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)

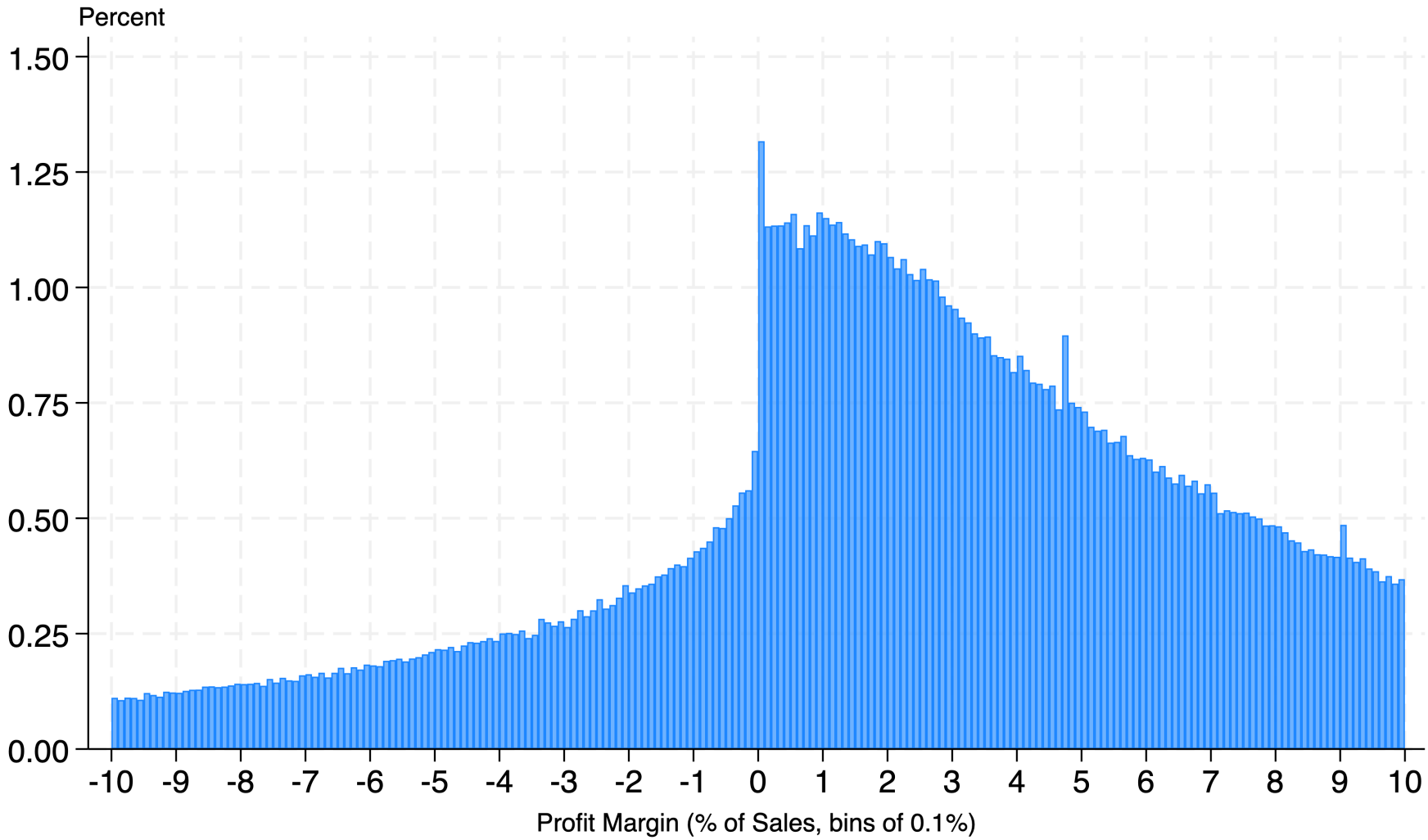
Firm Earnings, Capx and Credit

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:

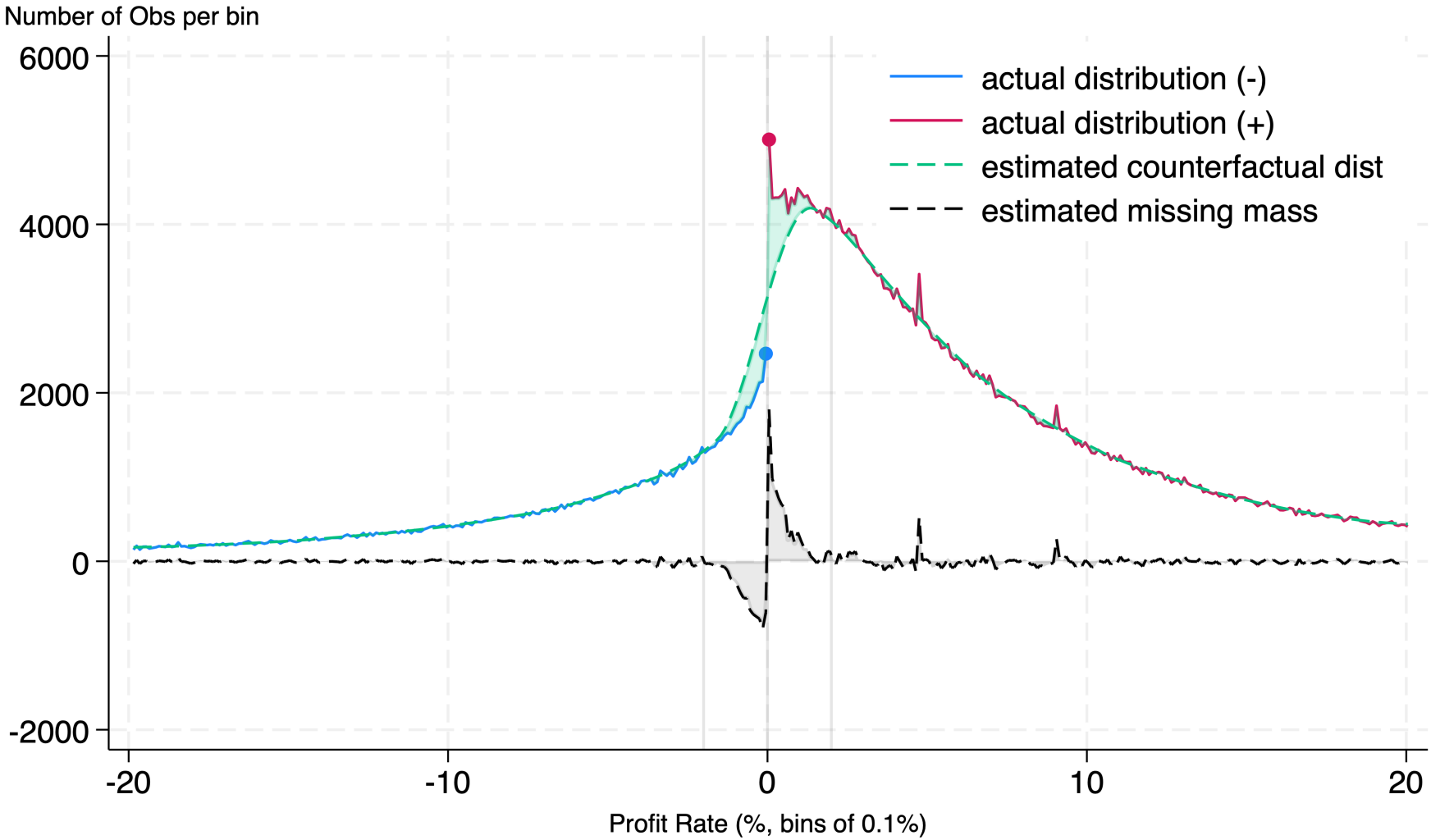
$$N_b^{data} = \sum_i 1(L_b \leq \pi_{it} < U_b) \tag{1}$$

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

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

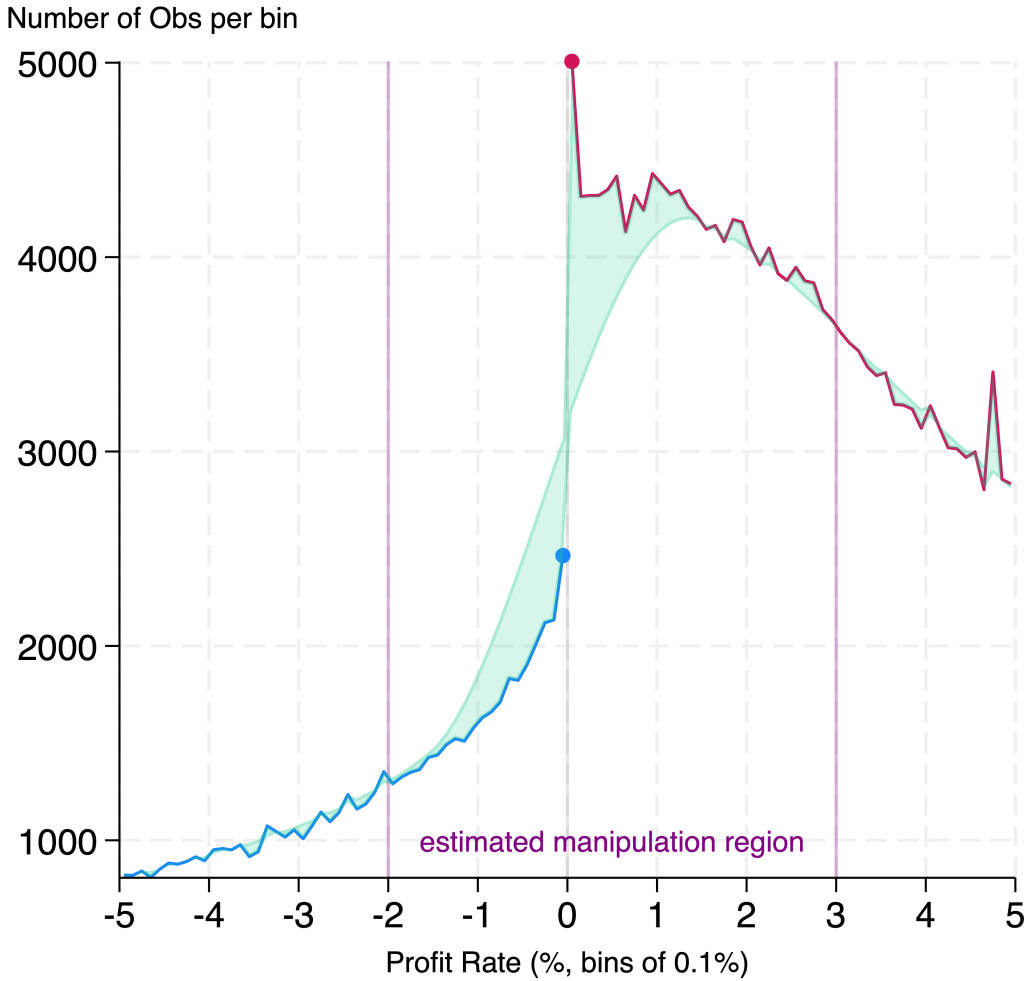
Methodology complications

- 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



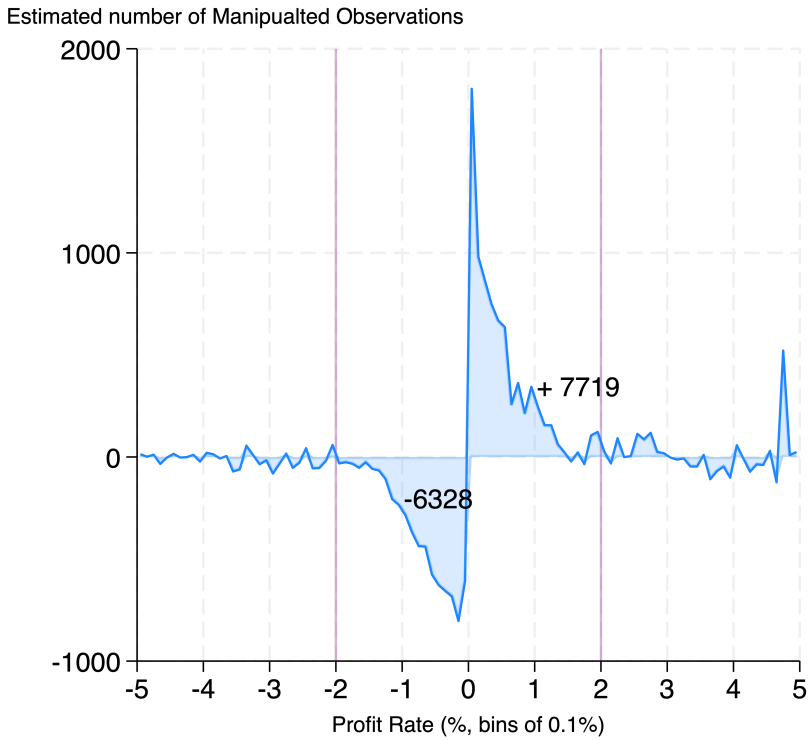
Source: FAME database of UK firms, listed and unlisted. 2003-2023

