Corporate Leverage and Monetary Policy Effectiveness in the Euro Area

Simone Auer, Marco Bernardini & Martina Cecioni
Banca d'Italia

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The effectiveness of monetary policy in a low interest rate environment

The views expressed in this presentation are those of the authors and do not necessarily reflect the position of the Bank of Italy or the Eurosystem

Motivation

- Corporate leverage is key for the transmission of monetary policy to the real economy
- At the **aggregate** level leverage amplifies the real effects of monetary policy through the financial accelerator mechanism (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997):
- At the **disaggregated** level which firms are more responsive to monetary policy is theoretically more ambiguous
  - highly leveraged firms, being more financially constrained, are in principle less reactive ...
  - ... but they are more exposed to the financial accelerator mechanism

This paper

- **What we do**: Empirical investigation of the relation between corporate leverage and output sensitivity to monetary policy shocks in the euro area
- **How**: State-of-the-art empirical macro approach
  - disaggregated euro-area panel data at country-industry level
  - high-frequency identified monetary policy shocks
  - *polynomial state-dependent* local projections
- **Preview of the results**: Evidence of a **non-linear relation**
  - **concave**: more leveraged industries adjust their production more strongly, but at sufficiently high leverage ratios this positive relation tends to weaken
  - **eventually non-monotonic**: the most leveraged industries do not necessarily display the strongest sensitivity, especially within the **short-term horizon** and in **recessions**

Theoretical insights on the relation between leverage and output sensitivity

- **Positive** (Bernanke et al., 1999)
  - **more leveraged** firms display an **excess sensitivity** to shocks, because they benefit more from the financial accelerator mechanism
- **Potentially non-linear** (Ottonello and Winberry, 2020)
  - **low leveraged** firms, being unconstrained, are **the least responsive** to monetary policy
  - **high leveraged** firms, being more risky, are **not the most responsive**, as the accelerator effect is attenuated by the presence of tighter financial frictions intuition
- **Dynamic** (Jeenas, 2019)
  - in the longer-term horizon **high leveraged** firms unambiguously benefit from the financial accelerator mechanism and are **the most sensitive** to monetary policy

Mixed empirical results

- Ottonello and Winberry (2020): US listed firms with low default risks, that is with **low leverage** and high credit ratings, are the **most responsive** to monetary policy shocks
- Cloyne et al. (2019) in US and UK, younger no-dividend payer firms that on average have **lower leverage** are **more responsive**.
- Jeenas (2019): US firms with **higher leverage** or with fewer liquid assets holdings become significantly **more responsive** to the shock after around 1 year
- Anderson and Cesa-Bianchi (2020): the effects of monetary policy surprises on borrowing costs, debt and investments are **larger** for US firms with **high leverage**.
- **Our contribution**:
  - euro-area data which include non-listed firms
  - relax the assumption of a linear relation between leverage and output sensitivity using *polynomial state-dependent* local projections

Plan of the talk

1. Data and methodology
2. Are more leveraged industries more sensitive to monetary policy?
3. State of the economy and sign of the monetary policy shocks
4. Wrapping up

Data and methodology

Data

- Three dimensions:
  1. **country**: 7 euro area countries (AT, BE, DE, ES, FR, IT, PT)
  2. **industry**: 22 manufacturing industries (NACE two-digits)
  3. **time**: monthly frequency in 2001-18

- Three main variables: Summary stats
  1. **Response variable**: industrial production (EUROSTAT)
  2. **Monetary policy shock**: high-frequency ECB shocks from Jarociński and Karadi (2018) (poor-man shocks) shocks
  3. **State variable**: leverage as ratio of total liabilities to total assets at book value and at the end-of-year (BACH)

Polynomial state-dependent local projections

- Jordá's (2005) local projections

$$\tilde{y}_{c,s,t+h} = \sum_{j=0}^{k} \ell^{j}_{c,s,t-12} \left[\alpha^{(h)}_j + \beta^{(h)}_j \varepsilon_t + \Theta^{(h)}_j (L) X_{c,s,t}\right] + \\ + \alpha^{(h)}_c + \alpha^{(h)}_s + \alpha^{(h)}_t + u^{(h)}_{c,s,t+h}$$

for $h = 0, \dots, H$

- if $k = 0$, *linear* panel LP
- if $k > 0$, *state-dependent* panel LP. Our baseline: $k = 2$

