# Monetary policy and endogenous financial crises

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# What is the link between monetary policy and financial instability?

- **Positive approach:**
  - What are the channels through which monetary policy affects financial stability?
  - Is there a trade–off between price and financial stability?
  - To what extent may monetary policy itself brew financial vulnerabilities?

- Normative approach
  - Should monetary policy (MP) account for financial stability (FS) risks? Conventional ("No") versus more recent ("yes") view

→ **Needed:** models where MP affects the incidence and severity of crises

# NK model with endogenous and microfounded financial crises

- Textbook New Keynesian (NK) model, with capital accumulation and sticky prices
  - + Idiosyncratic productivity shocks $\rightarrow$ capital reallocation among firms via a credit market
  - + Financial frictions $\rightarrow$ credit market prone to endogenous collapse when borrowers search for yield
  - + Global solution $\rightarrow$ capture nonlinearities and dynamics far away from steady state
- MP is the "only game in town" (*e.g.* no macroprudential policy)

# Main findings

1. Monetary policy affects financial stability in the short run, via aggregate demand and in the medium run, via capital accumulation
2. MP as a backstop is effective to address both financial and price instability. Normalisation path depends on the cause of financial stress
3. MP can lead to a crisis if the policy rate remains too low for too long and then increases abruptly
4. Reacting to both output and inflation improves FS and welfare upon strict inflation targeting

# Contribution to the literature

- We study how MP affects FS in a NK model with endogenous microfounded crises
- Monetary policy and financial stability (reduced form models of endogenous crises)

  Woodford (2012), Filardo and Rungcharoentkitkul (2016), Svensson (2017), Gourio, Kashyap, Sim (2018), Ajello, Laubach, Lopez–Salido, Nakata (2019), Cairo and Sim (2018), Borio, Disyatat and Rungcharoentkitkul (2019)
- Micro–founded models of endogenous financial crises

  Boissay, Collard, Smets (2016), Benigno and Fornaro (2018), Gertler, Kiyotaki, Prestipino (2019)
- Our approach: fragility of financial markets ($\neq$ institutions) and search–for–yield behaviours ($\neq$ collateral constraints)

# An extended New–Keynesian Model

# Model– Agents

- **Central bank**: sets nominal interest rate
- **Household**: representative, works, consumes, saves (nominal bonds, firm equity)
- **Retailers**: monopolistic, diversify intermediate goods, sticky prices
- **Intermediate goods firms**: competitive, issue equity, invest, produce with labor and capital

    + Idiosyncratic productivity shocks → capital reallocation among firms via a credit market

# Central bank

- Sets nominal interest rate $i_t$ on risk–free public bond $B_t$ according to the following policy rule:

$$1 + i_t = \frac{1}{\beta}(1 + \pi_t)^{\phi_\pi} \left( \frac{Y_t}{\bar{Y}} \right)^{\phi_y}$$

- We experiment with different specifications, including Taylor (1993)'s rule (TR93) and SIT

# Households

- The representative household consumes a basket of goods $C_t$, works $N_t$, invests in public bonds $B_t$ and in intermediate goods firm $j \in [0,1]$'s equity $P_t Q_t(j)$

$$\max_{C_t, N_t, B_t, Q_t(j)} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[ \frac{C_t^{1-\sigma}}{1-\sigma} - \chi \frac{N_t^{1+\varphi}}{1+\varphi} \right]$$

$$\text{s.t. } P_t C_t + B_t + P_t \int_0^1 Q_t(j) dj \leq W_t N_t + (1 + i_{t-1}) B_{t-1} + P_t \int_0^1 D_t(j) dj + \mathcal{X}_t$$

Optimality conditions

# Retailers

- Monopolistic retailer $i \in [0, 1]$ produces a differentiated final good using intermediate goods and sets its price subject to quadratic adjustment costs

$$\max_{P_t(i), Y_t(i)} \mathbb{E}_0 \sum_{t=0}^{\infty} \Lambda_{0,t} \left[ \frac{P_t(i)}{P_t} Y_t(i) - \frac{(1-\tau)p_t}{P_t} Y_t(i) - \frac{\varsigma}{2} \left( \frac{P_t(i)}{P_{t-1}(i)} - 1 \right)^2 Y_t \right]$$

$$\text{s.t.} \quad Y_t(i) = \left( \frac{P_t(i)}{P_t} \right)^{-\epsilon} (C_t + I_t) \quad \text{where } I_t \equiv K_{t+1} - (1-\delta)K_t$$

- Markup $\mathcal{M}_t \equiv \frac{P_t}{(1-\tau)p_t}$ will be important for the effect of MP on FS

Optimality conditions

# Intermediate goods firms

- Continuum of 1-period firms indexed by $j \in [0, 1]$
- **End of** $t-1$: Firms are similar and all get start–up equity funding $P_{t-1}Q_{t-1}$ and purchase capital $K_t = Q_{t-1}$

# Intermediate goods firms

- Continuum of 1-period firms indexed by $j \in [0, 1]$
- **End of** $t-1$: Firms are similar and all get start–up equity funding $P_{t-1}Q_{t-1}$ and purchase capital $K_t = Q_{t-1}$
- **Beginning of** $t$: firm $j$ has access to production technology

$$Y_t(j) = A_t(\omega_t(j)K_t(j))^{\alpha}N_t(j)^{1-\alpha}, \quad \text{where } \omega_t(j) = \begin{cases} 0 & \text{with probability } \mu \rightarrow \text{Unproductive} \\ 1 & \text{with probability } 1-\mu \rightarrow \text{Productive} \end{cases}$$

