Dynamic Credit Constraints: Theory and Evidence from Credit Lines

Niklas Amberg
Sveriges Riksbank

Tor Jacobson
Sveriges Riksbank

Vincenzo Quadrini
Uni. of Southern California

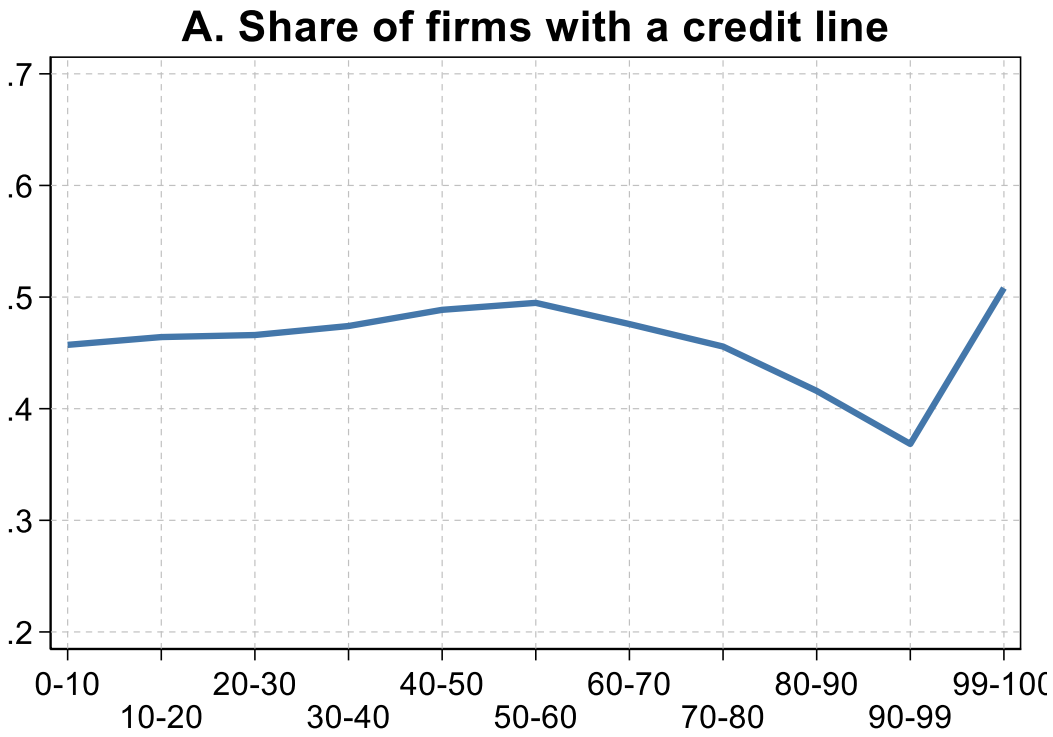
Anna Rogantini Picco
Sveriges Riksbank

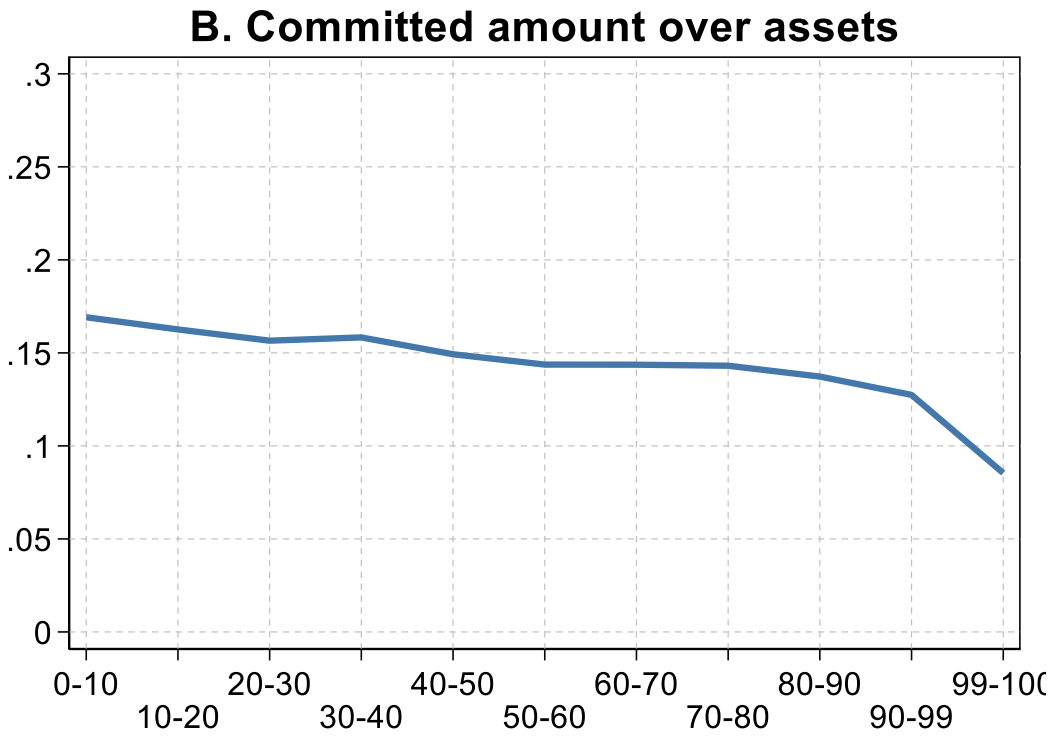
Fourth Conference on Financial Stability