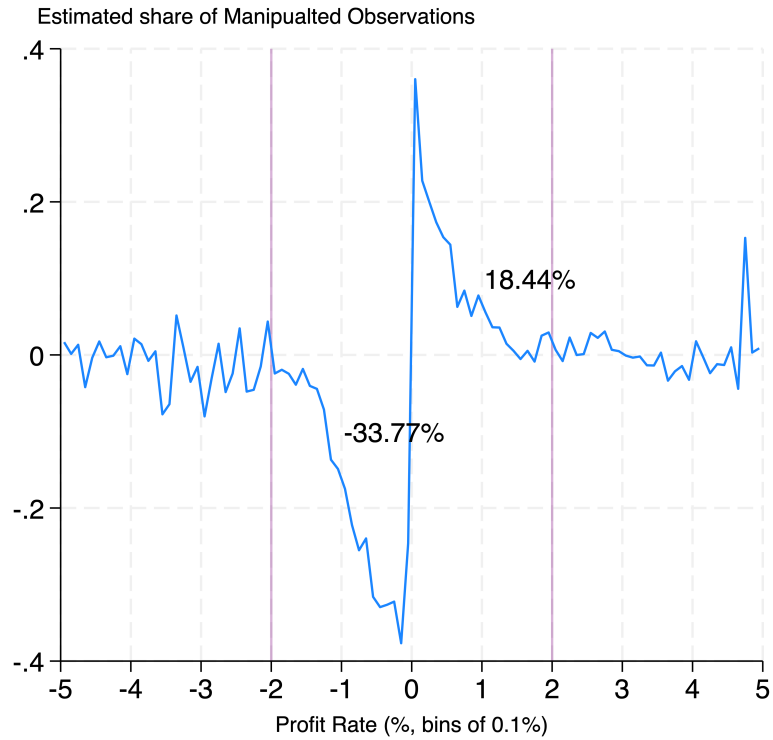
Figure 2: Jump in Density at $+\varepsilon$ Profits



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

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





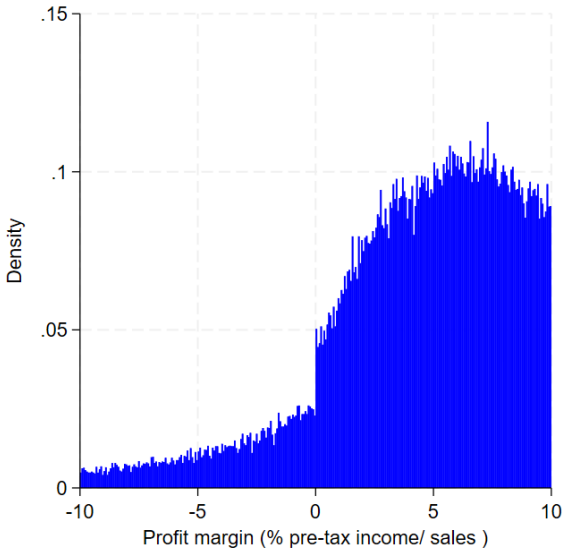
Source: FAME database of UK firms, listed and unlisted. 2003-2023

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

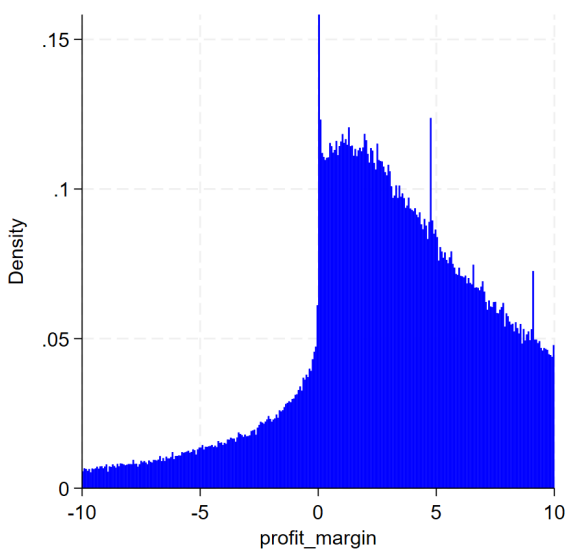
Will adjust CF fit such that two areas are approx. equal

Zero the mainstream firm dynamics datasets

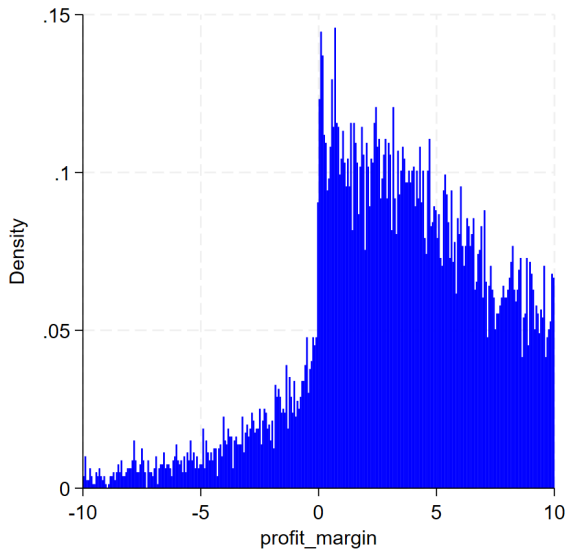
(a) US (compustat, large only)



(b) UK (fame)



(c) EU (DE,FR,IT,ES) (orbis)



Note: Compustat North America database, FAME, ORBIS.

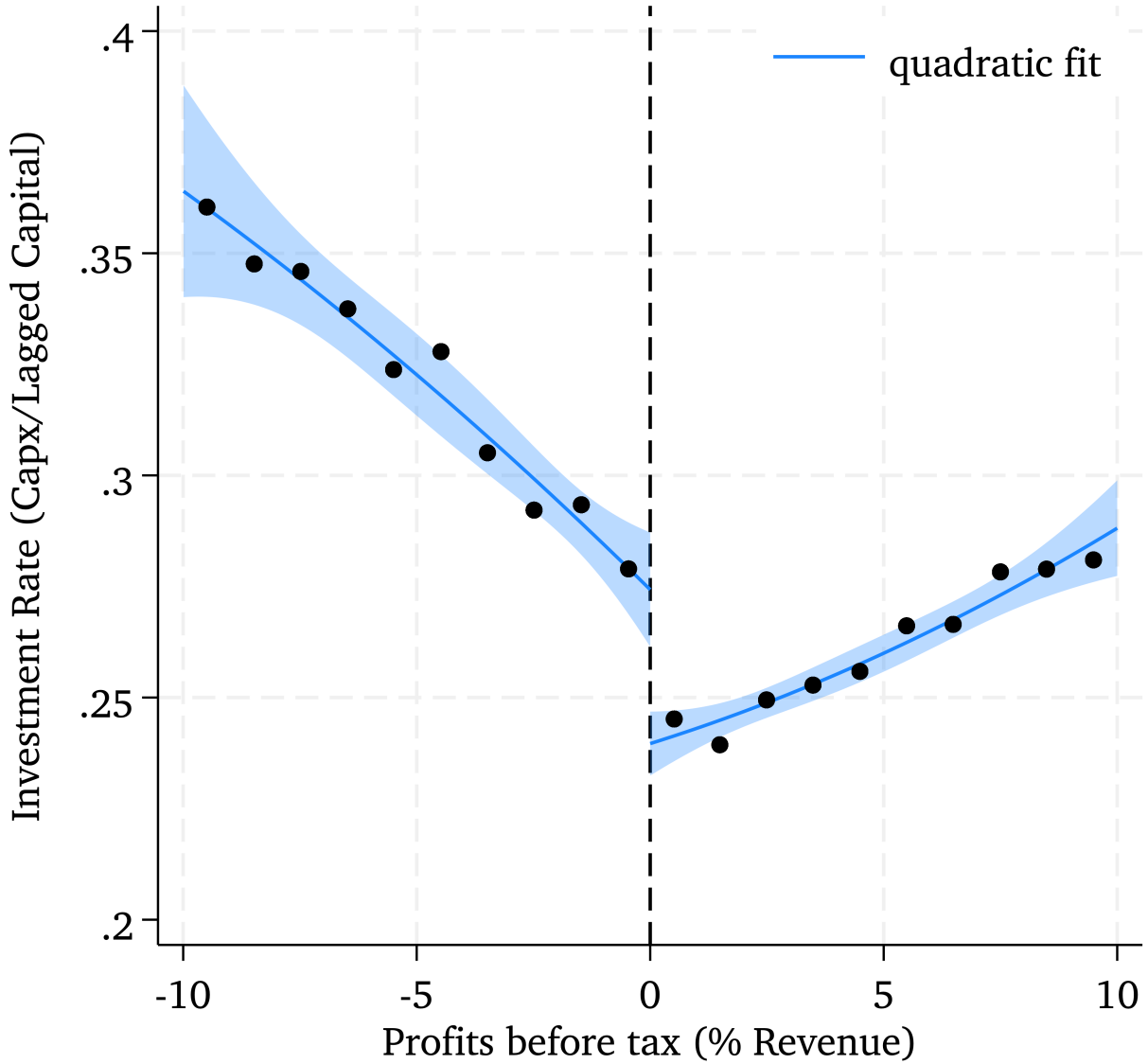
Figure 5: Density Jump at zero profits in US,UK,EU firms

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)