# Intermediate goods firms

$$\max_{N_t(j),K_t(j)} D_t(j) = \frac{p_t}{P_t} A_t(\omega_t(j) K_t(j))^\alpha N_t(j)^{1-\alpha} - \frac{W_t}{P_t} N_t(j) + (1-\delta) K_t(j) - (1+r_t^c)(K_t(j) - K_t)$$

Defining $r_t^k = \frac{p_t}{P_t} \frac{\alpha Y_t(j)}{K_t(j)} - \delta = \frac{p_t}{P_t} \frac{\alpha Y_t}{K_t} - \delta$ we obtain:

- Choices of an unproductive firm j with $\omega_t(j) = 0$:

$$\max_{K_t(j)} r_t^q(j) \equiv \frac{D_t(j)}{K_t} - 1 = r_t^c - (r_t^c + \delta) \frac{K_t(j)}{K_t}$$

- Choices of a productive firm j with $\omega_t(j) = 1$:

$$\max_{K_t(j)} r_t^q(j) \equiv \frac{D_t(j)}{K_t} - 1 = r_t^c + \left(r_t^k - r_t^c\right) \frac{K_t(j)}{K_t}$$

# Credit market

## ▶ Reallocation role

- Upon observing $\omega_t(j)$, firm $j$ adjusts its capital from $K_t$ to $K_t(j) \in \{K_t^u, K_t^p\}$:
  (i) Unproductive firms sell their capital $K_t$ and lend the proceeds on the credit market: $K_t^u = 0$
  (ii) Productive firms borrow and use the funds to buy $K_t^p - K_t > 0$ units of capital
- Credit market helps reallocate capital: $\mu K_t = (1-\mu)(K_t^p - K_t) \Rightarrow$ textbook NK model

- Asymmetric Information: $\omega_t(j)$ is private information
- Limited Commitment: firm $j$ may borrow, purchase capital goods, and abscond with them in search for yield

$\Rightarrow$ Borrowing limit is the same for all firms, and credit market is fragile

◀ Limited commitment only

- **Incentive Compatibility Constraint:**

  An unproductive firm has two options:

  1. **Behave:** sell its capital to lend the proceeds at equilibrium loan rate $r_t^c$ → $(1 + r_t^c)K_t$
  2. **Misbehave:** borrow to buy more capital $K_t^p - K_t$ (*i.e.* mimic productive firms) and abscond → $(1 - \delta)K_t^p$

- **Incentive Compatibility Constraint:**

Unproductive firms lend *iff* the equilibrium loan rate $r_t^c$ is high enough

$$\rightarrow \begin{cases} (1+r_t^c)K_t \geqslant (1-\delta)K_t^p \\ \text{where } r_t^c \text{ satisfies } \mu K_t = (1-\mu)(K_t^p - K_t) \end{cases} \Leftrightarrow r_t^c \geqslant \bar{r}^k \equiv \frac{\mu-\delta}{1-\mu}$$

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- **Participation Constraint:**

  Productive firms borrow iff $r_t^c$ is lower than their return on capital $r_t^k$

$$r_t^c \leqslant r_t^k \equiv \frac{p_t}{P_t}\frac{\alpha Y_t^p}{K_t^p} - \delta = \frac{p_t}{P_t}\frac{\alpha Y_t}{K_t} - \delta$$

# Credit market

## ▶ Financial fragility

- **Incentive Compatibility Constraint:**

  Unproductive firms lend *iff* the equilibrium loan rate $r_t^c$ is high enough

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- Trade is possible iff the marginal return on capital $r_t^k \geq \bar{r}^k$

◂ Credit market equilibrium

# MP affects financial fragility in the short and medium run

- **Condition for a crisis**

$$\frac{\alpha Y_t}{\mathcal{M}_t K_t} \leqslant \frac{(1-\tau)(1-\delta)\mu}{(1-\mu)}$$

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- **Short-run:** through macro–economic stabilization → Y– and $\mathcal{M}$–channels

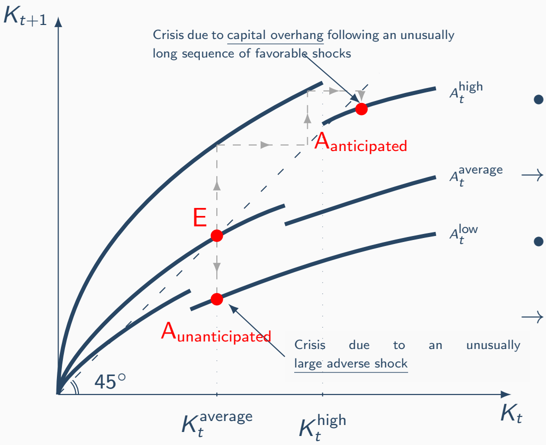
# MP affects financial fragility in the short and medium run

- **Condition for a crisis**

$$\frac{\alpha Y_t}{\mathcal{M}_t K_t} \leqslant \frac{(1-\tau)(1-\delta)\mu}{(1-\mu)}$$

- **Short-run:** through macro–economic stabilization ➞ Y– and $\mathcal{M}$–channels
- **Medium-run:** through capital accumulation ➞ K–channel