Banco de España and CEMFI – June 30, 2023

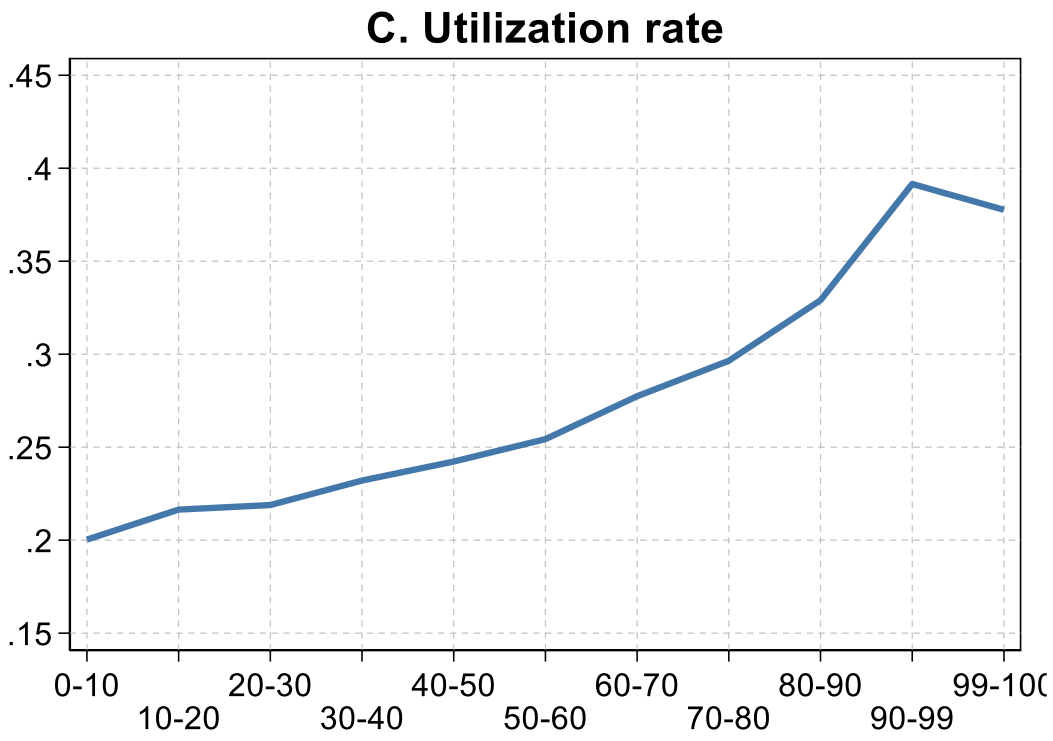
Stylized facts about firms' access to and use of credit lines

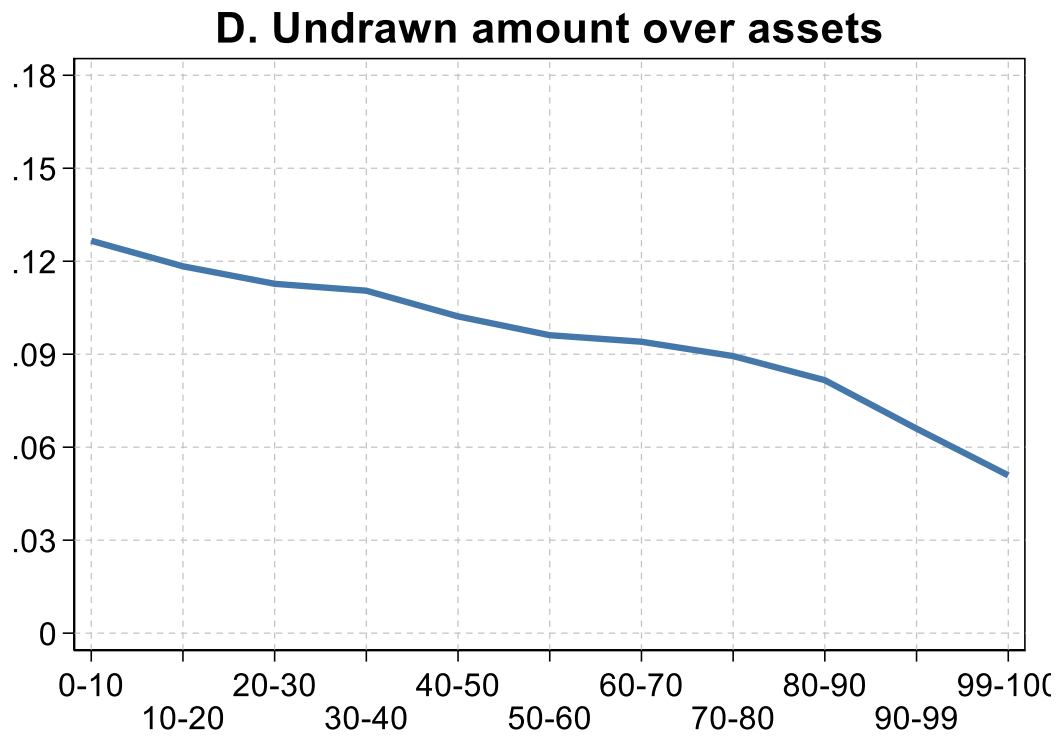
1. Credit lines are widespread and sizable



