What is the Role of Firm Balance Sheets in Economic Fluctuations?

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Michigan & NBER

Advancing Macro Finance Workshop,
University of Chicago, October 8th, 2021

Introduction

What is the role of firm balance sheets in economic fluctuations?

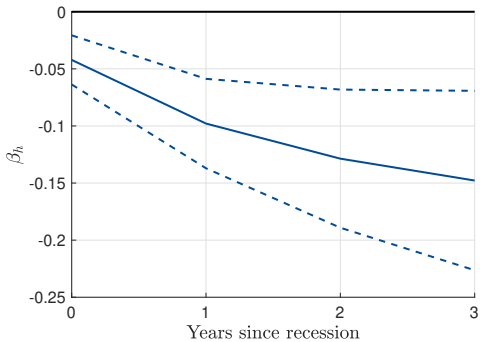
1. Pioneer theories: link between firms' net worth, external financing costs, and investment
   (Bernanke Gertler 1989, Kiyotaki Moore 1997)

2. Quantitatively: powerful channel amplifying effects of aggregate shocks and policies
   (Bernanke Gertler Gilchrist 1999, Jerman Quadrini 2012, Christiano Eichenbaum Trabandt 2014)

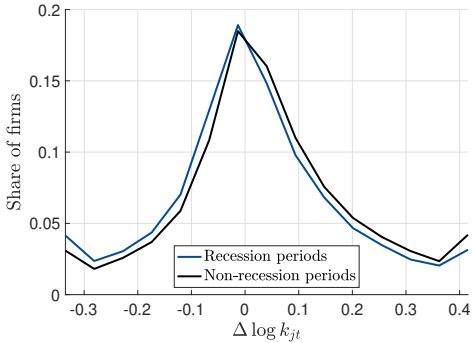
3. More recently: "**micro-to-macro**" approach
   - studies how different firms respond to aggregate shocks in micro data
   - combine data and models to analyze aggregate implications

Motivation: Firms' Investment During U.S. Recessions

Average investment dynamics



Distribution of investment rates across firms



$$\log k_{jt+h} - \log k_{jt-1} = \alpha_{jh} + \beta_h \text{recession}_t + e_{jt}$$

Data source: Compustat

Outline

1. **Theoretical framework**

   Discuss key mechanisms in exiting models in the literature through which aggregate shock affect firms with different financial positions

2. **Empirical evidence**

   Discuss existing evidence linking firms' financial positions and their responses to aggregate shocks through the lens of the model

3. **From micro evidence to macro implications**
   - Positive analysis
   - Normative analysis

Theoretical Framework

Environment

- No uncertainty, focus on firms' decisions for given path of prices
- Firms' objective:

$$\max \sum_{r=0}^{\infty} m_{t,t+r} div_{jt+r}$$

- Technology:

$$y_{jt} = A_t z_{jt} k_{jt}^{\alpha}$$

- Competitive markets, sells output at price p_t, purchases capital at price q_t

Financial Frictions

- Firms have access to equity and debt finance, both subject to frictions
- Flow-of-funds constraint:

$$q_t k_{jt+1} = \underbrace{n_{jt}}_{\text{net worth}} \underbrace{-div_{jt}(1 - \mathbb{I}_{\{div_{jt}<0\}}\mathcal{C}_t(div_{jt}, k_{jt+1}, \{z_{jt}\}))}_{\text{equity financing}} + \underbrace{\mathcal{Q}_t(d_{jt+1}, k_{jt+1}, \{z_{jt}\})d_{jt+1}}_{\text{debt financing}}$$

where $n_{jt} \equiv p_t y_{jt} + q_t(1-\delta)k_{jt} - d_{jt}$

$\mathcal{C}_t(.)$: cost of raising equity

$\mathcal{Q}_t(.)$: debt price schedule

Financial Frictions

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- $\{\mathcal{C}_t(.), \mathcal{Q}_t(.)\}$: govern **marginal cost of external finance**, nesting detailed financing frictions:
  - **Costly equity financing**
    (Myers Majluf 1984, Gomes 2001, Cooley Quadrini 2001, Hennessy Whited 2007, Jerman Quadrini 2012, Begenau Salomao 2018)
  - Collateral constraints
  - Default risk
  - Covenants, earnings-based constraints

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  - Default risk
  - **Covenants, earnings-based constraints**
    (Chodorow-Reich Falato 2020, Lian Ma 2021, Greenwald 2019, Drechsel 2021)