Polynomial state-dependent local projections

$$\begin{aligned}\tilde{y}_{c,s,t+h} = \alpha_0^{(h)} + \beta_0^{(h)}\varepsilon_t + \\ + \ell_{c,s,t-12}\left[\alpha_1^{(h)} + \beta_1^{(h)}\varepsilon_t\right] + \\ + \ell_{c,s,t-12}^2\left[\alpha_2^{(h)} + \beta_2^{(h)}\varepsilon_t\right] + \\ + \alpha_c^{(h)} + \alpha_s^{(h)} + \alpha_t^{(h)} + \text{controls} + u_{c,s,t+h}^{(h)}\end{aligned}$$

- $\boldsymbol{\beta_0^{(h)}}$ measures the **cumulative response** of industrial production at horizon $t+h$ to an expansionary shock hitting at time t
- $\boldsymbol{\beta_1^{(h)}}$ measures **if the excess sensitivity to monetary policy is positive/negative** when corporate leverage is higher
- $\boldsymbol{\beta_2^{(h)}}$ measures **if such excess sensitivity strengthens/weakens/remains constant** as leverage increases

Polynomial state-dependent local projections

$$
\begin{aligned}
\tilde{y}_{c,s,t+h} = {} & \alpha_0^{(h)} + \beta_0^{(h)} \varepsilon_t + \\
& + \ell_{c,s,t-12} \left[\alpha_1^{(h)} + \beta_1^{(h)} \varepsilon_t \right] + \\
& + \ell^2_{c,s,t-12} \left[\alpha_2^{(h)} + \beta_2^{(h)} \varepsilon_t \right] + \\
& + \alpha_c^{(h)} + \alpha_s^{(h)} + \alpha_t^{(h)} + \text{controls} + u^{(h)}_{c,s,t+h}
\end{aligned}
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- $\beta_{\mathbf{0}}^{(\mathbf{h})}$ measures the **cumulative response** of industrial production at horizon $t+h$ to an expansionary shock hitting at time t
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\end{aligned}
$$

- Country, industry and time fixed effect ($\alpha_c^{(h)}$, $\alpha_s^{(h)}$, and $\alpha_t^{(h)}$)
- $\alpha_0^{(h)}$ and $\beta_0^{(h)}$ are absorbed by the fixed effects

Measuring the relation

- **Level effect (sensitivity)**: cumulative response of industrial production to monetary policy shocks as a function of leverage

$$\psi^{(h)}[\ell] = \beta_0^{(h)} + \beta_{\mathbf{1}}^{(\mathbf{h})}\ell + \beta_{\mathbf{2}}^{(\mathbf{h})}\ell^2$$