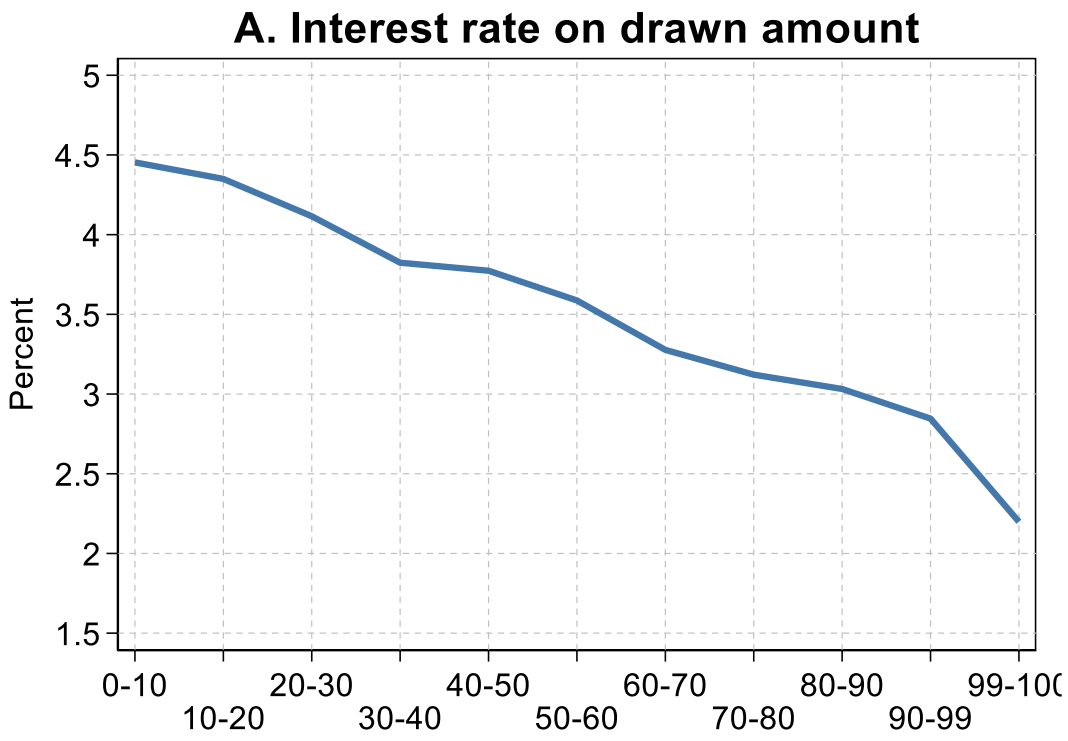


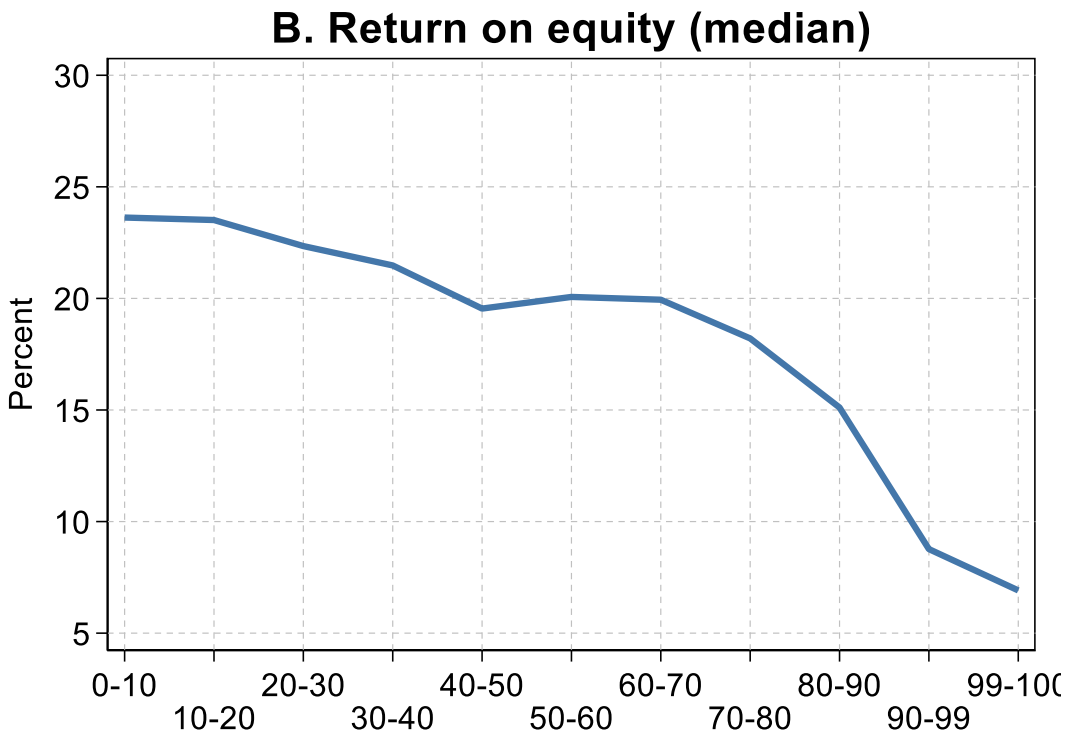
2. Credit-line utilization rates are low, especially among SMEs





3. Credit lines are not prohibitively expensive





Robustness and alternative measures

What do we learn?

1. Firms throughout the size distribution have access to fairly large and reasonably priced unused borrowing capacity via credit lines
2. SMEs hold more unused credit-line borrowing capacity than large firms (relative to assets)

Credit constraints

Common view: Credit constraints are widespread in the corporate sector, and small and young firms are the most constrained

- Among *many* others: Bernanke (1983), Gertler and Gilchrist (1994), Campello et al. (2010), Banerjee and Duflo (2014), and Besley et al. (2020)

Credit constraints typically captured by the Lagrange multiplier on the borrowing constraint or by the marginal cost of borrowing. But here:

i. Firms are generally far from their borrowing limits → Lagrange multiplier is zero

ii. The marginal cost of borrowing is not particularly high

Are credit constraints really that widespread?

- Yes they are! But firms are dynamically constrained, not statically constrained

A parsimonious model of dynamic credit constraints

Model overview

A firm produces output using labor. The firm faces:

- A collateral constraint: can borrow up to a fraction (ξ) of its expected next-period cash flow
- Uncertainty about next-period productivity (z) and access to external finance (ξ)
- Costly financial distress: must raise costly emergency funds if chosen debt turns out to be too high

These features generate an intertemporal trade-off for the firm

- Benefits of higher borrowing today versus risk of becoming illiquid tomorrow
- The firm may choose to stay below the borrowing limit for precautionary reasons

The model allows us to distinguish two concepts of credit constraints:

- Static: Lagrange multiplier on borrowing constraint or current marginal cost of borrowing
- Dynamic: Expected marginal cost of borrowing = Current marginal cost + marginal expected distress cost

Low credit-line utilization in the model is an indication of tight dynamic constraints!