# Two polar types of crisis




*Optimal decision rules* $K_{t+1}(K_t, A_t)$

- Crises due to capital overhang following an unusually long sequence of favorable shocks

$\rightarrow$ **MP may reduce their incidence via K–channel**

- Crises which break out in the face of an unusually large adverse shock

$\rightarrow$ **MP may reduce their incidence via Y– and M–channels**

# Overview of the model

$$1 = \mathbb{E}_t\left[\Lambda_{t,t+1}(1+r_{t+1})\right]$$

2. $1 = \mathbb{E}_t\left[\Lambda_{t,t+1}(1+r^k_{t+1})\right]$

3. $\frac{W_t}{P_t} = \chi N_t^{\varphi} C_t^{\sigma}$

4. $K_{t+1} = I_t + (1-\delta)K_t$

5. $\frac{W_t}{P_t} = \frac{\epsilon}{\epsilon-1}\frac{(1-\alpha)Y_t}{\mathcal{M}_t N_t}$

6. $r_t^k + \delta = \frac{\epsilon}{\epsilon-1}\frac{\alpha Y_t}{\mathcal{M}_t K_t}$

7. $1+i_t = \frac{1}{\beta}(1+\pi_t)^{\phi_\pi}\left(\frac{Y_t}{Y}\right)^{\phi_y}$

8. $Y_t = C_t + I_t$

9. $\Lambda_{t,t+1} \equiv \beta\frac{C_{t+1}^{-\sigma}}{C_t^{-\sigma}}$

10. $1+r_t = \frac{1+i_{t-1}}{1+\pi_t}$

11. $Y_t = A_t\left(\omega_t K_t\right)^{\alpha} N_t^{1-\alpha}$

12. $\omega_t = \begin{cases} 1 & \text{if } r_t^k \geq \frac{\mu-\delta}{1-\mu} \\ 1-\mu & \text{otherwise} \end{cases}$

13. $(1+\pi_t)\pi_t = \mathbb{E}_t\left(\Lambda_{t,t+1}\frac{Y_{t+1}}{Y_t}(1+\pi_{t+1})\pi_{t+1}\right) - \frac{\epsilon-1}{\varrho}\left(1 - \frac{\epsilon}{\epsilon-1}\cdot\frac{1}{\mathcal{M}_t}\right)$

# Anatomy of financial crises

# Quantitative analysis

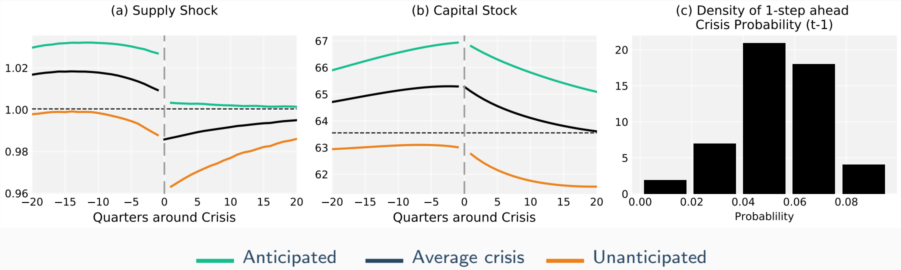
- **Quarterly parametrization**. The only non–standard parameter is the share of unproductive firms. $\mu = 2.42\%$ to have the economy spend 8% of the time in crisis (with TR93 as baseline)
- **Global solution and simulation** of the (nonlinear) model over one million periods
- **Study the dynamics 20 quarters around the beginning of a crisis**. Baseline analysis with technology shocks only. Conclusions hold with both technology and demand shocks

# Parametrisation

| Parameter | Target | Value |
|---|---|---|
| *Preferences* | | |
| $\beta$ | 4% annual real interest rate | 0.989 |
| $\sigma$ | Logarithmic utility on consumption | 1.000 |
| $\varphi$ | Inverse Frish elasticity equals 2 | 0.500 |
| $\chi$ | Steady state hours equal 1 | 0.814 |
| *Technology and price setting* | | |
| $\alpha$ | 64% labor share | 0.360 |
| $\delta$ | 6% annual capital depreciation rate | 0.015 |
| $\varrho$ | Same slope of the Phillips curve as with Calvo price setting | 105.000 |
| $\epsilon$ | 11% markup rate | 10.000 |
| *Aggregate TFP shocks* | | |
| $\rho_a$ | Persistence | 0.950 |
| $\sigma_a$ | Standard deviation of innovations (in %) | 0.700 |
| *Interest rate rule* | | |
| $\phi_\pi$ | Standard quarterly Taylor rule | 1.500 |
| $\phi_y$ | | 0.125 |
| *Proportion of unproductive firms* | | |
| $\mu$ | The economy spends 8% of the time in a crisis | 2.42% |

TFP and Demand shocks

# Average crisis dynamics and crisis variety




- Parameterized so that the economy spends 8% of the time in crises under the Taylor rule (TR93)

