Earnings Management and Firm Investment

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Plan

- New JMP: **Earnings Management and Firm Investment:**
  - Financial friction and earnings manipulation around zero
  - small methods innovation to measure bunching
  - lots of facts/jumps at zero
  - solved model with finger-in-the-air calibration

- **Emprirical Fiscal News**
  - high-frequency idenitification to filter out confounding news
  - IRFs macro dynamics around budget annoucements
  - Might add HANK model, but seems like a trap (fiscal/monetary dominance)

Earnings Management and Investment

Earnings Management and Bunching

In every firm panel I have tried:

- strong bunching at zero profits (earnings before tax % of revenue)
- Discontinuity in density function:

$$\lim_{X \to 0^+} f_\pi(X) - \lim_{X \to 0^-} f_\pi(X) > 0$$

- All your favourites: Compustat (US Listed), Orbis (EU, US), Fame (UK)
- Seems to be a universal feature (size, age, industry)
- The jumps in financial variables at $\pi_{it} = 0$, clues as to what drives bunching
- Not (just) exit dynamics: why would loss of £1 cause exit rates to jump compared to $+$£1
- Exiting firms drawn from full support of profitability

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Discontinuity in UK microdata

- Fame Sample: UK Listed and Unlisted firms.
- Approx $N = 80k$, $T = 20$ years.
- 73 percent private sector employment coverage in 2019
- Largest employers, Tesco, G4S, Serco, come close to 1 percent of labour force each.
- around 40% small ($N < 50$), 40% medium (50-249), 20% large (250+)

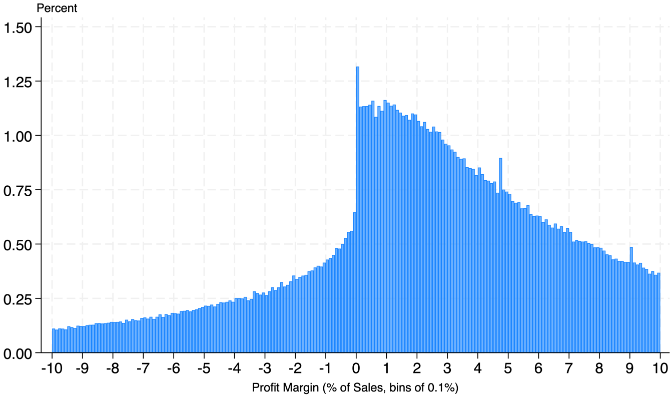


Figure 1: Earnings Distribution, full sample

- **running variable**: Profit Margin: pre-tax earnings as percent of revenue

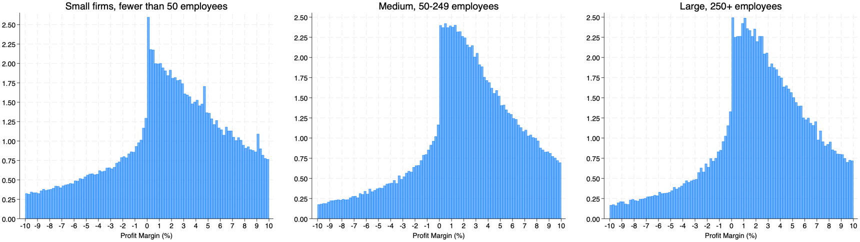


Figure 2: Earnings Distribution by Firm Size (number employees)

