

## Determinants of the credit cycle: a flow analysis of the extensive margin

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The views expressed herein are those of the author and do not necessarily reflect those of the Bank of Italy or the European Central Bank.

## Motivation

- Bank credit flows and business cycles are strictly intertwined (e.g. Schularick-Taylor 2012; Dell’Ariccia et al. 2012; Baron-Xiong, 2017)
- Yet little is known about the margins through which bank credit flows to HHs and to NFCs over the business cycle
- Borrowers can borrow from pre-existing lenders (**intensive margin**), borrow from new lenders (**extensive margin**), or both
- Over the course of a relationship the lender acquires private (“soft”) information about their borrowers ⇒ **new borrowers are imperfect substitutes for pre-existing clients**

## What We Do

1. We propose a methodology to disentangle the intensive from the extensive margin based on granular data
2. Show key determinants of credit expansions: the extensive margin
3. Apply a flow approach to assess the contribution of borrowers entering (inflows) and exiting (outflows) the bank credit market
4. Show borrower inflows are procyclical, more volatile than borrower outflows, and explain most of the fluctuations in the net creation of borrowers
5. Show matching frictions (prob. of finding a new bank) account for the bulk of volatility in borrower inflows

Motivation  
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**Data**  
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Intensive and Extensive Margins  
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Robustness  
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Concluding Remarks  
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# Data

## Data

- Italian Central Credit Register data
- 5.6 million HHs and 2.4 million NFCs borrowing from at least a bank
- January 1998-December 2019
  - credit granted or drawn  $\geq \text{€}75,000$  (lowered in January 2009 to  $\text{€}30,000$ )
  - term loans, credit lines, loan backed by account-receivables, and bad loans (“sofferenze”)
- Information on loan applications from new potential clients
  - The Bank of Italy collects information on customers’ borrowings from the intermediaries and notifies them of the risk position of each customer vis-à-vis the banking system

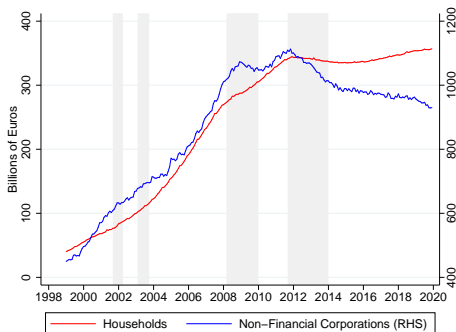
## Summary statistics

	NFC		HH	
	average	st. dev.	average	st. dev.
Credit disbursement (€bn)	877	191	244	111
Bad loans (€bn)	124	70	20	11
Bank-borrower relationships (mn)	1.7	0.2	1.7	0.8
Borrowers (mn)	0.9	0.2	1.7	0.8
Applicants (k)	115	39	239	97

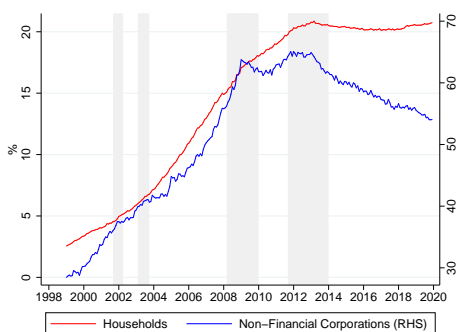
Notes: Averages and standard deviations are calculated over the period 1999:1-2019:12.

Each NFC borrows on average €970,000 from three banks  
 Each HH borrows on average €140,000 from a single bank

