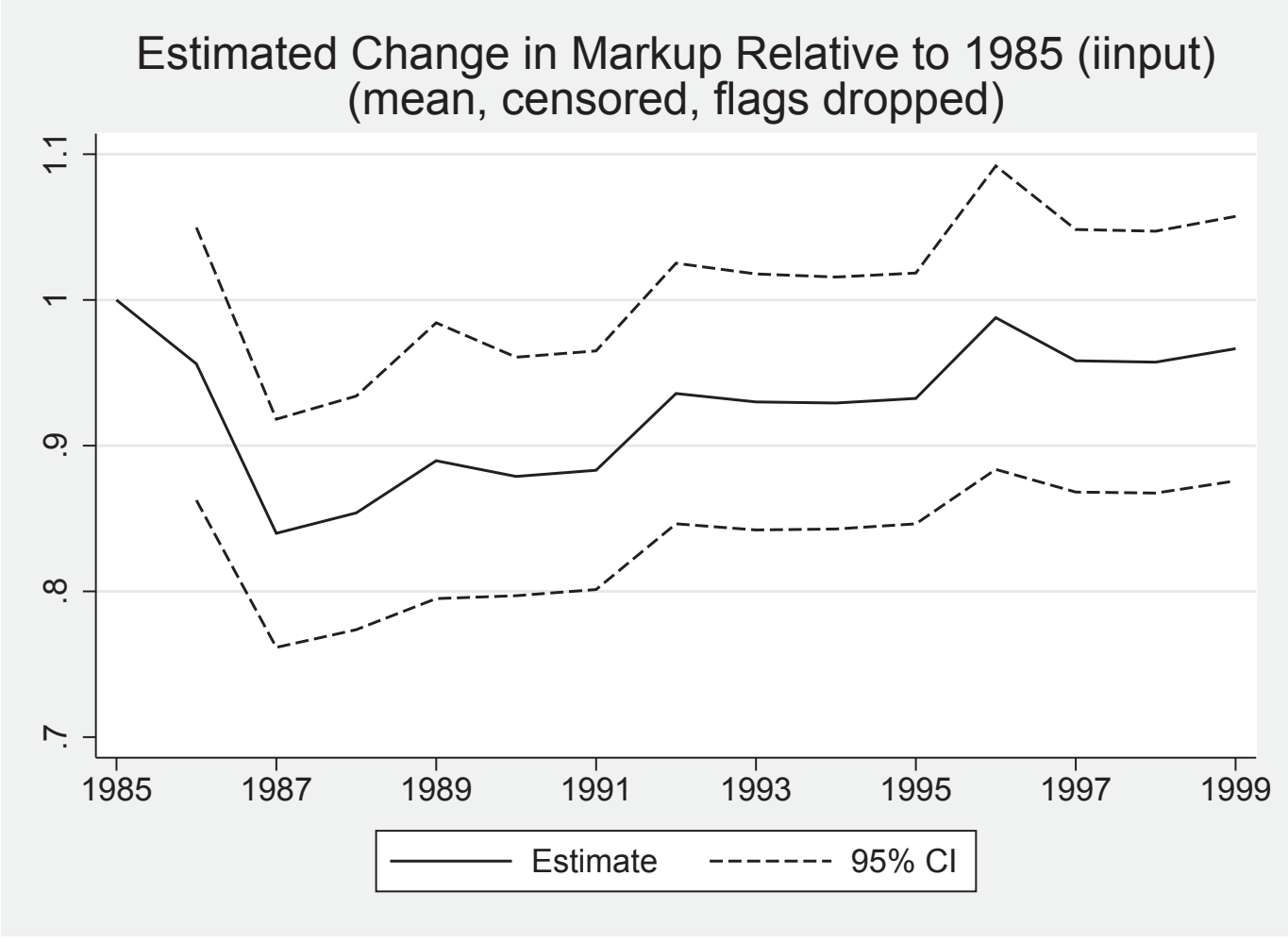
Indonesia manufacturing over time



Note: Firm age is the number of years since the first year a firm was surveyed. Employment is defined as the reported number of paid production employees at a firm in a year. The 1985 cohort is excluded as it cannot be accurately identified due to data limitations.

