Bank Loan Reliance and Inflation Inattention [1]

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[1] The views expressed here should not be interpreted as representing the views of the Bank of Italy or any other institution with which the authors are affiliated.

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Motivation

Janet Yellen (2016): How (firms') expectations are formed has taken on heightened importance . . . many central banks have adopted policies that are directly aimed at influencing expectations of future interest rates and inflation.

Christopher A. Sims (2010): If I were continually dynamically optimizing, I would be making fine adjustments in portfolio . . . why I don't, the benefits would be slight and I have more important things to think about.

Motivation

- Dispersed firms' inflation expectation in survey carried out by Bank of Italy

  $\Longrightarrow$ **What drives the expectation dispersion?**

- Italian firms rely **heavily** on bank loans
  term loan to total liability ratio (2006-2019): 24%
  corporate bond to total financial debt ratio (2009-2019): 9.8 %

  $\Longrightarrow$ **Why firms should pay attention? Does their financing structures affect inflation attention?**

This paper

1. **Casual evidence on how financing composition affects inflation attentiveness**
   - $\uparrow$ Loan reliance $\Rightarrow$ $\uparrow$ inflation forecast accuracy
   - $\uparrow$ Loan reliance $\Rightarrow$ $\downarrow$ response to provided public-available news

2. **A partial equilibrium model with rational inattention**
   - Firms: endogenous financing composition + costly information
   - Economy: $\uparrow$ inflation $=$(banks)$\Rightarrow$ $\uparrow$ financing cost

   Mechanism:
   $\uparrow$ Loan reliance $\Rightarrow$ $\uparrow$ sensitivity to inflation (financing cost) $\Rightarrow$ $\uparrow$ incentive to acquire information $\Rightarrow$ better & broader information set