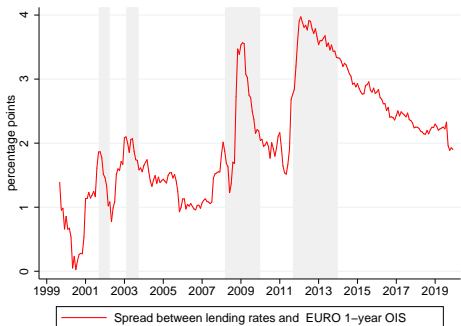
## Credit disbursement



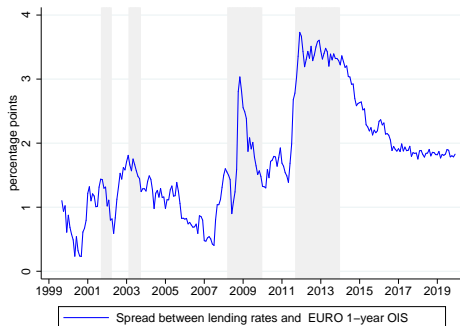
## Credit-to-GDP ratios



### HH credit risk premium

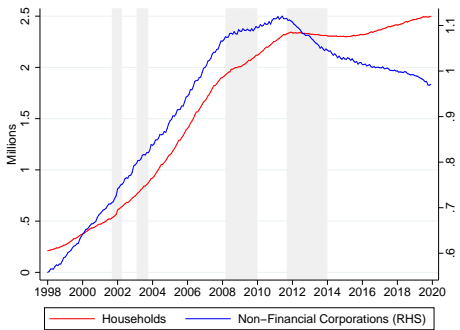


### NFC credit risk premium

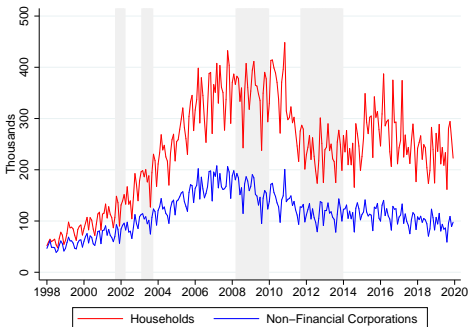




### Borrowers



### Applicants



## Intensive and Extensive Margins

## Intensive and extensive margin

- Two measures based on i) bank-borrower relationship or ii) borrower's exposure to the banking system
- Net change in credit stocks = Net change in credit to continuing relationships/borrowers + Net flow of loans to new relationships/borrowers

$$\Delta L_t = \underbrace{\sum_{f \in \mathcal{F}} \sum_{b \in \mathcal{B}} (l_{fbt}^I - l_{fbt-1}^I)}_{\text{Intensive margin}} + \underbrace{\sum_{f \in \mathcal{F}} \sum_{b \in \mathcal{B}} (l_{fbt}^C - l_{fbt-1}^D)}_{\text{Extensive margin}} \quad (1)$$

$$\Delta L_t = \underbrace{\sum_{b \in \mathcal{B}} (l_{bt}^I - l_{bt-1}^I)}_{\text{Intensive margin}} + \underbrace{\sum_{b \in \mathcal{B}} (l_{bt}^C - l_{bt-1}^D)}_{\text{Extensive margin}}, \quad (2)$$

## Contributions to credit fluctuations

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	bank-borrower	borrower
Intensive margin	17.6	40.4
Extensive margin	82.4	59.6

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*Notes:* The extensive and intensive margin are calculated according to eq. (1). In column “bank-borrower” *bank-borrower relations* active in  $t$  and  $t - 1$  are included in the intensive margin, while the remaining ones are in the extensive margin. In column “borrower” *borrowers* active in  $t$  and  $t - 1$  are included in the intensive margin, while the remaining ones are in the extensive margin. The average contribution of each margin to aggregate credit growth is calculated when both margins are positive.

## Variance decomposition of the extensive margin

- Loans to borrowers entering the mkt:

$$I_t^C = a_t^C B_t^C$$

- Loans to borrowers exiting the makt:

$$I_{t-1}^D = a_{t-1}^D B_{t-1}^D$$

- **80/90% of the variance is explained by  $B$**
  - Correlation between  $B$  and  $I^C$  (or  $I^D$ ) is 0.98
- ⇒ Focus on **fluctuations in the number of borrowers**

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**Flow Approach**  
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## Flow Approach

## Baseline Definitions

- Borrower.** HHs and NFCs that have at least one credit relationship with a bank.
- Applicant.** HHs and NFCs that submit at least one loan application to a new bank *and* do not have any credit relationship with a bank at the reporting date.
- Inactive.** HHs and NFCs that are neither borrowers nor applicants during the period but are classified as applicants or borrowers in the previous *or* next six months.

## Transition Matrix

	Status in next period		
	<i>Borrower</i>	<i>Applicant</i>	<i>Inactive</i>
Status in current period			
<i>Borrower</i>	BB	BA	BI
<i>Applicant</i>	AB	AA	AI
<i>Inactive</i>	IB	IA	II

*Notes:* The letter *B* stands for Borrower, *A* stands for Applicant and *I* for Inactive in the credit market.

The **net creation of borrowers**  $\Delta_6 B_{t+6}$  can be decomposed into the difference between borrower inflows and borrower outflows:

$$\Delta_6 B_{t+6} = \underbrace{AB_{t+6} + IB_{t+6}}_{\text{borrower inflows}} - \underbrace{(BA_{t+6} + BI_{t+6})}_{\text{borrower outflows}}, \quad (3)$$



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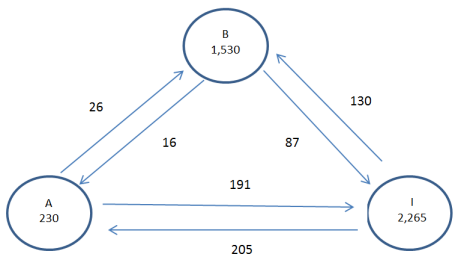
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Concluding Remarks  
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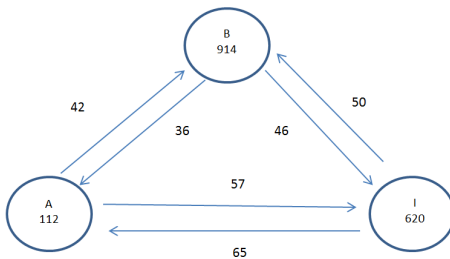
## Results

