The Macro Impact of Zero Profit Bunching

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My Plan for Today

- 1a) Present some novel “stylised facts" in firm-level microdata (most work done)
- 1b) Some light empirical analysis to quantify what is going on and kick the tires
- 2) *Ideas for model(s)* to structure thinking about facts (least complete)

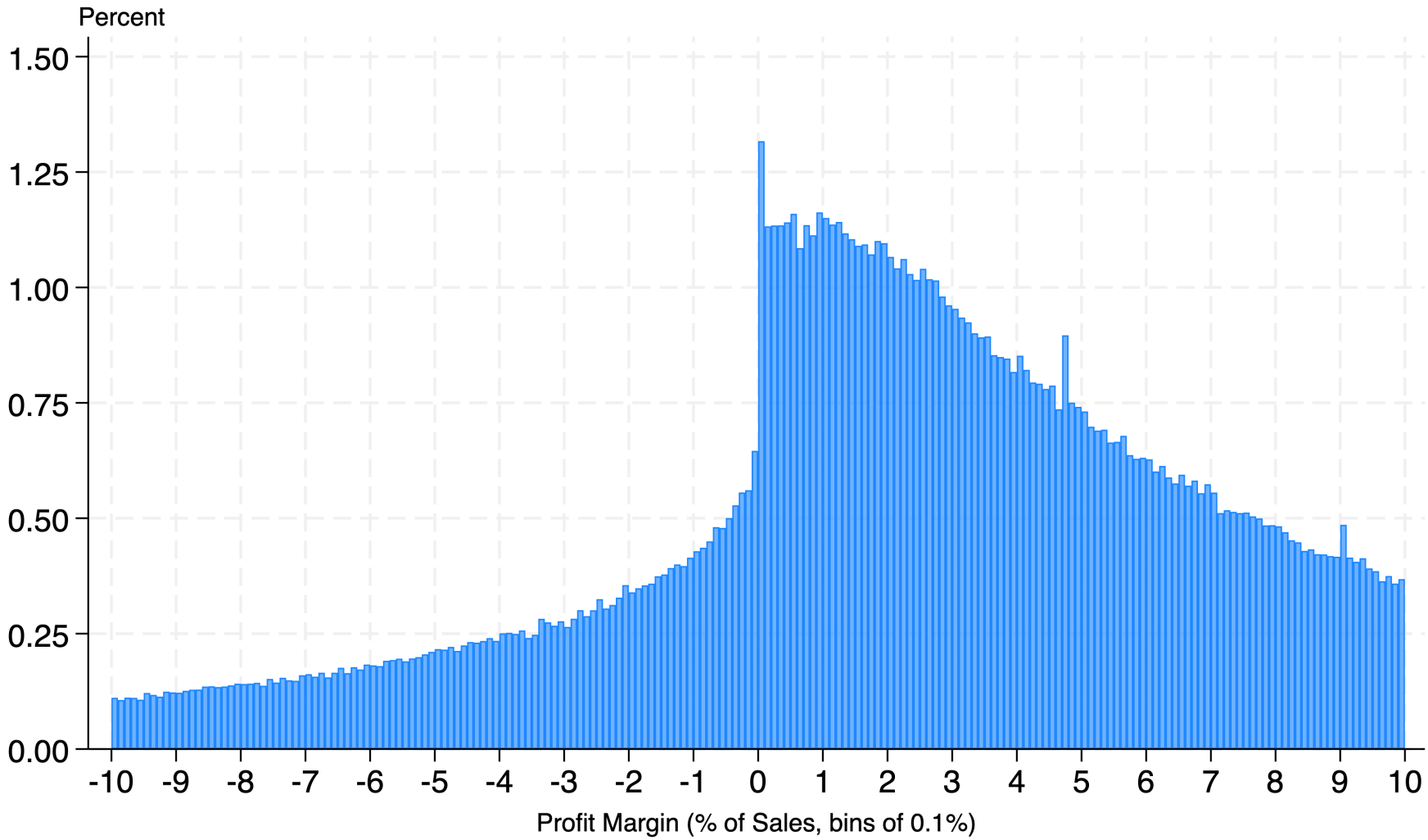
Firm Earnings, Capx and Credit

Zero is a special number in all 'mainstream' firm-level datasets (US, UK, EU):

- very strong **bunching in the PDF** of firms over profits at $+\epsilon\%$ profits
- spike not driven by exit of negative earners
- macro impact: firms (optimally?) cut expenditures to maintain positive earnings and cheaper credit.

Some quick numbers on losses/negative profits for large, listed firms:

- around 30 percent firms make a loss in any year
- over 5-year period, 60 percent have at least one year with losses
- at the frequency of the business cycle, majority of firms transit across threshold



Source: Profits are pre-taxation. FAME database of UK firms, listed and unlisted. 2003-2023

Figure 1: Distribution of Profitability (% of Sales)

▸ profit based on opex

What is the macro impact of this bunching?

If firms cut their investment to maintain positive profits...

Firm-level:

- Looks a lot like Present-Bias or "$\beta - \delta$ discounting" in reduced form
- Depresses firm capital accumulation, (mechanisms: cuts in inv. and bond price)
- firms slower to reach optimal size in DRTS world

Macro-level:

- Distorts allocation of resources over active firms (agg measured TFP)
- Distorts set of active firms (shutdown-point of shocks is higher)

GE effects could offset

- lower firm capital demand $\downarrow R$
- lower agg TFP from misallocation $\downarrow R$
- $K - N$ substitution

Quantifying Bunching at Zero

Estimate Counterfactual Distribution

Density is approximated by counts within narrow bins, b:

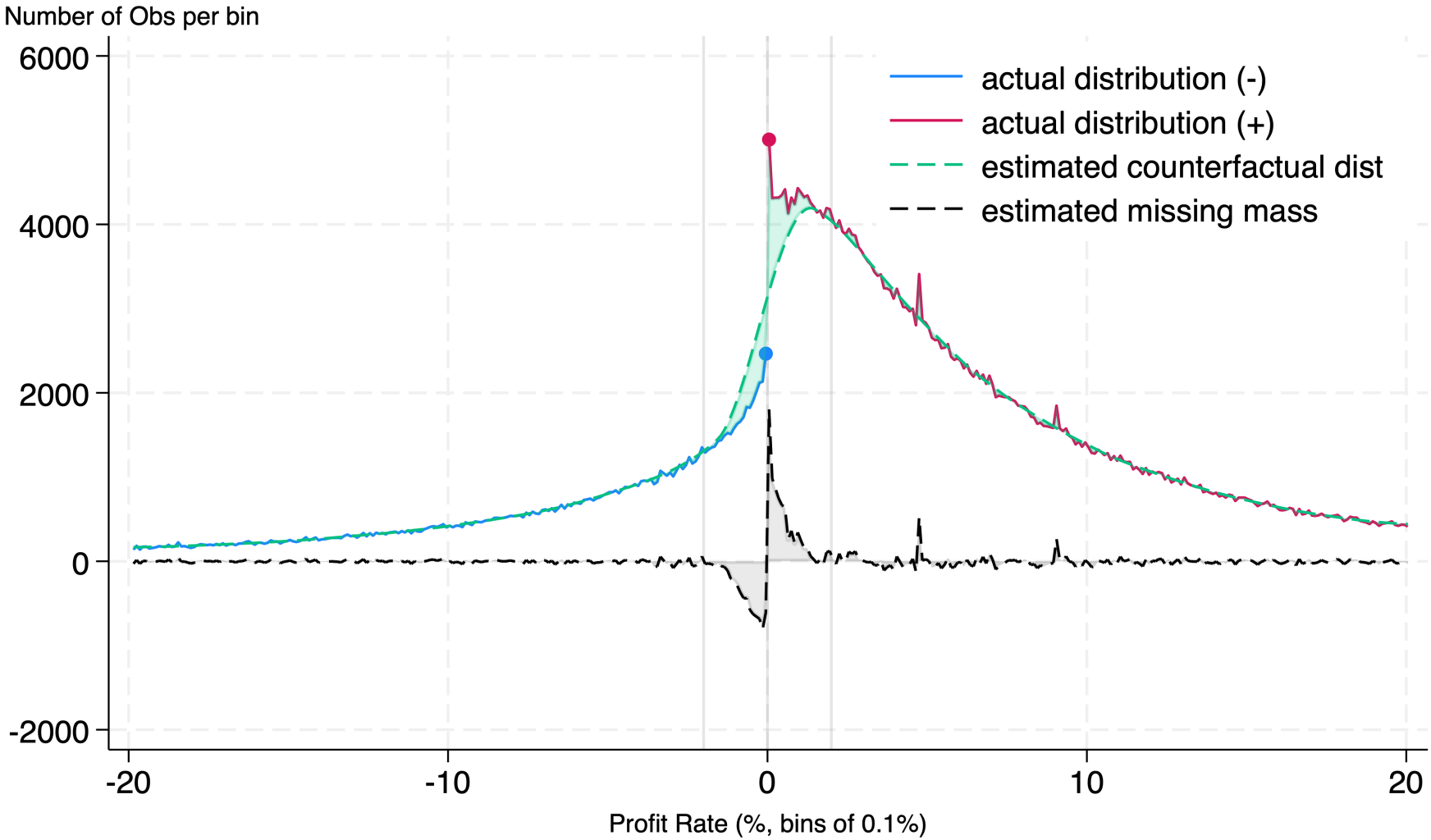
$$N_b^{data} = \sum_i 1(L_b \leq \pi_{it} < U_b) \tag{1}$$

counterfactural N_b^{cf} built from a **local polynomial regression**

$$N_b^{cf} = \hat{\mathcal{P}}(N_b^{data}, \mathbb{1}(\pi > 0), bw^*) \tag{2}$$

Methodology complications

- usual fit inappropriate due to high curvature near cutoff
- uses full support to select optimal bandwidth for smoothing
- fits density away from distorted area well