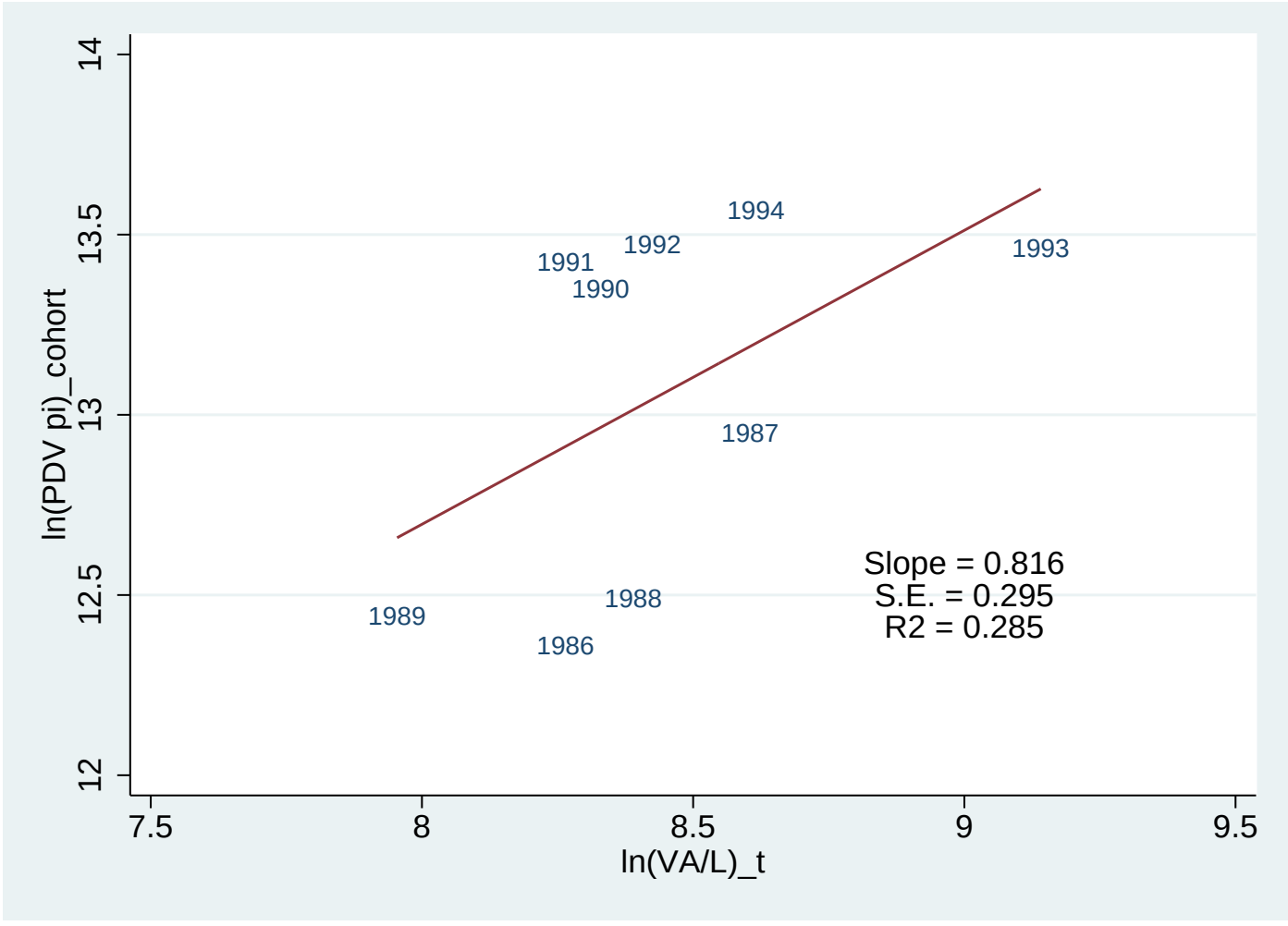
Markup via intermediate share

Indonesia manufacturing over time



PDV of profits per firm

Indonesia manufacturing over time



US Census of Manufacturing 1967-2012 (in progress)

- real value added per establishment of *entrants* increases strongly with real value added per worker
- no trend in post-entry growth rate
- no trend in exit rate by age
- no trend in the markup

Suggests PDV of profits per firm ↑ with development

This talk

Why are our facts interesting?

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Interpretation of our facts

Entry costs rise with development due to labor costs

Suppose

$$\ln c_e = constant + \lambda \ln \frac{Y}{L} + \ln A_e$$

Y/L is endogenous to A_e so can't use OLS

But can use GMM to estimate λ

GMM estimation of λ U.S. over time

Identifying assumptions	λ	$\frac{(1-\gamma)(1-\lambda)}{1-(1-\gamma)(1-\lambda)}, \gamma = 2/3$ (amplification)
$\ln A_e \perp \ln A_y$	0.802 (0.014)	0.071
$\ln A_e \perp \ln A_y$, $\ln A_e \perp \ln L$	0.819 (0.012)	0.064

Conclusion

Data on mfg. in U.S., Indonesia, India and China suggests PDV of profits per entering cohort rises with development

Implications for workhorse models:

1. entry costs increase with development
2. the labor share of entry is closer to 1 than 0
3. welfare effects are not greatly amplified through entry