Discussion of “Financial Heterogeneity and the Investment Channel of Monetary Policy” by Pablo Ottonello and Tom Winberry

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This paper

1. Presents a new empirical regularity
   - Firms with low leverage respond more to monetary policy shocks than firms with high leverage
2. Shows that this fact is consistent with a New Keynesian model with heterogeneous firms and financial frictions
   - Firms with low leverage are unconstrained and respond strongly through a neoclassical cost-of-capital channel
   - Firms with high leverage have essentially no response and choose to de-leverage instead
   - Contributes to a literature that shows that heterogeneity is important for understanding the m.p. transmission mechanism
     - One of the first to focus on investment
My assessment of the paper

- Potential to become an important paper in this new literature
- Very nice combination of empirics and theory
  - Model is ambitious combination of
    - Bernanke-Gertler-Gilchrist (sticky prices + financial frictions)
    - Khan-Senga-Thomas (het. firms + default, but flexible prices)
  - Nice micro-to-macro approach: matching data and model elasticities
- My discussion:
  1. Review and discuss the empirical findings
  2. Review and discuss the model and intuitions
Empirical finding

- Main specification runs, for Compustat firms over 1990-2007

\[ \Delta \log k_{jt} = \alpha_j + \alpha_{st} + \beta l_{j_{t-1}} \epsilon^m_t + \text{Controls}_{jt} + \epsilon_{jt} \]

where \( \epsilon^m_t \) are monetary innovations identified using HFI

- Find \( \hat{\beta} \approx -0.7 \):
  - 1sd increase in \( l \) (from 26% to 62%) reduces \( \frac{d \log k}{d \epsilon^m} \) from 1.4 to 0.7

- Interpretation of \( \hat{\beta} \)?
  - Does **not** provide 'causal effect' of leverage \( l_{j_{t-1}} \) on sensitivity of investment to mp shocks
  - Lots of reverse causality issues
    - eg firms with high sensitivity to mp might choose not to lever up
  - **Does** provide descriptive evidence of the way in which sensitivity of investment to mp shocks varies in the cross-section of firms with different leverage
Structural interpretation:

- Ex-ante homogeneous firms lever up to grow, putting themselves at risk of default.
- Older firms with low leverage are less at risk, can more freely adjust as their target capital changes.
Structural interpretation

- **Structural interpretation:**
  - Ex-ante homogeneous firms lever up to grow, putting themselves at risk of default
  - Older firms with low leverage are less at risk, can more freely adjust as their target capital changes

1. Are firms really ex-ante homogeneous?
   - Industry is an important cross-sectional driver of leverage (eg Lemmon, Roberts, Zender 2008)
   - If industries with systematically low leverage also are more exposed to mp, challenges structural interpretation
   - **1 digit** sic code fixed effects (eg 'Manufacturing', 'Services') unlikely to be granual enough. Does sample size allow to go beyond?

2. Is there supportive evidence for this life cycle story?
   - Firm age as a predictor of leverage?
An alternative view

- **Alternative view**: firms with high (esp. floating-rate) debt respond *more* because of cash flow effects
  - Seems rejected by data: $\hat{\beta}$ *more negative* when $l \equiv \frac{ST \text{ debt}}{\text{Assets}}$
Alternative view: firms with high (esp. floating-rate) debt respond more because of cash flow effects

- Seems rejected by data: \( \hat{\beta} \) more negative when \( I \equiv \frac{ST}{Assets} \)


\[
\Delta \log k_{jt} = \beta_0 + \beta_1 \epsilon_t^m + \beta \left( \frac{\text{Bank debt}}{\text{Assets}} \right)_{jt-1} \epsilon_t^m + \text{Controls}_{jt} + \epsilon_j 
\]

separately for hedgers and non-hedgers. \( \epsilon_t^m \) also from HFI.

- Find evidence of \( \hat{\beta} > 0 \) for non-hedgers
  - Fairly strong supportive evidence from stock prices, cash holdings, etc
  - Should cite paper and discuss source of differences
    - sample, fixed-effect strategy, etc.
Consider the partial eqbm neoclassical model of investment:

\[ V_t(b, k) = \max \left\{ k^\alpha - (k' - (1 - \delta) k) + \frac{b'}{1 + r_t} - b + \frac{1}{1 + r_t} V_{t+1}(b', k') \right\} \]

where \( b \) is debt, \( k \) is capital.
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where \( b \) is debt, \( k \) is capital. Well-known FOCs:

1. \( V_b = 1 \Rightarrow \) Modigliani-Miller theorem for capital structure
2. \( \alpha k_{t+1}^{\alpha-1} = r_t + \delta \Rightarrow \) investment very sensitive to \( r_t \) changes

\[
\frac{dk_{t+1}}{k} = \frac{-1}{1 - \alpha r + \delta} dr_t
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\[
\frac{di_t}{i} = \frac{-1}{1 - \alpha} \frac{1}{r + \delta} \frac{1}{\delta} dr_t
\]
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\[
\frac{di_{t+1}}{i} = \frac{-1}{0.15} \frac{1}{0.01 + 0.03} \frac{1}{0.03} dr_t
\]
Consider the partial eqbm neoclassical model of investment:

\[
V_t (b, k) = \max \left\{ \begin{array}{c}
  k^\alpha - (k' - (1 - \delta) k) + \frac{b'}{1 + r_t} - b + \frac{1}{1 + r_t} V_{t+1} (b', k') \\
  \text{investment} \\
  \text{debt issuance}
\end{array} \right\}
\]

where \( b \) is debt, \( k \) is capital. Well-known FOCs:

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\[
\frac{di_{t+1}}{i} \approx 5555dr_t
\]

- If mp moves cost of capital by \( dr_t = 25 \text{bps} \) over a quarter
- ... firms adjust their capital stock next period by 41\% (6 \( \rightarrow \) 8.5)
- ... so their investment rises from \( \delta k = 0.18 \) to 2.68, ie 1400\%
General equilibrium considerations

- Flexible prices (RBC, Khan and Thomas etc): makes $dr_t$ tiny
- Sticky prices with flexible investment choice:
  - Aggregate diminishing returns to $K$: lowers $\alpha$
  - **But** endogenous fall in markups $\mu_t \downarrow$ amplifies even more

$$MPK_t = \mu_t (r_t + \delta)$$

**Solution:** add aggregate adjustment costs

$$q_{t+1} = \epsilon dq_t = \epsilon \sum_{s=0}^{\infty} \left(1 + r \right)^s \left\{dMPK_t + s + 1 - dr_t + s\right\}$$

**Semielasticity now can be calibrated to $\epsilon$ (say $\approx 1$)

**Should absolutely be the baseline, not just for robustness

**Partial equilibrium formulas not informative because all the action is in GE endogenous responses of $q_t$ and $\mu_t$ to $r_t$**
General equilibrium considerations

- Flexible prices (RBC, Khan and Thomas etc): makes $dr_t$ tiny
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$$MPK_t = \mu_t (r_t + \delta)$$

- Solution: add aggregate adjustment costs $\Rightarrow q$ theory

$$\frac{di_t}{i} = \epsilon dq_t = \epsilon \sum_{s=0}^{\infty} \left( \frac{1}{1+r} \right)^{s+1} \left\{ dMPK_{t+s+1} - dr_{t+s} \right\}$$

- Semielasticity now can be calibrated to $\epsilon$ (say $\sim 1$)
- Should absolutely be the baseline, not just for robustness
- Partial equilibrium formulas not informative because all the action is in GE endogenous responses of $q_t$ and $\mu_t$ to $r_t$
Adding constrained firms

- Add positive-dividend constraint and convex $C(b)$

$$V_t(b, k) = \max \left\{ D + \frac{1}{1 + r_t} V_{t+1}(b', k') \right\}$$

s.t. $D = k^\alpha - (k' - (1 - \delta) k) + \frac{b'}{1 + r_t} - b + C(b)$

$D \geq 0$

- FOCs now

$$1 + C'(b_t) = \frac{1 + \lambda_t}{1 + \lambda_{t+1}} = \frac{\alpha k_{t+1}^{\alpha-1} + 1 - \delta}{1 + r_t}$$

1. While $\lambda_t > 0$, reduce $b_t$ and increase $k_t$
2. Rearrange $\alpha k_{t+1}^{\alpha-1} = r_t (1 + C'(b_t)) + \delta$
Add back productivity shocks $z_{t+1}$

$$\alpha z_{t+1} k_{t+1}^{\alpha-1} = r_t (1 + C'(b_t)) + \delta$$

**Question**: What special endogenous feature of $C(b, k)$ schedule can jointly explain lack of sensitivity of constrained firms to $r_t$, but high sensitivity to productivity $z_{t+1}$?

**Bond price formulation** $Q_t(b') = b$ shuts down cash flow effects.

- Alternative: $q_t(b') - (1 + r_{t-1}) b$

**General equilibrium intuition for het firm model $\simeq$ rep firm model** relies on flexible prices.

- Expect larger differences, the stickier prices are
Wrapping up and suggestions

- Ambitious project on an important topic! My suggestions:
  - Empirics: tidy up and compare with existing literature
    - Can you back up your structural interpretation? Can you convincingly rule out the cash flow channel?
  - Model: make $q$ theory the baseline, drop formulas for one-period shocks and focus on precise explanation of the key mechanism using combination of FOCs and counterfactuals
  - Make empirics-model connection even tighter by matching model and data elasticities