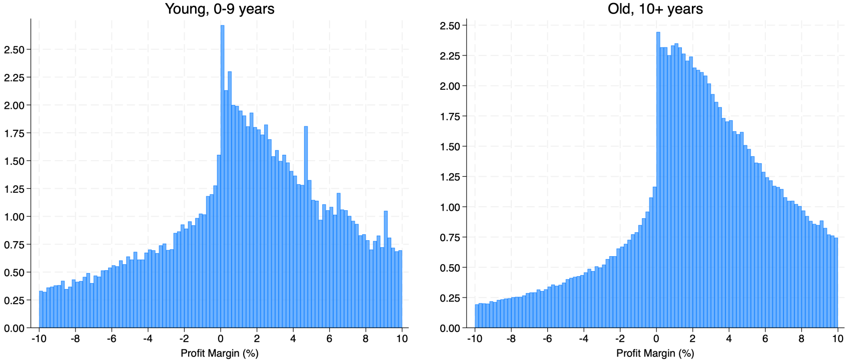


Figure 3: Earnings Distribution by Firm Age (since legal inception)

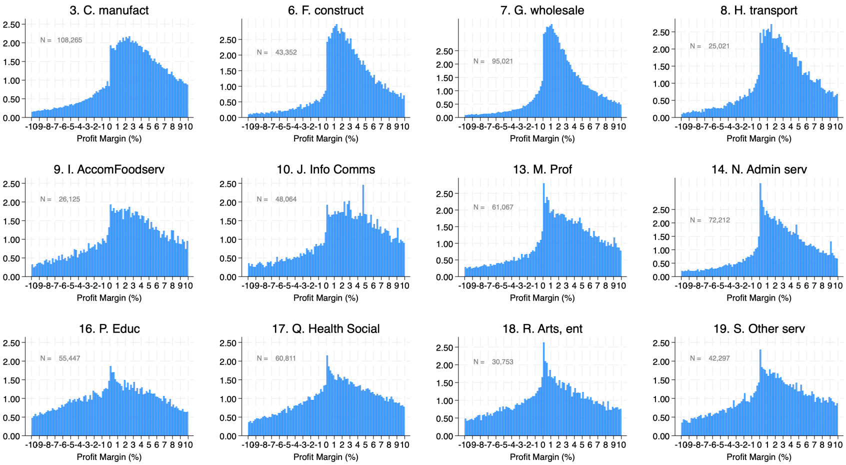


Figure 4: Earnings Distribution by Industry (SIC 1-digit letter group)

This Paper's Contribution

- Measure bunching mass at zero profits (location complicates calculation)
- Document discontinuities/kinks in relevant financial variables
- Build heterogeneous firms model with financial frictions to fit the facts

