Banking Panic Risk and Macroeconomic Uncertainty

Bank of Russia Workshop

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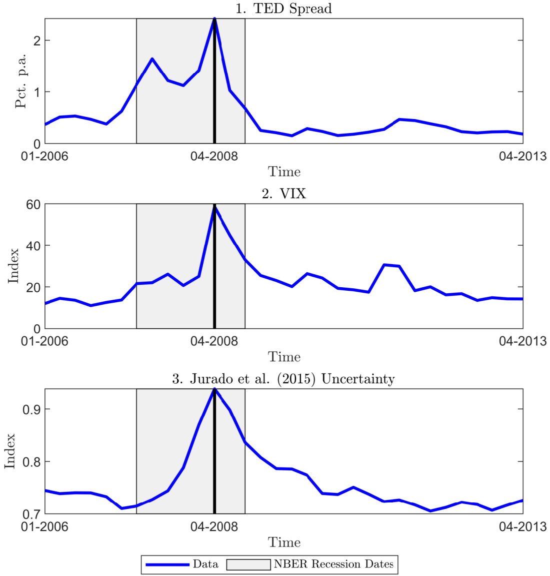
Financial crisis of 2008: Increase in Systemic Risk and Macroeconomic Uncertainty



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- **Result 3:** A countercyclical capital buffer reduces systemic risk and thereby also macroeconomic uncertainty

Literature

1. **Financial crises in dynamic macroeconomic models**
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   Gourio (2012), Basu and Bundick (2017)
3. **Macroprudential regulation of banks**
   Gertler, Kiyotaki, and Queralto (2012), Christiano and Ikeda (2016), Begenau and Landvoigt (2018), Begenau (2019), Di Tella (2019)

Model Setup

Households ▸ Details

- Epstein-Zin preferences
- Consume, work, make loans to banks and firms, own banks, face a cost when lending to firms

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Choose lending & borrowing to maximize the bank's equity value

$$V_t^B = \max_{a_{t+1}^B, d_{t+1}^B} \{\mathbb{E}_t \underbrace{\Lambda_{t,t+1}}_{\text{Household SDF}} \underbrace{(1 - p_{t+1})}_{1-\text{Default prob.}} \underbrace{\bar{V}_{t+1}^B}_{\text{Future bank value}} \} \tag{1}$$

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Net Worth

$$n_t^B = R_t^A a_t^B - R_t^D d_t^B. \tag{4}$$

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Banks can be aggregated into a representative bank

Financial crises

Price of assets Q_t adjusts to clear the market for assets:

$$\underbrace{A^H_{t+1} + A^B_{t+1}}_{\substack{\text{Asset demand by} \\ \text{households } H \text{ and banks } B}} = \underbrace{A^F_{t+1}}_{\substack{\text{Asset supply by} \\ \text{firms } F}} \tag{6}$$

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Return on assets:

$$R^A_t = r^A_t + (1 - \delta) Q_t \tag{7}$$

Measuring systemic risk: the financial crisis probability

Future net worth of incumbent banks:

$$\mathbf{n}_{t+1}^{B} = \begin{cases} n_{t+1}^{B} & = \mathbf{R_{t+1}^{A}} a_{t+1}^{B} - R_{t+1}^{D} d_{t+1}^{B} \quad \text{If assets are valued at normal prices} \end{cases} \tag{8}$$

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p_{t+1} measures **endogenously time-varying** systemic risk

The Effect of Systemic Risk on Macroeconomic Uncertainty

Asset return in $t+1$:

$$\mathbf{R}^{A}_{t+1} = \begin{cases} \mathbf{R^{A}_{t+1}} & \text{with prob. } 1 - p_{t+1} \\ \mathbf{R^{A*}_{t+1}} & \text{with prob. } p_{t+1} \end{cases} \tag{9}$$

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Uncertainty Index (VIX):

$$StDev_t(\mathbf{R}^{A}_{t+1}) = 400\sqrt{\mathbb{E}_t\left(\mathbf{R}^{A}_{t+1} - \mathbb{E}_t\mathbf{R^{A}_{t+1}}\right)^2} \tag{10}$$