Source: FAME database of UK firms, listed and unlisted. 2003-2023

Figure 2: Jump in Density at $+\varepsilon$ Profits

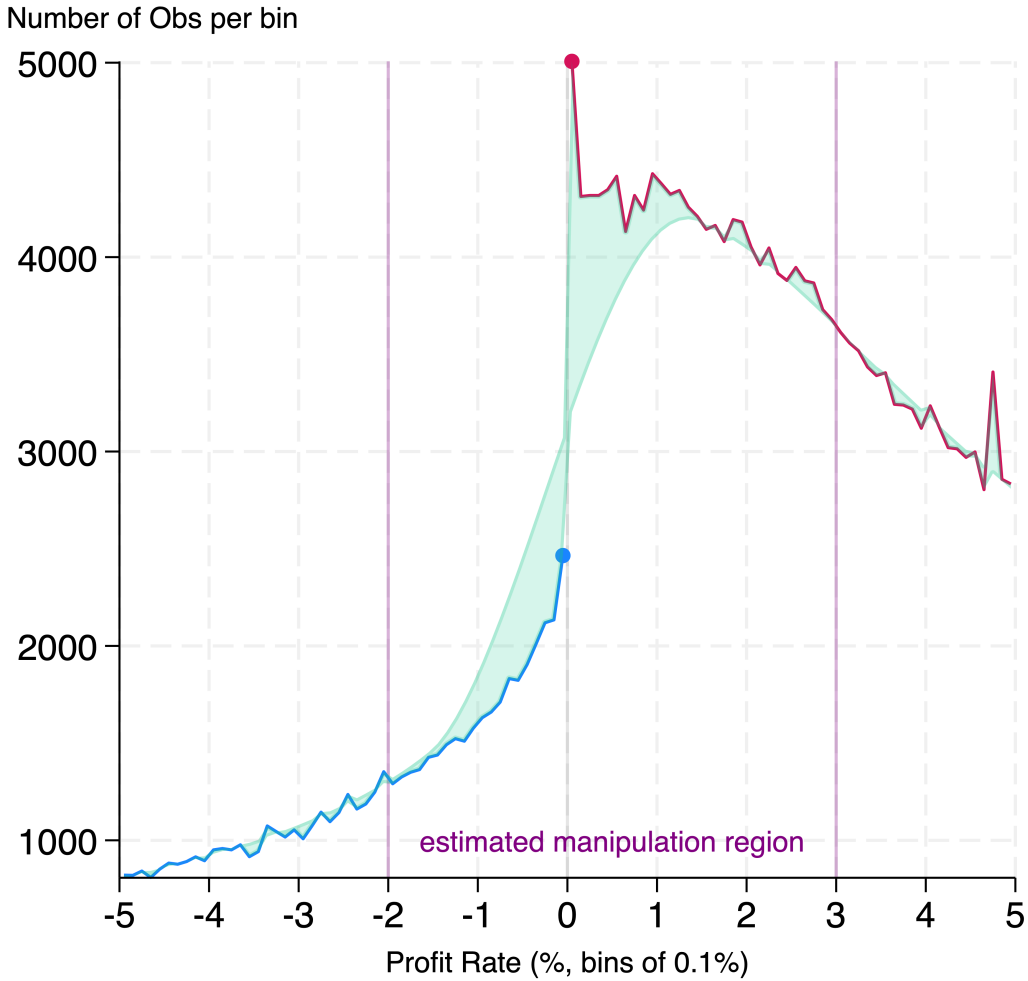


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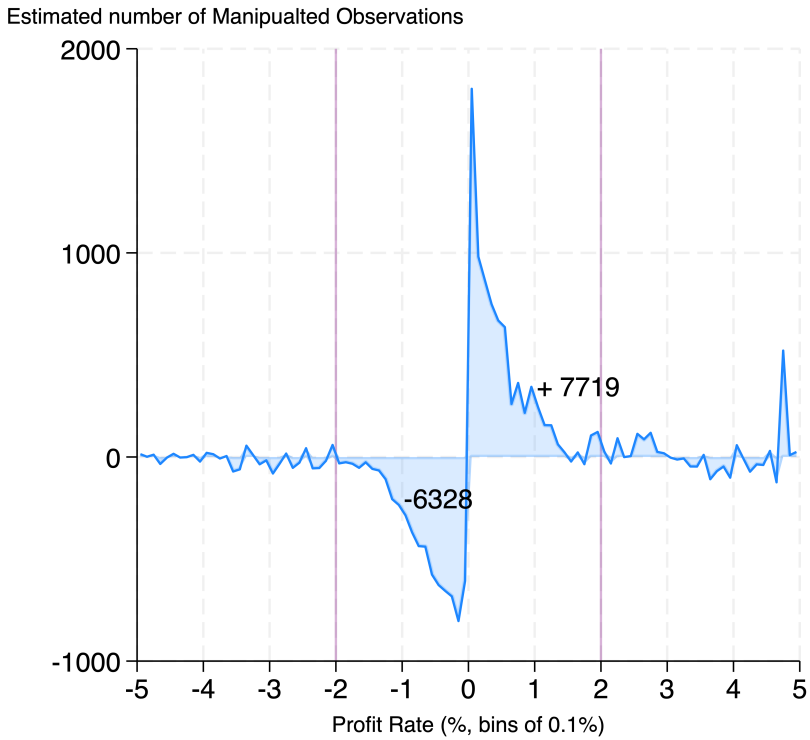
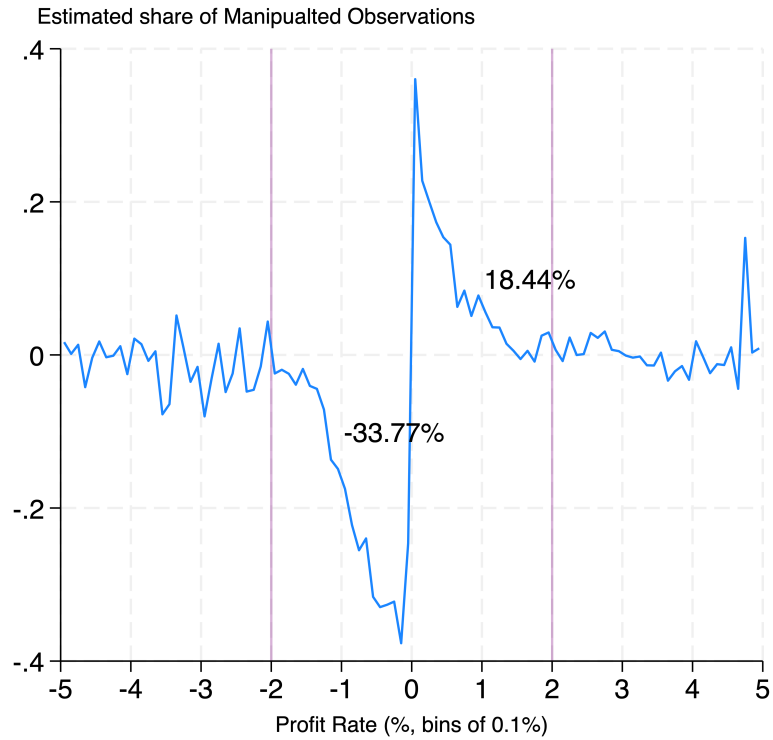
Figure 3: Jump in Density at $+\varepsilon$ Profits



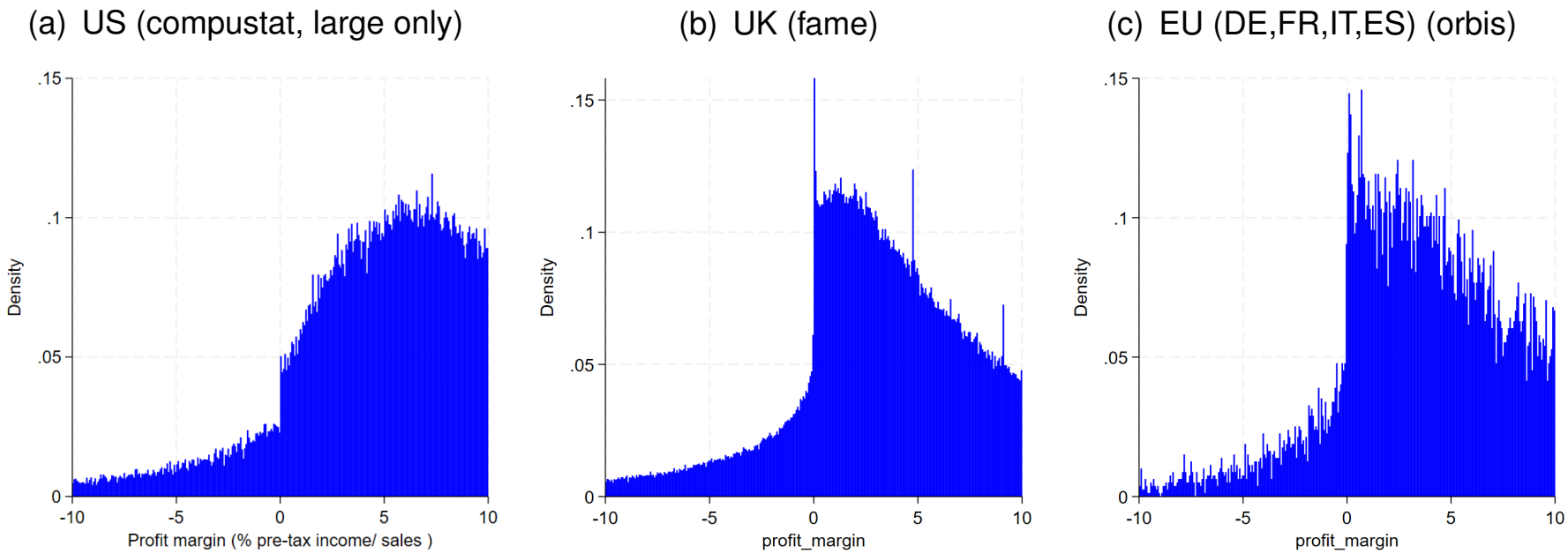


Source: FAME database of UK firms, listed and unlisted. 2003-2023

Figure 4: Jump in Density at $+\varepsilon$ Profits

Will adjust CF fit such that two areas are approx. equal

Zero the mainstream firm dynamics datasets



Note: Compustat North America database, FAME, ORBIS. Sample restricted to firms with 3 years of prior positive profitability and survive to the next year.

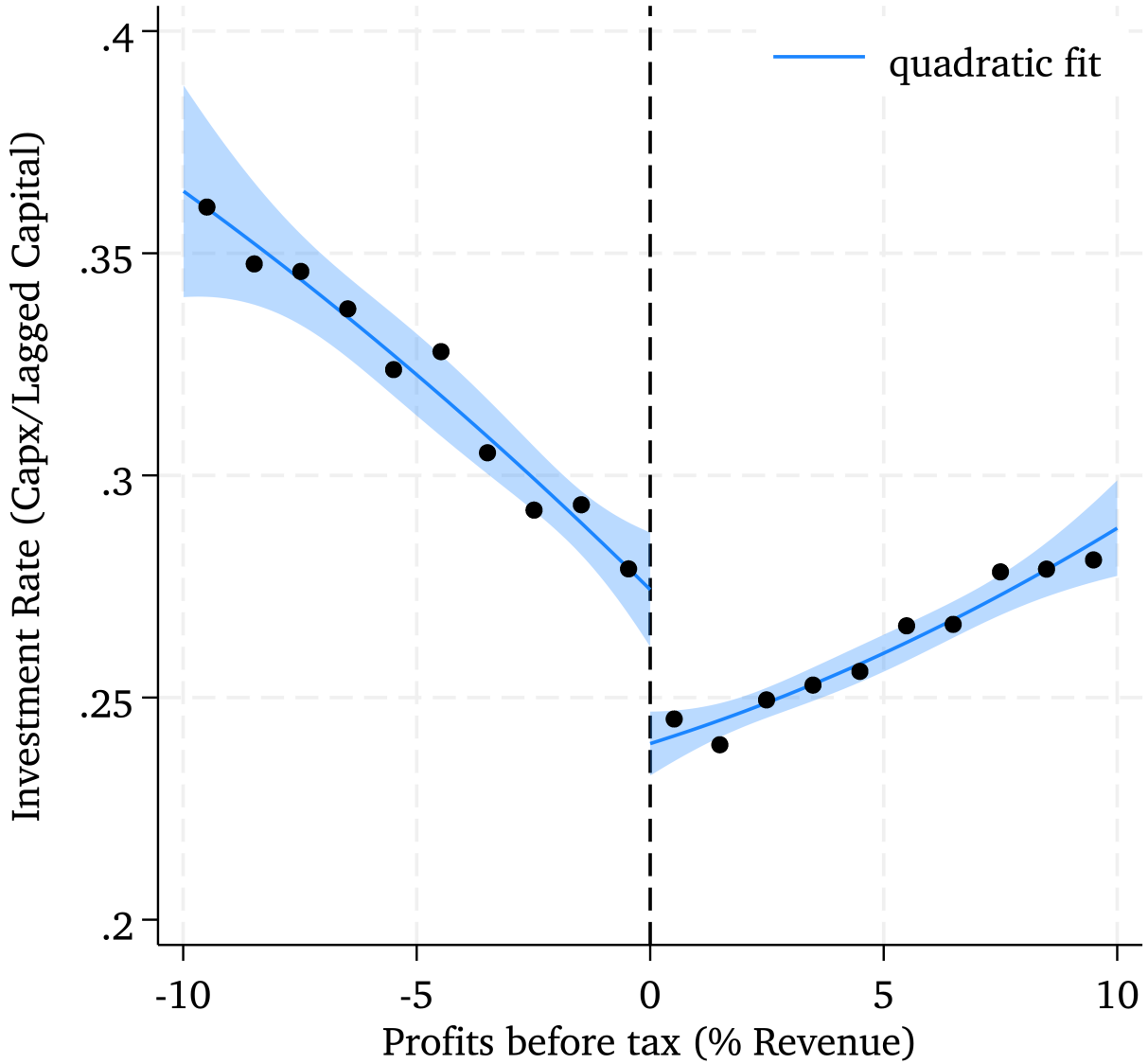
Figure 5: Density Jump at zero profits in US,UK,EU firms

Firm-level Bunching and Spending

Regression Discontinuity and Donut Plots

Capx spending rates (ppts), intensive margin

CAPX Investment Rate $=$ (*Investment in Fixed Assets*$_t$ / *Fixed Assets*$_{t-1}$)



Macro implications?