Production technology

The firm's production technology is

$$Y_t = z_t N_t$$

where

- z_t is an idiosyncratic productivity shock
- N_t is employment

Hiring is subject to an adjustment cost, $\Upsilon(N_{t+1}/N_t)$, which is strictly increasing and convex

Key elements in the firm's borrowing decision

1. Firm chooses next period debt B_{t+1} subject to the collateral constraint

$$B_{t+1} \leq \bar{\xi}_{t+1} \bar{z}_{t+1} N_{t+1}$$

2. In the next period, ξ_{t+1} and z_{t+1} are realized and the firm ends up insufficiently collateralized if

$$B_{t+1} > \xi_{t+1} z_{t+1} N_{t+1}$$

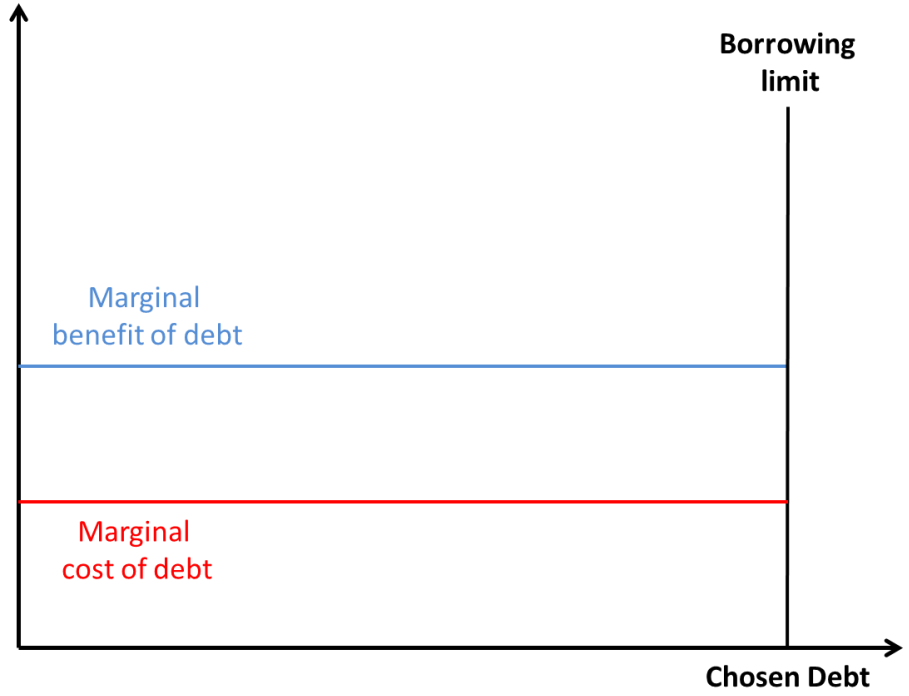
3. If the debt becomes insufficiently collateralized, the firm needs to raise "emergency" funds at cost

$$\varphi_{t+1}(B_{t+1}) = \kappa \cdot (\max\{B_{t+1} - \xi_{t+1} z_{t+1} N_{t+1}, 0\})^{\eta}$$

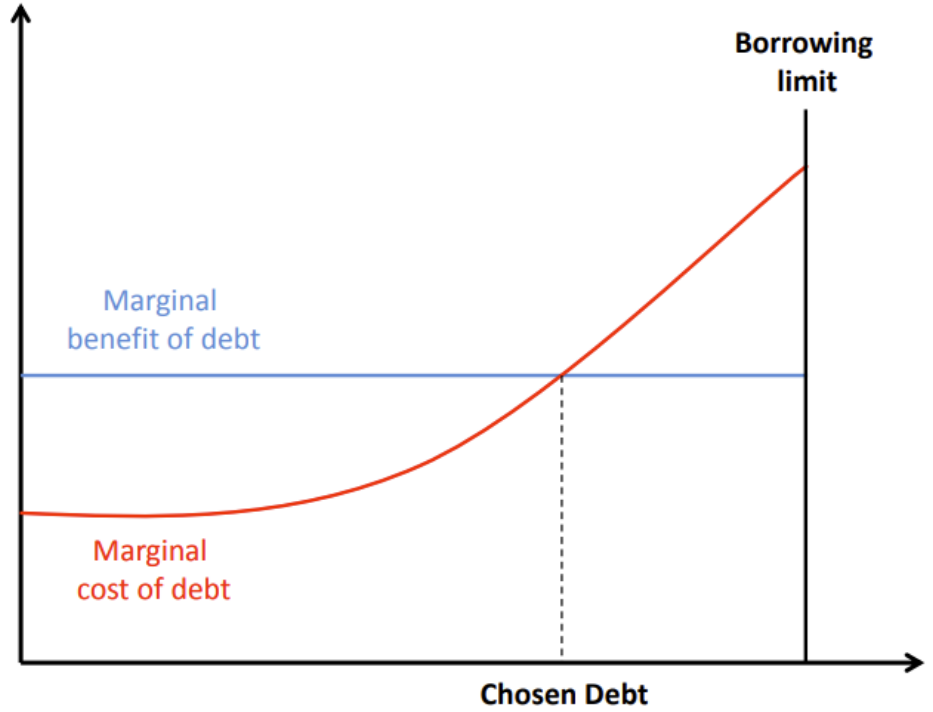
4. Hence, the expected cost of borrowing is the marginal interest cost plus the marginal expected future distress cost, $\mathbb{E}_t \varphi'_{t+1}(B_{t+1})$.