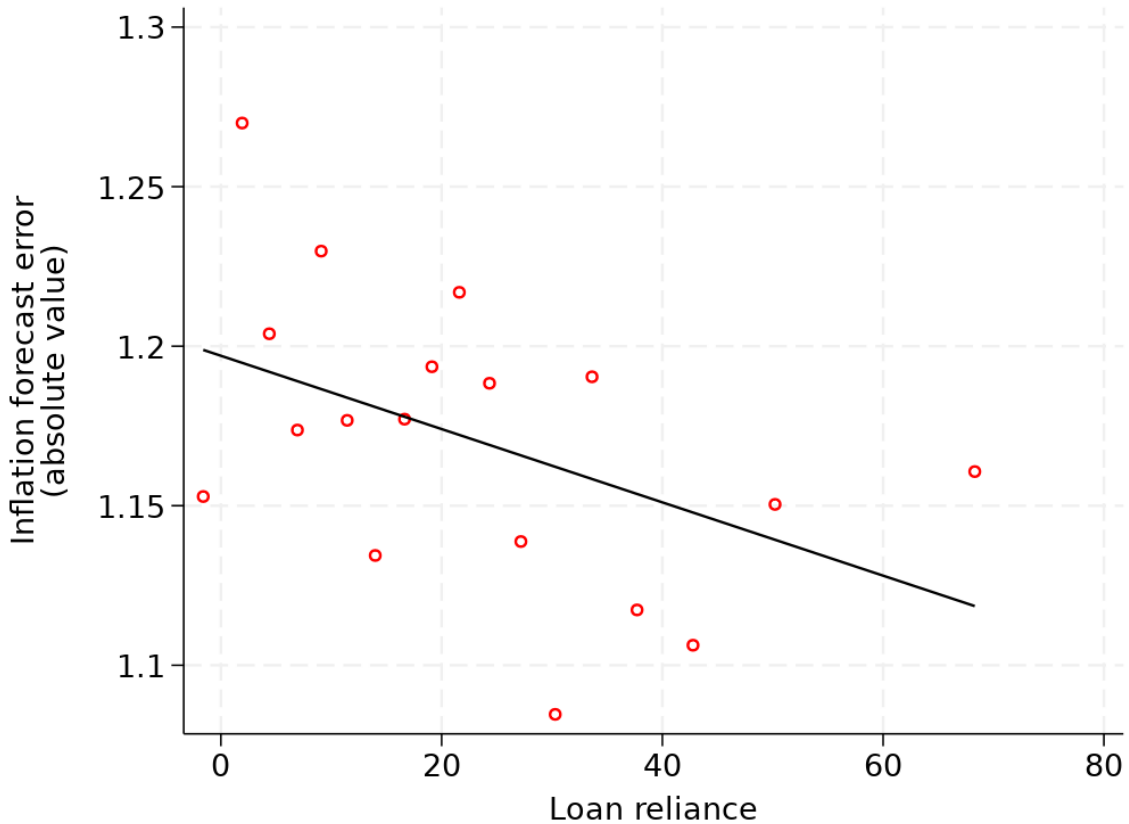
Data and measurement

- Data (2006 - 2019)
  - Survey of Inflation and Growth Expectations (SIGE): inflation expectations, RCT (2013Q1)
  - Central Credit Registry (CCR): credit position reported by banks and financial institutions
  - Analytical Survey of Interest Rates (TAXIA): lending rates
  - Company Accounts Data Service (CADS): firm-level balance sheet

- Measures
  1. Bank credit reliance: $\text{Loan Reliance}_{j,t} = \frac{\sum_{i \in \text{banks}} \text{Term Loan}_{i,j,t}}{\text{Liability}_{j,t}}$ plot
  2. Inflation (in)attention: $\text{Attention}_{j,t}^{(\pi)} = |\pi_{t,t+4} - \pi_{j,t,t+4}^{e}|$ plot

Motivation

Figure 1: Binned scatter plot: loan reliance and inflation inattention



OLS and 2SLS

1. **OLS for suggestive inference**

$$\text{Attention}_{j,t}^{(\pi)} = \beta_{OLS}\text{Loan Reliance}_{j,t} + \epsilon_{j,t}$$

2. **2SLS**

$$\text{Attention}_{j,t}^{(\pi)} = \beta_{2SLS}\widehat{\text{Loan Reliance}}_{j,t} + \epsilon_{j,t}$$

- A Bartik instrument for loan reliance

$$\bar{\delta}_{j,t} = \sum_{i \in \text{banks}} \underbrace{\frac{\text{Term Loan}_{i,j,t-1}}{\sum_{i \in \text{banks}} \text{Term Loan}_{i,j,t-1}}}_{\textit{Exposure}_{i,j,t-1}} \hat{\delta}_{i,t}$$

  - $\textit{Exposure}_{i,j,t-1}$: exposure of firm j to bank i
  - $\hat{\delta}_{i,t}$: credit supply shock in bank i at time t (Khwaja and Mian 2008)

$$\text{Loan markup}_{i,j,t} = \delta_{i,t} + \lambda_{j,t} + \epsilon_{i,j,t}$$

Empirical evidence

OLS: ommited variable bias, reverse causality, ...

Table 1: Effects of Loan Reliance on Inflation Inattention

	(1) β_{OLS}	(2) β_{2SLS}
Loan Reliance$_{j,t}$	0.000406	-0.116**
	(0.000970)	(0.0482)
Observations	21,461	21,461
Fixed effect	Firm	Firm
First-stage F-stat		23.88

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Empirical evidence: RCT

- Randomized control trail ▸ Question
  - Treatment: information on current inflation ($\mathbb{I}_j = 1$)
  - Prior: one-year ahead inflation forecast in last quarter
  - Posterior: one-year ahead inflation forecast in this quarter