Area measures lost investment, approximated:

- 1 in 3 firms in the (0,5] profits range.
- 14% drop at cutoff (4/28)
- triangle area $=$ half the “square"
- $0.33 \times 0.14 \times 0.5$

$\approx$ 2.3 percent of agg investment

$\Rightarrow$ meaningful magnitudes for (potential) macro dynamics (depends on what large firms do)

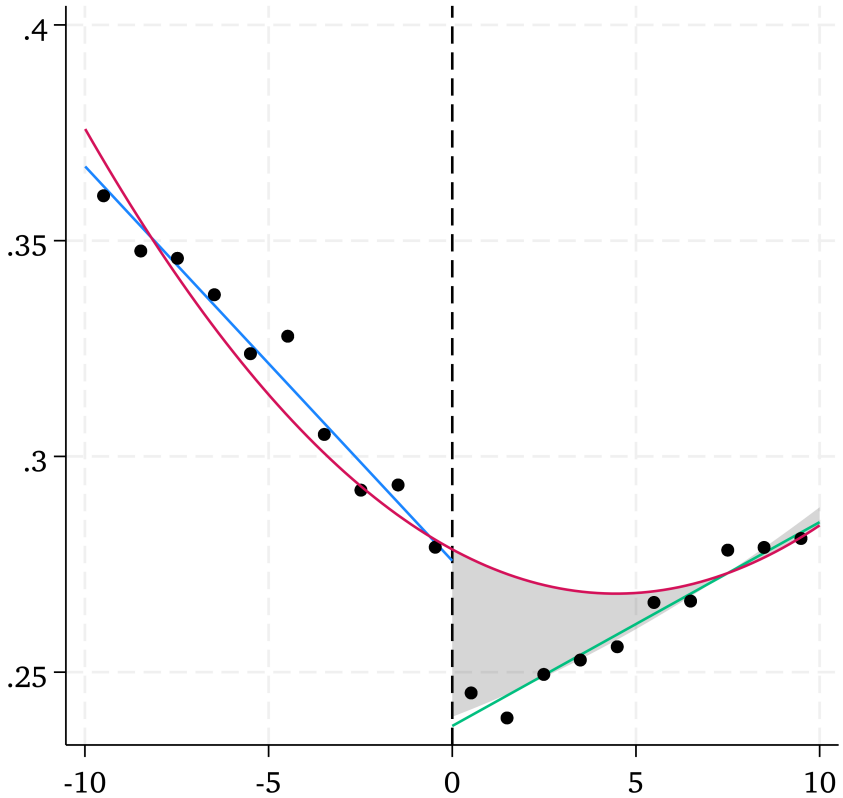
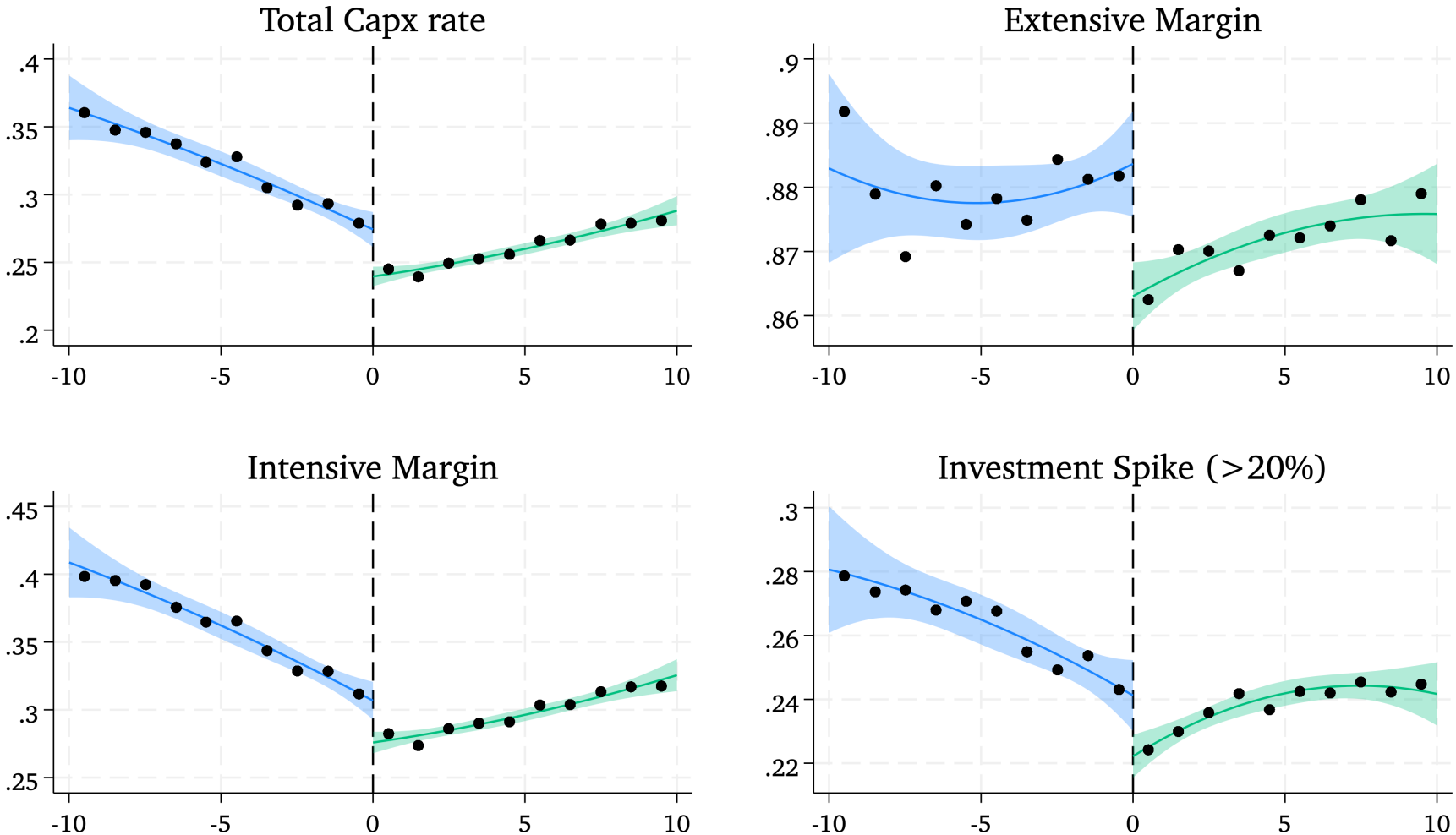


Figure 6: Missing Investment

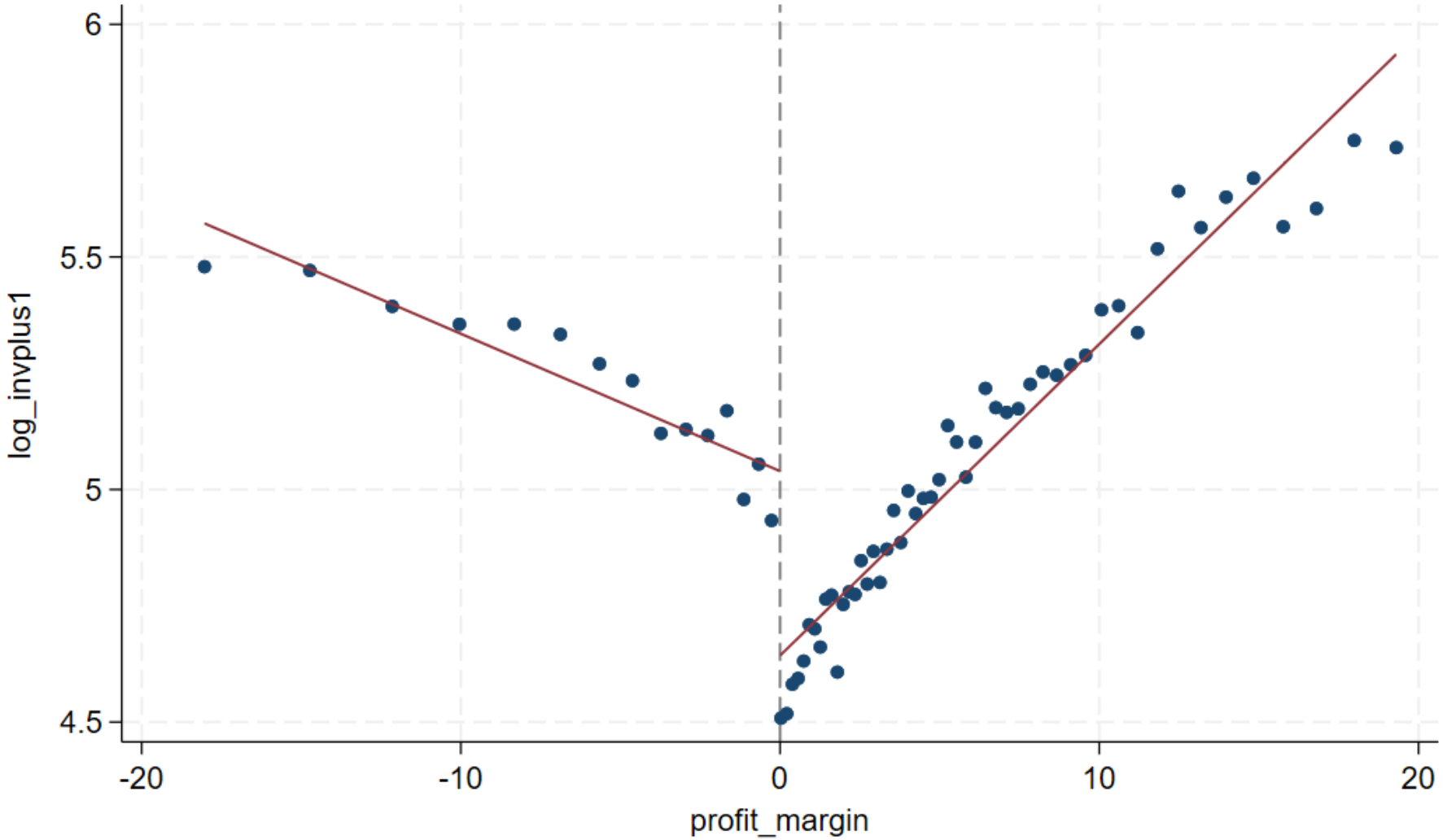


Note: Capx rate is capx over lagged capital stock. Extensive margin is the share of firms with capx>0, intensive margin is average capx given capx>0, spike is share of firms with capx>0.2.

Figure 7: Margins of Firm-level Capital Adjustment

Alternative measure, $ln(1 + CAPX_t)$

combines extensive and intensive margins, harder to interpret directly, *asinh* also similar (applied economists look away now)