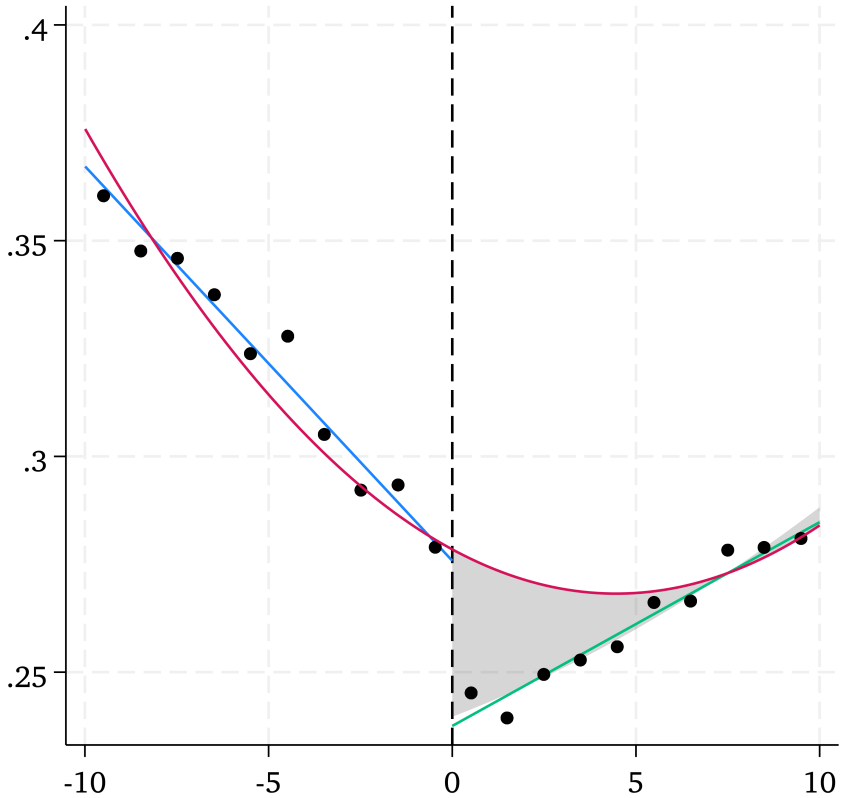
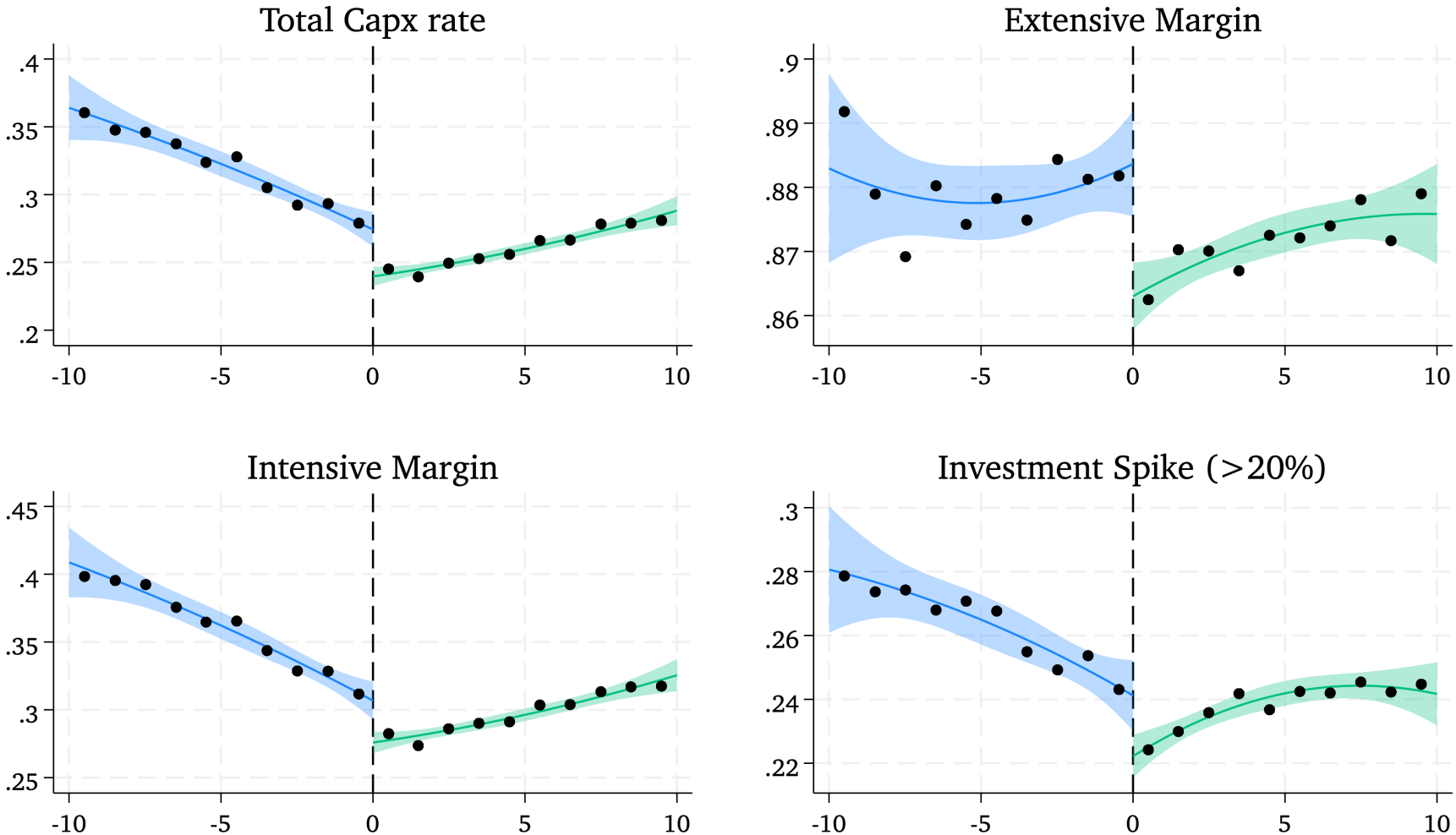


Figure 6: Missing Investment

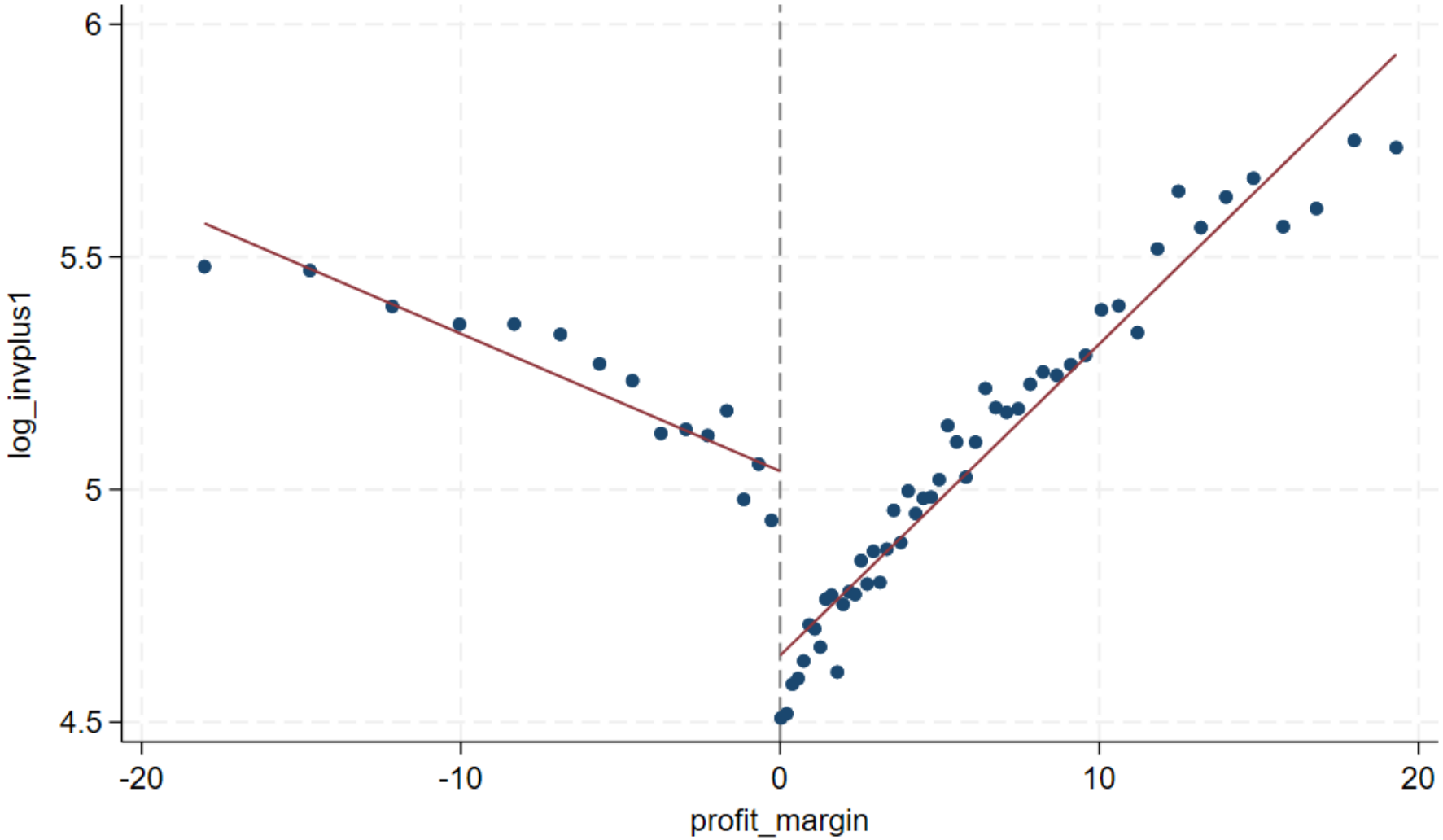


Note: Capx rate is capx over lagged capital stock. Extensive margin is the share of firms with capx>0, intensive margin is average capx given capx>0, spike is share of firms with capx>0.2.

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)