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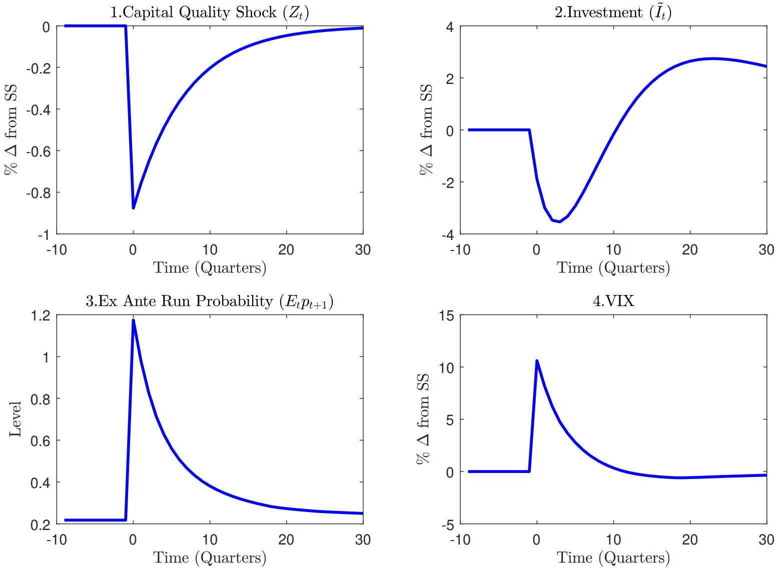
Equivalent indices can be constructed for each endogenous variable

Endogenous Uncertainty in Response to Level Shocks



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Macroeconomic uncertainty affects the economy through three channels:

1. **Precautionary savings channel**
   - Household deposit FOC (abstracting from creditors' loss in default):

$$1 = \mathbb{E}_t \Lambda_{t,t+1} R^D_{t+1}.$$

   - Higher uncertainty, lower deposit rate R^D_{t+1}
   - Lowers financial crisis probability

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Macroeconomic uncertainty affects the economy through three channels:

1. **Precautionary savings channel**
2. **Credit spread channel**
   - Household risky asset FOC:

$$Q_t + f_t = \mathbb{E}_t \Lambda_{t,t+1} R^A_{t+1}.$$

   - Higher uncertainty, higher risky return $\mathbb{E}_t R^A_{t+1}$
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The Effects of Macroeconomic Uncertainty on Systemic Risk

Macroeconomic uncertainty affects the economy through three channels:

1. **Precautionary savings channel**
2. **Credit spread channel**
3. **Bank leverage channel**
   - Banks' incentive constraint:

$$\psi Q_t a^B_{t+1} = \mathbb{E}_t \Lambda_{t,t+1} (1 - p_{t+1}) \bar{V}^B_{t+1}$$

   - Higher uncertainty, lower bank leverage
   - Lowers financial crisis probability

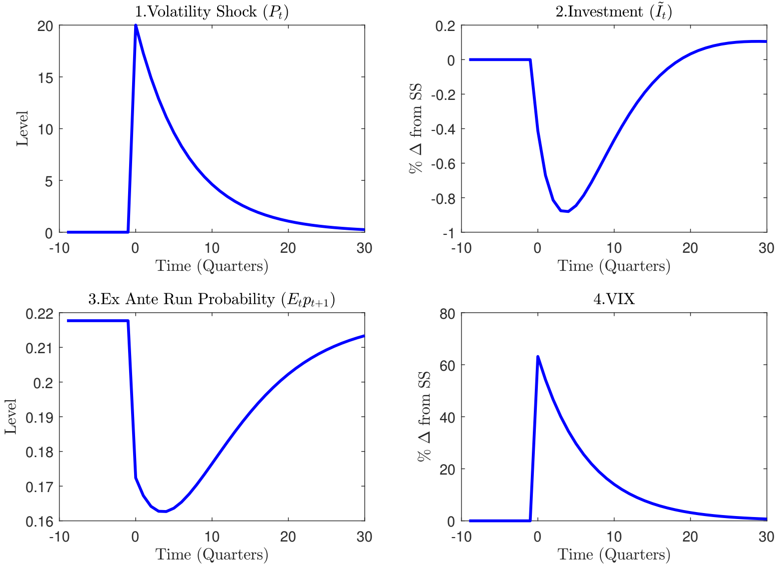
The Effects of Macroeconomic Uncertainty on Systemic Risk

Macroeconomic uncertainty affects the economy through three channels:

1. **Precautionary savings channel**
2. **Credit spread channel**
3. **Bank leverage channel**

All three channels are contractionary, but **reduce** the probability of a financial crisis.