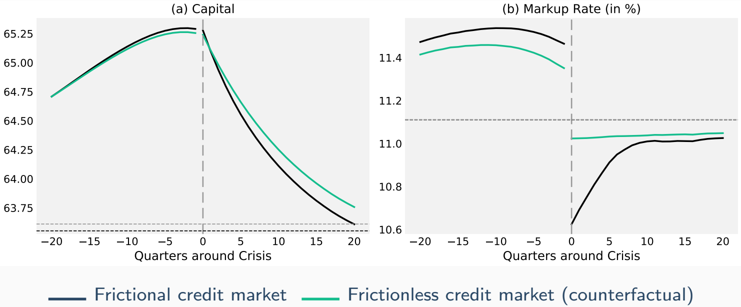
→ **Most crises** break out on the back of an **investment boom**

→ **Few crises** follow **severe adverse** TFP shocks

Paths TFP shocks | Paths TFP and demand shocks | Paths demand shocks

# "Precautionary savings" and "markup" externalities

▶ The case for policy intervention




- The household accumulates precautionary savings in anticipation of revenue losses
- Retailers frontload price increases in anticipation of inflationary pressures

⇒ Individual "hedging" behaviors precipitate the crisis via K– and M–channels

# The price versus financial stability trade-off

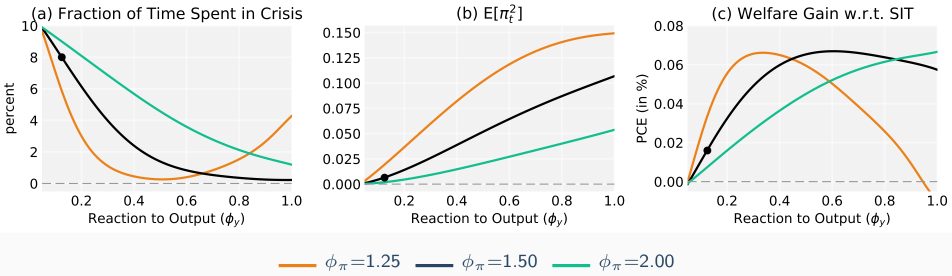
# Responding to output lowers the crisis probability but increases price volatility

| Rule | Crisis time (%) | Output loss (%) | $\mathbb{E}(\pi_t^2)$ |
|---|---|---|---|
| SIT | 9.85 | -5.78 | 0.0000 |
| TR93 | 8.00 | -4.94 | 0.0064 |

◂ Full table ◂ AD shocks ◂ Output loss during GFC

# Financial stability–price stability tradeoff

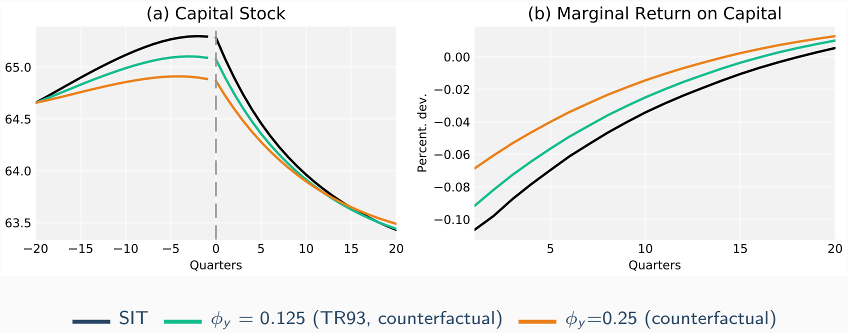
▶ **Conventional parameter space**




- One may reduce the time spent in crisis by responding systematically to output fluctuations alongside inflation...
- ... but beyond a certain point, too much price volatility ($\mathcal{M}$–channel) can be detrimental to financial stability

# Why is there fewer crises under TR93?

▶ **A counterfactual experiment**

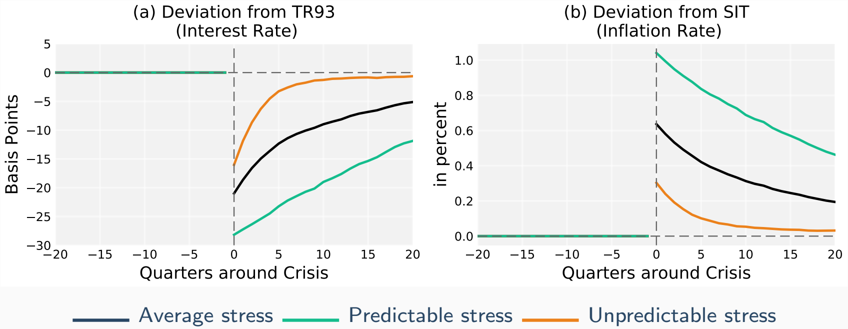



- **Medium run:** capital builds up more slowly under TR93 than under SIT
- **Short run:** TR93 cushions better the fall in $r_t^k$ in the face of adverse shocks