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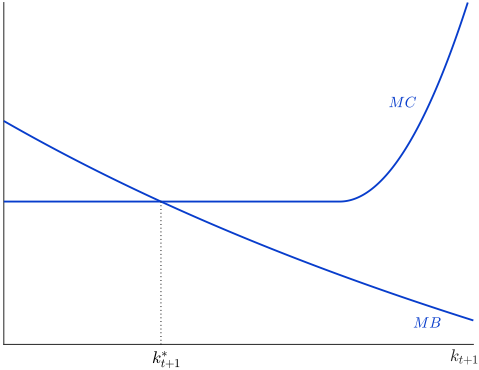
- $\{\mathcal{C}_t(.), \mathcal{Q}_t(.)\}$: govern **marginal cost of external finance**, nesting detailed financing frictions
- Parameterize with $\mathcal{C}_t(.) = \phi_t x_{jt}^{\eta_t}$ with $\phi_t > 0$, $\eta_t > 1$, $d_{jt+1} \leq \overline{d}_t$

Firms' Differential Response to Aggregate Shocks

- Consider unanticipated expansionary aggregate shock to either
  - Productivity A_t
  - Other exogenous variables (e.g., monetary policy shocks or financial shocks), which affect $\mathcal{P}_t \equiv [p_t, q_t, m_{t,t+1}]$
- Discuss channels through which shock affect firms with different financial positions in MC/MB diagram, as in Ottonello and Winberry (2020)

Firms' Optimal Investment

(a) Unconstrained Firms



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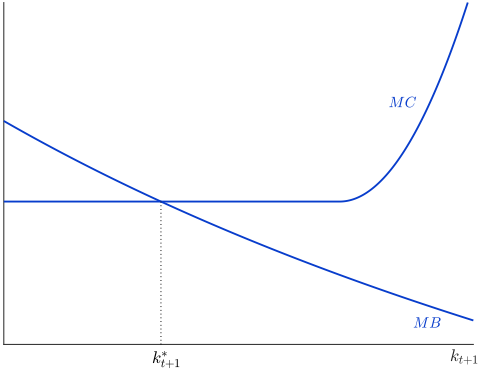
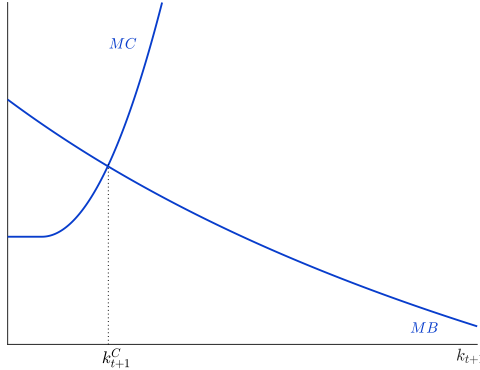


(b) Constrained Firms



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Firms' Differential Response: Shift in MB curve

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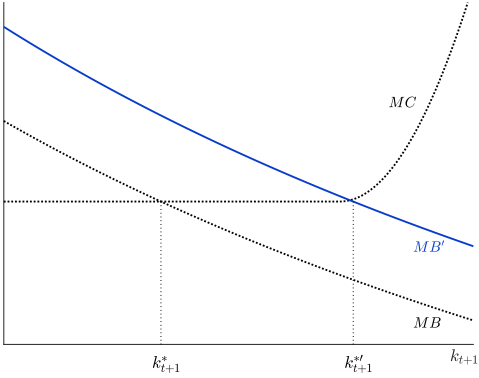

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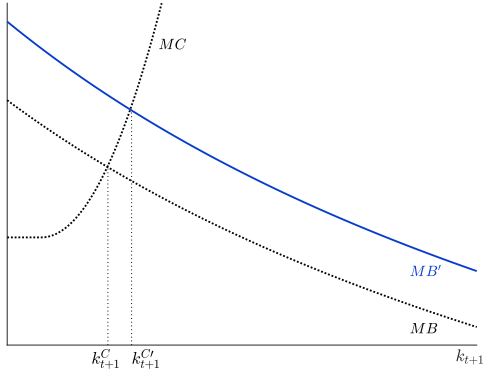

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Firms' Differential Response: Shift in MC curve – Price of Capital