$\Rightarrow$ (later down the line) run counterfactual analysis

Measurement and Counterfactual

PDF 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 fit**

$$N_b^{cf} = \hat{\mathcal{P}}(N_b^{data}, bw^*) \tag{2}$$

Methodology

- 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

Counterfactual Distribution

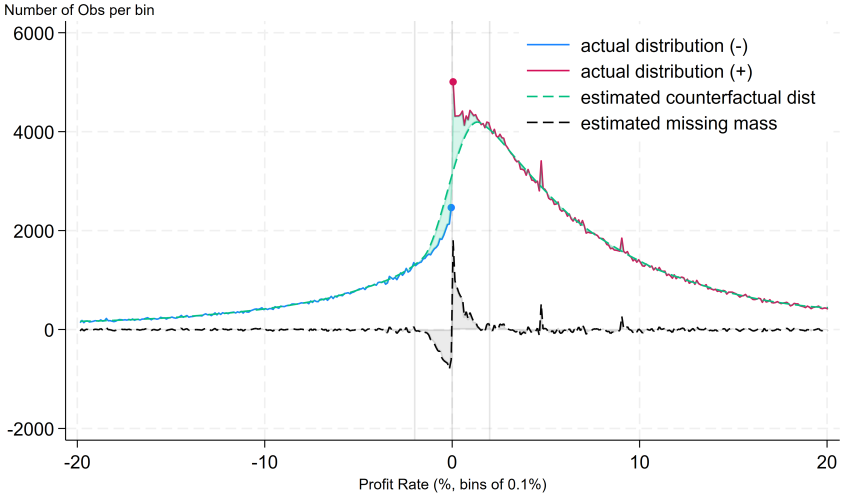


Figure 5: Caption

Distortions: Capex, Interest Rates, Leverage

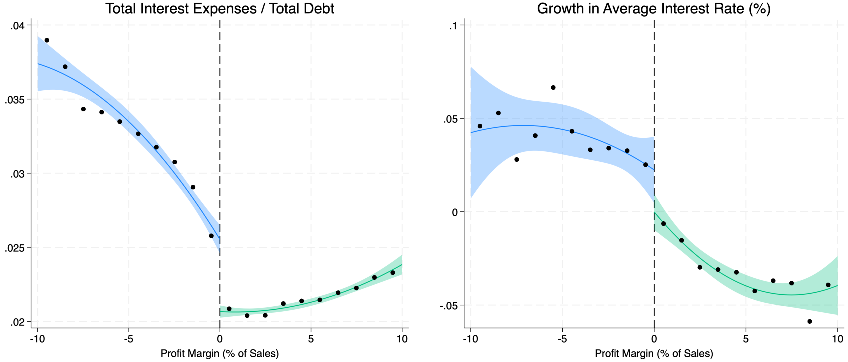
Discontinuities in firm-level variables

- Credit conditions improve discontinuously at zero
- Capex also drops
- Story: sacrific some capex to reach profitability, improve borrowing conditions

Firm investment in lumpy: large, infrequent bursts of activity

- average investment
- share of firms undergoing large capital adjustments

Credit Conditions



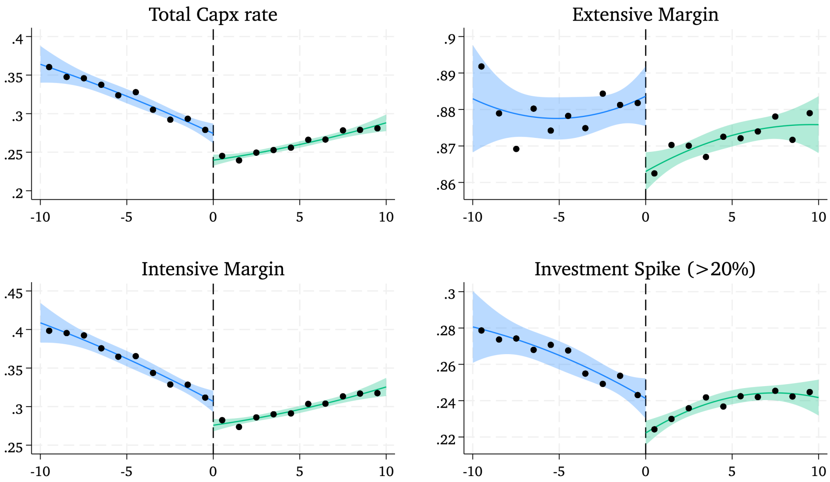


Figure 6: Margins of Capital Adjustment Responses

Adding Controls etc.

Results are robust to controlling for lagged size, employment, sales growth, profitability (in paper).

Model Overview and Comments

- Heterogeneous Firms Model with External Finance Premium
  - Firms vary in their idiosyncratic productivity, z
  - Hold liquid assets, b (borrow/save) s.t. LTV constraint
  - illiquid capital, k (quadratic and noconvex adjustment costs, partial irreversibility $p_s < p_k$)
- External financing premium, λ: Negative earnings raises the premium
  - unit cost of borrowing $(r + \lambda)$
- Lender charges premium for
  1. new issuance and
  2. total debt when pricing credit
- Quite difficult to get negative capex discontinuity:
  - small manipulation frees up to much liquidity at the threshold
  - investment explodes upwards as user cost jumps
  - need more complicated pricing

Production, Adjustment, Operations

Production is DRS in K, N taking wage as given. Solve-out labour

$$y = \max_n \left\{ zk^\alpha n^\theta - wn \right\} = ak^{\frac{\alpha}{1-\theta}} = F(z,k); \quad \alpha + \theta < 1 \tag{3}$$