IRFs

# Two Policy Experiments

# MP as backstop policy and MP normalisation path

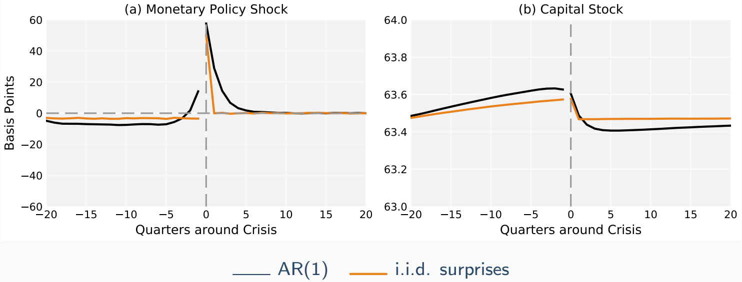


# Backstop policies increase welfare

| Rule | | $\phi_y$ | Welfare loss (%) | BP time (%) | Length (quarter) | $\mathbb{E}(\pi_t^2)$ |
|---|---|---|---|---|---|---|
| SIT | | – | 0.0013 | 15.16 | 8.84 | 0.0019 |
| Taylor rules | ($\phi_\pi = 1.5$) | 0.025 | 0.0012 | 17.99 | 9.17 | 0.0011 |
| | | 0.050 | 0.0013 | 16.30 | 8.70 | 0.0017 |
| | | 0.125 | 0.0019 | 11.81 | 7.45 | 0.0063 |
| | | 0.250 | 0.0044 | 6.30 | 5.93 | 0.0196 |
| | | 0.500 | 0.0117 | 1.38 | 4.43 | 0.0196 |
| | | 0.750 | 0.0196 | 0.37 | 5.11 | 0.0821 |

- Mix of SIT and backstop ("Fed put") reduces the welfare loss to 0.0012% (from 0.1114%)
- The financial sector is more fragile when backstopped though, which forces the central bank to intervene 15% of the time

# Discretionarily keeping rates too low for too long may lead to a crisis




- Discretionary deviations from TR93 → simulate the model with MP shocks only
- Crises occur after a "Great Deviation" (Taylor (2011))

# Takeaways

# Takeaways

- NK model with micro–founded endogenous financial crises:
  - → Monetary policy affects financial stability via Y–M–K channels
  - → Backstop policy effective but normalisation path depends on the nature of the stress
  - → Discretionary loose MP followed by abrupt reversal may lead to crisis
  - → Systematic response to output ($\neq$ SIT) improves both financial stability and welfare

- More in the paper on: the externalities that warrant MP bias toward FS, differentiated effects of supply and demand shock on financial stability

- Still work–in–progress: Calvo–type rigidities (better measure of welfare cost of price volatility)

- Future extensions (distinct papers): ZLB, macroprudential policy

# APPENDIX

# Representative household

The representative household consumes a basket of goods $C_t$, works $N_t$, invests in public bonds $B_t$ and in intermediate goods firm $j \in [0,1]$'s equity $P_t Q_t(j)$

$$\max_{C_t, N_t, B_t, Q_t(j)} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[ \frac{C_t^{1-\sigma}}{1-\sigma} - \chi \frac{N_t^{1+\varphi}}{1+\varphi} \right]$$

$$\text{s.t.} \quad \int_0^1 P_t(i) C_t(i) di + B_t + P_t \int_0^1 Q_t(j) dj \leq W_t N_t + (1+i_{t-1}) B_{t-1} + P_t \int_0^1 D_t(j) dj + \mathcal{X}_t$$

$$W_t / P_t = \chi C_t^{\sigma} N_t^{\varphi}$$

$$C_t(i) = (P_t(i)/P_t)^{-\epsilon} C_t$$

$$1 = \beta(1+i_t) \mathbb{E}_t \left\{ (C_{t+1}/C_t)^{-\sigma} (1/(1+\pi_{t+1})) \right\}$$

$$1 = \beta \mathbb{E}_t \left\{ (C_{t+1}/C_t)^{-\sigma} (1 + r_{t+1}^q(j)) \right\} \quad \forall j \in [0,1]$$

where $C_t \equiv \left[ \int_0^1 C_t(i)^{1-\frac{1}{\epsilon}} di \right]^{\frac{\epsilon}{\epsilon-1}}$, $\pi_{t+1} \equiv \frac{P_{t+1}}{P_t} - 1$ and $1 + r_{t+1}^q(j) \equiv \frac{D_{t+1}(j)}{Q_t(j)}$

Back to main

# Retailers

Monopolistic retailer $i \in [0,1]$ produces a differentiated final good using intermediate goods and sets its price subject to quadratic adjustment costs

$$\max_{P_t(i),Y_t(i)} \mathbb{E}_0 \sum_{t=0}^{\infty} \Lambda_{0,t} \left[ \frac{P_t(i)}{P_t} Y_t(i) - \frac{(1-\tau)p_t}{P_t} Y_t(i) - \frac{\varsigma}{2} \left( \frac{P_t(i)}{P_{t-1}(i)} - 1 \right)^2 Y_t \right]$$

$$\text{s.t.} \quad Y_t(i) = \left( \frac{P_t(i)}{P_t} \right)^{-\epsilon} (C_t + I_t) \quad \text{where } I_t \equiv K_{t+1} - (1-\delta)K_t$$

→ Price setting behavior

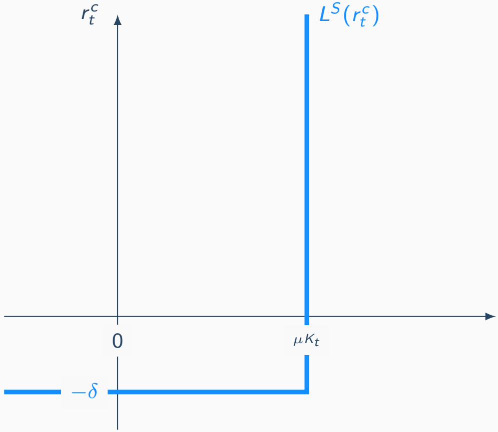
$$(1+\pi_t)\pi_t = \mathbb{E}_t \left\{ \Lambda_{t,t+1} \frac{Y_{t+1}}{Y_t} (1+\pi_{t+1})\pi_{t+1} \right\} - \frac{\epsilon - 1}{\varsigma} \left( 1 - \frac{\mathcal{M}}{\mathcal{M}_t} \right)$$

where $\mathcal{M}_t = \frac{P_t}{(1-\tau)p_t}$ denotes the markup rate and $\mathcal{M} \equiv \frac{\epsilon}{\epsilon - 1}$ its steady state. Markup $\mathcal{M}_t$ will be important for the effect of MP on FS