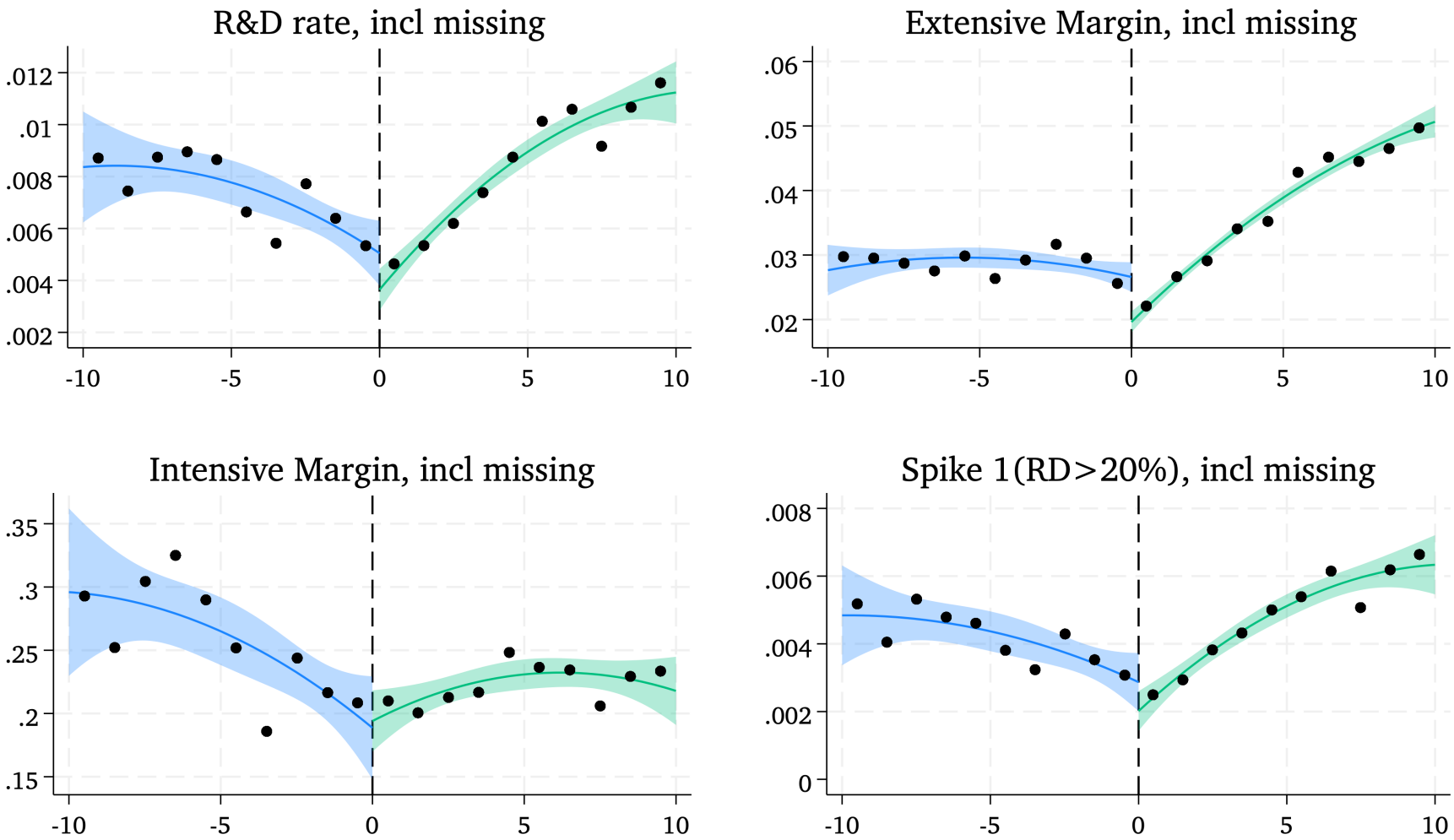


Figure 8: Firm-level XRD spending

Salaries/Turnover

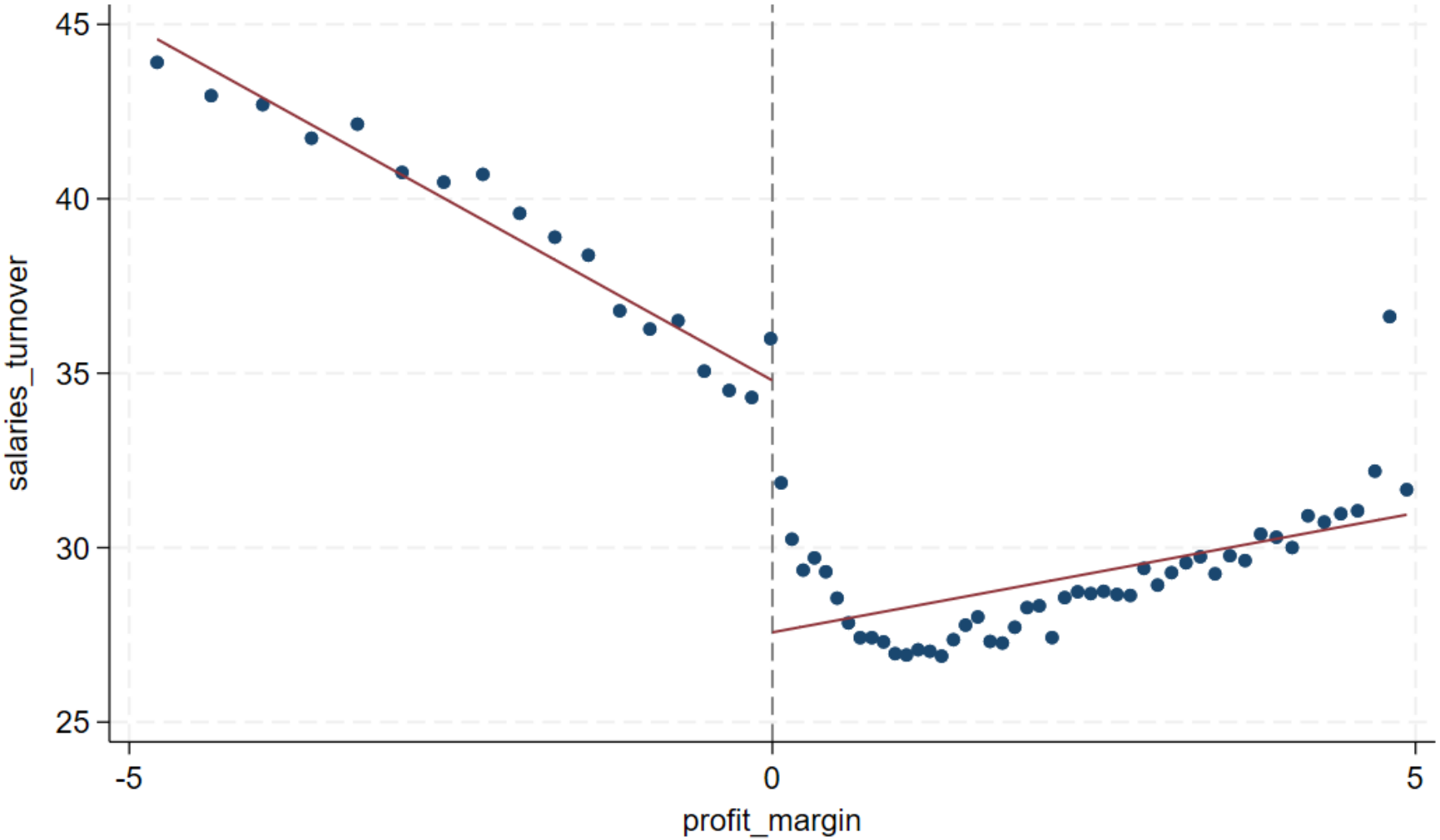
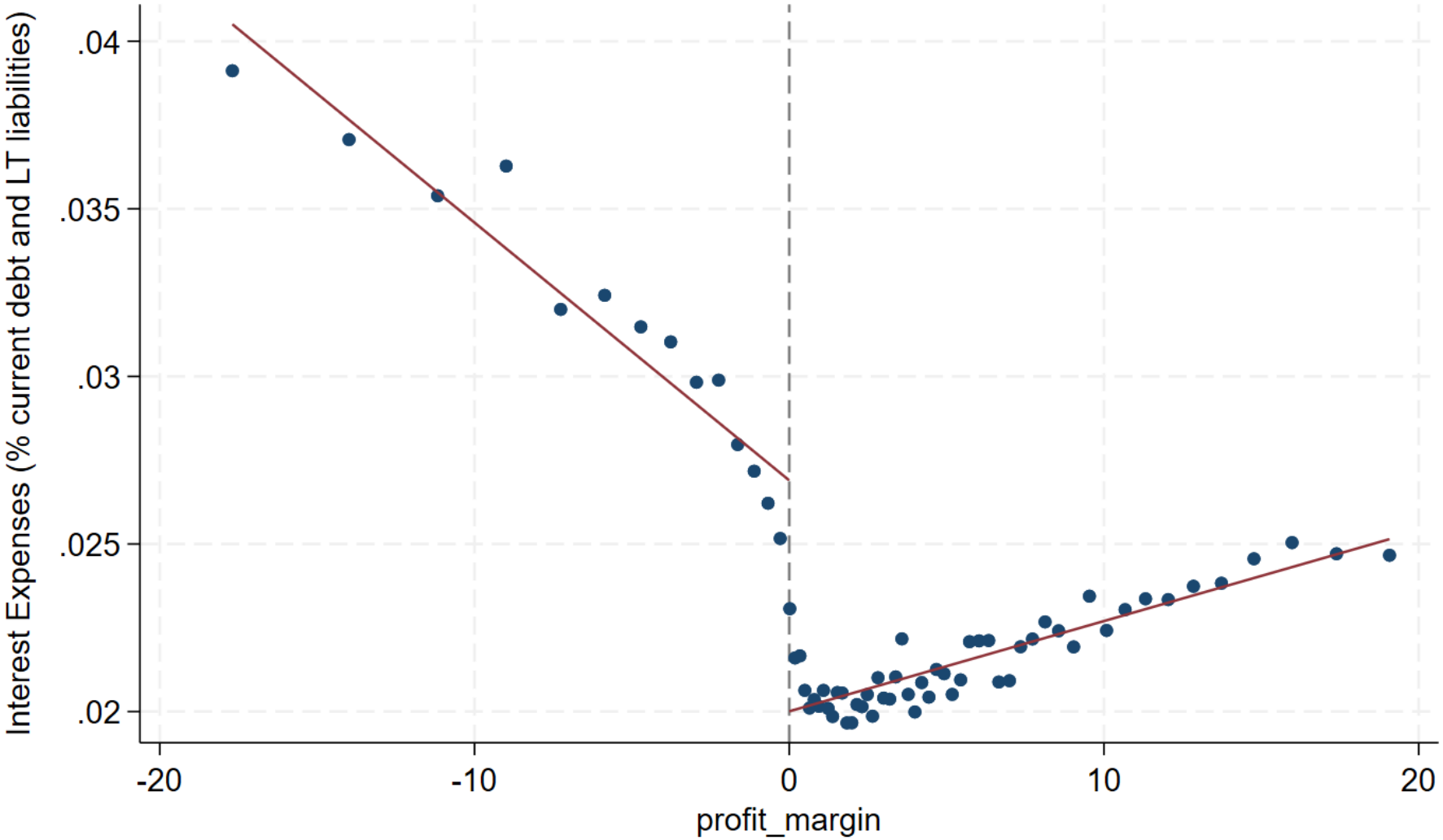


Figure 9: Caption

Interest Rates on debt

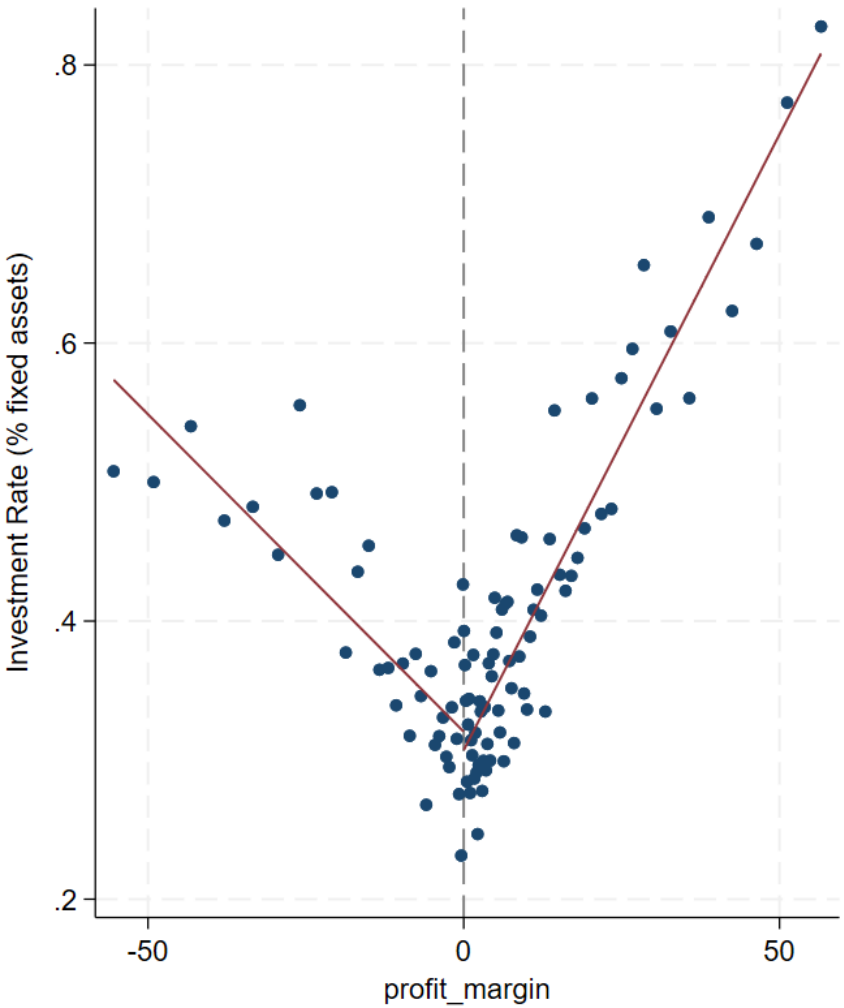
XINT (interest paid on ST and LT debt as % liabilities) drops at threshold