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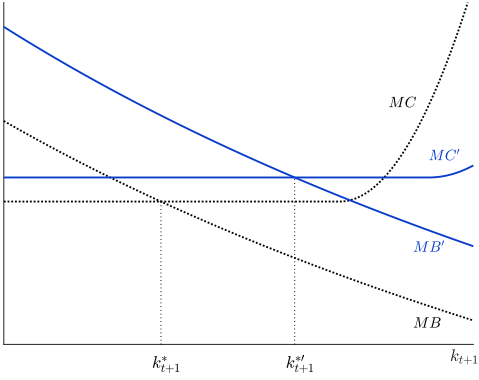
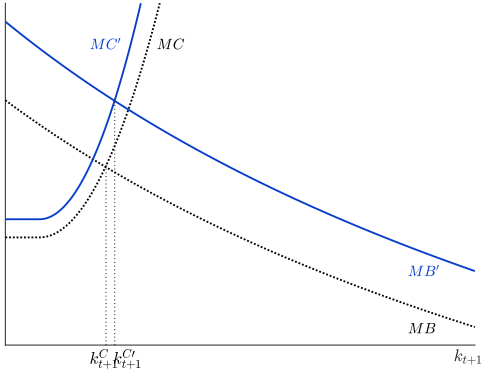


(b) Constrained Firms



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Firms' Differential Response: Shift in MC curve – Cash Flows

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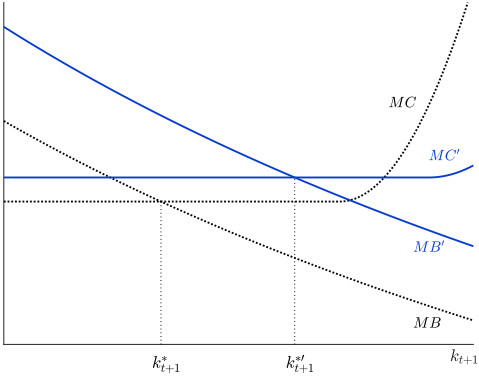

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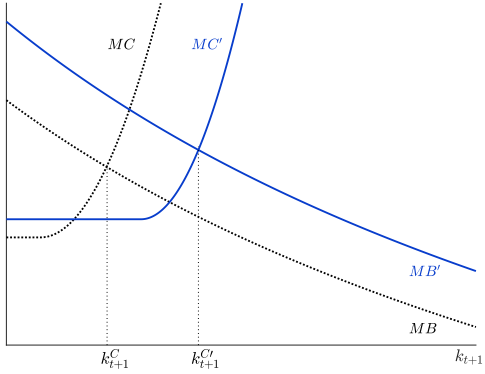

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Firms' Differential Response: Shift in MC curve – Financing Cost

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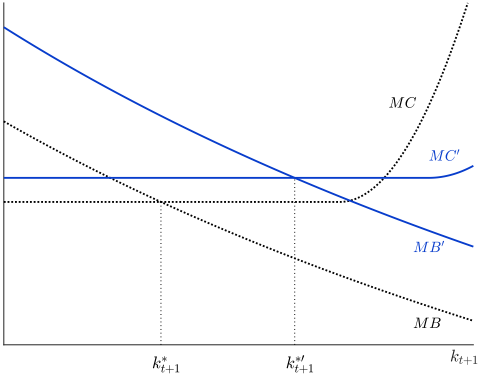

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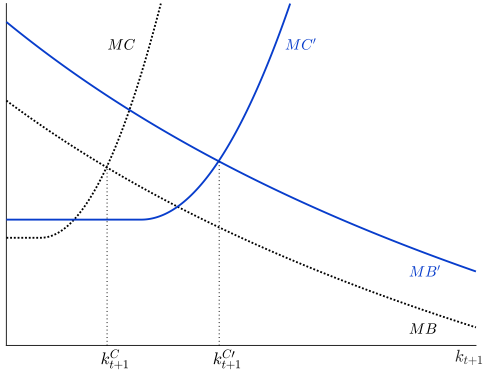

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Theoretical Framework: Main Takeaways

1. Which firms are more responsive
   - is an empirical question:
     - Constrained firms face steeper MC curves, which dampens their responses
     - Constrained firms exhibit additional shifts in MC curves, which amplifies their responses
   - depends on the aggregate shock considered

2. Heterogeneity in firms' responses can be used to inform about degree of financial frictions: steepness and responsiveness of MC curve in financial-frictions models

Empirical Evidence

Firms' Differential Responses by Size and Age

- **Small firms** tend to exhibit larger responsiveness to aggregate shock
  - Gertler and Gilchrist (1994): monetary policy shocks
  - Chodorow-Reich (2014), Duygan-Bump, et al. (2015): financial crises
  - Crouzet and Mehrotra (2020): cyclicality
- **Young firms** tend to exhibit larger responsiveness to aggregate shock
  - Cloyne et al. (2018): monetary policy shocks
- Financial-frictions interpretation: small/young firms face a steeper MC curve than large/old firms, but small/young firms' MC curve are more sensitive to aggregate shocks