Back to main

# Credit market (given $r_t^k$)

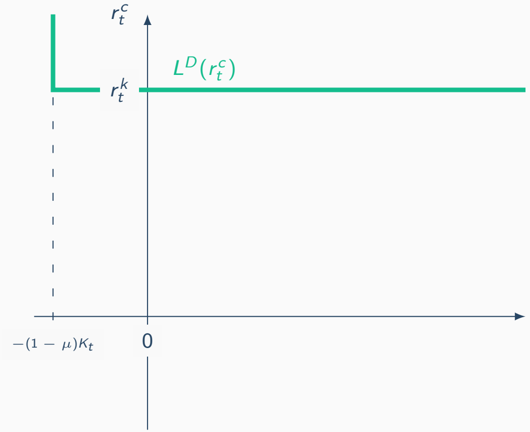
▶ **Frictionless case**




- Unproductive firms' net loan supply

$$L^S(r_t^b) = \begin{cases} \mu K_t & \text{for } r_t^c > -\delta \\ (-\infty, \mu K_t] & \text{for } r_t^c = -\delta \\ -\infty & \text{for } r_t^c < -\delta \end{cases}$$

Back to main



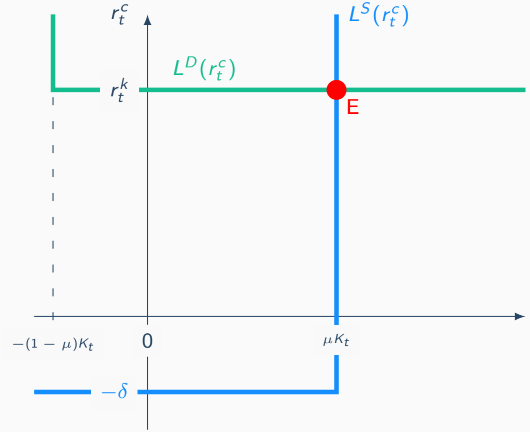

- Productive firms' net loan demand

$$L^D(r_t^b) = \begin{cases} -(1-\mu)K_t & \text{for } r_t^c > r_t^k \\ [-(1-\mu)K_t, +\infty) & \text{for } r_t^c = r_t^k \\ +\infty & \text{for } r_t^c < r_t^k \end{cases}$$

◂ Back to main

# Credit market (given $r_t^k$)

▶ **Frictionless case**




- In E, $r_t^k = r_t^c$ and capital is perfectly reallocated to productive firms:

$$\mu K_t = (1-\mu)(K_t^p - K_t)$$

- Model boils down to the textbook NK model with one representative firm

Back to main

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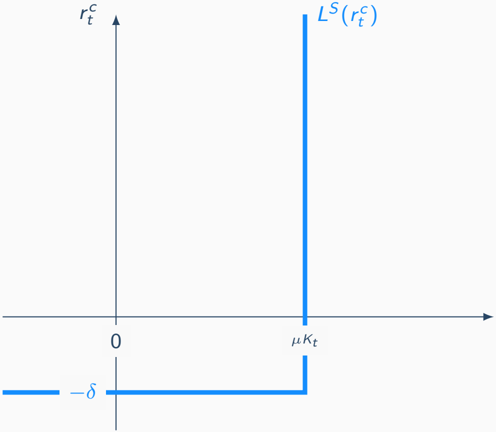
▶ **Frictional case**




- Unproductive firms' net loan supply...

◂ Back to main

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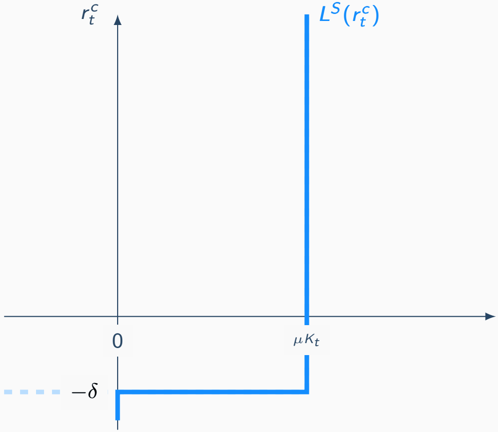
▶ **Frictional case**




- Unproductive firms' net loan supply...