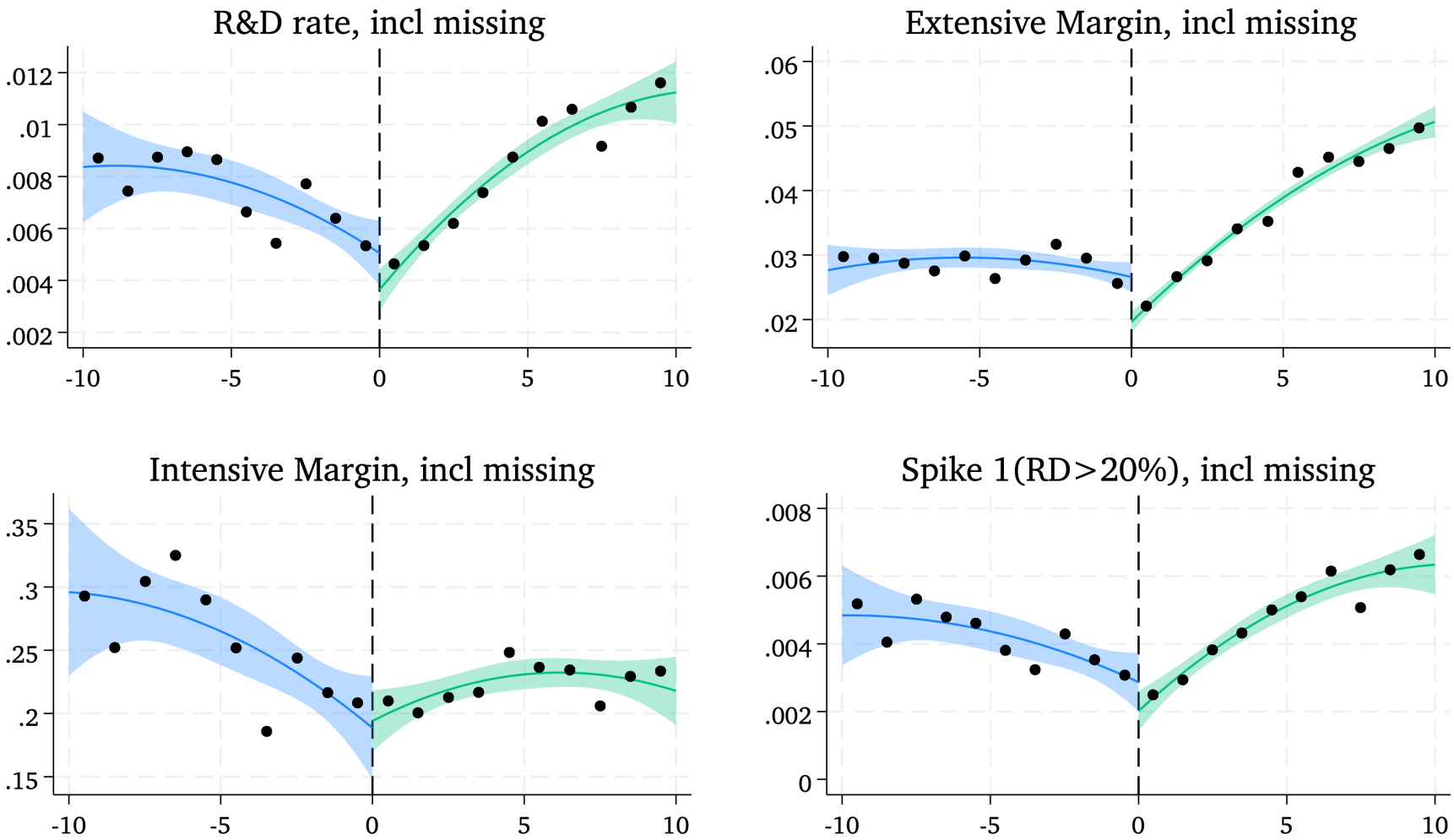


Figure 8: Firm-level XRD spending

Salaries/Turnover

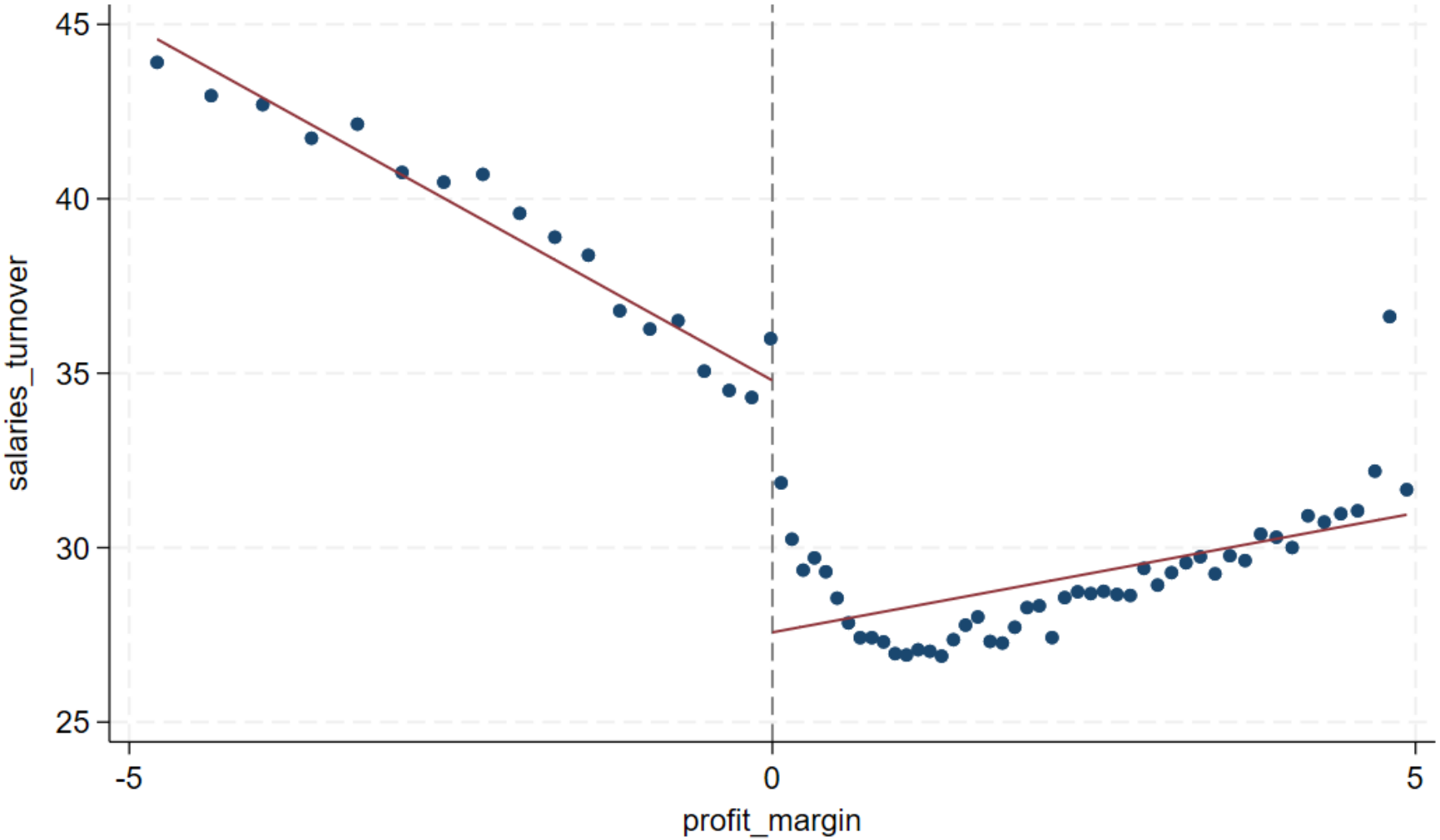
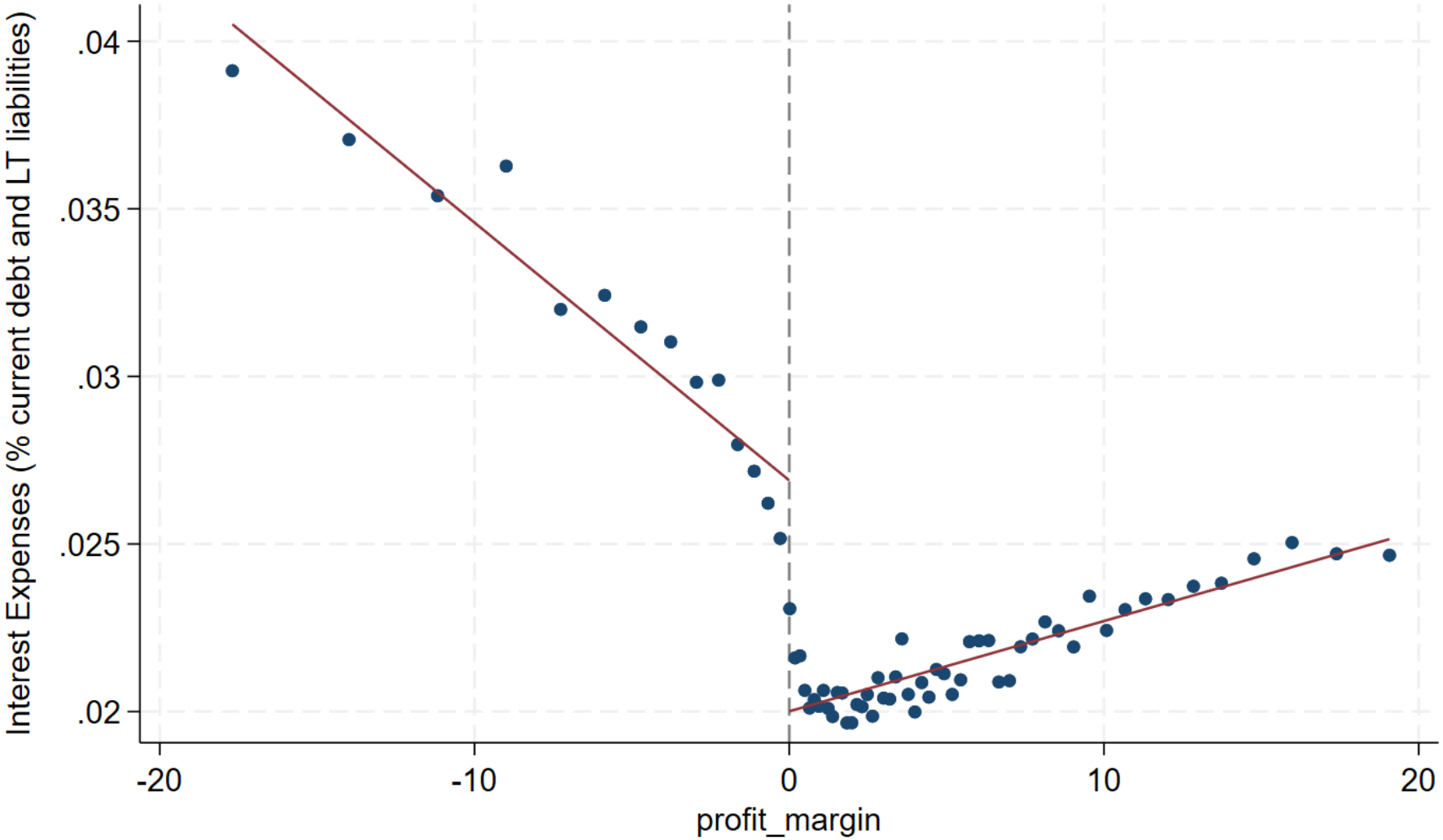


Figure 9: Caption

Interest Rates on debt

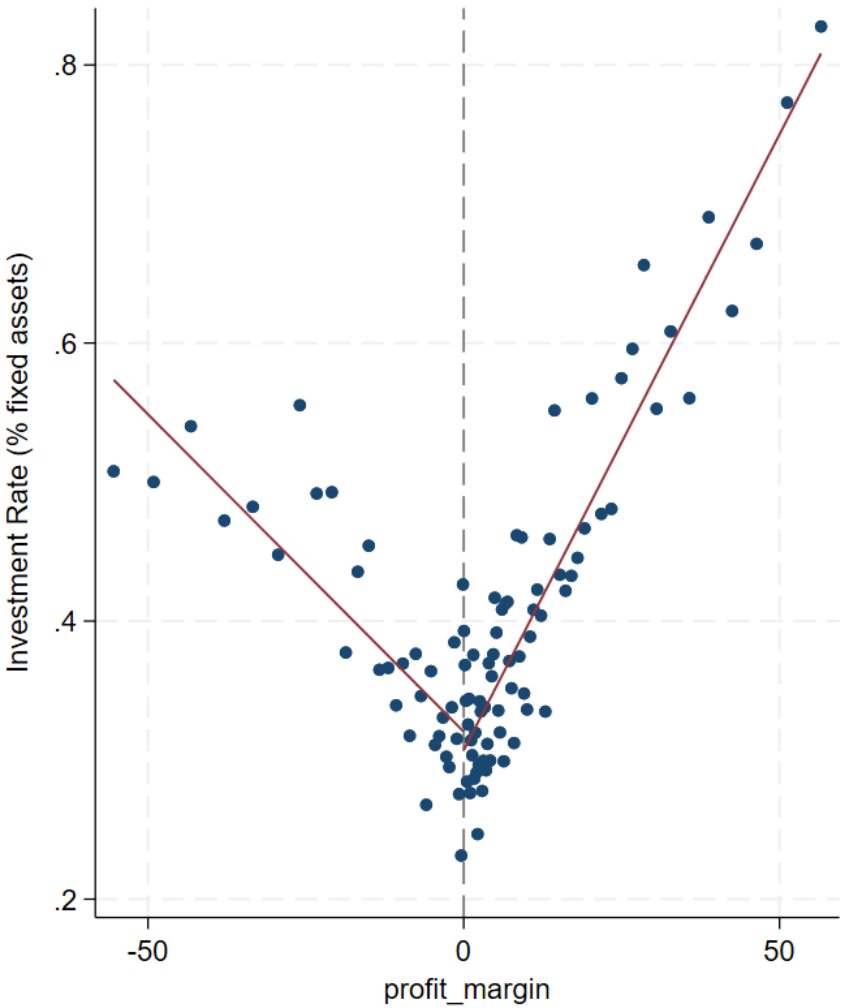
XINT (interest paid on ST and LT debt as % liabilities) drops at threshold