Lower Bank Run Probability in Response to Volatility Shocks



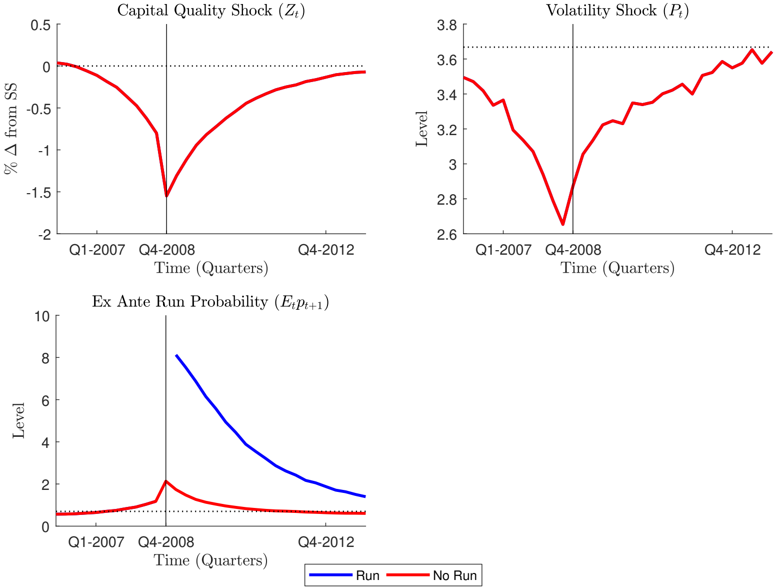
Event Study Approach

Gauge the model fit using an **event study approach:**

1. Simulate the model for many periods
2. Extract all financial crisis episodes from the simulation
3. Compute the average paths of variables around a financial crisis
4. For each financial crisis, compute the counterfactual path given the same shocks if no crisis would have occured
5. For all of these counterfactual paths, compute again average paths

Advantage: Does not impose the shocks that lead to a financial crisis exogenously.

A Typical Banking Panic



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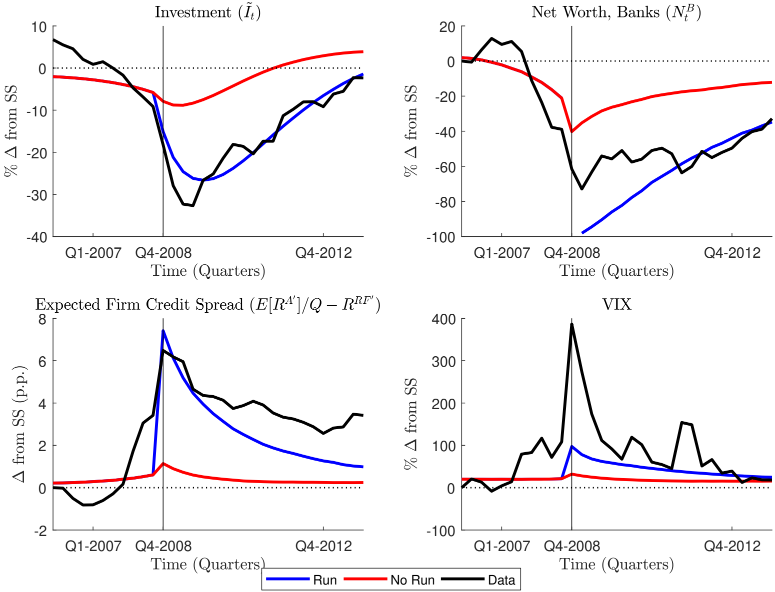

A Capital Requirement with a Countercyclical Buffer

Bank Leverage

$$\phi_t^B \equiv \frac{Q_t a_{t+1}^B}{n_t^B} \tag{11}$$

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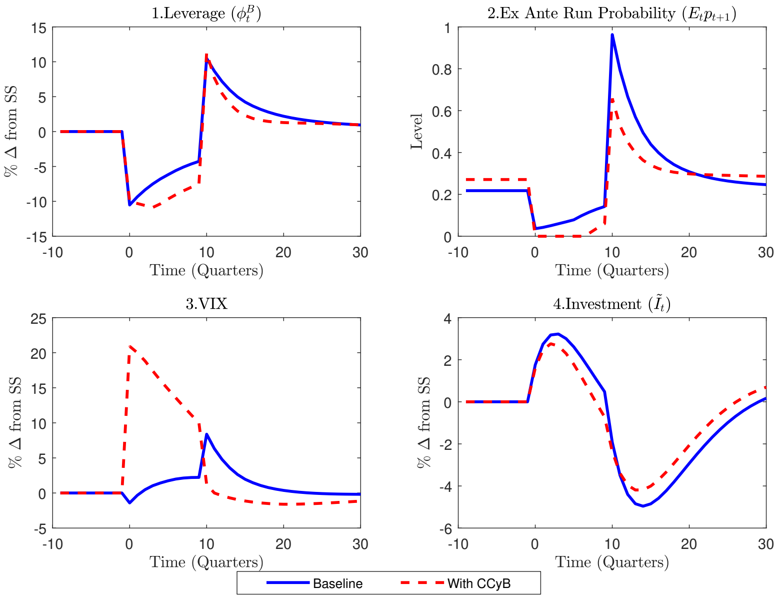
Leverage Constraint:

$$\phi_t^B \leq \bar{\phi}_t^B \tag{12}$$

Model the leverage rule as in Gertler, Kiyotaki, and Prestipino (2019b)

$$\bar{\phi}_t^B = \bar{\phi}^B \mathbb{1}(n_t^B > n^B) \tag{13}$$

The Effects of the CCyB on a Boom-Bust Cycle



Conclusion

Novel feedback loop between systemic risk and macroeconomic uncertainty

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Future Work: Optimal policy, more sophisticated policy rules