# Gross Flows and Stocks (Thousands)

## Households

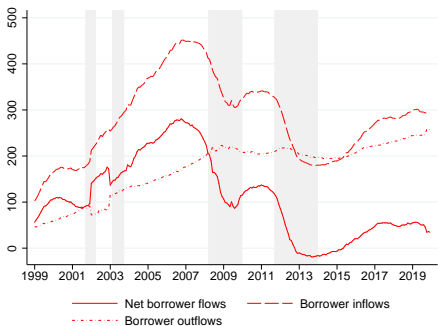


## Non-Financial Corporations

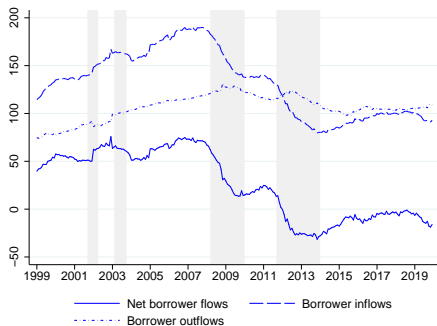


# Gross Borrower Flows (Annual Changes)

## HH Borrowers



## NFC Borrowers

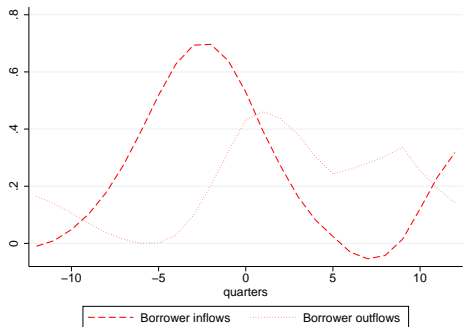


$$\underbrace{\Delta B}_{\text{net flows}} = \underbrace{AB + IB}_{\text{inflows}} - \underbrace{(BA + BI)}_{\text{outflows}}, \quad (4)$$

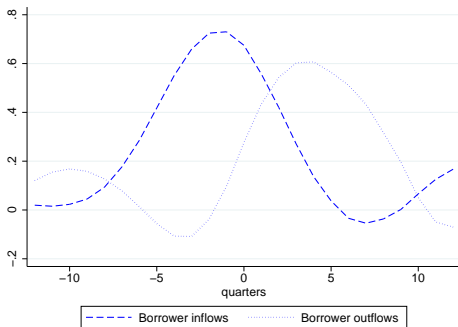
The bulk of fluctuations in net borrower flows is accounted for by borrower inflows

## Cross-correlations with GDP

### HHs



### NFCs



Notes: Correlation is between the cyclical component of each series. Inflows= $AB + IB$  and Outflows= $BA + BI$

borrower inflows are procyclical and tend to lead the business cycle

## Standard deviation

GDP	1.93	
Net creation of borrowers $b$	2.83	
- <i>borrower inflows</i>	15.85	
- <i>borrower outflows</i>	8.40	
	<b>HH</b>	<b>NFC</b>
Net creation of borrowers $b$	10.66	3.85
- <i>borrower inflows</i>	19.79	11.29
- <i>borrower outflows</i>	11.72	6.06

*Notes:* Numbers are in percentage. All series are annual growth rates. Inflows= $AB + IB$  and Outflows= $BA + BI$ .

borrower inflows are highly volatile and twice as volatile as borrowers outflows

## Alternative theories on borrower inflows

- Borrower inflows operate mainly via two mechanisms:
  1. the inflow of borrowers can increase either because, at a given acceptance rate, the number of potential borrowers rises
  2. or because the acceptance rate itself rises
- Literature:
  1. Dell'Ariccia-Marquez (2006) focus on the number of *unknown borrowers* and asymmetric information among lenders
  2. den Haan et al (2003) and Wasmer-Weil (2004) emphasize the role of *matching frictions* between the bank and the borrower

## Alternative theories on borrower inflows

$$(\widehat{AB + IB})_{t+4} = \widehat{f}_{t+4} + (\widehat{A + I})_t, \quad (5)$$

where

- $f = \frac{AB+IB}{A+I}$  is the new bank matching probability: **matching frictions**
- $A + I$  denotes unknown potential borrowers in the market: **asymmetric information between banks**

### Decomposition of borrower inflows

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#### HH sector

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$\beta^f$	loan finding probability	0.68
$\beta^{A+I}$	non borrowers	0.29

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#### NFC sector

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$\beta^f$	loan finding probability	0.73
$\beta^{A+I}$	non borrowers	0.25

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# Robustness

- Hodrick-Prescott filter.
- Unemployment rate.
- Non-performing borrowers.
- €30k threshold.
- Alternative definitions.

borrower vs. applicant;  
market vs. relationships



## Concluding Remarks

- New evidence on the role of the extensive margin in shaping the pattern of aggregate credit dynamics
- Three new facts:
  1. cyclical fluctuation in the net creation new borrowers is largely driven by gross inflows of borrowers
  2. gross inflows of borrowers are procyclical, highly volatile and tend to lead the business cycle
  3. gross inflows of borrowers are twice as volatile as gross outflows and their volatility is mainly explained by changing in the probability of finding a loan
- Monitoring/steering inflows of new borrowers may be key for macroprudential authority (smoothing credit cycle) but also for monetary policy (smoothing business cycle)