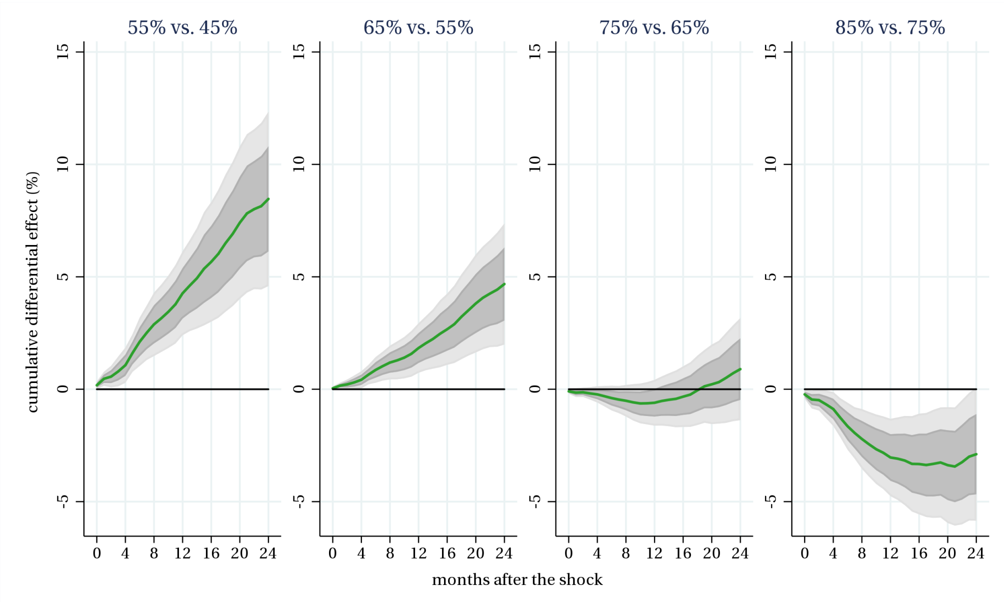
$\psi^{(h)}[\ell]$ is estimated up to an unidentified constant $\beta_0^{(h)}$

- **Differential effect (excess sensitivity)**: differential cumulative response associated with a 10 pp difference in leverage

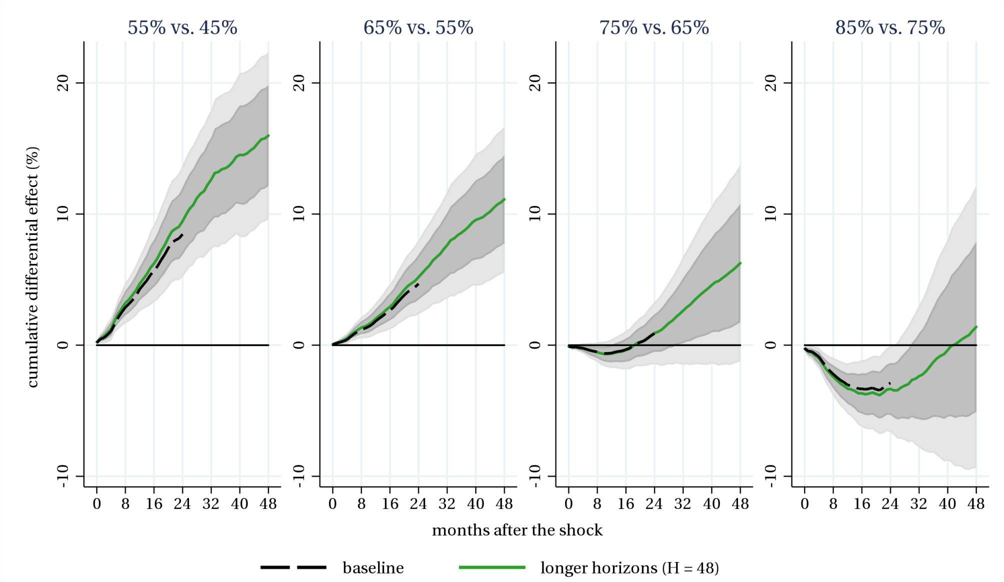
$$\tilde{\psi}^{(h)}[\ell] = \psi^{(h)}[\ell + 10] - \psi^{(h)}[\ell] = \beta_{\mathbf{1}}^{(\mathbf{h})}10 + \beta_{\mathbf{2}}^{(\mathbf{h})}\left(10^2 + 20\ell\right)$$

Are more leveraged industries more sensitive to monetary policy?

Evidence of a negative differential effect at sufficiently high leverage ratios. . .