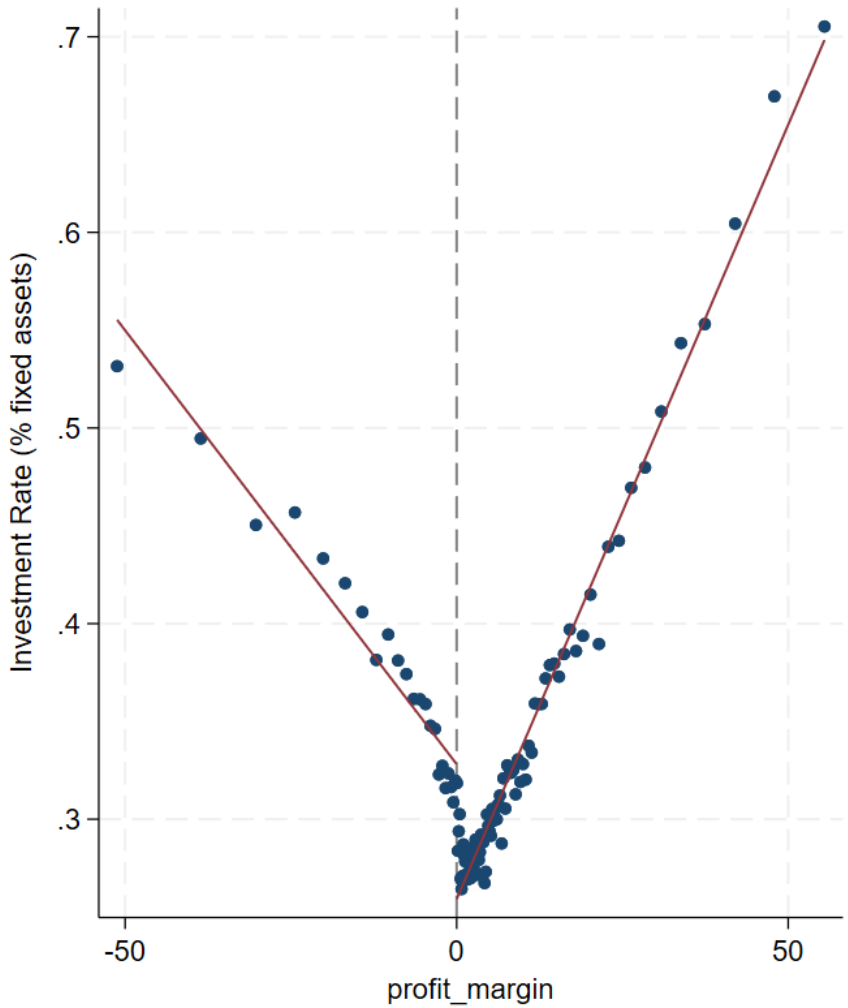
CAPX by Young and Old Firms

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

young



old



Heterogeneity in Investment Discontinuity Estimates

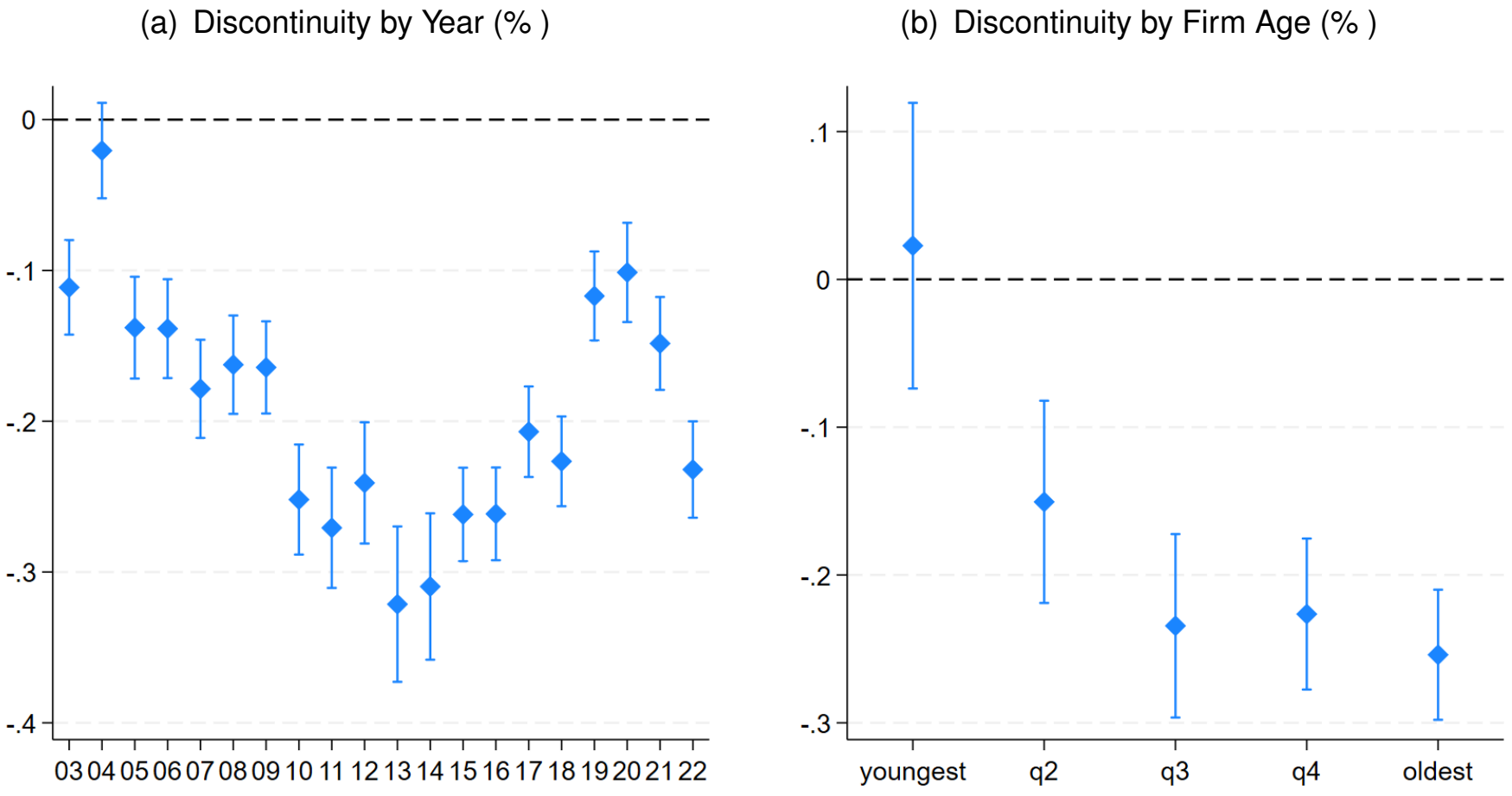


Figure 10: Heterogeneity by year and age

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

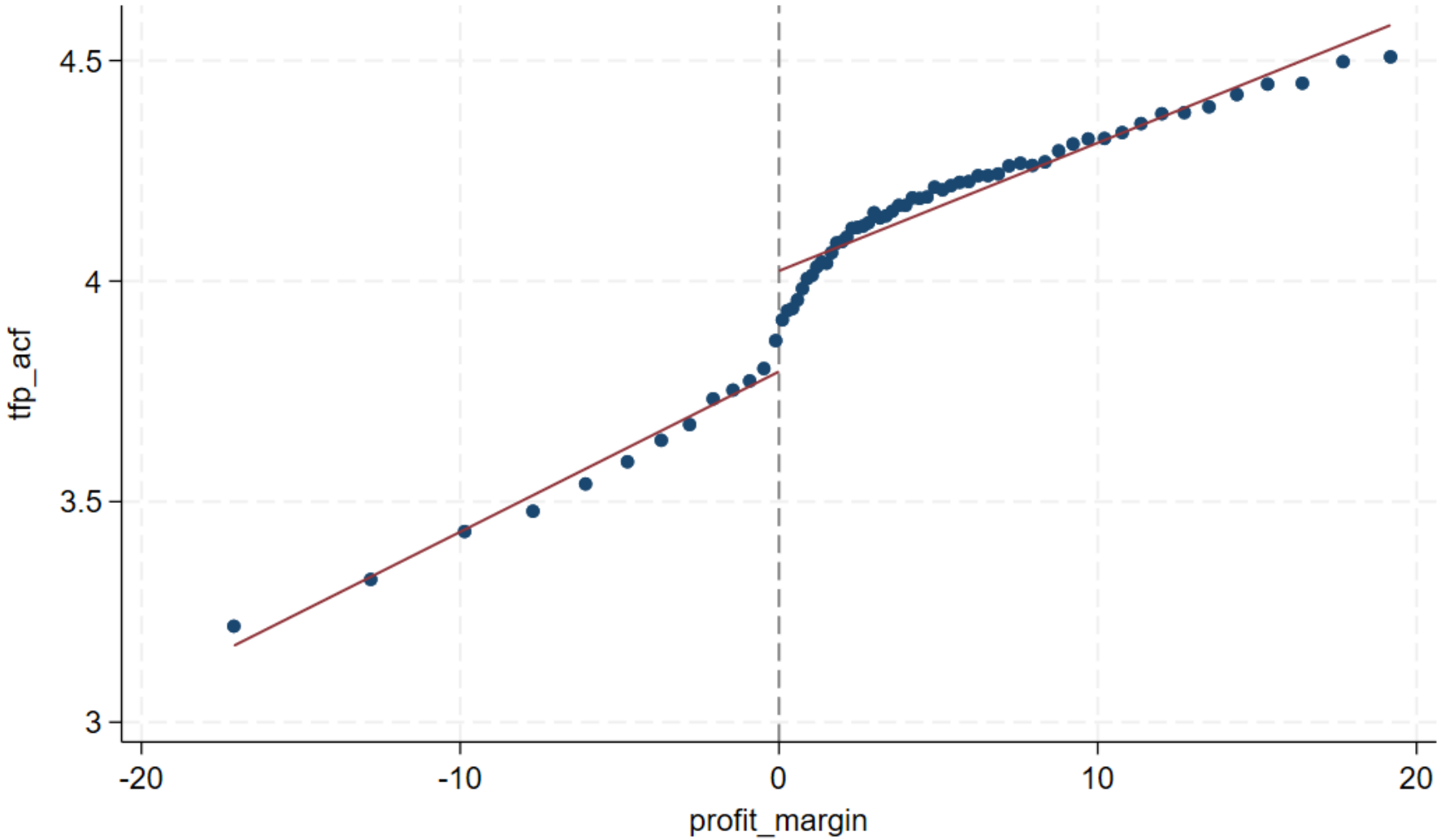


Figure 11: TFPR (AC)

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?