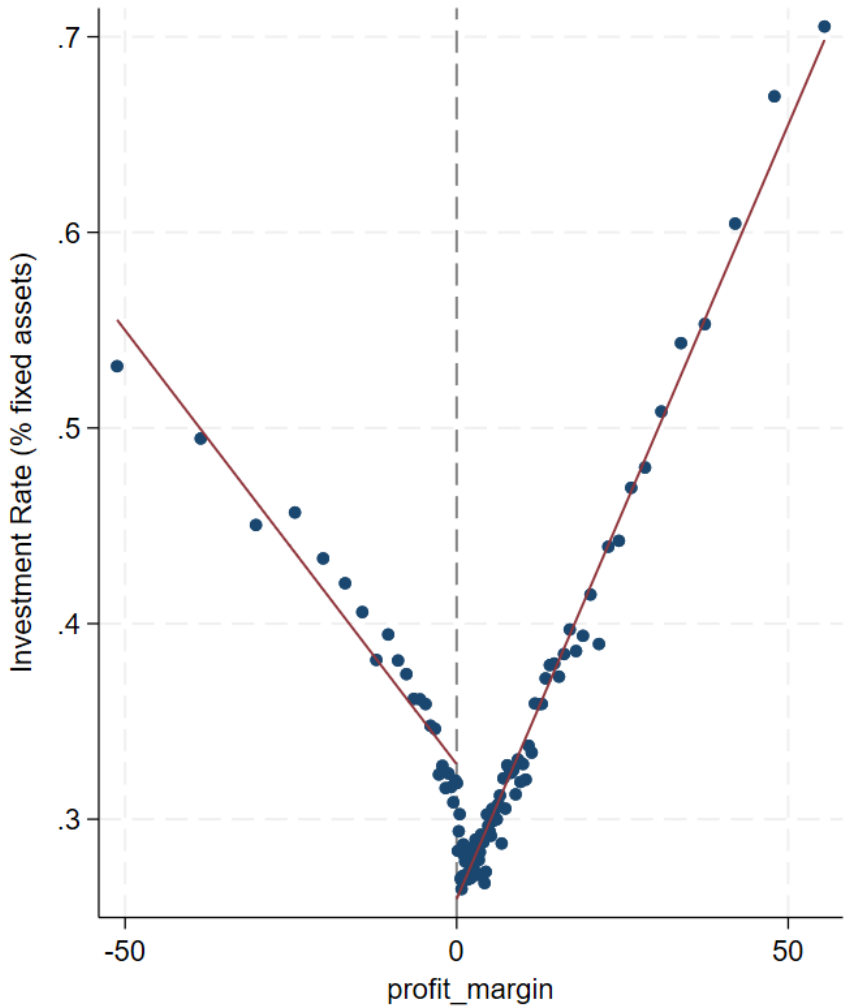
CAPX by Young and Old Firms

no discontinuity for young (<5yrs) firms (stronger motive to grow capacity to survive?)

young



old



Heterogeneity in Investment Discontinuity Estimates

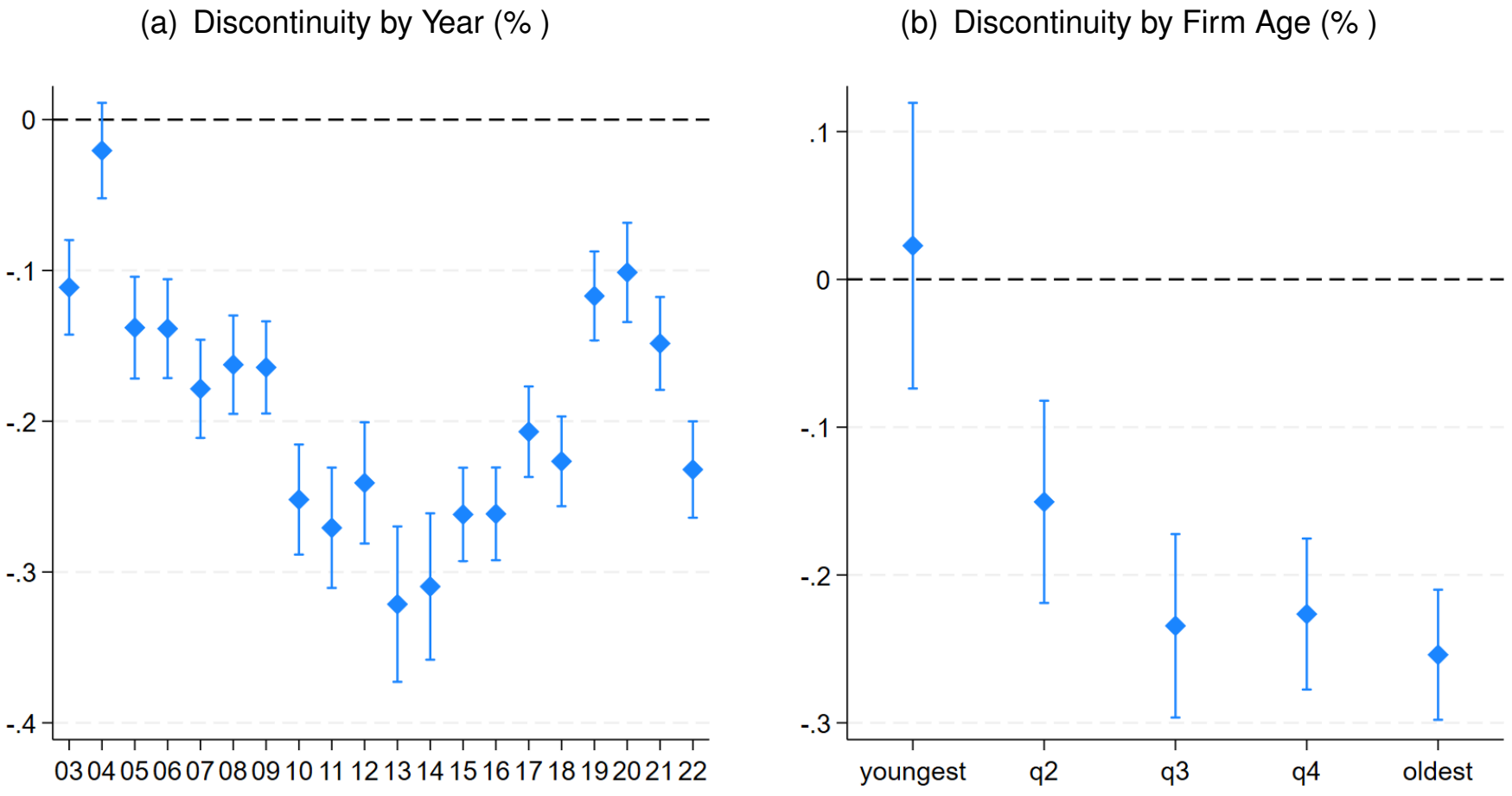


Figure 10: Heterogeneity by year and age

Productivity, Depreciation and Other Issues

Lower Costs and Apparent Productivity

$$Y = zF(K, N) \tag{3}$$

$$logy = logz + \alpha k + \beta n \tag{4}$$

Lower labour and financing costs on RHS also boosts apparent productivity

- (rK, wN)
- other methods will still rely on distorted stocks of capital, or distorted capx flows

TFP AC

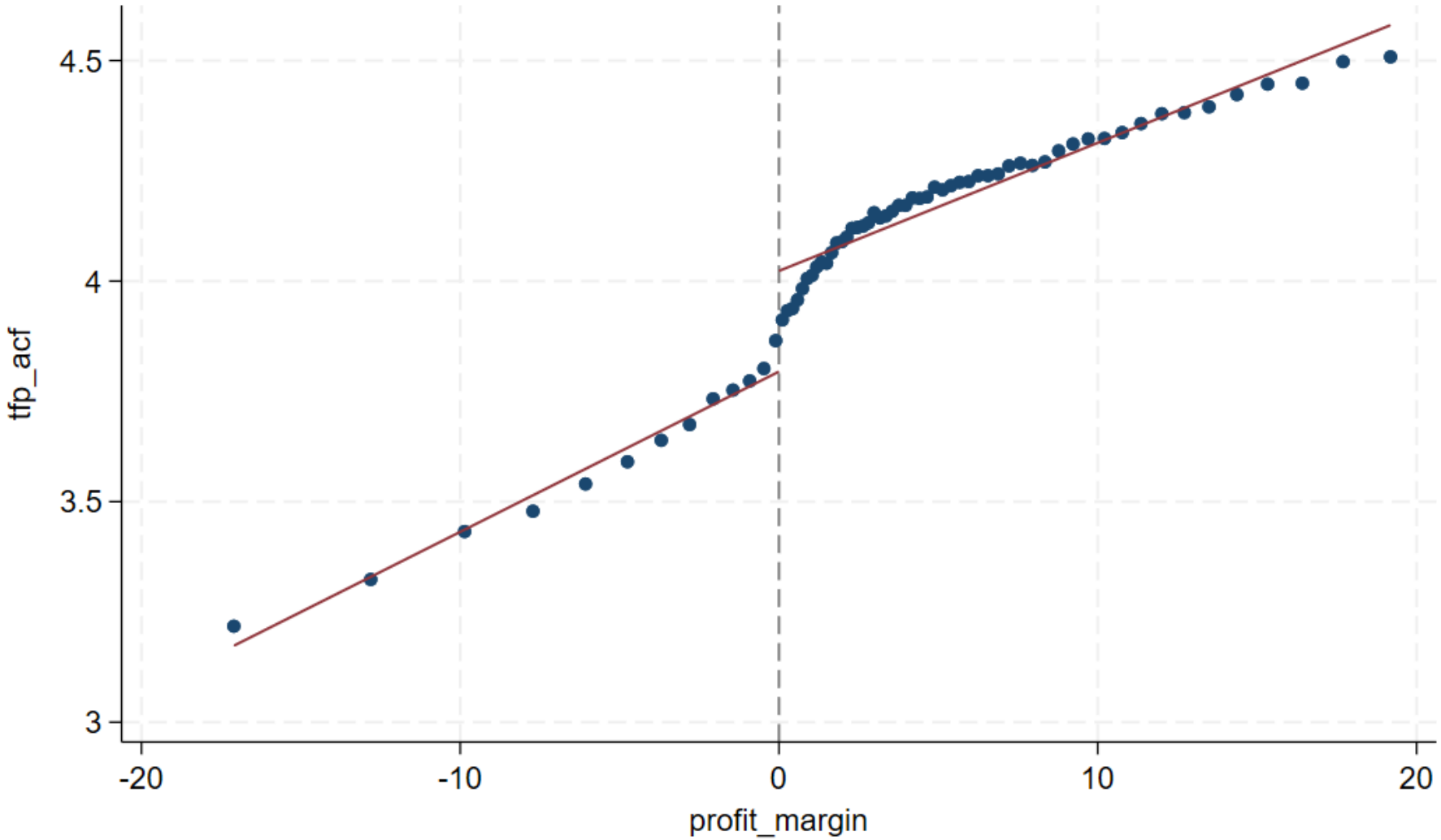


Figure 11: TFPR (AC)

If threshold distorts choice of *K* it can have consequences for TFP calculations

Other open issues

How do you measure TFP when factor prices or optimal policies jump at $\pi = 0$

Sidenote: Climbing the “capital ladder" is risky for firms? High investment rates are correlated with large profits and large losses

Bonus: Depreciation. More generalised distortion of choices?

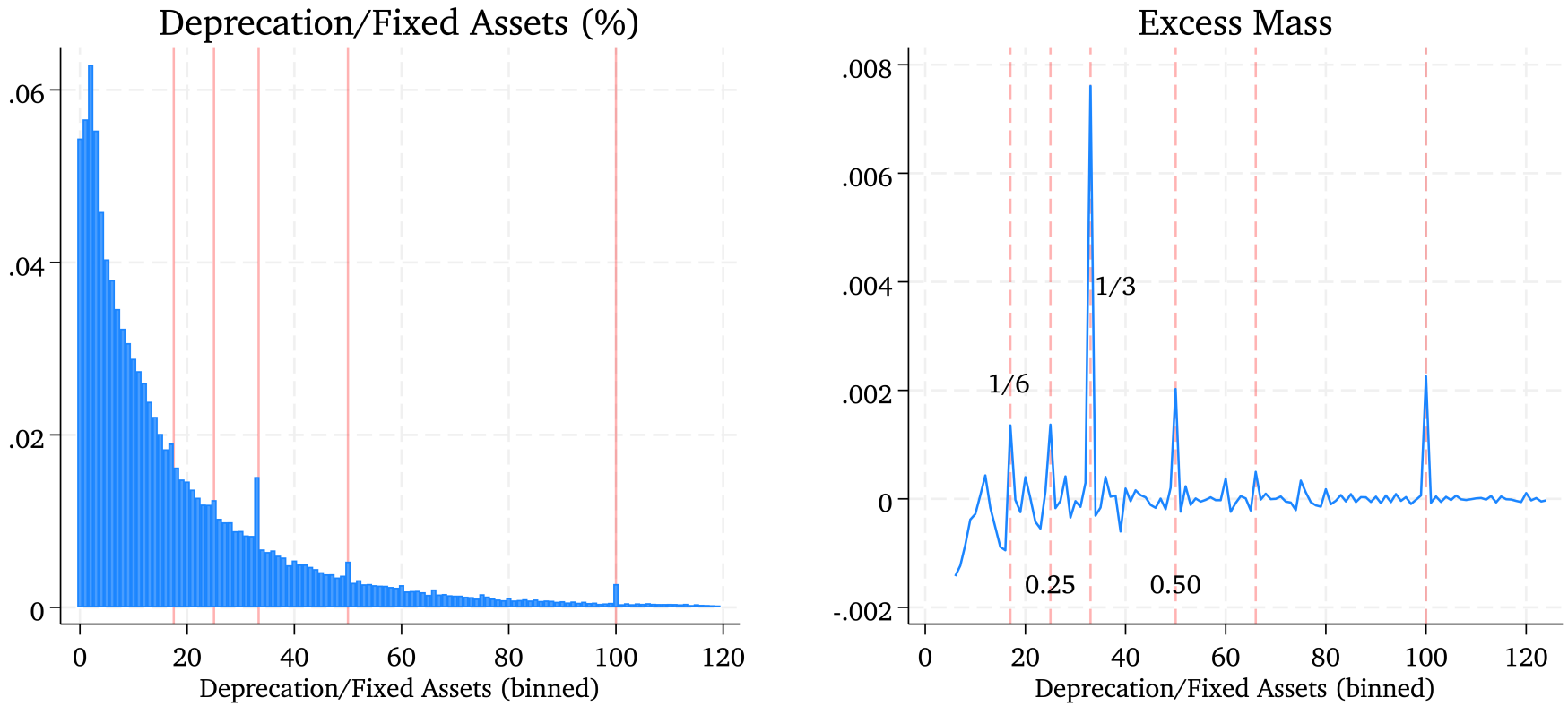


Figure 12: Depreciation Distortions relative to polynomial fit

- **Over-represented** nice fractions: $6^{-1}, 4^{-1}, 3^{-1}, 2^{-1}, 1$
- multiples of 5, 10 generally no more likely.
- don't know the true state of PPE, so guess? Impatient response?