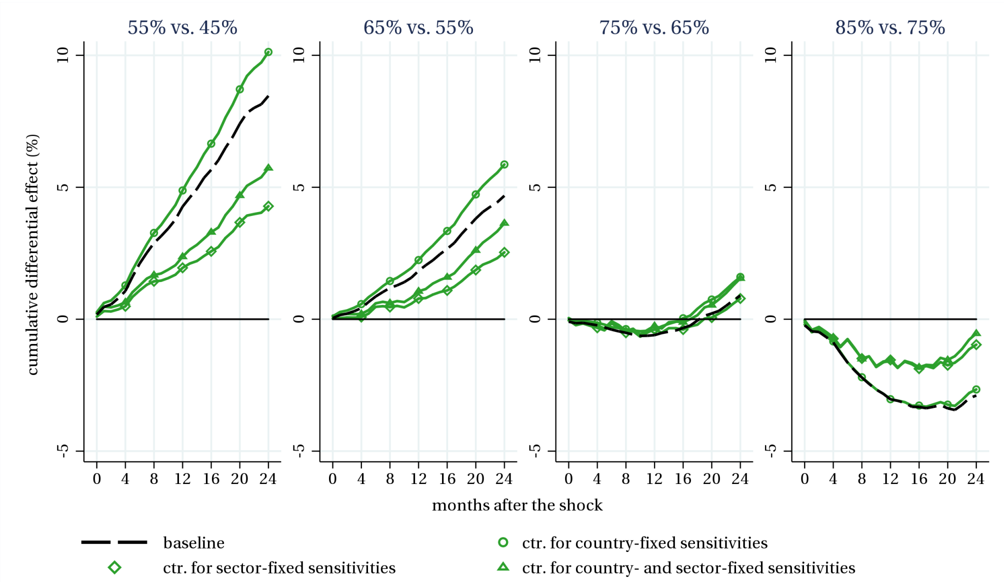
...that fades at longer horizons



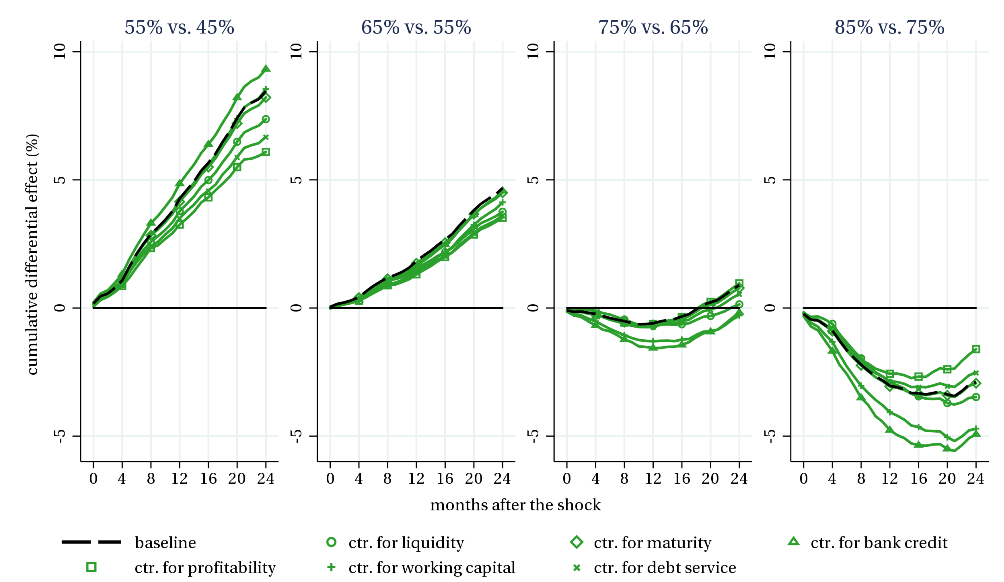
Is it leverage or other factors?

- Results may be driven by **group-specific factors** unrelated to financial frictions but correlated with leverage (e.g. heterogeneous demand elasticities, fiscal reaction function) ...
- ... or **other corporate balance sheet indicators** (e.g.liquidity, bank credit)
- Estimate the model augmented with the **monetary policy shock interacted with a set of country and industry dummies** and **with other balance sheet indicators**.
- The exercises might absorb valuable information also linked to financial frictions, but the analyzed **relation does not change meaningfully**