Firms' Differential Responses by Size and Age

- **Small/young firms** tend to exhibit larger responsiveness to aggregate shock
- Alternative interpretation:
  - Small/young firms' MB curves are more sensitive to aggregate shocks
  - For size, Crouzet and Mehrotra (2020) argue that size effects are not driven by financial covariates
  - An illustration for age:

Age quartile			
1	2	3	4
Uber Technologies	Plains GP Holdings	Dell Technologies	McKesson Corp.
Howmet Aerospace	NBC Universal	Costco	CVS Health
Carrier Global	T-Mobile	**Alphabet**	**Apple**
Dow Inc.	**Facebook**	AmerisourceBergen	Berkshire Hathaway
Albertsons	Phillips 66	**Amazon**	Walmart

Data source: Compustat, Datastream

Firms' Differential Responses by Balance-Sheet Components

- Advantages of balance-sheet based measures
  - Easier to link to a particular mechanism in existing models (e.g., debt and default risk)
  - Exhibit substantial within-firm variation
- Limitations of balance-sheet based measures
  - Data availability, especially to extract permanent differences across firms
  - Multidimensionality of balance sheet, e.g.,:
    - Leverage
    - Liquidity (Jeenas 2020)
    - Credit lines (Greenwald Krainer Paul 2021)

Firms' Differential Responses by Leverage and Default Risk

- Firms with higher leverage and lower distance to default tend to be **less responsive** to monetary policy shocks (Ottonello Winberry 2020)
  - Financial-frictions interpretation: default risk leads to steeper MC curve
  - Interpretation based on MB curve has to account for within firm results

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  - Financial-frictions interpretation: default risk leads to steeper MC curve
  - Interpretation based on MB curve has to account for within firm results
- Firms with higher leverage and lower distance to default tend to be **more responsive**:
  - to financial shocks (Ottonello Song 2021)
  - to monetary policy shock in the post-Great Recession period (Lakdawala Moreland 2021, Caglio Darst Kalemli-Ozcan 2021):

Empirical Evidence: Main Takeaways

1. Evidence shows substantial heterogeneity in firms' responses to aggregate shocks
   - Can be used to inform steepness and responsiveness of MC curve
2. Differences in severity of financial frictions are not easy to isolate
   - Effects of confounders (e.g., permanent differences across firms)
   - Multidimensionality of balance sheet
3. **Models** are critical to interpret empirical findings
   - Evidence is ultimately descriptive (due to endogeneity of financial positions)
   - Firms' heterogeneous responses vary depending on the aggregate shock

From Micro Evidence to Macro Implications

From Micro Evidence to Macro Implications

- Models consistent with microlevel evidence show that firms' financing frictions **amplify effects** of aggregate shocks and policies
  - E.g.: Khan and Thomas 2013, Arellano Bai Kehoe 2019, Ottonello Winberry 2020, ...

From Micro Evidence to Macro Implications

- Models consistent with microlevel evidence show that firms' financing frictions **amplify effects** of aggregate shocks and policies
- Remarks:
  1. Positive side: **quantitative** conclusions significantly depend on model elements that are hard to measure
     - sensitivity of capital prices to shocks, share of unconstrained firms, decreasing returns (e.g., Guo 2021)

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     Complementary approaches that would help inform macro implications:
     - Direct estimation of regional / GE effects (Huber 2018)
     - Semi-structural methods (Wolf 2020, Guren McKay Naramura Steinsson 2020)

From Micro Evidence to Macro Implications

- Models consistent with microlevel evidence show that firms' financing frictions **amplify effects** of aggregate shocks and policies
- Remarks:
  2. **Normative side**:
     - Financial amplification is not sufficient for borrowing inefficiencies (Davila Korinek 2017)
     - Inefficiencies critically depend on specific form of debt contracts (Ottonello Perez Varraso 2021)

       _Inefficient when contracts involve **current prices**: $d_{t+1} \leq \theta_t q_t k_{t+1}$ (Bianchi Mendoza 2018)

       _Efficient when contracts involve **future prices**: $d_{t+1} \leq \theta_t q_{t+1} k_{t+1}$ (Kiyotaki Moore 1997)
     - Both type of models lead to similar macro dynamics
     - Micro-evidence on the form of debt contracts is essential ingredient for policy design (e.g., Chodorow-Reich Falato 2020, Lian Ma 2021, Greenwald 2019, Drechsel 2021)

Conclusions

- Firms balance sheets appear at the center of economic fluctuations
- Evidence shows substantial heterogeneity in the response of firms with different financial positions to aggregate shocks
- Quantitative models are necessary to interpret empirical findings, but not sufficient to assess GE effects and policies
- Additional measurement would help models by answering:
  - what are the GE effects of changes in firms' financial positions
  - how prices affect debt contracts