Adjustment Cost structure:

$$\mathcal{AC}(x,k) = \left[\frac{\gamma}{2} \left(\frac{x}{k} \right)^2 + F \cdot \mathbb{I}_{\{x \notin [0, \delta k]\}} \right] k \quad s.t. \quad \gamma > 0,\ F > 0 \tag{4}$$

- Quadratic costs smooth investment
- Nonconvex FC (and resale wedge) drive inaction/maintenance
- Depreciation-maintenance is free

Fixed Opex

- fixed costs of operations: ξ to generate negative profits

Ad Hoc Lender and the External Finance Premium

Net Cashflow position, ω: revenue, expenses, adj costs, net issuance, fixed costs

$$\omega = F(z,k) - P(x) - \mathcal{AC}(x,k) + (1+r)b - b' - \xi \tag{5}$$

Price of capital good features resale wedge (irreversibility)

$$P(x) = P_k \mathbb{I}_{(x>0)} x - P_s \mathbb{I}_{(x<0)} x$$

The (ad hoc) Lender prices perceived risk according to the rule-of-thumb:

$$\lambda^{EXT}(x,k,b,b') = \begin{cases} 0 & \text{\textit{if} } \omega \geq 0 \\ \lambda_1(-\omega) + \lambda_2 \cdot \mathbb{I}_{(b'<0)}(-b') & \text{\textit{if} } \omega < 0 \end{cases} \tag{6}$$

Net profits: $\omega - \lambda$

Borrowing Limits

We assume Lender has deep pockets, will fund any debt up to collateral constraint

$$b' \geq -\psi \frac{(1-\delta)}{1+r} P_s k \tag{7}$$

- ψ is exogeneous haircut (e.g. 0.75)
- residual (scrap) value of assets sets the constraint
- could be income-contingent under worst-case $\{z_t\}$ forever

Bellman Equation and Solution

Recursive problem

$$V(z,k,b) = \max_{x,b'} \Big\{ F(z,k) - P(x) - \mathcal{AC}(x,k) - \lambda^{EXT} + (1+r)b - b' - \xi \\ + \beta E_{z'|z} V(z', x + (1-\delta)k, b') \Big\} \qquad (8)$$

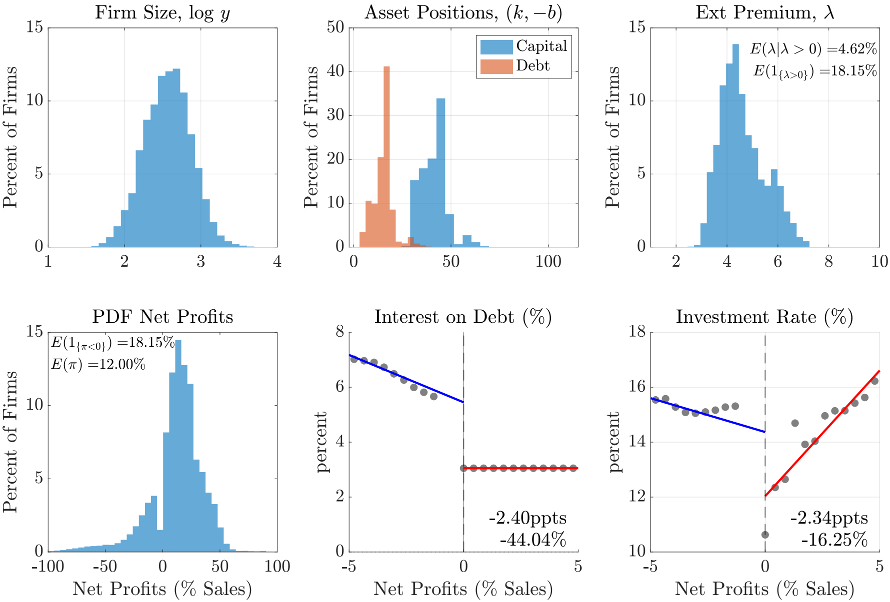
Modes: $\mathcal{A}$djust ($x > \delta k$), $\mathcal{M}$aintain ($x = \delta k$), $\mathcal{I}$naction($x = 0$), $\mathcal{S}$ell ($x < 0$)