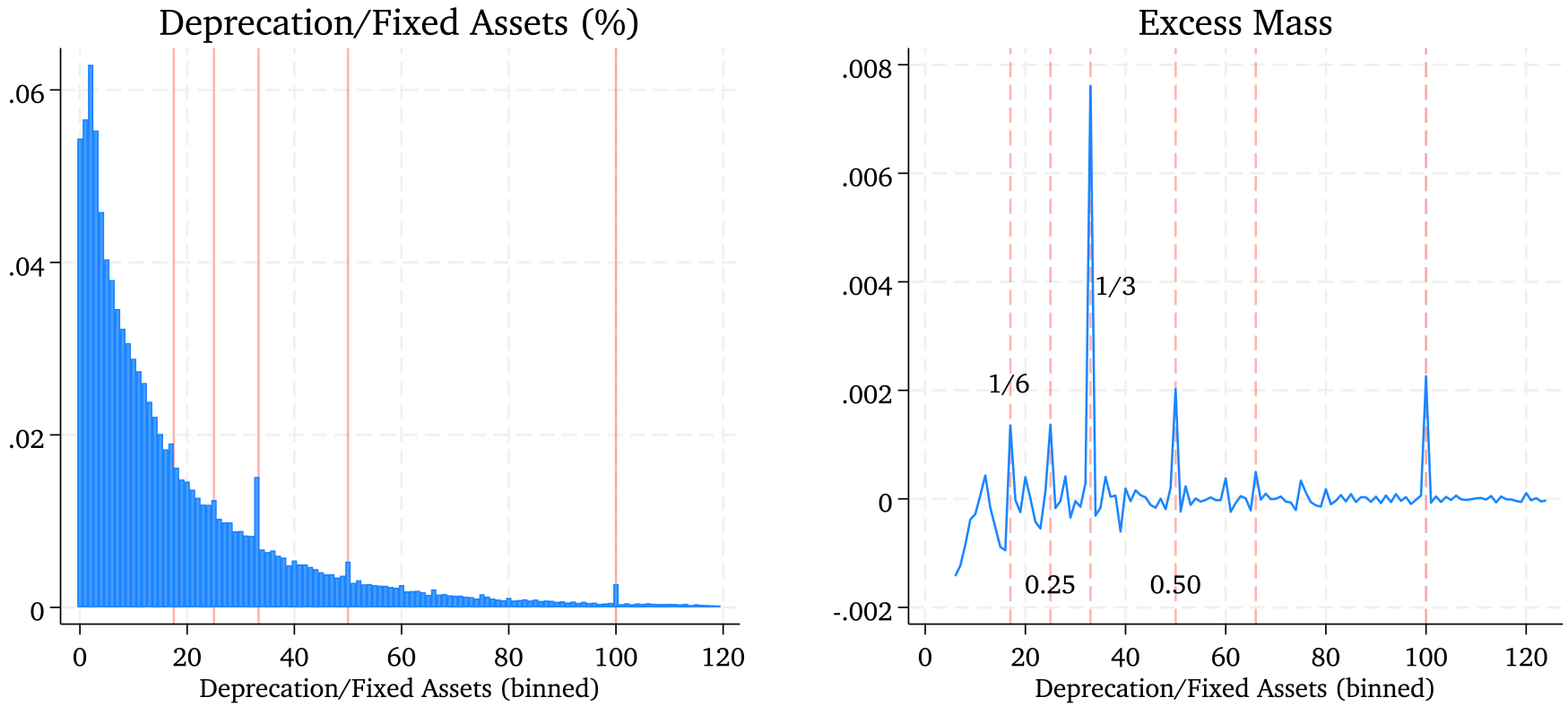


Figure 12: Depreciation Distortions relative to polynomial fit

- **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?

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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

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

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

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

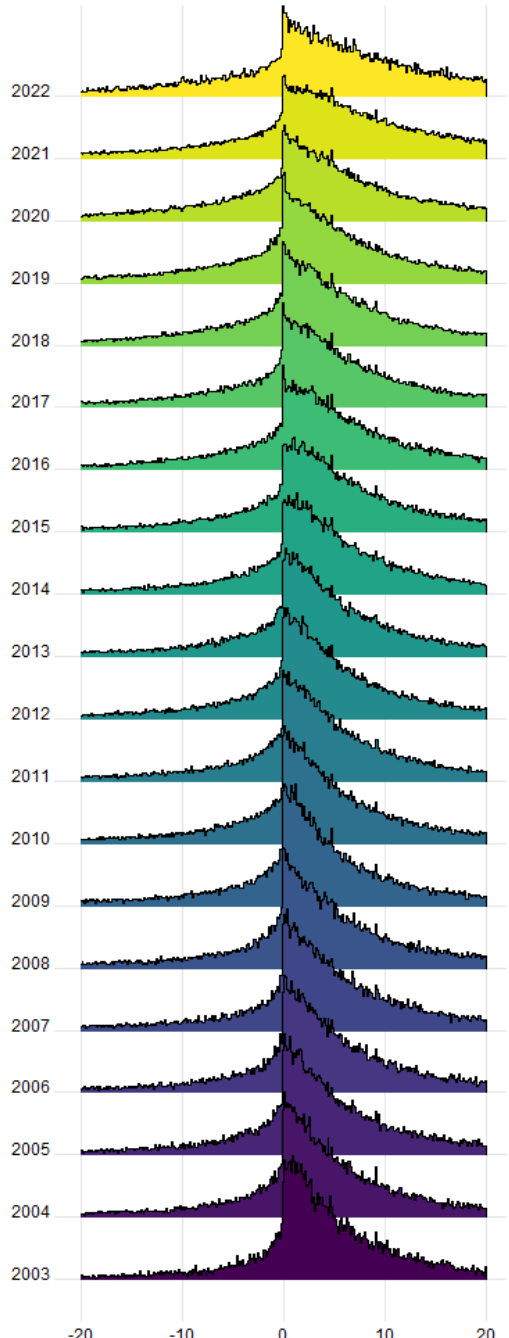
Lender's Problem

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?

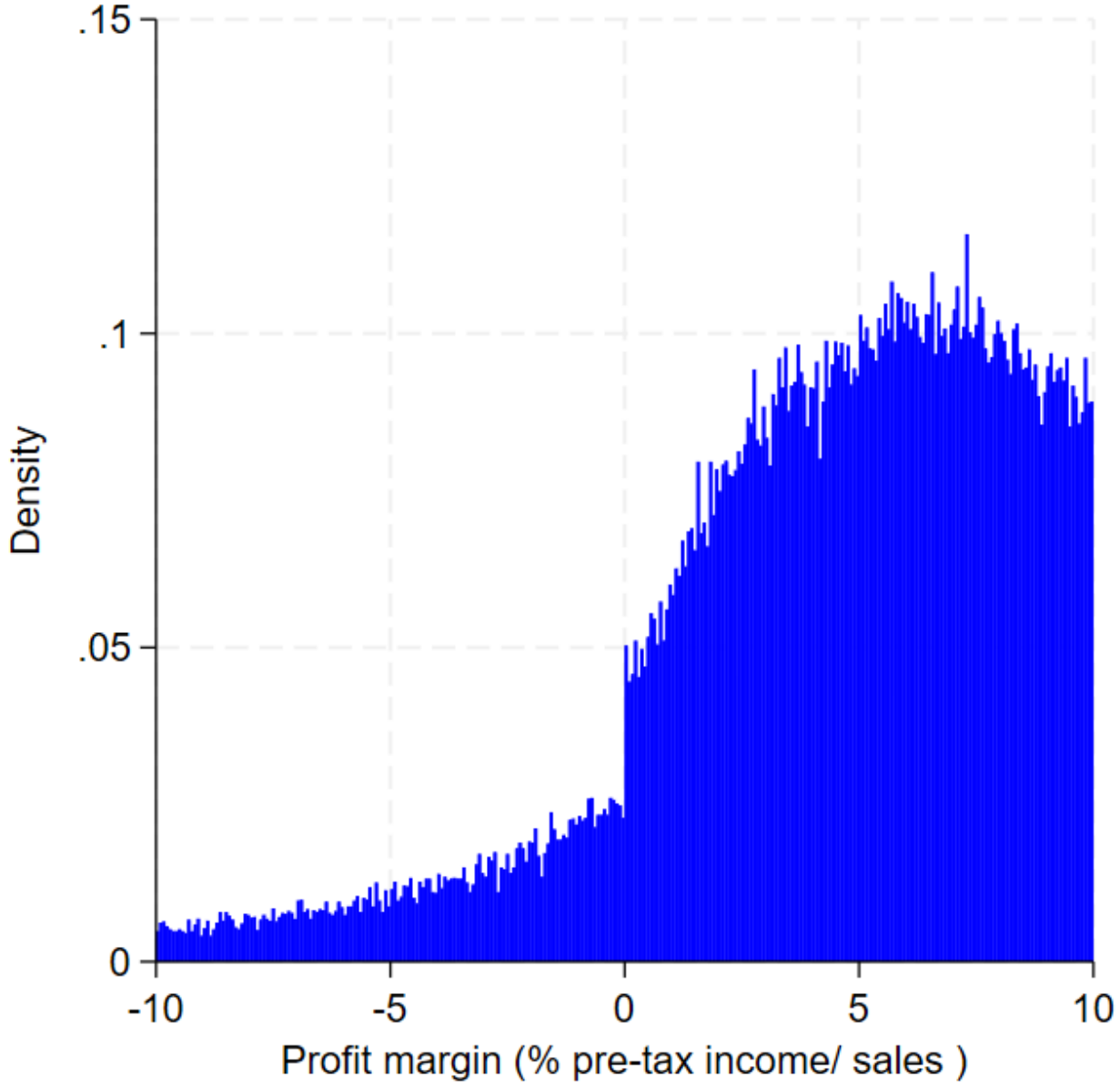
Thanks!

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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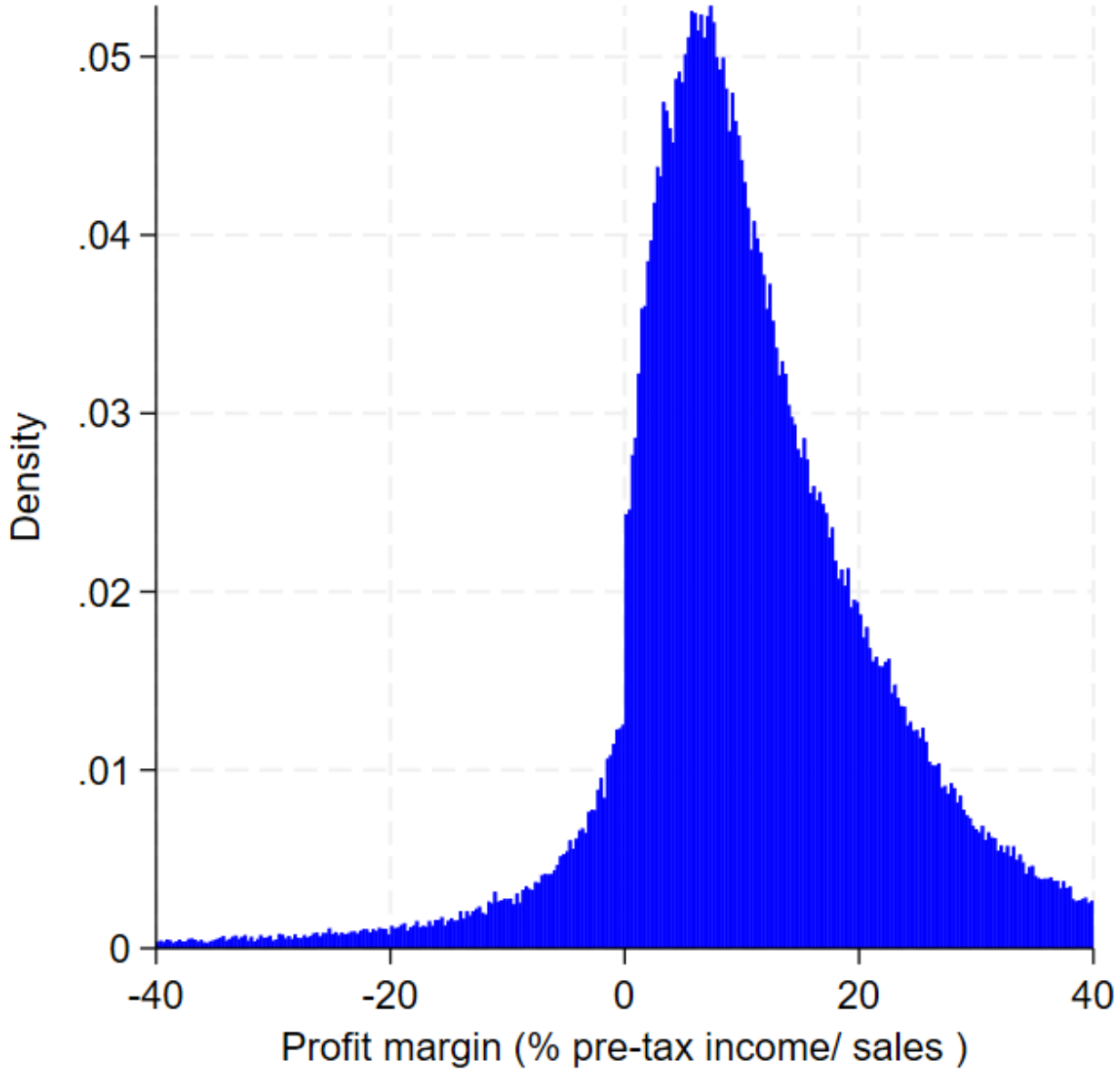