Group-fixed characteristics



Balance sheet characteristics



Robustness

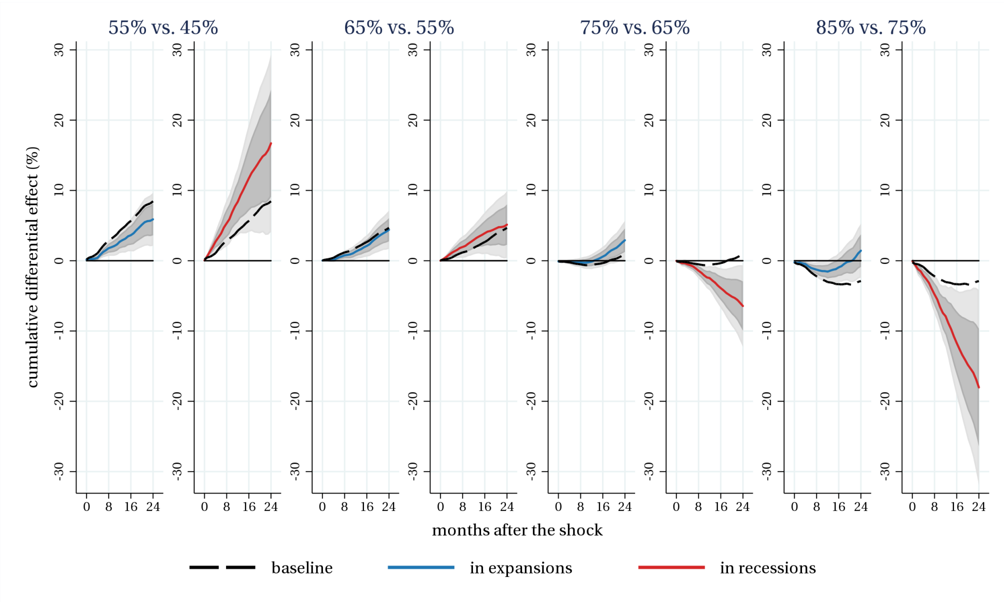
- **shocks**
  - daily frequency
  - sign restrictions to control for information shocks
- smaller **samples**
  - fully-balanced
  - ending in 2011 or 2014
  - remove one country or one sector at a time
- **measures of leverage**
  - narrower (loans & debt securities as a ratio of net assets)
  - structural (median leverage ratio over time)
- **approaches to assess the non-linear relationship**
  - threshold approach
  - two-step approach

State of the economy and sign of the monetary policy shocks

Good and bad times

- In **bad times** highly leveraged companies are likely to
  - be perceived as **more risky** (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997)
  - feel a **need to repair** their balance sheets (Myers, 1977; Occhino and Pescatori, 2015)
- Allow our baseline model to differ in good and in bad times model
  - We employ a **discrete indicator** $I_{c,s,t}$ which takes value one when an industry is in recession and zero otherwise
  - An industry recession is defined as a **negative year-on-year growth** in the industrial production index $y_{c,s,t}$ for at least **six consecutive months**

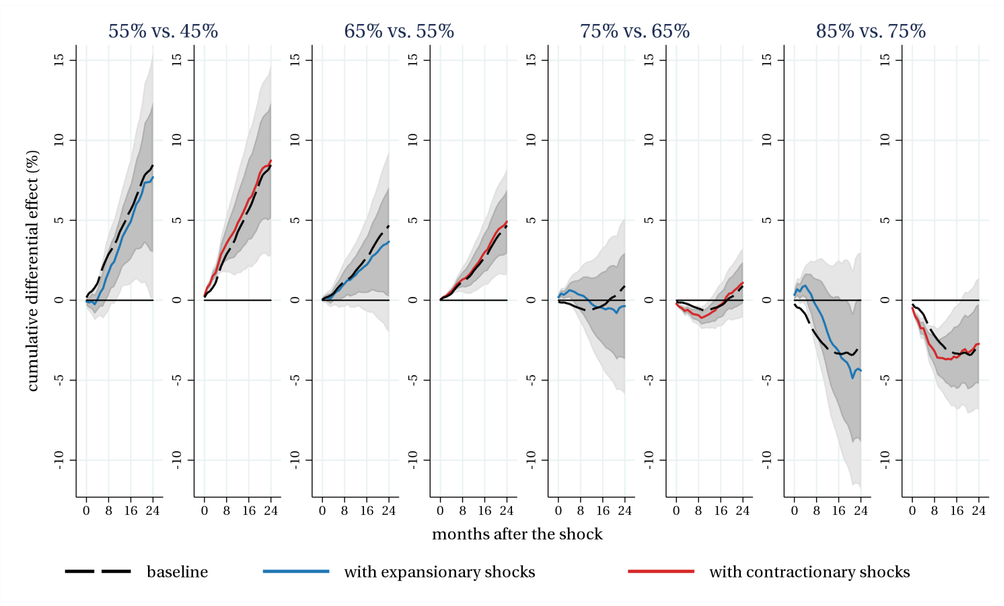
Evidence of attenuation effect at high leverage stronger in bad times