- Empirical design

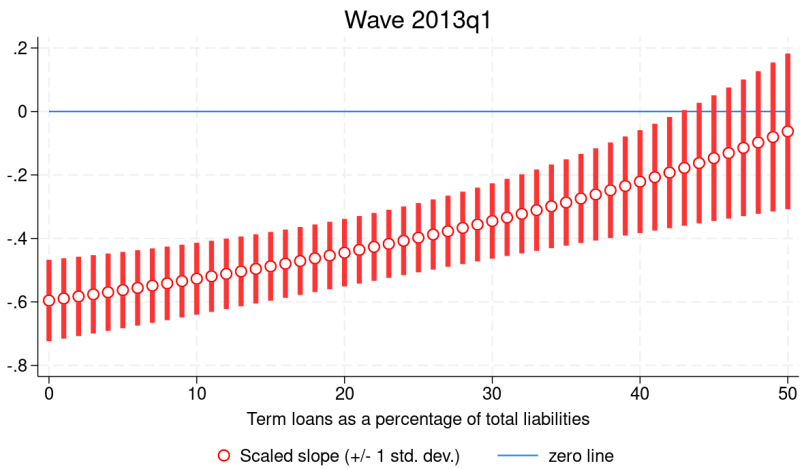
$$\text{posterior}_j = \alpha_1 \times \text{prior}_j + \alpha_2 \times \text{Loan Reliance}_j \times \text{prior}_j + \gamma_1 \times \mathbb{I}_j \times \text{prior}_j + \gamma_2 \times \mathbb{I}_j \times \text{Loan Reliance}_j \times \text{prior}_j + \cdots + \epsilon_j.$$

Changes in prior-posterior relationship of treated group:

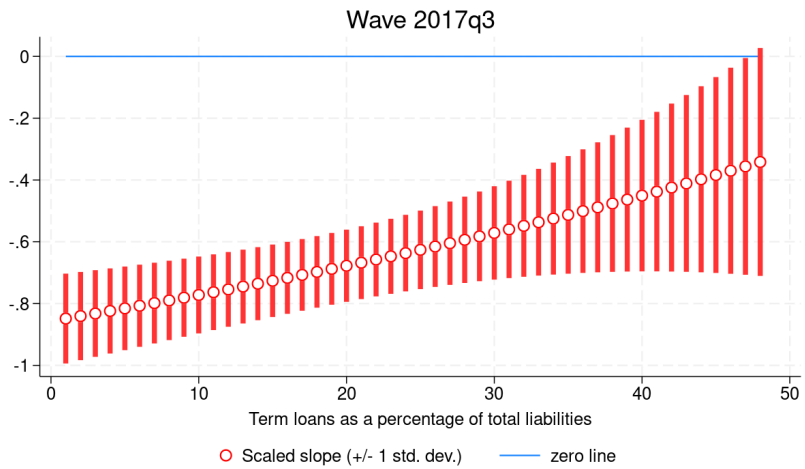
$$\frac{\hat{\gamma}_1 + \hat{\gamma}_2 \text{Loan Reliance}}{\hat{\alpha}_1 + \hat{\alpha}_2 \text{Loan Reliance}}$$

Empirical evidence: RCT

- $\hat{\gamma} < 0$: treatment group is placing less weight on their priors and more weight on the new information
- High loan reliance firms respond less: already in the information set!



(a) First RCT



(b) Reshuffling

Model - firms

- Two-stage problem
  1. Minimize financing cost: combination of interval funds & bank loans

$$FC_{j,t} \equiv \min_{\Gamma^I_{j,t},\Gamma^E_{j,t}} \Gamma^I_{j,t} + \Phi_{j,t}\Gamma^E_{j,t}, \text{ where: } \Phi_{j,t} \equiv \frac{R^b_{j,t}}{R^s_t} = \Phi_j \Phi_t = \Phi_j \mathcal{F}(\pi_t)$$

$$s.t. \left[\left(\Gamma^I_{j,t}\right)^\rho + \left(\Gamma^E_{j,t}\right)^\rho\right]^{\frac{1}{\rho}} = 1$$

  2. Maximize profits: optimal investment rate

$$\max_{V_{j,t} \equiv \frac{I_{j,t}}{K_{j,t}}} \sum_t^\infty \beta^t \mathbb{E}_t \left\{ AK_{j,t} - FC_{j,t}\left[\frac{I_{j,t}}{K_{j,t-1}} + \frac{\varphi_k}{2}\left(\frac{I_{j,t}}{K_{j,t-1}} - \delta\right)^2\right] K_{j,t-1} \right\}$$

- Why firms care inflation? $\underbrace{\pi_t \Rightarrow \Phi_{j,t}}_{\text{Banking market}} \Rightarrow V_{j,t}$

▸ $\Phi_{j,t}$: micro-foundation

Model - banks

- Input: deposits ($R_t^s = R^s \left(\frac{\Pi_t}{\Pi}\right)^{\tau_\pi}$, inflation-targeting Taylor rule)
- Output: bank loans (R_t^b)
- Monopolistic competitive market & Calvo price stickiness