Capital Investment

Slight drop in capital investment

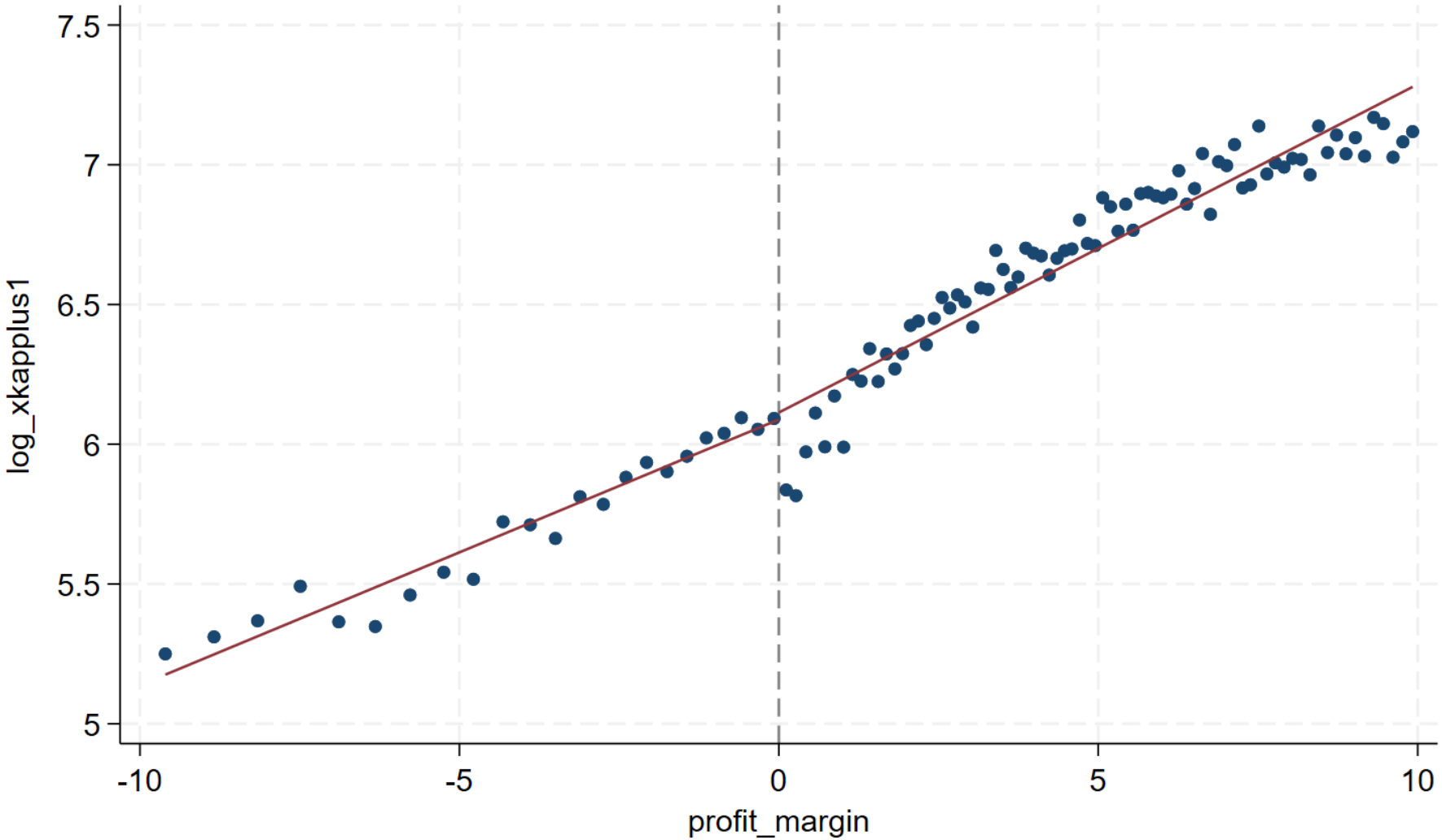

Figure 16: Manipulators boost profits but cutting CAPX slightly

Research Investment

Stronger drop in research and development

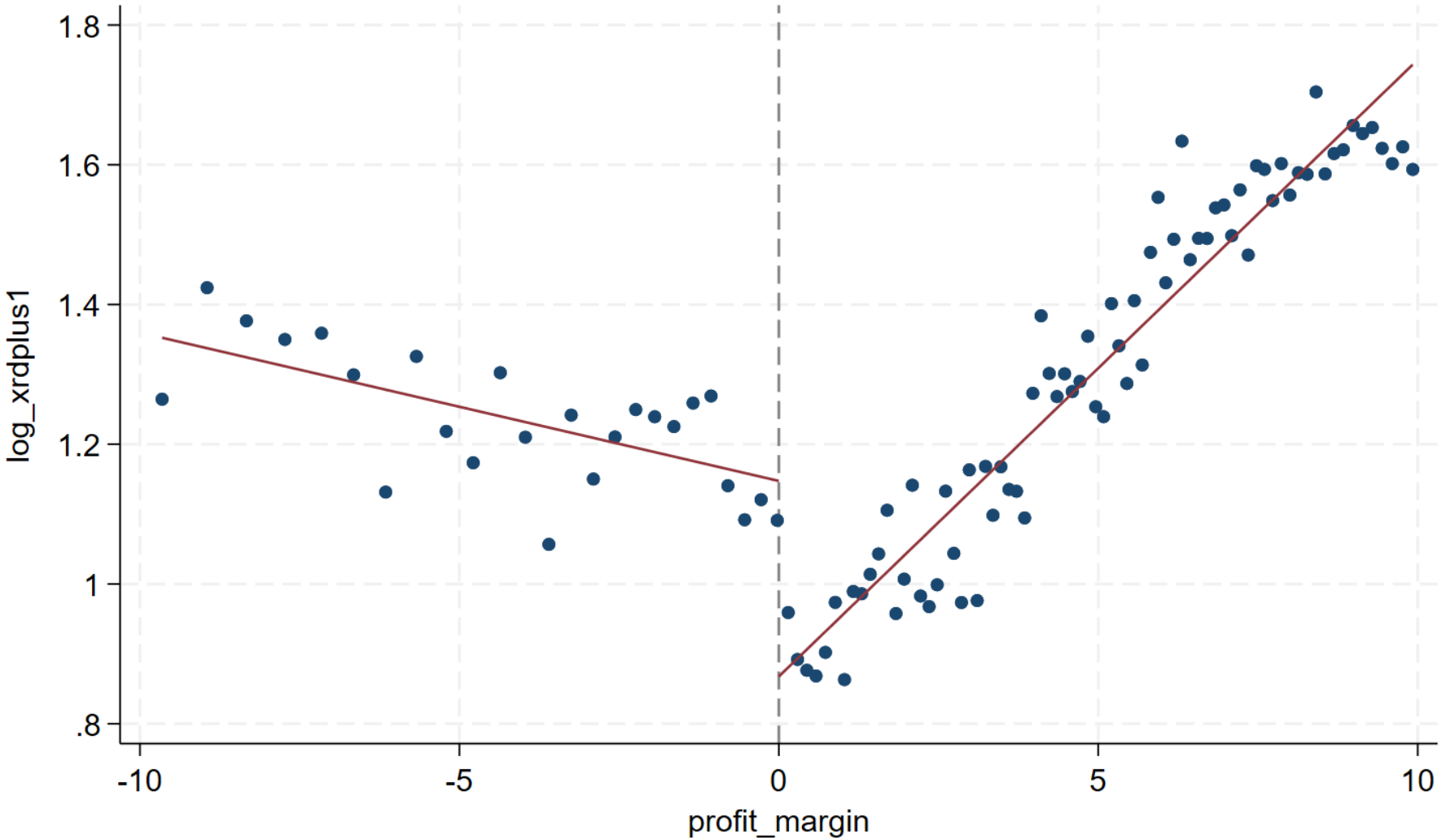

Figure 17: Manipulators boost profits but cutting Research & Development (XRD)