Under expansionary and contractionary shocks

- In theory the attenuation effect at high leverage ratios does not necessarily depend on the **sign of the shock**
- However for particular shapes of the capital supply curve it could be **more likely that the attenuation effect is more intense under expansionary shocks**
- Additional analysis separating the effects of expansionary and contractionary shocks

No evidence of a more pronounced attenuation effect after expansionary shocks



Wrapping up

Conclusions

- The relation between output sensitivity to monetary policy and corporate leverage is
  - **Concave**: excess sensitivity is smaller at high leverage ratios
  - **Eventually non-monotonic**: highly leveraged firms are not necessarily the most responsive to monetary policy shocks (especially within the short-term horizon and in recessions)
- **Take-home message**: More leverage does not always imply a greater sensitivity of output to monetary policy, as the amplification effect generally associated with the balance sheet channel is attenuated when leverage is likely to be excessive.

THANK YOU!

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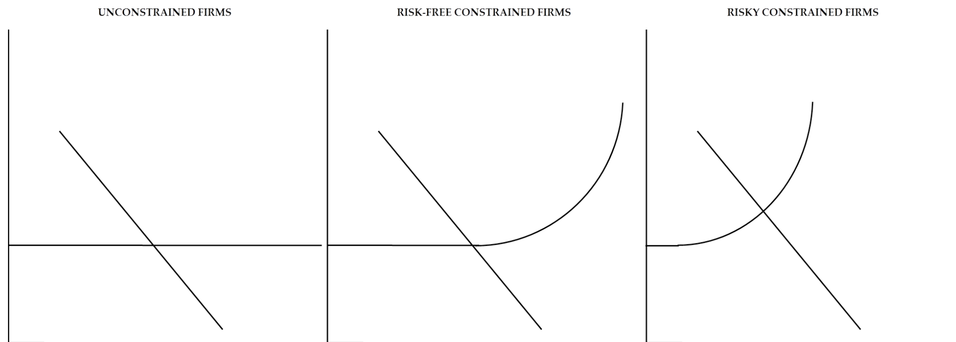
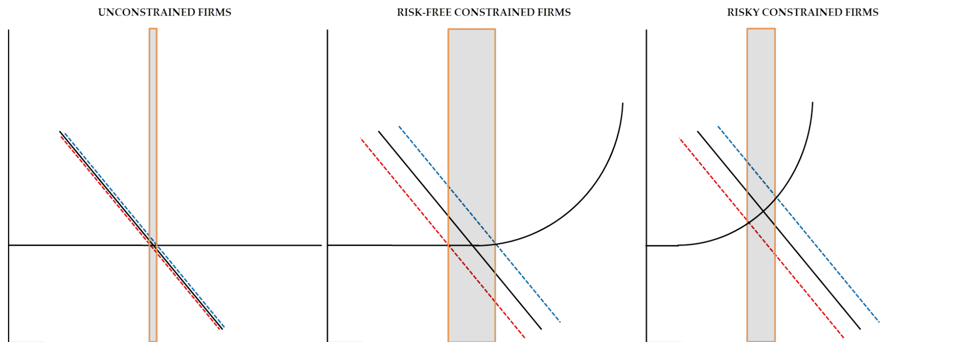
Ottonello and Winberry (2018) back