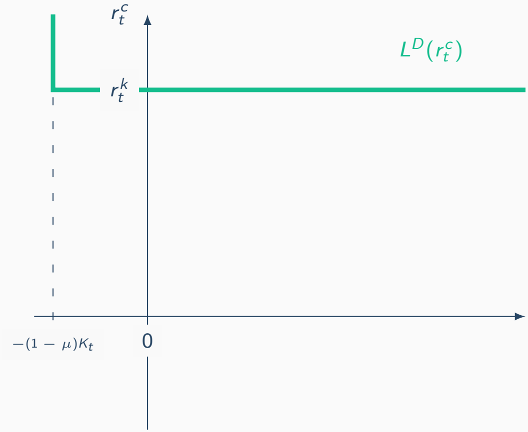
  ... now with IC constraint

$$L^S(r_t^b) = \begin{cases} \mu K_t & \text{for } r_t^c > -\delta \\ [0, \mu K_t] & \text{for } r_t^c = -\delta \\ 0 & \text{for } r_t^c < -\delta \end{cases}$$

◂ Back to main

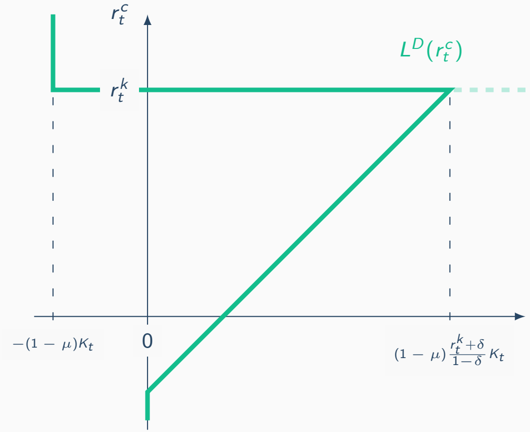
# Credit market (given $r_t^k$)

▶ **Frictional case**




- Productive firms' net loan demand...

◂ Back to main




- Productive firms' net loan demand...

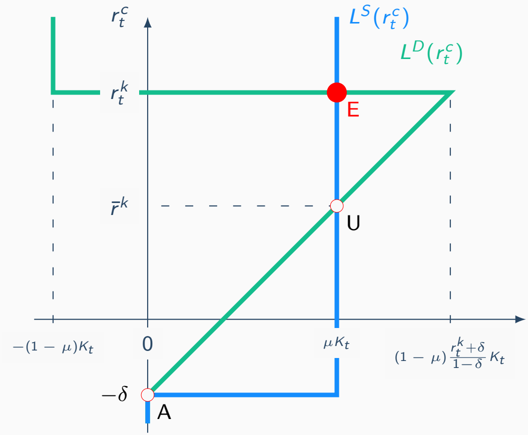
  ... now with IC constraint

$$L^D(r_t^b) = \begin{cases} -(1-\mu)K_t & \text{for } r_t^c > r_t^k \\ \left[-(1-\mu)K_t, (1-\mu)\frac{r_t^k+\delta}{1-\delta}K_t\right] & \text{for } r_t^c = r_t^k \\ (1-\mu)\max\{\frac{r_t^c+\delta}{1-\delta}, 0\}K_t & \text{for } r_t^c < r_t^k \end{cases}$$

Back to main

# Credit market (given $r_t^k$)

## ▶ Frictional case

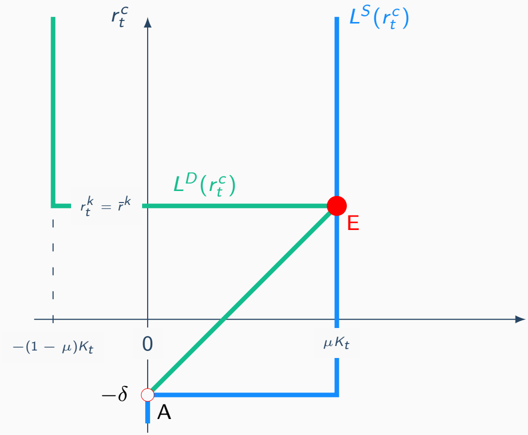



- Equilibrium E is the same as in the frictionless case and textbook model:

$$\mu K_t = (1-\mu)(K_t^p - K_t)$$

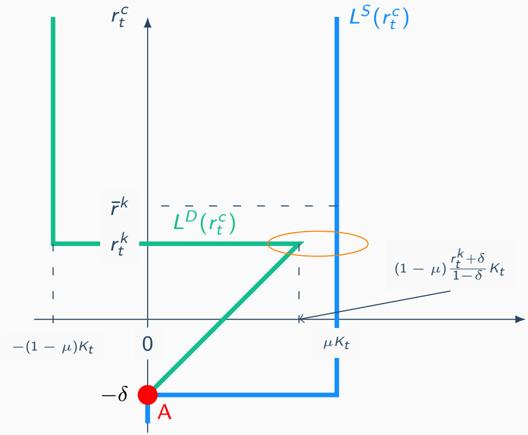
- Aggregate outcome is the same in E and U
- Absence of coordination failure rules out equilibrium A

◂ Back to main




- $\bar{r}^k$ is the minimum loan rate that ensures that all unproductive firms lend (i.e. there is no rationing)

Back to main




- $\bar{r}^k$ is the minimum loan rate that ensures that all unproductive firms lend (i.e. there is no rationing)
- When $r_t^k < \bar{r}^k$, there is excess supply and every unproductive firm left out has an incentive to borrow and abscond
- In this case, A (autarky) is the unique equilibrium