An illustration of the firm's borrowing decision

MODEL WITHOUT FINANCIAL DISTRESS



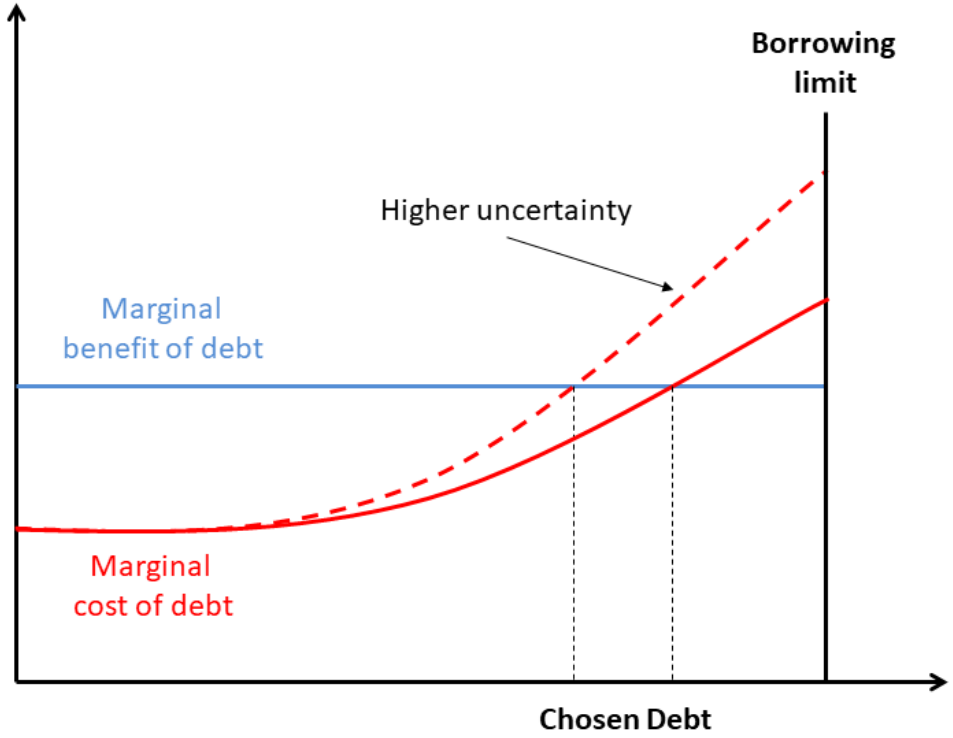
MODEL WITH FINANCIAL DISTRESS



Two main testable predictions

Provided that the distress cost is sufficiently high:

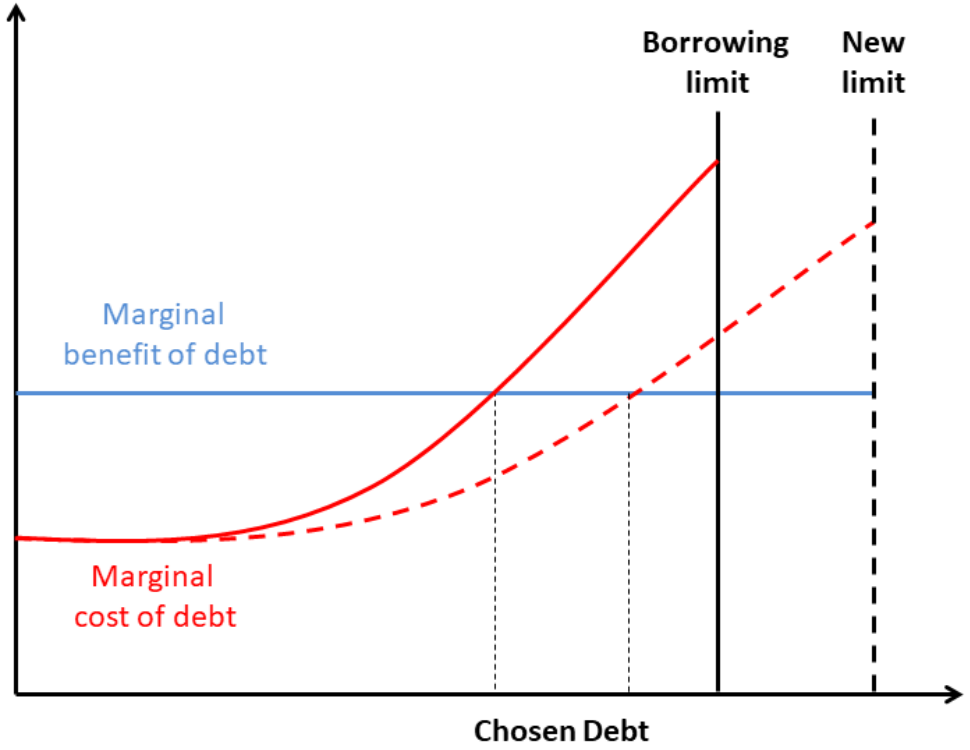
1. An increase in uncertainty about future (a) access to credit or (b) productivity leads a firm to reduce borrowing and real activity



Two main testable predictions

Provided that the distress cost is sufficiently high:

2. An increase in the credit limit leads a firm to increase (a) borrowing and (b) real activity, *even if it had not exhausted its borrowing capacity prior to the increase*



Taking the testable predictions of the model to the data

Data and sample

Loan-level data from the Riksbank's corporate credit register KRITA

- New administrative credit register developed as part of ESCB's AnaCredit
- Detailed loan-level information at monthly frequency covering 95 percent of the volume of corporate loans extended by Swedish banks
- No lower size threshold for a loan to be included. Nearly the universe of loans!