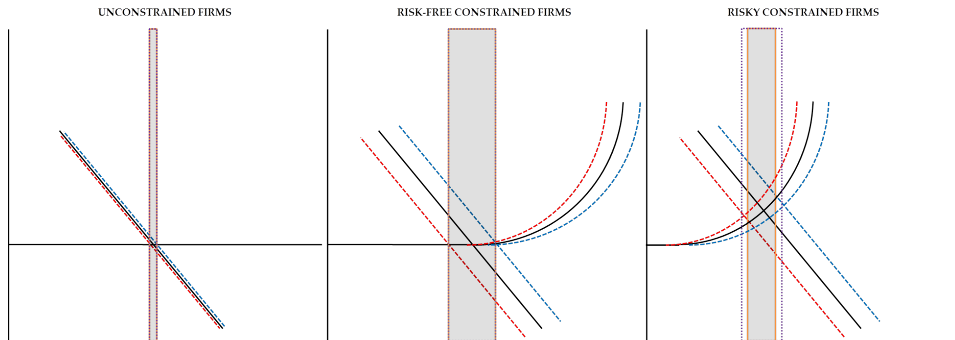
- a firm produces up to the point at which MC = MB
- the MB curve is *downward sloping*, reflecting diminishing returns of capital
- the MC curve is *flat* when risk premia are zero and becomes *upward sloping* when risk premia start to increase (debt capacity shrinks)

Ottonello and Winberry (2018) back



- assume that a monetary policy shock induces only a shift in the MB curve
- constrained firms *react more* than unconstrained firms because the monetary policy shock induces a greater shift in the MB curve
- risky constrained firms *react less* than risk-free constrained firms because they face an upward-sloping and steeper MC curve (dampening effect)

Ottonello and Winberry (2018) back



- a monetary policy shock, however, also induces a shift in the MC curve
- the shift in the MC curve induces a larger reaction of risky constrained firms and increases aggregate volatility (**accelerator effect**)
- risky constrained firms are more (less) responsive than risk-free constrained firms if the shift in MC curve is (is not) large enough to compensate for its upward slope

ECB monetary policy shocks back

Summary statistics back

variable	description	obs	mean	median	sd	1st pct	99th pct
$\Delta_1 \ln y_{c,s,t}$	production growth (%, mom)	27,279	-0.03	0.00	6.55	-16.59	15.95
ε_t	intraday shocks (sd)	27,279	-0.10	0.00	1.00	-4.81	2.97
$\ell_{c,s,t-1}$	leverage (%)	27,279	63.15	63.20	9.49	40.85	87.86
$I_{c,s,t-1}$	recession (dummy)	27,279	0.29	0.00	0.46	0.00	1.00

- **time**: 179 months (i.e., excluding lags and leads, 2002m2-2016m12)
- **industries**: 22 two-digit manufacturing industries
- **countries**: 7 EA countries (IT, DE, FR, ES, PT, BE, AT)

The model in good and bad times

back

$$
\begin{aligned}
\tilde{y}_{c,s,t+h} =& (1 - I_{c,s,t-1}) \sum_{j=0}^{2} \ell^{j}_{c,s,t-1} \left[\alpha^{(h)}_{Ej} + \beta^{(h)}_{Ej} \varepsilon_t + \Theta^{(h)}_{Ej}(L) X_{c,s,t} \right] + \\
& + I_{c,s,t-1} \sum_{j=0}^{2} \ell^{j}_{c,s,t-1} \left[\alpha^{(h)}_{Rj} + \beta^{(h)}_{Rj} \varepsilon_t + \Theta^{(h)}_{Rj}(L) X_{c,s,t} \right] + \\
& + \alpha^{(h)}_{c} + \alpha^{(h)}_{s} + \alpha^{(h)}_{t} + u^{(h)}_{c,s,t+h}
\end{aligned} \tag{1}
$$

for $h = 0, \ldots, H$