Monetary Policy, Uncertainty, and Credit Supply

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Research Question.

How does inflation forecasts shape credit conditions?

- Higher uncertainty or asymmetry leads banks to raise rates and tighten credit.
- Financially constrained firms are hit hardest.
- Expectations' uncertainty or asymmetry matter for CB.

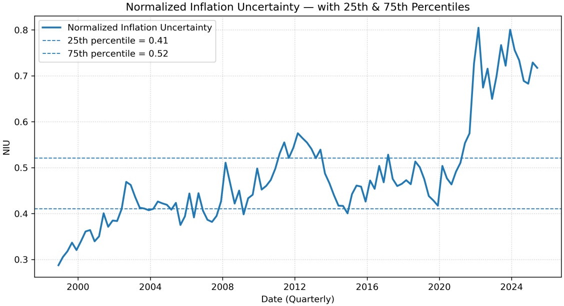
Key Result:

- **Theory:** Dispersion in banks' inflation forecasts $\rightarrow$ higher loan rates and more credit rationing.
- **Evidence:** In France, higher uncertainty/asymmetry raise loan rates by $>$10 bps ($\sim$ 0.5 bn € annually).

In a nutshell

1. **Theoretical model**:
   banks' subjective forecast & their lending decisions;
2. **Parameter-free uncertainty measure**;
3. **Empirical estimation** of the effect of uncertainty to Non-Financial Corporations credit constraints.

Impact of lending conditions from 25th to 75th percentile?



Source: ECB-SPF, 1-year ahead inflation forecast.

What is an "Uncertain Forecast"?

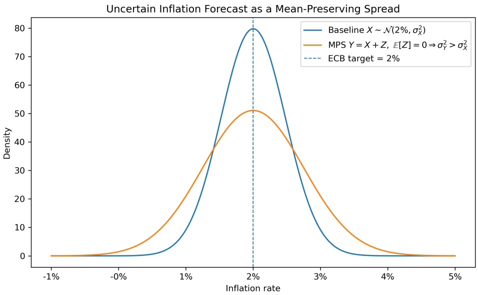
(MPS). A forecast Y is an uncertainty-inflated version of X if it is a mean-preserving spread:

$$Y \;=\; X + Z, \qquad \mathbb{E}[Z] = 0, \quad Z \perp X \;\;\Rightarrow\;\; \mathbb{E}[Y] = \mathbb{E}[X].$$

Equivalently, X second-order stochastically dominates Y:

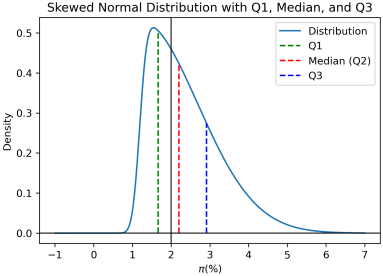
$$\int_{-\infty}^{t} F_Y(s)\,ds \;\geq\; \int_{-\infty}^{t} F_X(s)\,ds \quad \forall t,$$

so that for any concave u, $\mathbb{E}[u(X)] \geq \mathbb{E}[u(Y)]$.



What is a “Strong Asymmetric Forecast"?

1. Take a subjective probability distribution (SPD);
2. Measure its median versus a target;
3. Measure its skewness.



Source: Author's illustration

“*The bank believes that inflation will be above the 2% target, and has an asymmetric bias toward higher inflation*[a].”

1. SPD median $> 2\%$;
2. SPD skewness > 0.

[a] wrt to his belief, not the CB target.

This paper

1. **Theoretical Model**
   - Extends Stiglitz and Weiss (1981), asymmetric information, with dispersion in banks' inflation beliefs
   - Predictions:
     - Higher inflation uncertainty or skewness $\Rightarrow$ higher loan rates (credit tightening)
2. **Empirical Analysis**
   - Data: AnaCredit loan-level dataset for France (2018–2025)
   - Method: Finite mixture density regressions
   - Findings:
     - Uncertainty and Asymmetry both raise loan rates and skew distributions
     - Effects concentrated in the right tail $\Rightarrow$ higher costs for financially constrained firms
     - Forecast disagreement: weaker, less systematic effect

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Theoretical Model

- **Building blocks:**
  - Monti–Klein framework of monopolistic banking (Ho and Saunders, 1981; Monti et al., 1972)
  - Credit rationing under asymmetric information (Stiglitz and Weiss, 1981)
  - Risk aversion and subjective beliefs: uncertainty, skewness, ambiguity (Vansteenberghe, 2025)

- **Main ingredients:**
  - Loan rate R_L set to maximize expected utility of real profits
  - Deposit rate $R_D(\pi)$ follows a Taylor-type rule
  - Default probability $p(R_L, \pi, X)$ endogenous, convex in R_L, decreasing in π (Bhamra et al., 2023; De Marco and Friedheim, 2025)
  - Two channels:
    - Real Return Channel
    - Default Risk Channel

Proposition 1: Uncertainty-Induced Credit Tightening

Statement

Let F be a distribution of inflation and $\widetilde{F}$ a mean-preserving spread (MPS) of F. Then the optimal loan rate is strictly higher under $\widetilde{F}$:

$$R_L^*(\widetilde{F}) \; > \; R_L^*(F).$$

- Higher inflation uncertainty $\Rightarrow$ precautionary increase in lending rates
- Risk-averse banks demand a premium to insure against tail risks

Proposition 2: Uncertainty-Induced Credit Rationing

Statement

If $D(R_L^*) > S_F(R_L^*)$ under beliefs F, then for $\widetilde{F}$ (a mean-preserving spread of F):

$$S_{\widetilde{F}}(R_L) \; < \; S_F(R_L) \quad \forall R_L,$$

so credit rationing increases.