Interest Expenses

Interest expenses drop

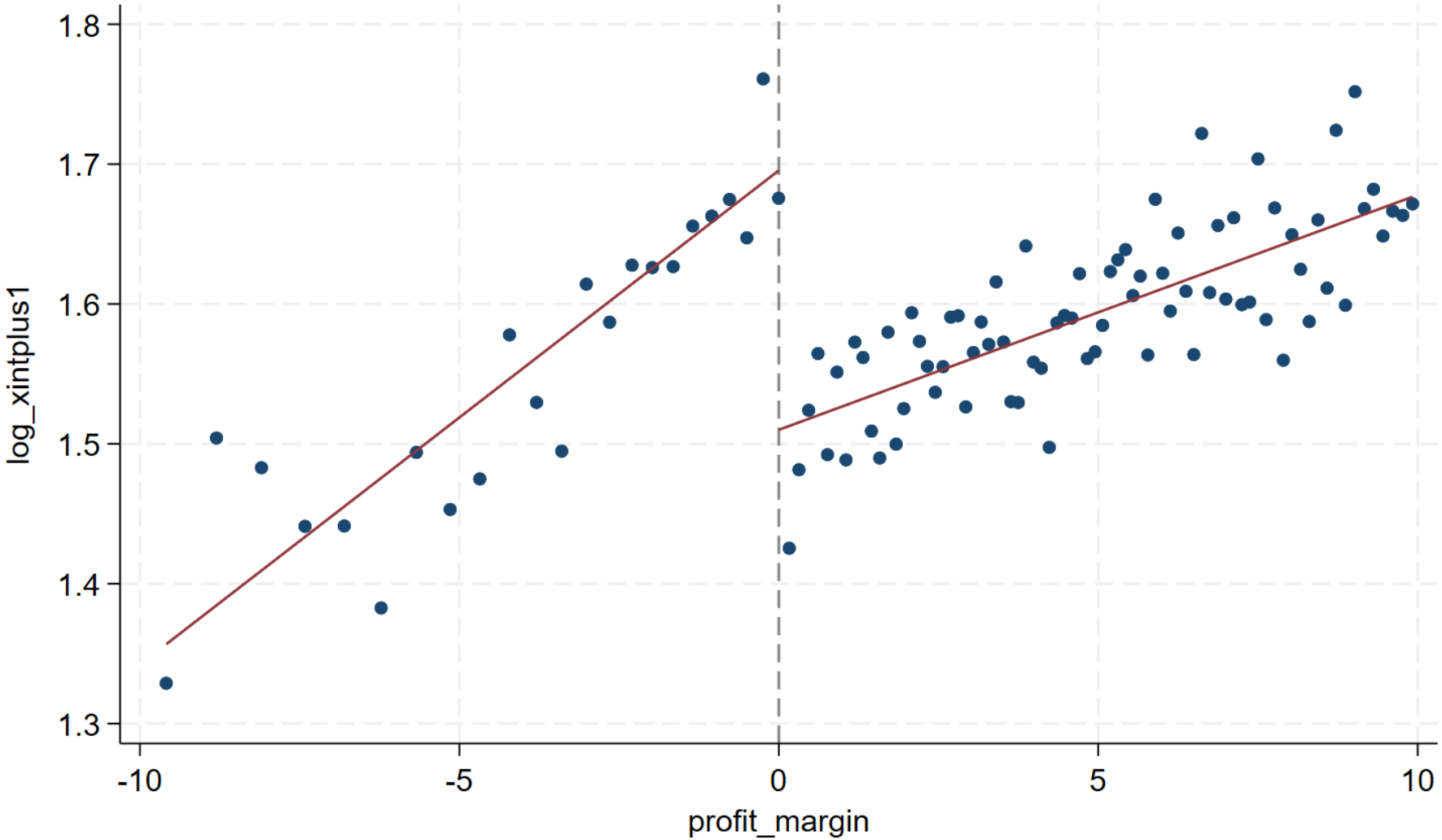

Figure 18: Interest expenses more favourable on the RHS

Employment

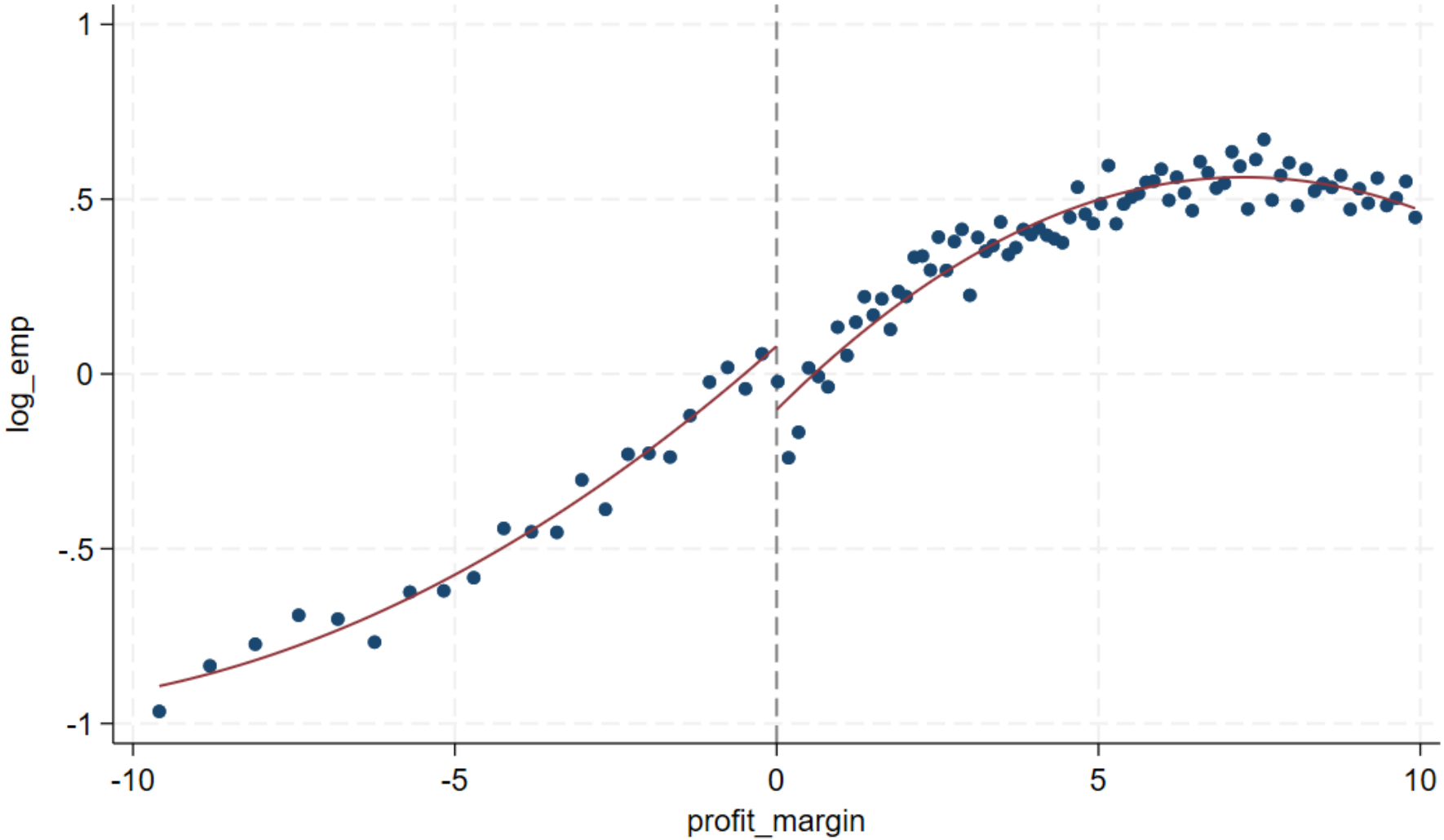

Figure 19: Employment cuts?

Inventories

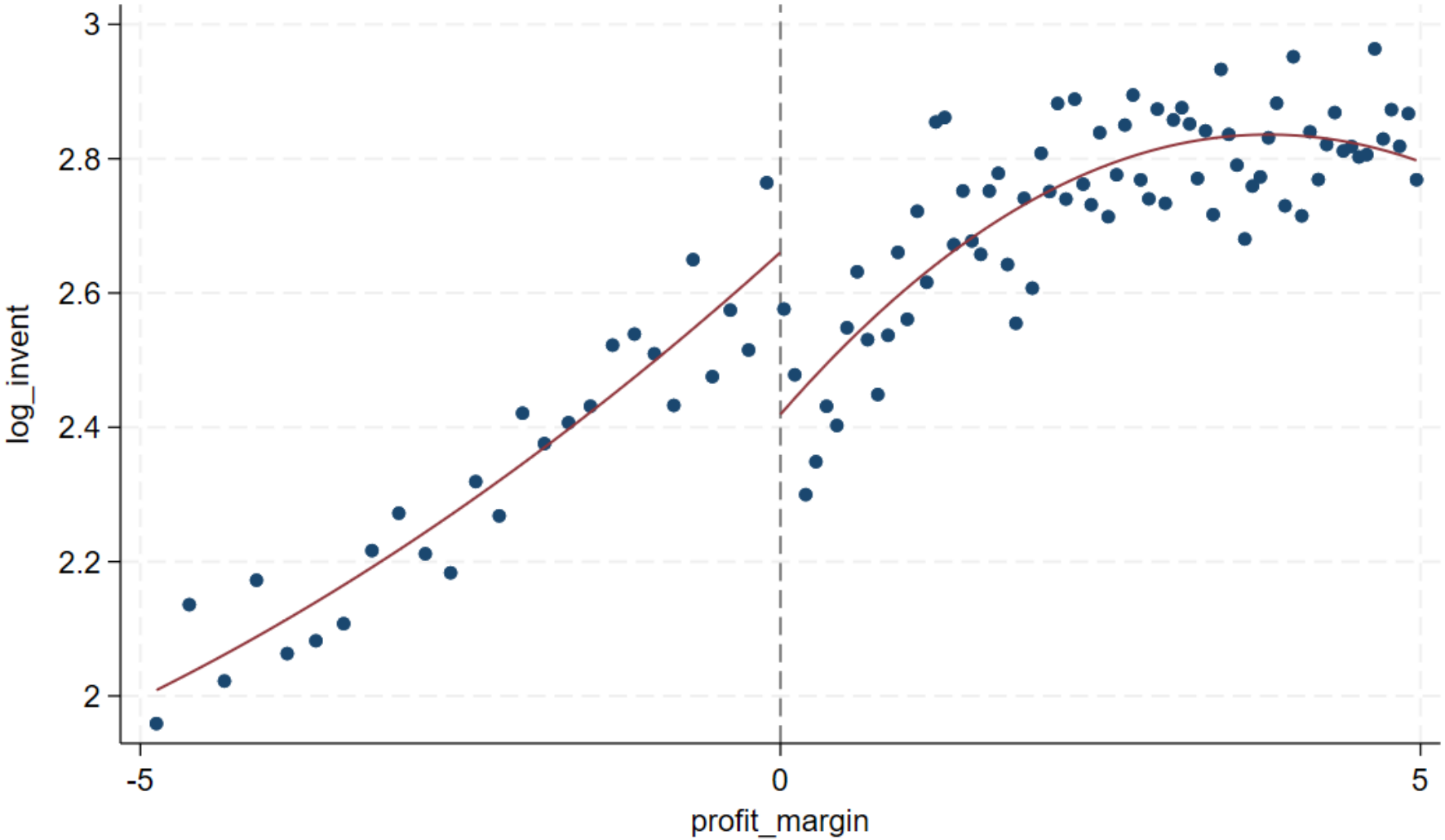

Figure 20: Lower stocks of inventories

	(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

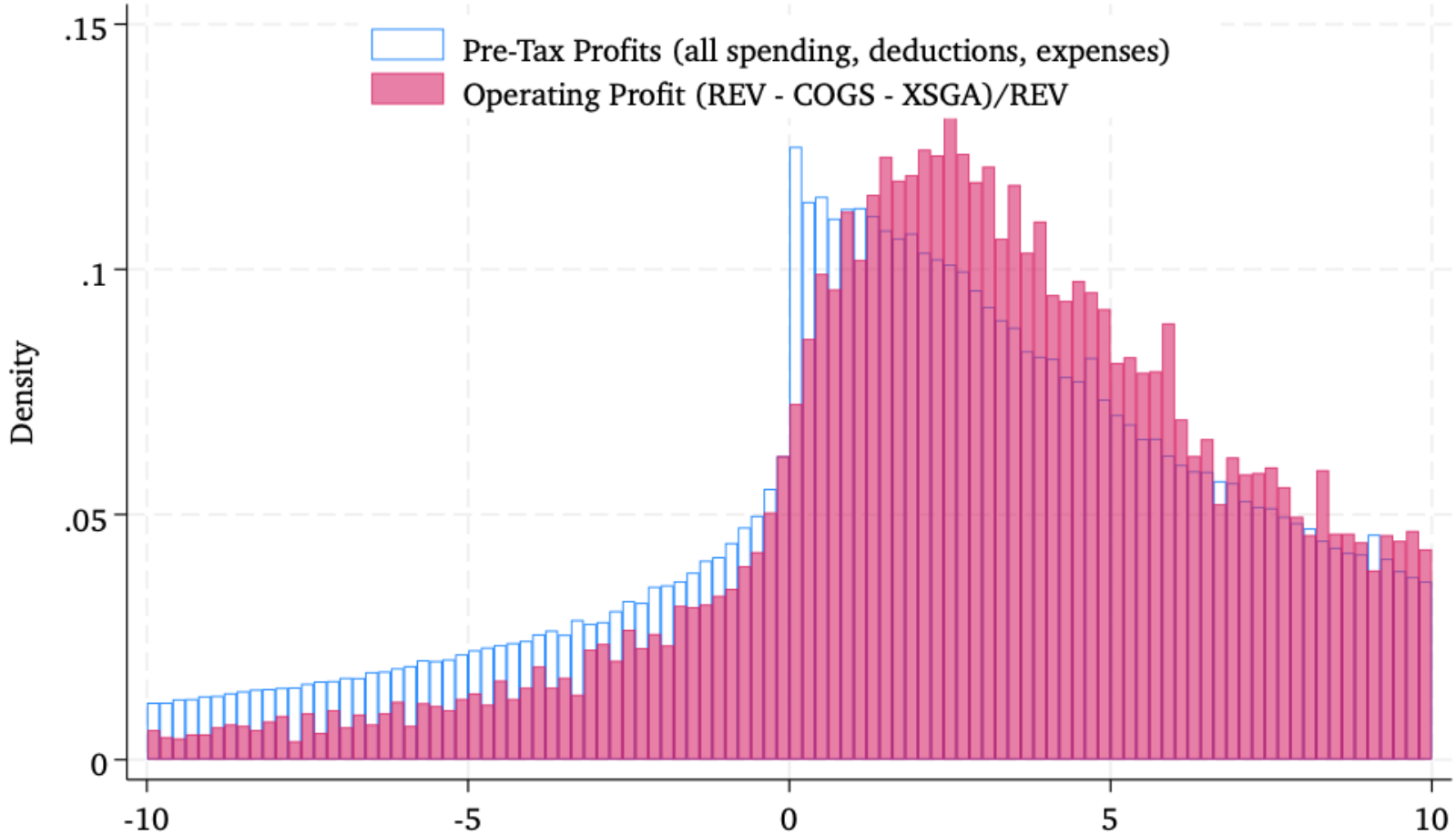

Figure 21: Net Profit and Operating Profit

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

Back to Density