Taking Data to a Model

- Focus on **CAPX** drop
- **Interest rate** jump at zero
- ignore other stuff for now

Modelling Choices

Terry (ECMA 2023) says quarterly earnings targets help control indulgent managers who make malinvestments for prestige $[\pi_{it} - E_{t-\Delta}(\pi_{it})]$

This work profitability itself matters $[\pi_{it}, \mathbb{1}_{\{\pi_{it}>0\}}]$

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- Story A Fixed Costs: simple lumpy-adjustment model with convex and nonconvex adj cost of K? Adjustment is risky and sometimes too disruptive?
- Story B Signals of Control: not being able to make a marginal saving of ε at the threshold is a strong negative signal of management quality or decision making power:
  - lack of information on current state of firm (distance to threshold)
  - lack of precision in decision making / trembling hand choices
  - lenders infer type of firm (σ_H^2, σ_L^2) from low negative profits

$$V(z,k,b) = \max_{k',b'} \left\{ zk^{\alpha} - px - b - F + q(y)b' + \beta E_{z'|z} V(z', k' + \epsilon, b') \right\} \quad (5)$$

$$\epsilon \sim N(0, \sigma_j^2) \quad (6)$$

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- Story C Bond Price: (no explicit evidence in data) $q(y) = [1 + r + \xi \mathbb{1}_{\{y<0\}}]^{-1}$

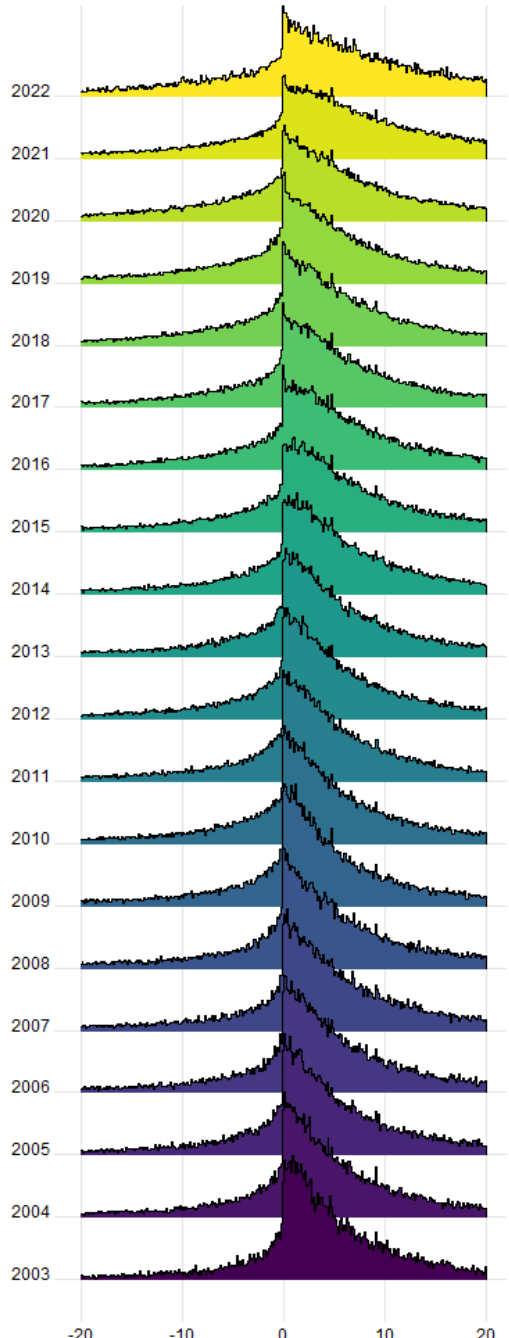
Lender's Problem

Lender put a lot of weight on small losses – suggest managers aren't really in control and hiding worse performance if they cannot find even small savings?

is it possible to write a lenders problem which in eqm gives a discontinuous bond price?

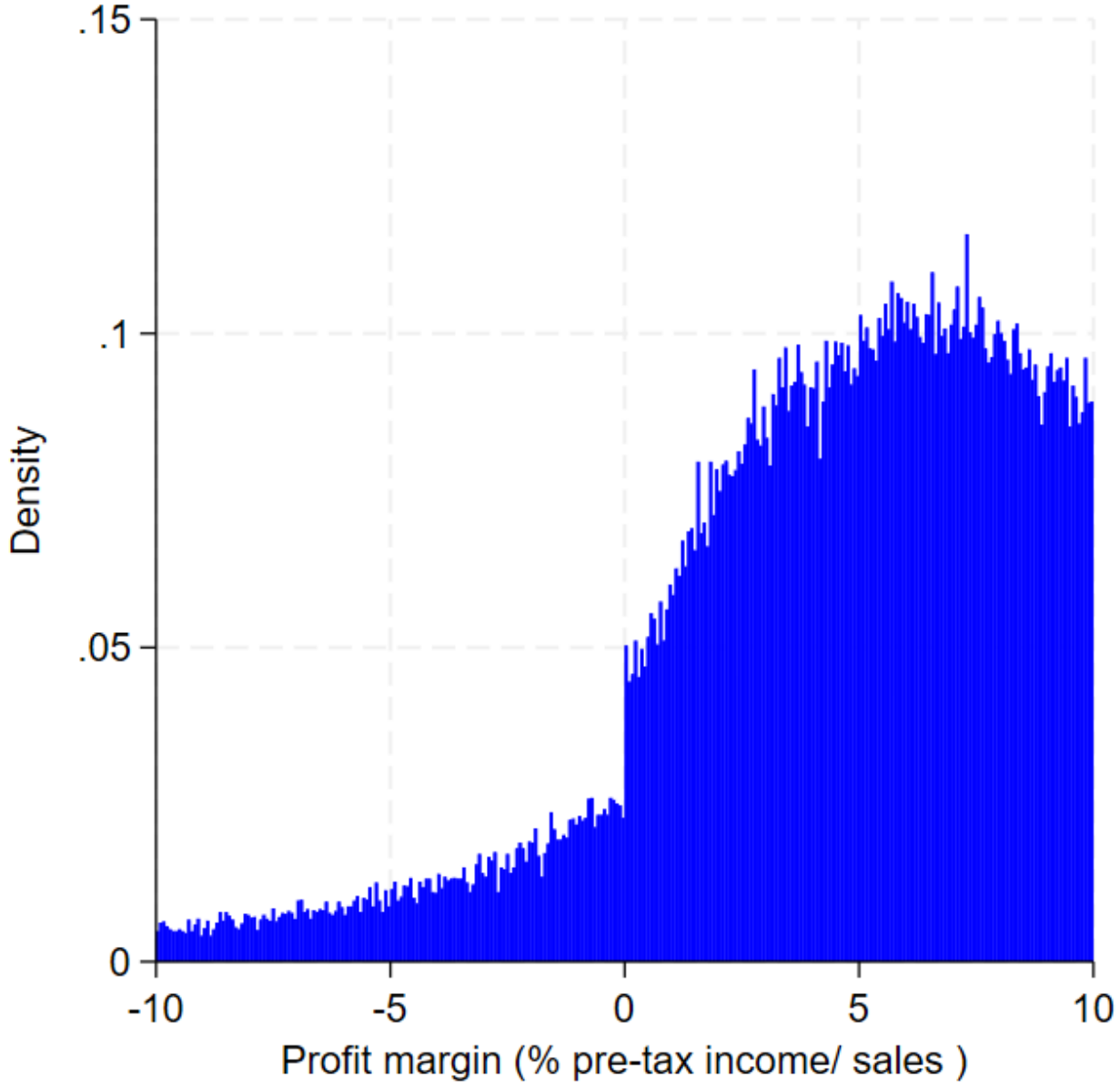
Thanks!

Appendix: Discontinuity in Profit Margin Density by Year



Compustat (US listed firms only)

Compustat firms also seem to rearrange expenditures to achieve profitability



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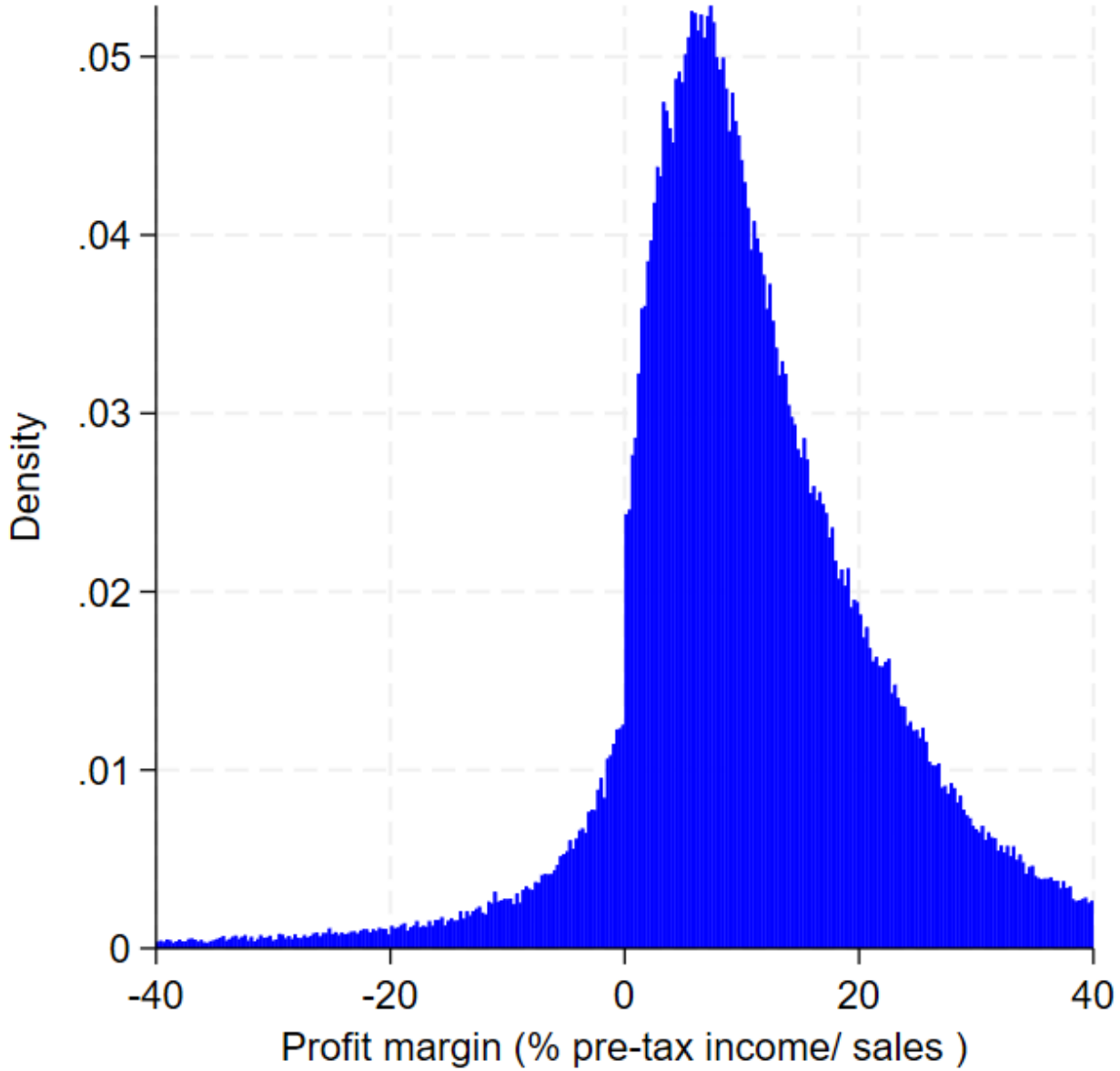