- Greater uncertainty shifts the entire loan supply curve inward
- Adverse selection and moral hazard amplify rationing

Proposition 3: Skewness-Induced Credit Tightening

Statement

For distributions $F, \widetilde{F}$ with equal means, if $\widetilde{F}$ has greater skewness, then:

$$R_L^*(\widetilde{F}) \; > \; R_L^*(F).$$

- Banks react to asymmetric tail risks by charging higher rates

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Empirical Analysis: Key Determinants of Loan Pricing

- **Loan maturity**
  - Longer maturities $\Rightarrow$ higher rates (term premium, exposure to interest rate and solvency risk)
  - Yield curves: upward-sloping for high-grade issuers, flatter for riskier firms (Merton, 1974)

- **Loan volume**
  - Larger loans: bargaining power, scale economies $\Rightarrow$ lower spreads
  - Very large exposures: concentration risk $\Rightarrow$ higher required returns

- **Borrower credit risk (PD)**
  - Higher PD $\Rightarrow$ higher rates (risk compensation + capital charges)
  - Exclude firms with PD $> 5\%$ ("zombies") (Caballero, Hoshi and Kashyap, 2008)

Empirical Analysis: Inflation Expectations and Controls

- **Bank inflation expectations**
  - Normalized Inflation Uncertainty (NIU) and Asymmetry Strength Index (ASI): level-orthogonality of the subjective forecast (Vansteenberghe, 2025)
  - Forecast disagreement: cross-bank heterogeneity
- **Macroeconomic & bank-level controls**
  - Industrial production: captures cyclical credit risk
  - Lender fixed effects: business model, market power, composition
  - Sector dummies: absorb industry-specific risk factors

Estimation Approach: Finite Mixture Model

- **Motivation**
  - Loan pricing is heterogeneous across banks and borrowers (pricing strategies, firm size, sector, credit quality).
  - Standard regressions impose a single pricing rule $\Rightarrow$ miss segmentation in credit markets.

- **Method**
  - Finite mixture of generalized linear models (Grün and Leisch, 2008)
  - Captures latent regimes in loan pricing
  - Estimated via maximum likelihood with EM algorithm

- **Relevance for credit conditions**
  - Identifies latent pricing regimes and tail behavior in loan-rate distributions (Lacroix, 2008)
  - Captures heterogeneous transmission of monetary policy
  - Shows how inflation uncertainty and asymmetry generate **right-tail credit tightening**

Estimation Approach: Specification

- Let r_i denote the interest rate on loan i, conditional on covariates x_i:

$$f(r_i \mid x_i) \;=\; \sum_{g=1}^{G} \pi_g \, f_g(r_i \mid x_i;\, \beta_g)\,,$$

  where
  - π_g : mixing probability of regime g $\quad (\sum_g \pi_g = 1)$
  - f_g : likelihood contribution of regime g

- Where:
  - $r_i \sim \mathcal{N}(\mu_{ig}, \sigma_g^2)$
  - $\mu_{ig} = x_i' \beta_g$
  - Covariates x_i: loan characteristics, credit risk, inflation expectations, fixed effects

Main Results: Uncertainty and Asymmetry

- **Normalized Inflation Uncertainty (NIU):**
  - Higher NIU shifts loan-rate distribution to the right and increases skewness
  - Average rate rises from 2.47% to 2.62% (median, +14 bps)
  - Effect reaches +16 bps in the right tail (q75)
  - Economic cost: $\approx$ 0.5 bn euros annual additional interest expenses for NFCs

- **Asymmetry Strength Index (ASI):**
  - Positive skewness in inflation beliefs increases both median and right-tail loan rates
  - Median rises from 2.17% to 2.32% (+15 bps), q75 from 2.70% to 2.88% (+18 bps)
  - Comparable magnitude to NIU $\Rightarrow$ second and third moments independently matter

- **Contrast:** Forecast disagreement shows weaker and less systematic effects.

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- **Theoretical contribution**
  - Extends Monti–Klein and Stiglitz and Weiss (1981) with risk aversion, subjective beliefs, and ambiguity aversion
  - Predicts: higher inflation uncertainty and asymmetry $\Rightarrow$ tighter credit, stronger rationing

- **Empirical evidence**
  - Using French loan-level data (AnaCredit, 2018–2025)
  - Finite mixture regressions uncover latent pricing regimes
  - Normalized Inflation Uncertainty (NIU) and Asymmetry Strength Index (ASI) systematically increase loan rates and skew their distribution
  - Effects concentrated in the right tail $\Rightarrow$ financially constrained firms disproportionately affected

- **Implications**
  - Uncertainty and asymmetry in inflation expectations constitute <u>independent and significant channels</u> of monetary policy transmission.

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