Solution

- grid-search VFI feeds initial guess into continuous solver-based methods
- Off-grid points found with Chebyshev interpolation
- Somewhat fractal nature of the kinks in $V, E_{z'|z}[V]$ make this suboptimal
- I dont (yet) know a better way except to rewrite in continuous time

Temporal	discount factor	β	0.9500
	risk-free rate	r	0.0305
Production	capital parameter	α	0.60
	labour parameter	θ	0.15
	depreciation	δ	0.150
	fixed costs	ξ	3
	wage rate	w	0.20
Capital Adjustment	quadratic adjustment cost	γ	0.070
	nonconvex cost	F	0.029
TFP Process	TFP persistence	ρ_a	0.70
	TFP innov sd	σ_a	0.15
External Finance	premium, debt stock	λ_2	0.04
	premium, new issuance	λ_1	0.07
	haircut on collateral	$1-\psi$	0.4
Capital Prices	capital purchase price	P_k	1.2
	capital sale price	P_s	0.7 P_k
	output price (normalisation)	P_y	1

Table 1: Informal Parameterisation of the model



Firm Size, log y
Percent of Firms
Asset Positions, $(k, -b)$
Capital
Debt
Ext Premium, λ
$E(\lambda|\lambda > 0)$ =4.62%
$E(1_{\{\lambda>0\}})$ =18.15%
PDF Net Profits
$E(1_{\{\pi<0\}})$ =18.15%
$E(\pi)$ =12.00%
Net Profits (% Sales)
Interest on Debt (%)
percent
-2.40ppts
-44.04%
Investment Rate (%)
-2.34ppts
-16.25%

Roadmap

Adjust model to fit correct investment item from cashflow statement

On Selective Exits

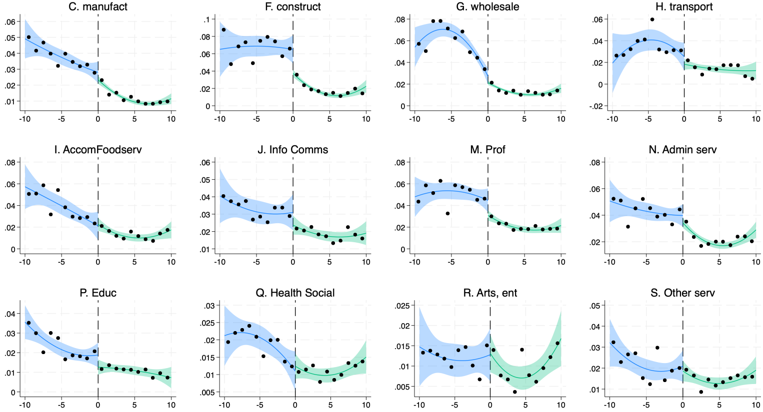


Figure 7: Exit Rates* by Industry (SIC 1-digit letter group)

An exit is defined by "revenue exit": the last year in which I can see revenue before $T = 2019$

Construction is potentially problematic

No hard evidence either way, BUT:

- Somewhat notorious industry fly-by-night types
- Fast turnover of paper/legal entities
- Shutdown at the first sign of trouble, ‘default’ on clients
- I default on my obligations to clients as ‘Walsh Construction Ltd’, close firm, start ‘Walsh Constructors Ltd’, ‘Walsh Bros Ltd’

Theory: manufacturing is very intensive in firm- and location-specific capital

- Manufacturing: high option value, wait-and-see, very negative shutdown point
- Construction: high resale value of assets, easy to liquidate, shutdown point close to zero