Capital Investment

Slight drop in capital investment

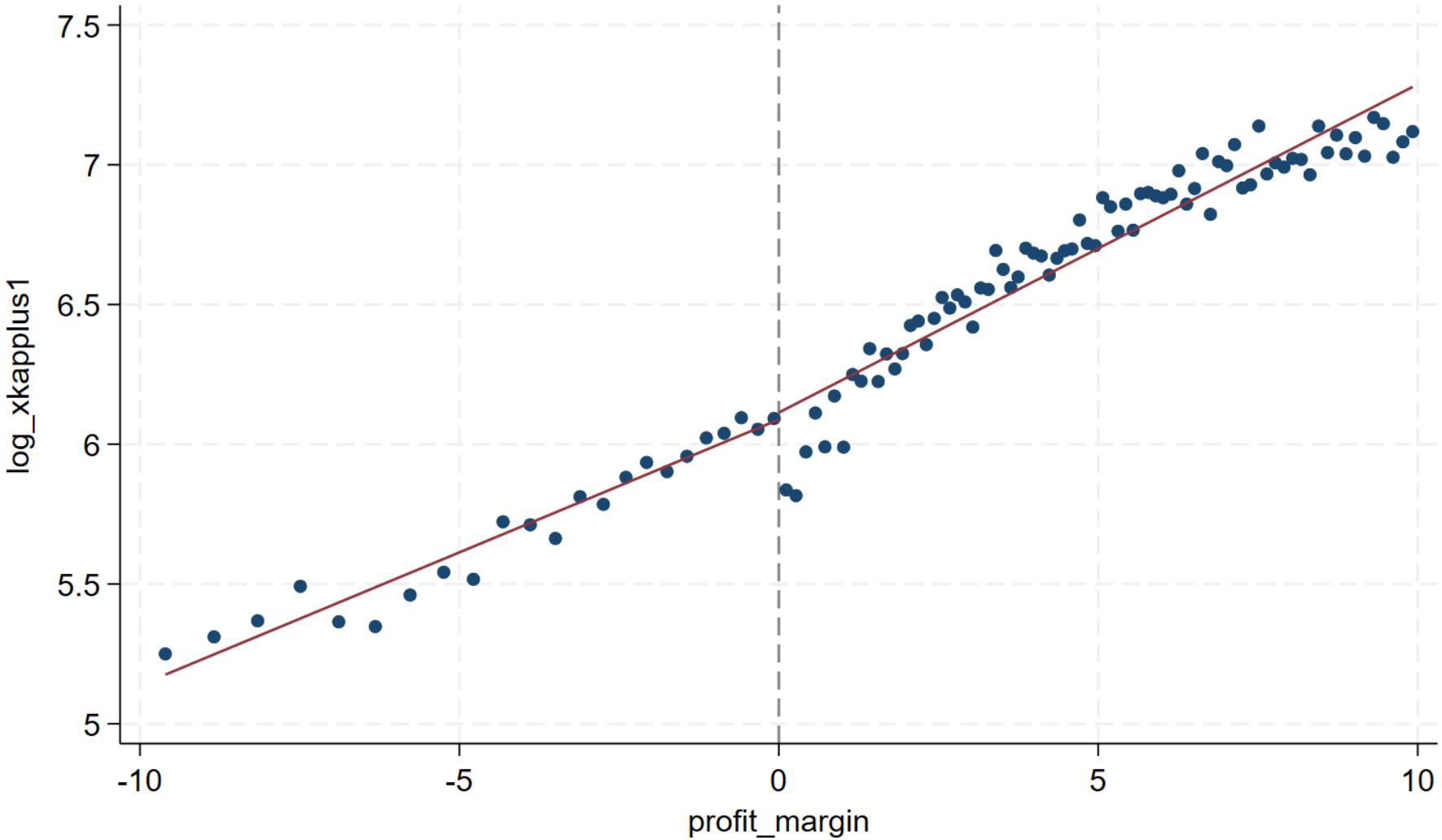

Figure 16: Manipulators boost profits but cutting CAPX slightly

Research Investment

Stronger drop in research and development

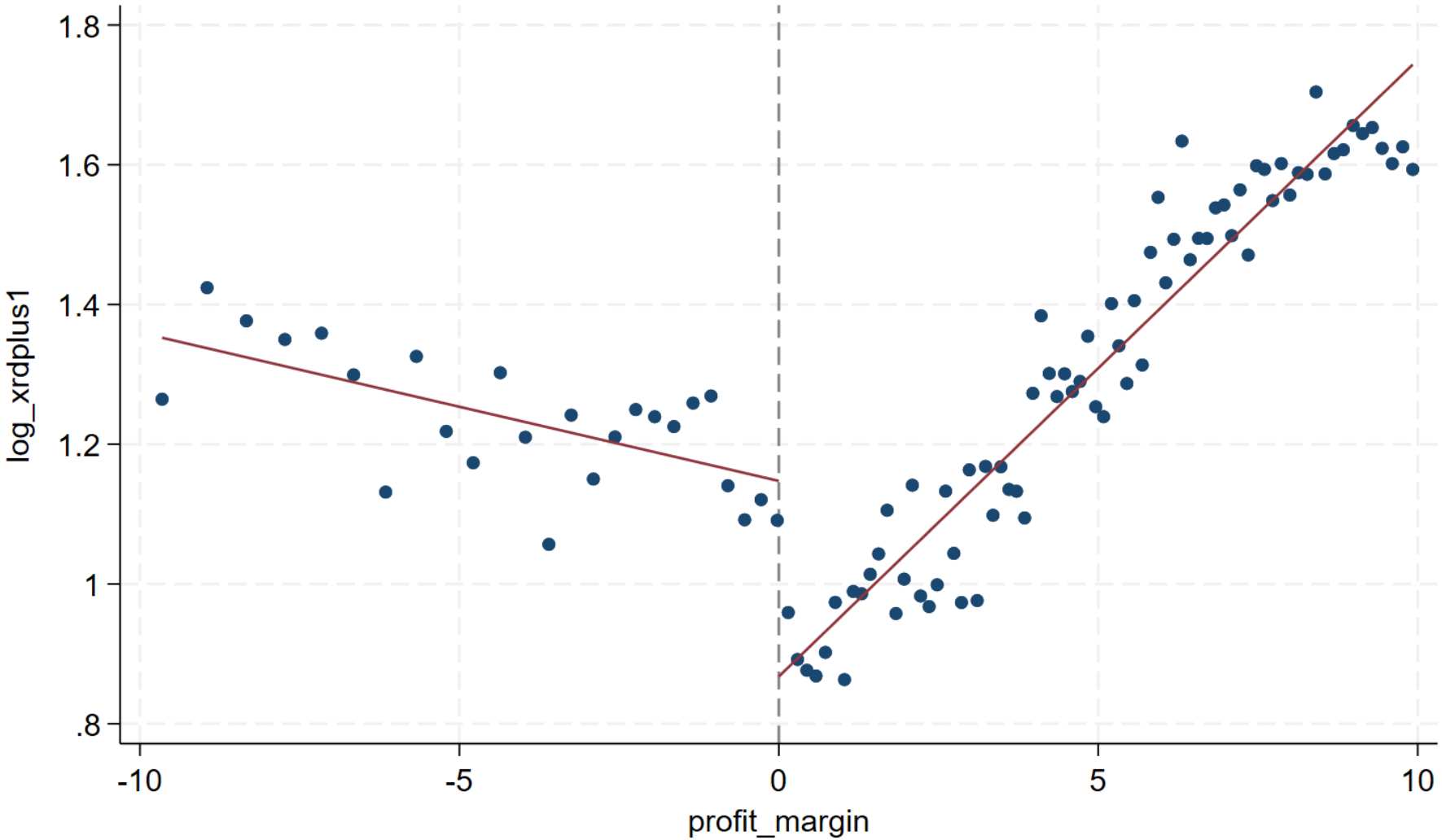

Figure 17: Manipulators boost profits but cutting Research & Development (XRD)