Financial accounts and other firm-level data from UC

- Covers the universe of Swedish incorporated firms at annual frequency

Our sample: All non-financial firms with at least five million SEK in net assets and annual sales and five employees

Data aggregated to the firm-month level throughout the empirical analysis

Tests and findings

1. Effect of uncertainty about future credit access (ξ) on utilization rates
   - **Test:** Regress credit-line utilization rate on credit-line maturity (proxy for uncertainty in access to credit) + controls
   - **Finding:** Firms with short-maturity credit lines on average have 40 p.p. lower utilization rates than firms with long-maturity lines
2. Effect of productivity uncertainty on utilization rates
   - **Test:** Regress utilization rate on cash-flow volatility (proxy for productivity uncertainty, z) + controls
   - **Finding:** Difference in utilization rates between firms in industries with the highest versus lowest cash-flow volatility is 10 p.p.

Tests and findings, cont'd

3. Response of borrowing to changes in credit-line limits
   - **Test:** Regress change in drawn amount on change in committed amount. Allow the response to differ depending on the distance to the limit when limit is changed.
   - **Finding:** Following a 1 SEK increase in limit, borrowing increases by
     - 0.17 SEK for firms furthest from the limit
     - 0.34 SEK for firms in the middle
     - 0.68 SEK for firms nearest the limit

Summing up

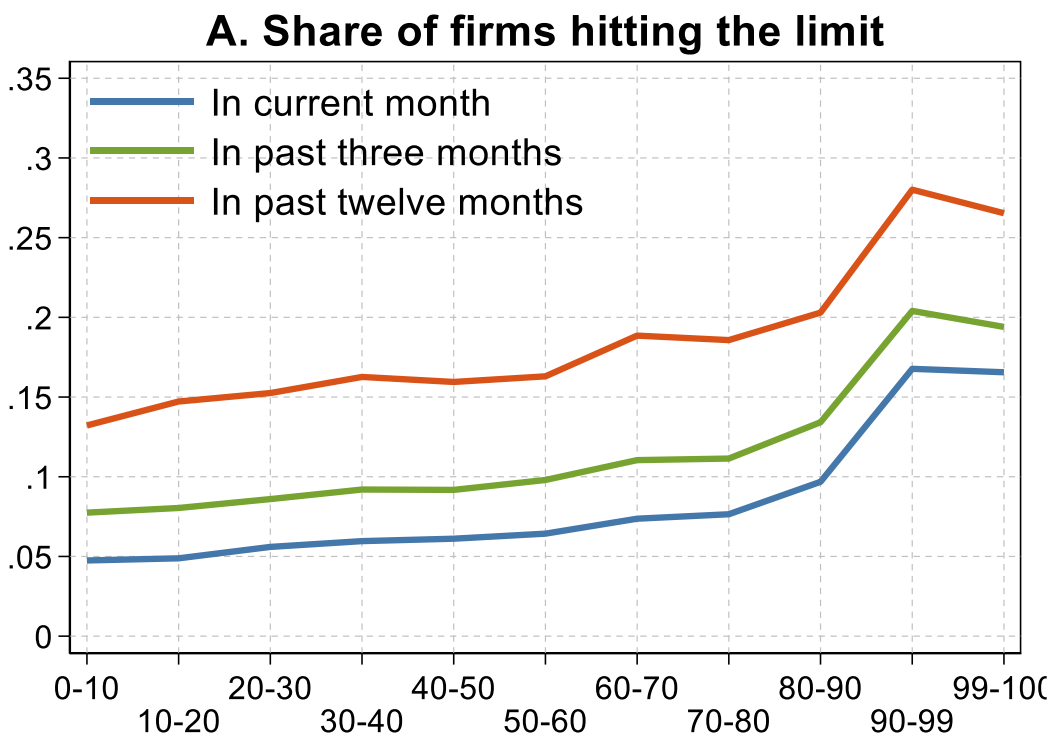
1. We use a comprehensive Swedish credit register to show that statically binding credit constraints are relatively uncommon, even among SMEs

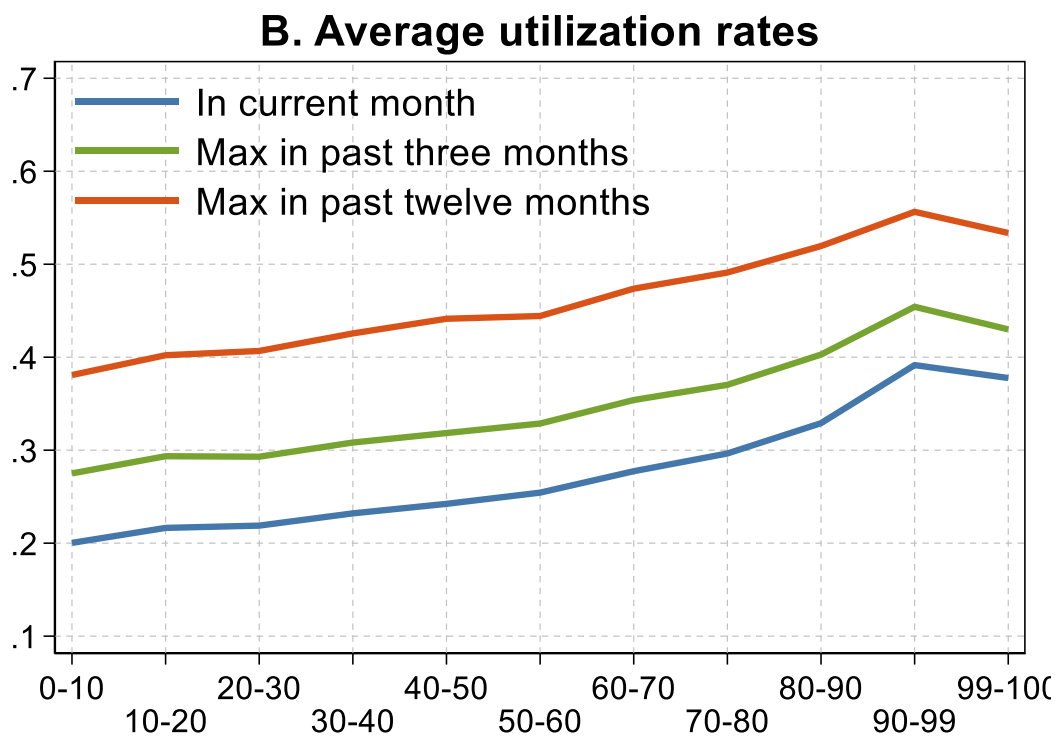
2. We argue that the data is nevertheless consistent with credit constraints being widespread, once we understand constraints in a dynamic sense