Channel:

$$\{\epsilon_t, \epsilon_{t+1}, \cdots\} \Rightarrow \{\pi_t, \pi_{t+1}, \cdots\} \underbrace{\Rightarrow}_{①} \{R_t^s, R_{t+1}^s, \cdots\} \underbrace{\Rightarrow}_{②} R_{i,t}^{b,*} \Rightarrow \Phi_t$$

1. Monetary authority raises policy rate after exogenous inflation shock
2. Banks pass the increasing operational cost to firms

Model - rational inattention

Following Mackowiak, Matejka, and Wiederholt (2018),

$$\min_{\kappa_j, h_j} \sum_{t=0}^{\infty} \beta^t \mathbb{E}_{-1} \left[(\mathbb{E}(v^*_{j,t} | \mathcal{I}_t) - v^*_{j,t})^2 \right] + \lambda_\kappa \kappa_j$$

with:

- optimal investment under perfect information

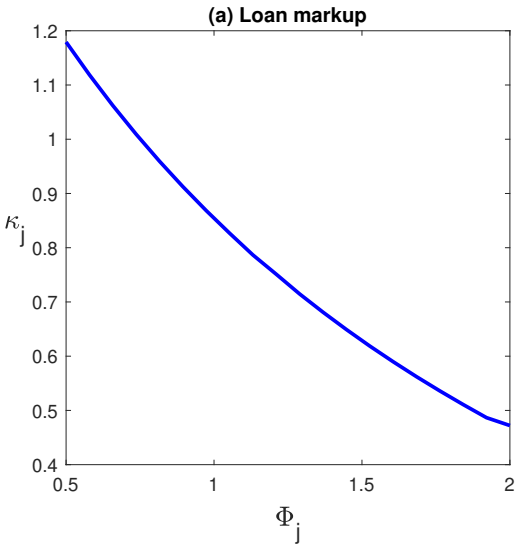
$$v^*_{j,t} = (\omega_b + \rho_\pi) v^*_{j,t-1} - \omega_b \rho_\pi v^*_{j,t-2} + C_1 \epsilon_{\pi,t} + C_2 \epsilon_{\pi,t-1} + C_3 \epsilon_{\pi,t-2}$$

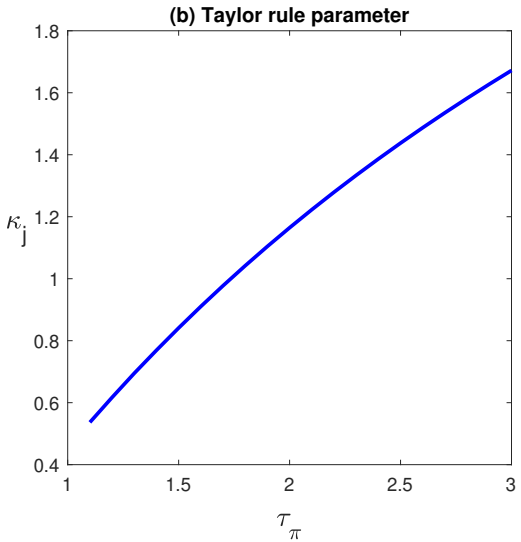
- Signal structure

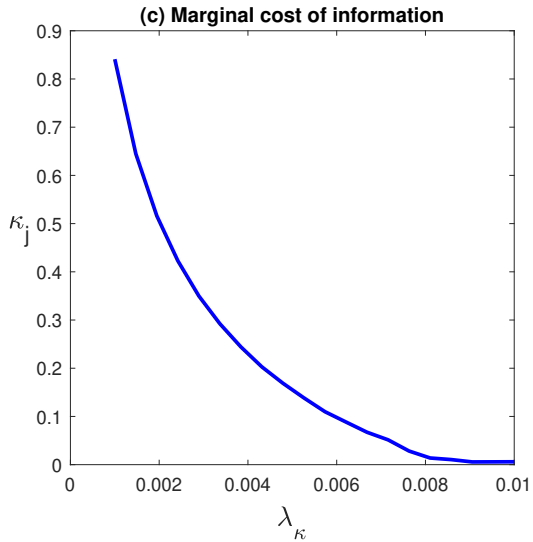
$$S_{j,t} = h'_j z_{j,t} + \psi_t \text{ , with } z_{j,t} = (v^*_{j,t} \; v^*_{j,t-1} \; \epsilon_{\pi,t} \; \epsilon_{\pi,t-1})'$$