Appendix

Household ▸ Back

Maximize Utility

$$V_t^H = \max_{a_{t+1}^H, d_{t+1}^H, c_t^H} \left\{ \left((1-\beta) \left(c_t^H \right)^{1-\sigma} + \beta \left[\mathbb{E}_t \left(V_{t+1}^H \right)^{1-\gamma} \right]^{\frac{1-\sigma}{1-\gamma}} \right)^{\frac{1}{1-\sigma}} \right\} \tag{14}$$

Budget Constraint

$$c_t^H + (Q_t + f_t) a_{t+1}^H + d_{t+1}^H = R_t^A a_t^H + \tilde{R}_t^D d_t^H + W_t + \Pi_t \tag{15}$$

Asset Holding Cost

$$f_t = \chi \max \left(\frac{a_{t+1}^H}{A_{t+1}} - \zeta, 0 \right) \tag{16}$$

Consumption good producers' problem ▸ Back

$$V_t^F = \max_{a^F_{t+1}, k_{t+1}, l_t} \left(\Pi_t^F + \mathbb{E}_t \Lambda_{t,t+1} V_{t+1}^F \right) \quad (17)$$

s.t.

$$\Pi_t^F = e^{\mu^A} s_t^{\alpha} l_t^{1-\alpha} + (1-\delta) Q_t s_t - Q_t k_{t+1} - W_t l_t - R_t^A a_t^F + a_{t+1}^F \quad (18)$$

$$k_{t+1} = a_{t+1}^F \quad (19)$$

$$k_t = Z_t s_t \quad (20)$$

$$\ln Z_t = (1-\rho^Z)\mu_t^Z + \rho^Z \ln Z_{t-1} + \varepsilon_t^Z \quad (21)$$

$$\mu_t^Z = \begin{cases} \mu^{Z,H} & \text{if no run} \\ \mu^{Z,L} \leq \mu^{Z,H} & \text{if run} \end{cases} \quad (22)$$

Capital good producers' problem ▸ Back

$$V_t^Q = \max_{i_t} \left(\Pi_t^Q + \mathbb{E}_t \Lambda_{t,t+1} V_{t+1}^Q \right) \tag{23}$$

s.t.

$$\Pi_t^Q = Q_t i_t - i_t - \frac{\theta}{2} \left(\frac{i_t}{I_{t-1}} - 1 \right)^2 I_{t-1} \tag{24}$$

Model Fit - Targeted Moments - Aggregates

	Data / Target	Model
St. Dev., Output (%)	4.073	4.875
St. Dev., Investment (%)	12.311	10.090
Autocorrelation, Output	99.008	98.930

Model Fit - Targeted Moments - Asset Prices

	Data / Target	Model
St. Dev., Output (%)	4.073	4.875
St. Dev., Investment (%)	12.311	10.090
Autocorrelation, Output	99.008	98.930
Deposit Rate in SSS (% p.a.)	1.870	1.875
Credit Spread in SSS (% p.a.)	3.886	3.885
St. Dev., Deposit Rate (%)	2.107	1.692
St. Dev., Credit Spread (%)	1.614	1.293

Model Fit - Targeted Moments - Financial Sector

	Data / Target	Model
St. Dev., Output (%)	4.073	4.875
St. Dev., Investment (%)	12.311	10.090
Autocorrelation, Output	99.008	98.930
Deposit Rate in SSS (% p.a.)	1.870	1.875
Credit Spread in SSS (% p.a.)	3.886	3.885
St. Dev., Deposit Rate (%)	2.107	1.692
St. Dev., Credit Spread (%)	1.614	1.293
Bank Lending/Total Lending in SSS (%)	50	47.894
Bank Leverage in SSS	10	9.512

Model Fit - Targeted Moments - Financial Crises

	Data / Target	Model
St. Dev., Output (%)	4.073	4.875
St. Dev., Investment (%)	12.311	10.090
Autocorrelation, Output	99.008	98.930
Deposit Rate in SSS (% p.a.)	1.870	1.875
Credit Spread in SSS (% p.a.)	3.886	3.885
St. Dev., Deposit Rate (%)	2.107	1.692
St. Dev., Credit Spread (%)	1.614	1.293
Bank Lending/Total Lending in SSS (%)	50	47.894
Bank Leverage in SSS	10	9.512
Bank Run Frequency (% p.a.)	4.089	4.156
Bank Run Duration (yrs)	0.750	0.747
Mean, Δ Credit Spread in Crisis (% p.a.)	7.290	7.341

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