3. Finally, we take the predictions of our model to the data and show that many firms indeed behave as if they are dynamically constrained

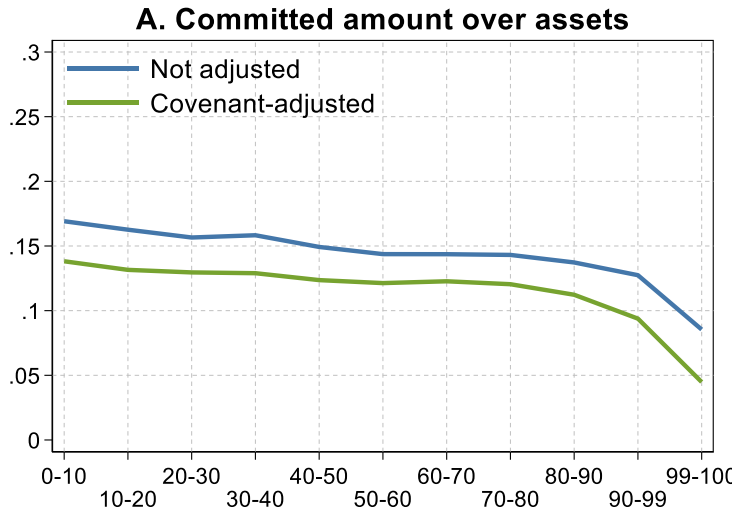
Extras

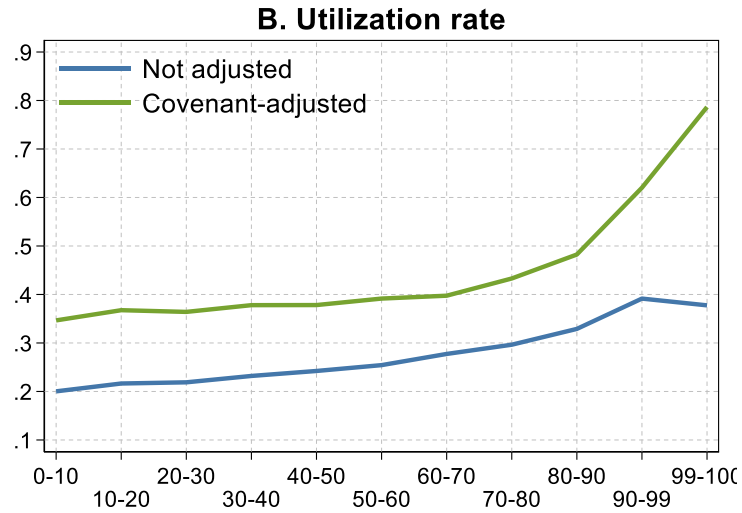
Measuring firms' maximum utilization rates over time