Implication - comparative statistics

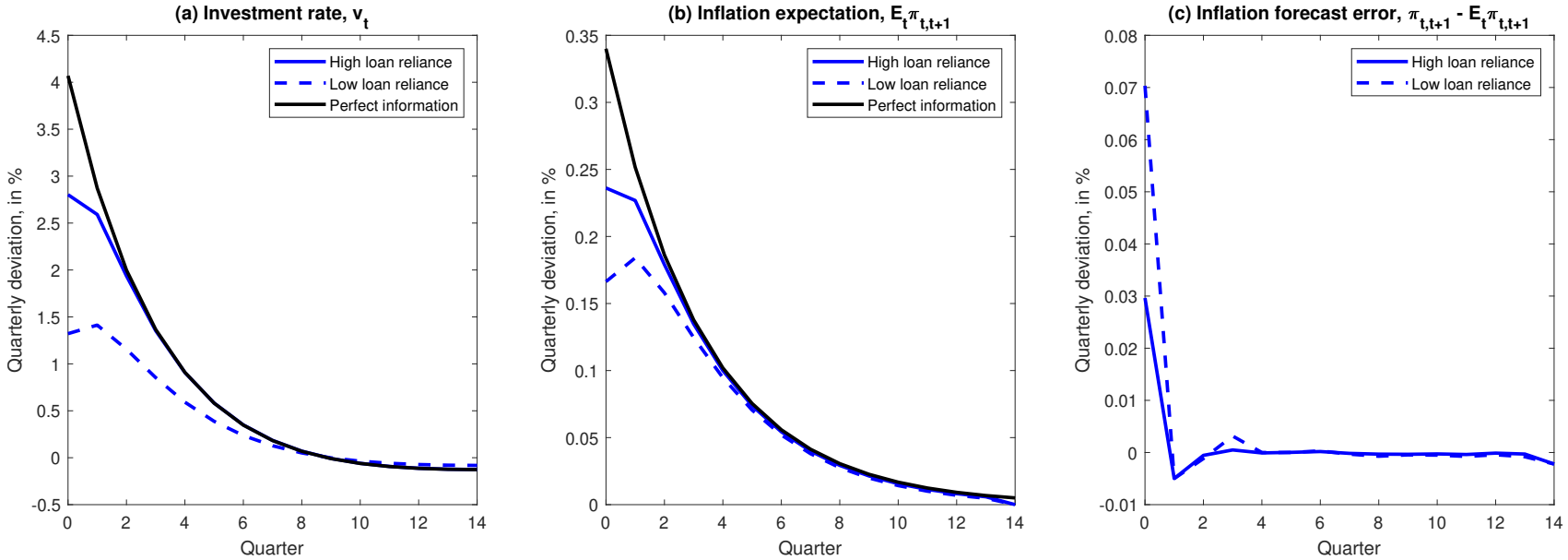
- Steady-state κ (amount of information processed) varies across parameter values
  1. Less loan-reliant firms
  2. More aggressive central bank
  3. Higher information processing cost







Implication - IRFs



Notes: The figures display the impulse response functions to 1 positive standard deviation shock in (0.0034) $\epsilon_{\pi,t}$, which increases the annualized inflation by 1.35%. The autoregressive coefficient of the inflation process is 0.74. The solid (dashed) blue line is under the parameter values with average loan reliance of 24% (11%).