Interest Expenses

Interest expenses drop

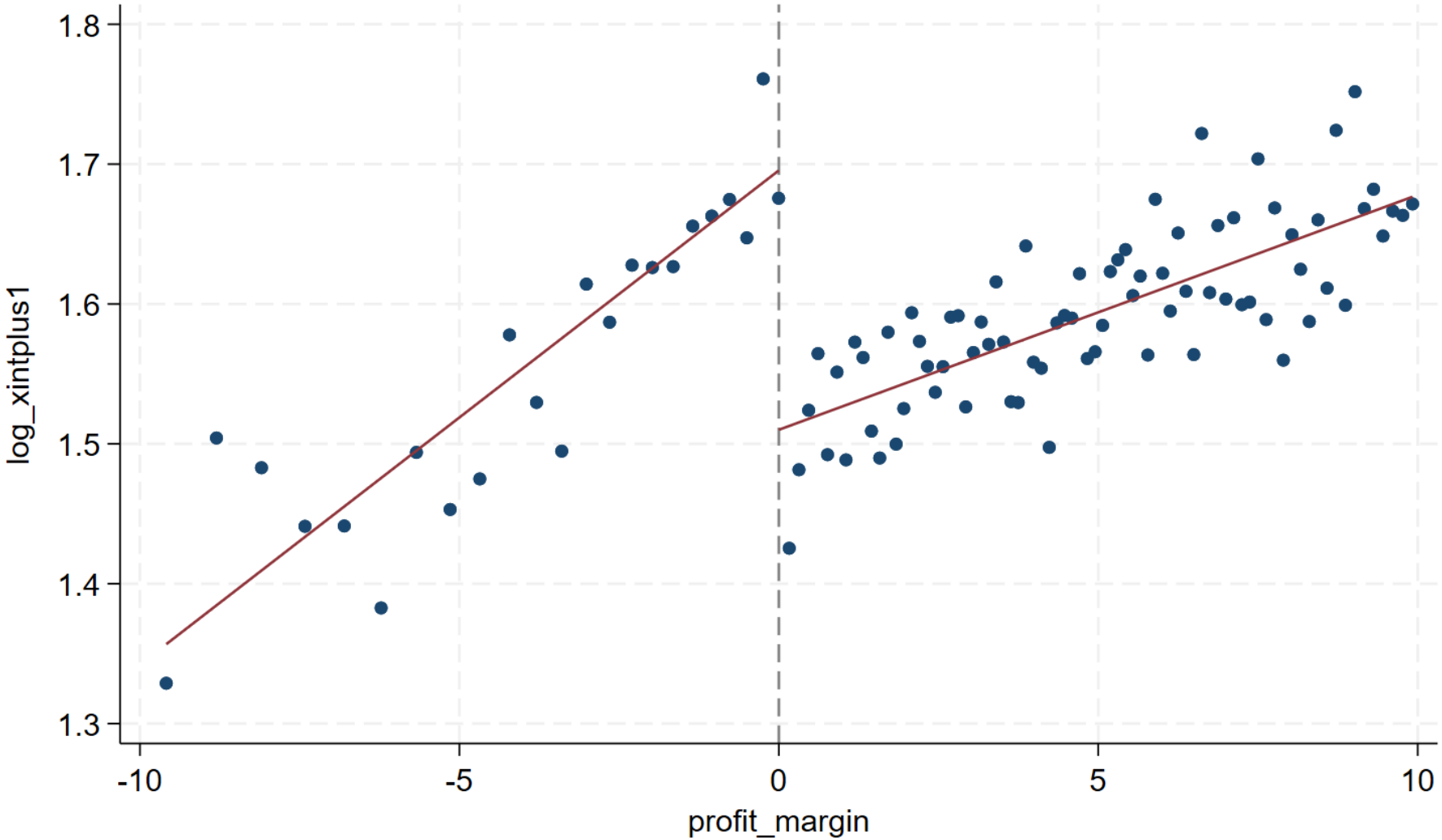

Figure 18: Interest expenses more favourable on the RHS

Employment

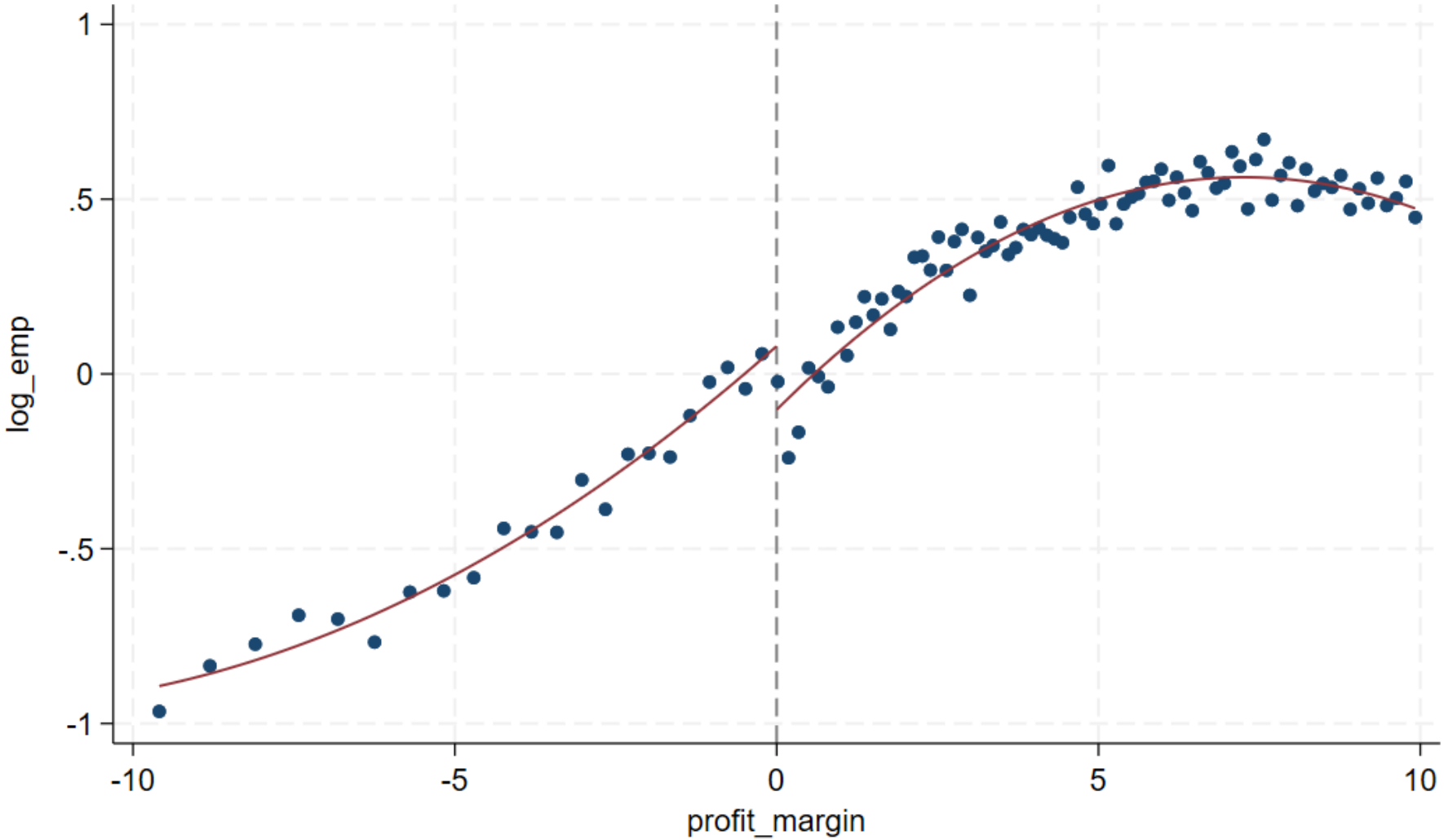

Figure 19: Employment cuts?

Inventories

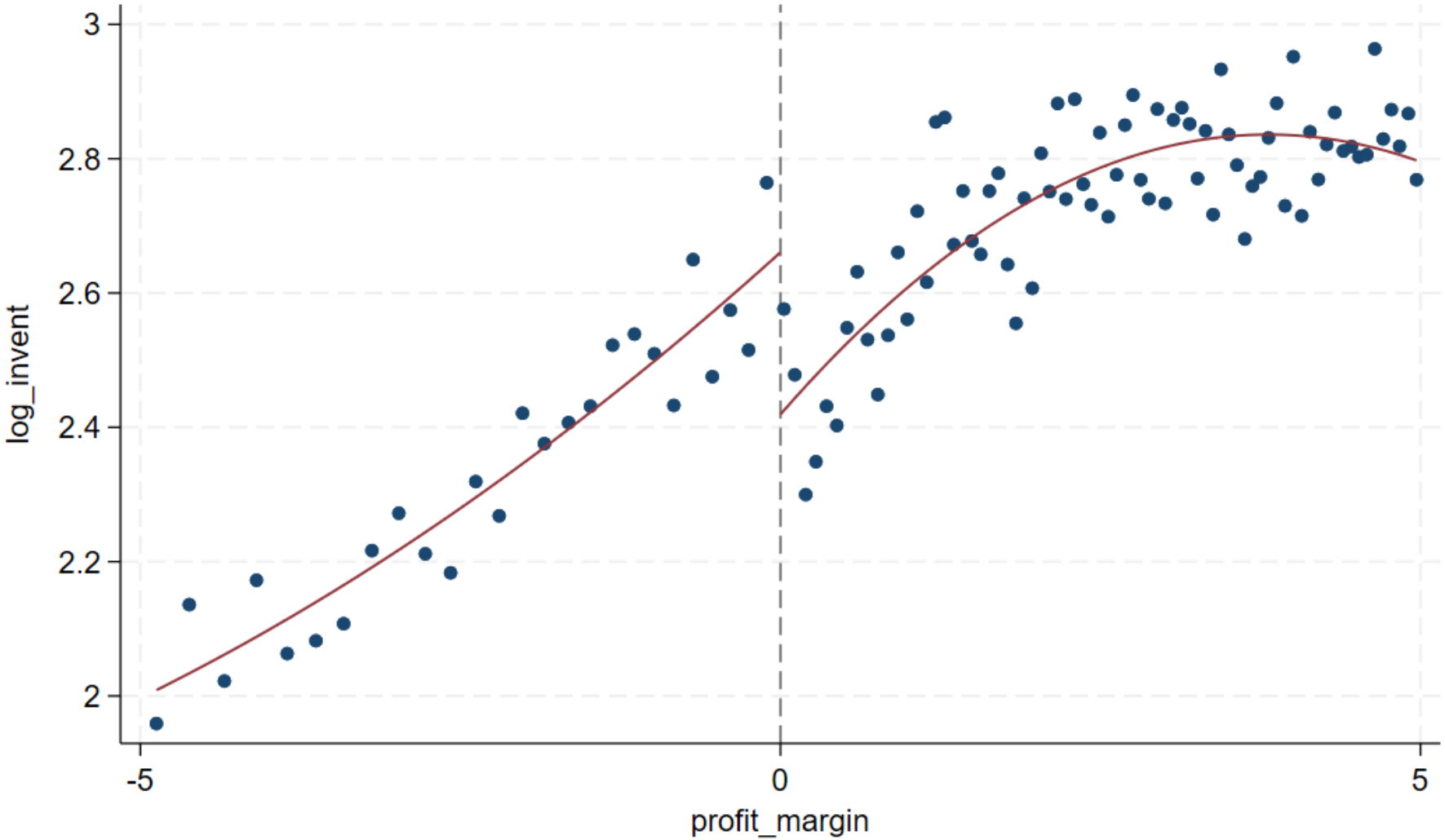

Figure 20: Lower stocks of inventories

	(1) log_real_capx	(2) log_xkapplus1	(3) log_xrdplus1	(4) log_xrd	(5) log_invent
posprofits	-0.242***	-0.246***	-0.139***	-0.322***	-0.238***
	(0.0580)	(0.0571)	(0.0405)	(0.0950)	(0.0501)
Observations	90122	91642	40476	27426	88490

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

	(1) log_cash	(2) log_emp	(3) log_xint	(4) log_xintplus1	(5) xint_share
posprofits	-0.157***	-0.122**	-0.238***	-0.135***	-0.0845
	(0.0575)	(0.0486)	(0.0501)	(0.0311)	(0.101)
Observations	80077	87038	88490	92112	84697

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: RD regression, polynomial order $p = 2$ width fixed bandwith $h = 10$. Controls: year, sector, age proxy. Robust standard errors clustered at firm and year levels.

Table 1: Simple RD regressions

Operating Profit

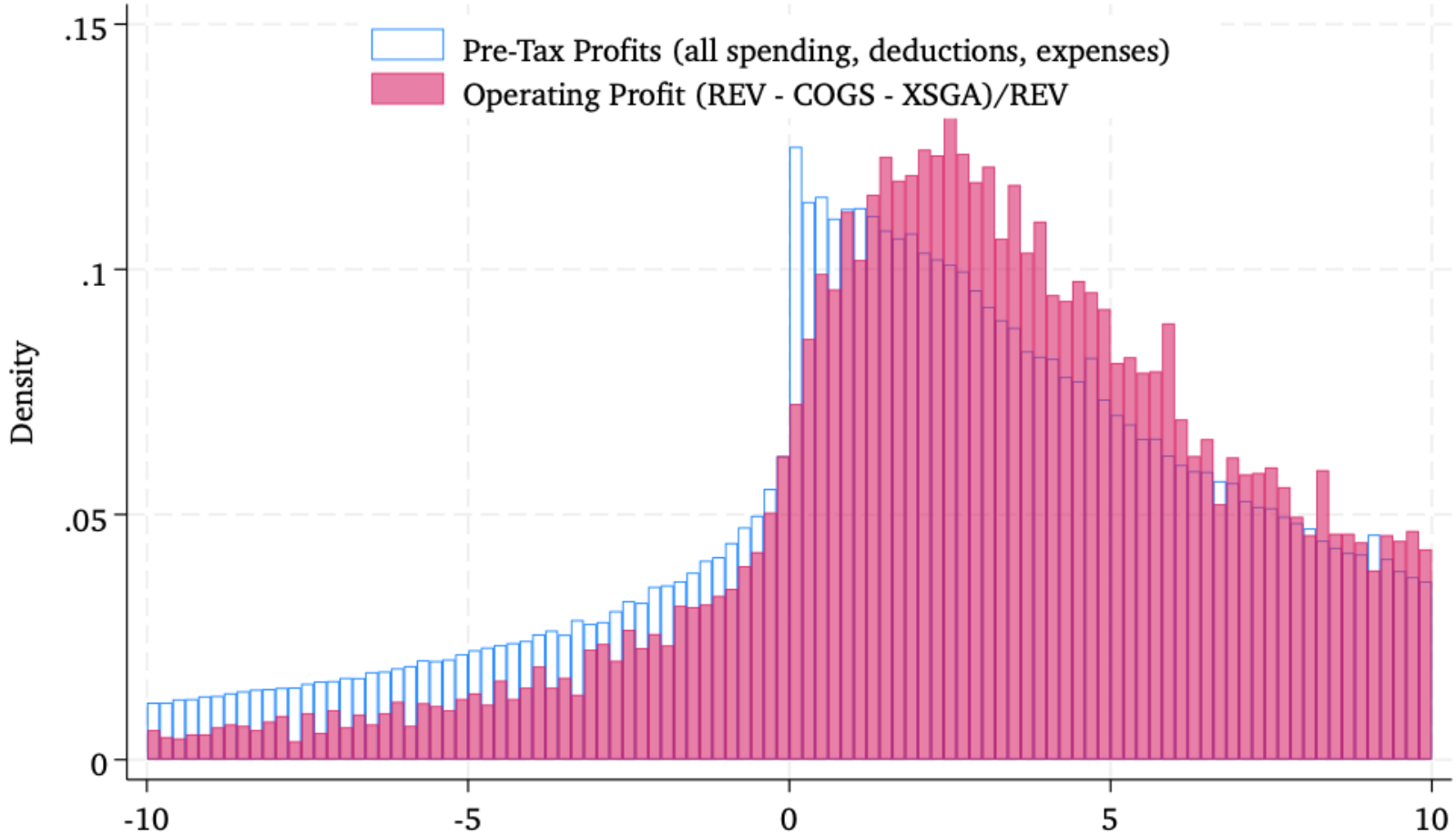

Figure 21: Net Profit and Operating Profit

No OPEX related jump: not a story about output, driven by interest, depreciation, etc

Back to Density