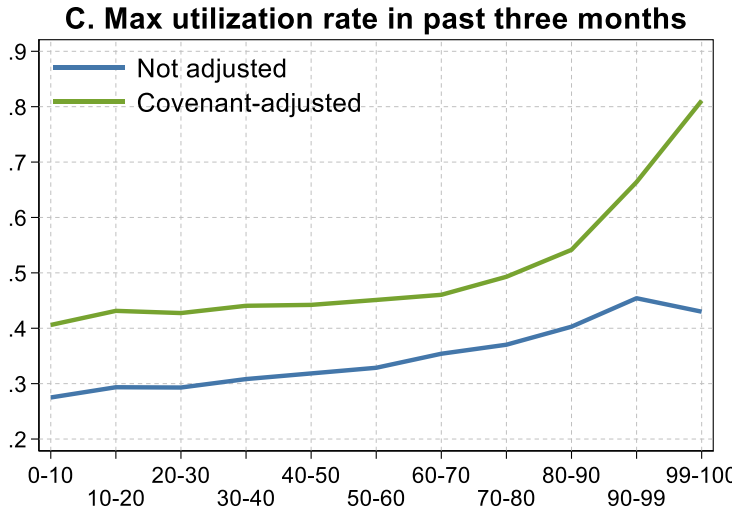


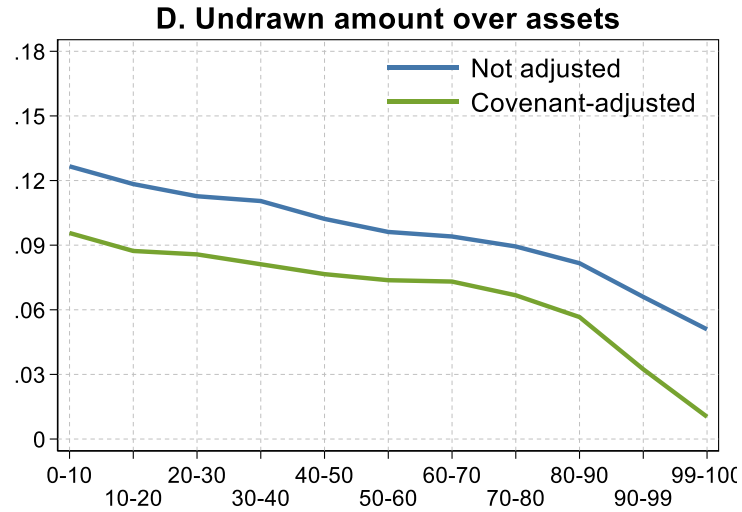


Covenant-adjusted measures of credit-line size and utilization

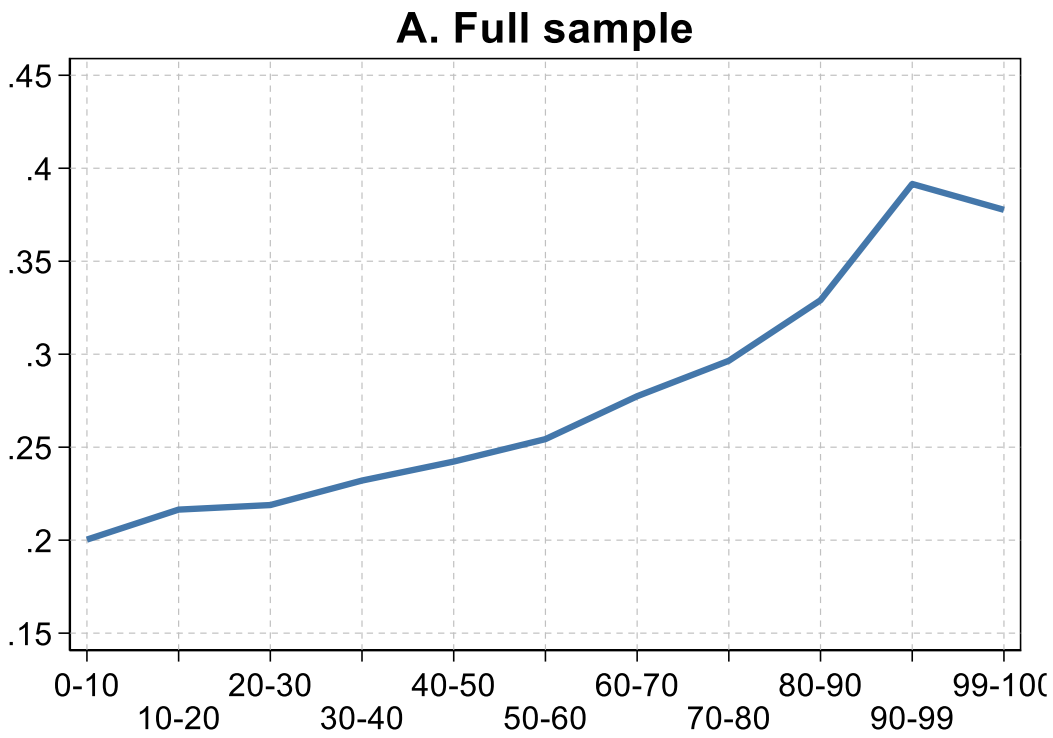


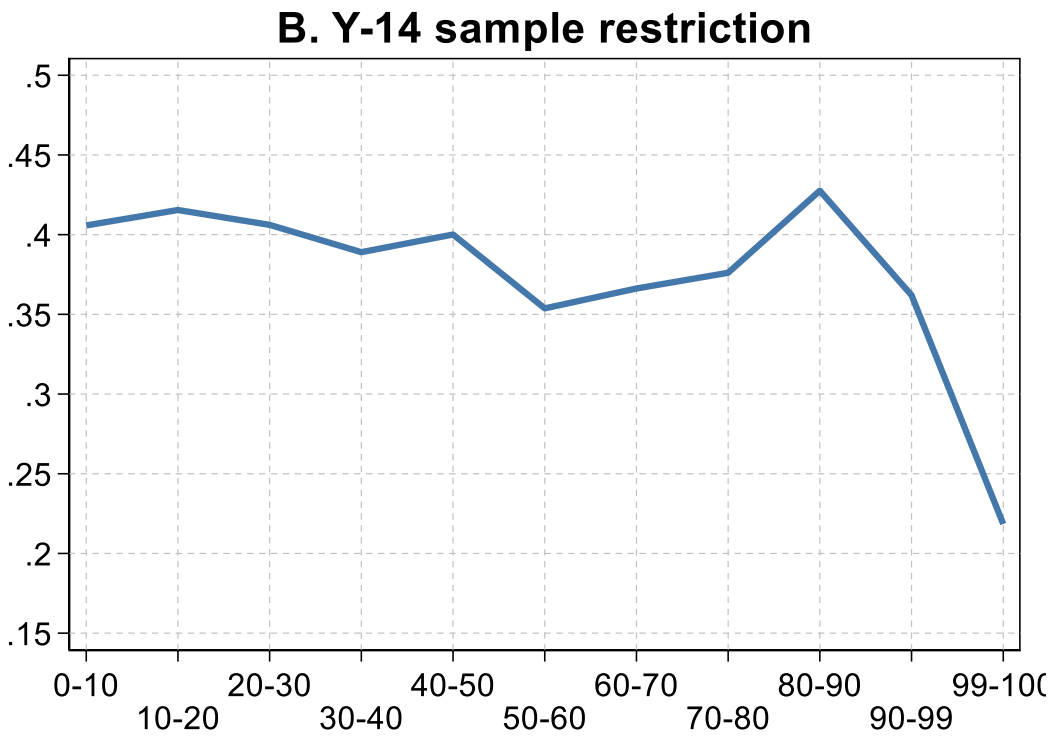






Utilization rates over size distribution depending on sample





The rightmost figure shows the average utilization rate over the restricted sample obtained when imposing the same loan size restriction as in the Federal Reserve's Y-14 dataset, namely, only including loans with a committed amount of at least 10 million SEK (roughly one million USD).

Share of firms with short-maturity (≤ 1 year) credit lines