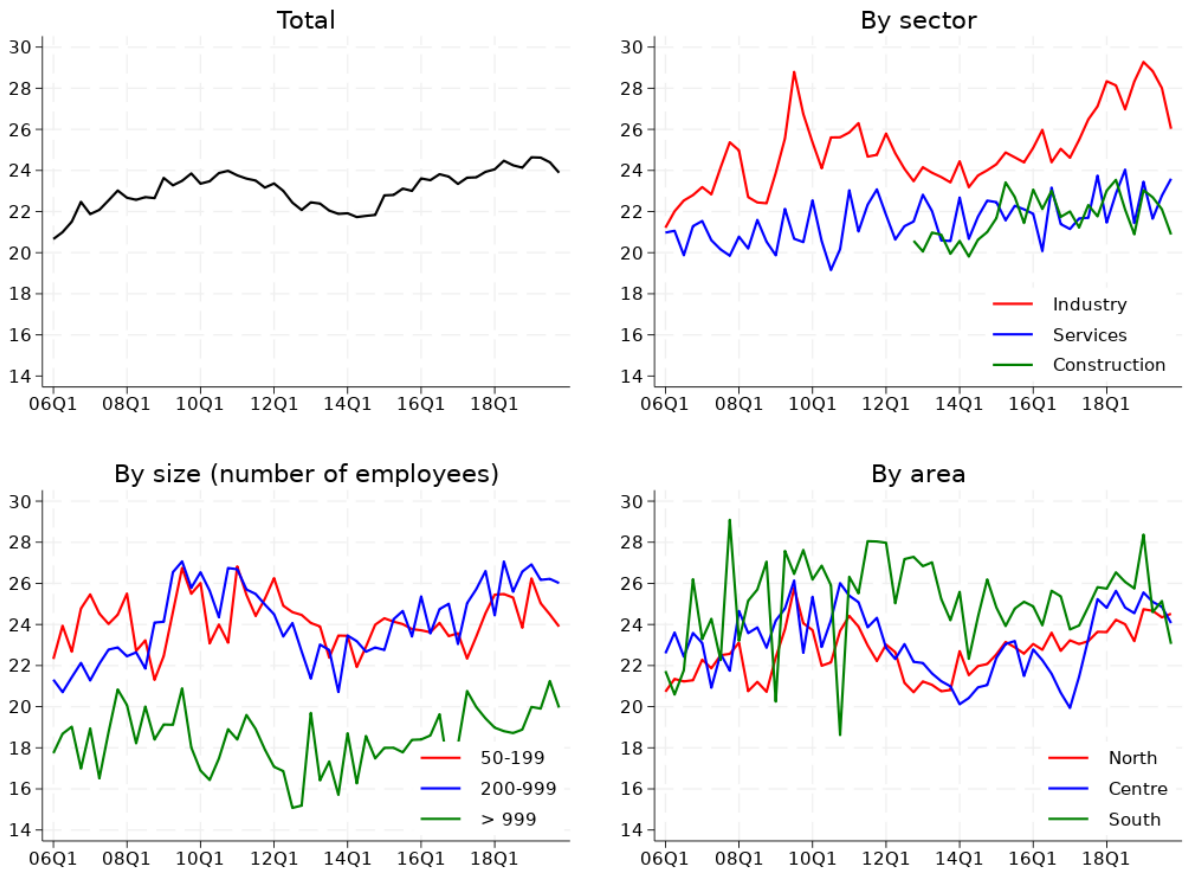
Conclusion

1. Financing composition as an important determinant for firms' inflation expectations (suggestive evidence for rational inattention theory)
   - Incentive to acquire information
   - How firms learn from new information

2. An analytical model featuring endogenous financing composition and attention allocation
   - Explain the empirical findings
   - Interesting implications: effectiveness of monetary policy

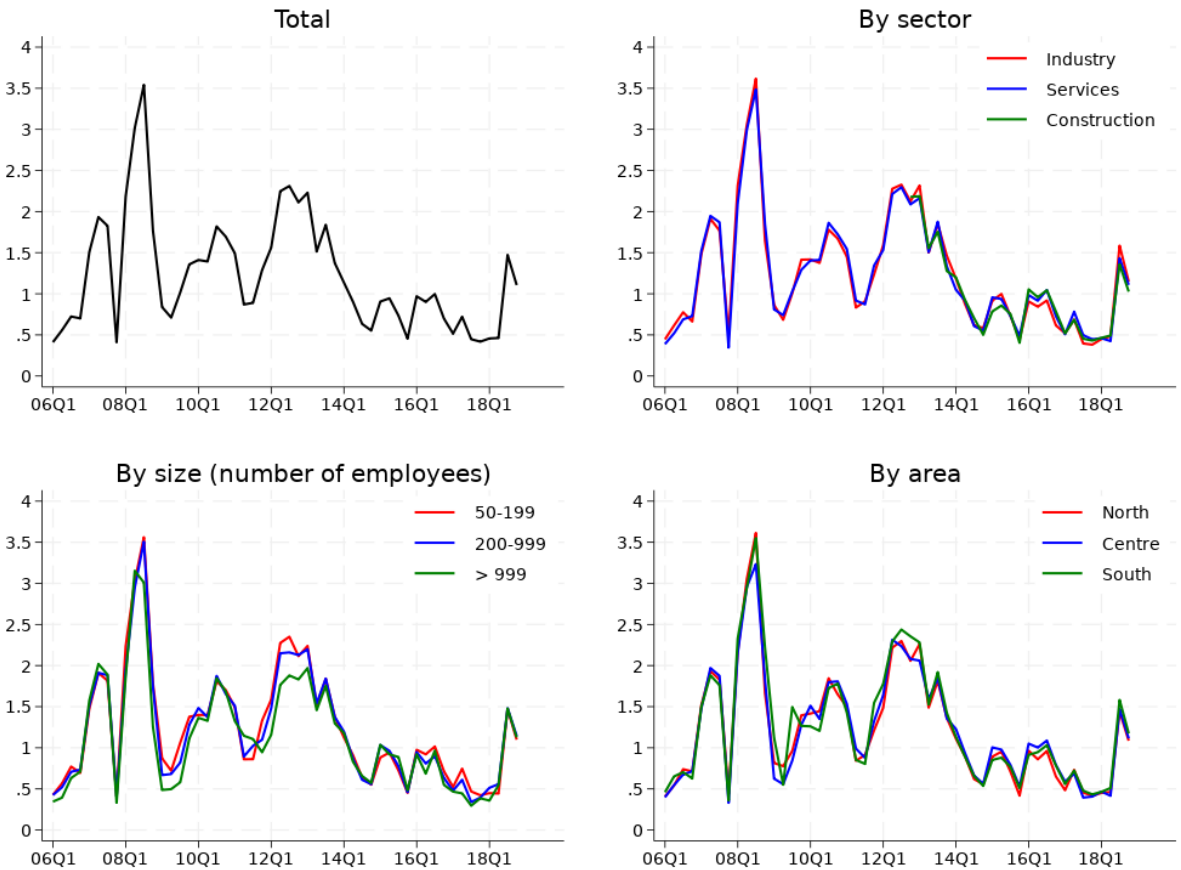
A.1: Loan reliance

Figure 2: Developments in Firms' Loan Reliance



A.2: Inflation (in)attention

Figure 3: Developments in Firms' Attention



A.3: RCT

- "In [previous month], consumer price inflation measured by the 12-month change in the Harmonized Index of Consumer Prices was [X.X]% in Italy and [Y.Y]% in the Euro area. What do you think it will be in Italy ... six-month ahead, one-year ahead, and two-year ahead."
- "What do you think consumer price inflation in Italy, measured by the 12-month change in the Harmonized Index of Consumer Prices, will be ... "

Back

A.4: Microfoundation for $\Phi_{j,t}$

Relative cost $\Phi_{j,t}$ between bank loans (R_t^b) and internal financing (opportunity cost R_t^s)

$$\max \mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t \frac{\Lambda_t}{\Lambda_0} \left(\text{Revenue}_{j,t} - R_{t-1}^b \gamma \text{Borrowing}_{j,t-1} - (1-\gamma) \text{Borrowing}_{j,t} \right) \right]$$

$$= C_{-1} + \max \mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t \frac{\Lambda_t}{\Lambda_0} \left(\text{Revenue}_{j,t} - \left[(1-\gamma) + \beta \frac{\Lambda_{t+1}}{\Lambda_t} R_t^b \gamma \right] \text{Borrowing}_{j,t} \right) \right]$$

$$= C_{-1} + \max \mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t \frac{\Lambda_t}{\Lambda_0} \left(\text{Revenue}_{j,t} - \left[(1-\gamma) + \gamma \frac{R_t^b}{R_t^s} \right] \text{Borrowing}_{j,t} \right) \right]$$

Back