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# Perfect Information Case

## ▶ Incentive Compatibility Constraint

- Unproductive firms do not get any loan
- Productive firm $j$s' borrowing limit is given by the incentive compatibility constraint

$$(1-\delta)K_t(j) \leq (1+r_t^q(j))K_t = (1+r_t^c)K_t + \left(r_t^k - r_t^c\right) K_t(j)$$

$$\Leftrightarrow K_t(j) - K_t \leq \frac{r_t^k + \delta}{1-\delta+r_t^c - r_t^k} K_t$$

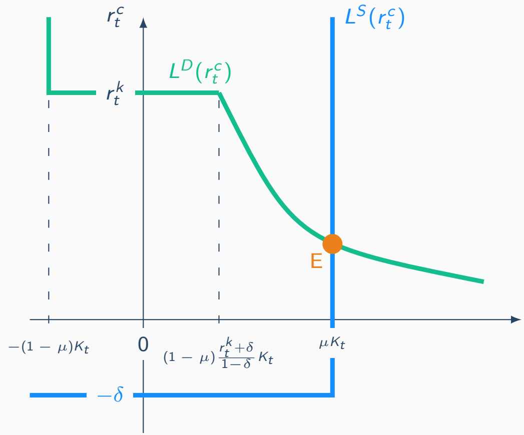
$$\Rightarrow L^D(r_t^c) \equiv (1-\mu)(K_t(j) - K_t) = (1-\mu)\frac{r_t^k + \delta}{1-\delta+r_t^c - r_t^k} K_t \quad \text{if } r_t^k \geq r_t^c$$

- Aggregate loan demand monotonically decreases with $r_t^c$

◂ Back to main

# Perfect Information Case

▶ **Credit Market Equilibrium (given $r_t^k$)**

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# Aggregate outcome — Crisis versus normal times

- **Crisis times:** unproductive firms keep capital idle and capital mis–allocation lowers TFP

$$Y_t = A_t\left((1-\mu)K_t\right)^{\alpha} N_t^{1-\alpha}$$

- **Normal times:** capital is perfectly reallocated (as in the credit–frictionless economy)

$$Y_t = A_t K_t^{\alpha} N_t^{1-\alpha}$$

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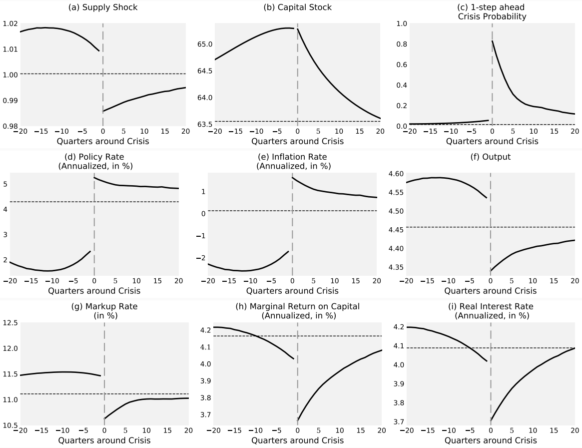
# Anatomy of the average crisis

## ▶ Technology shocks

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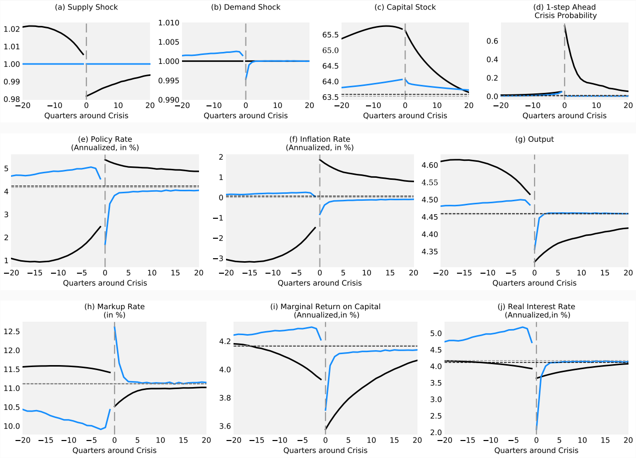
# Anatomy of the average crisis

▶ Technology versus demand shocks




Model with TFP shocks only — Model with demand shocks only

◂ Back to main

# Should the central bank deviate from SIT to foster FS?

| | | Frictionless | Frictional credit market | | | | |
|---|---|---|---|---|---|---|---|
| Rule | $\phi_y$ | Welfare Loss CEV (%) | Welfare Loss CEV (%) | Crisis time (%) | Length (quarter) | Output loss (%) | $\mathbb{E}(\pi_t^2)$ |
| SIT | – | 0 | 0.1114 | 9.85 | 5.91 | -5.78 | 0.0000 |
| Taylor rules ($\phi_\pi = 1.5$) | 0.025 | 0.0000 | 0.1198 | 10.47 | 5.94 | -5.75 | 0.0004 |
| | 0.050 | 0.0001 | 0.1137 | 9.87 | 5.80 | -5.53 | 0.0012 |
| | 0.125 | 0.0009 | 0.0964 | [8.00] | 5.31 | -4.94 | 0.0064 |
| | 0.250 | 0.0037 | 0.0706 | 5.00 | 4.58 | -4.24 | 0.0200 |
| | 0.500 | 0.0116 | 0.0466 | 1.39 | 3.64 | -3.16 | 0.0516 |
| | 0.750 | 0.0197 | 0.0467 | 0.45 | 4.49 | -2.45 | 0.0817 |

Back to main

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# AS and AD shocks

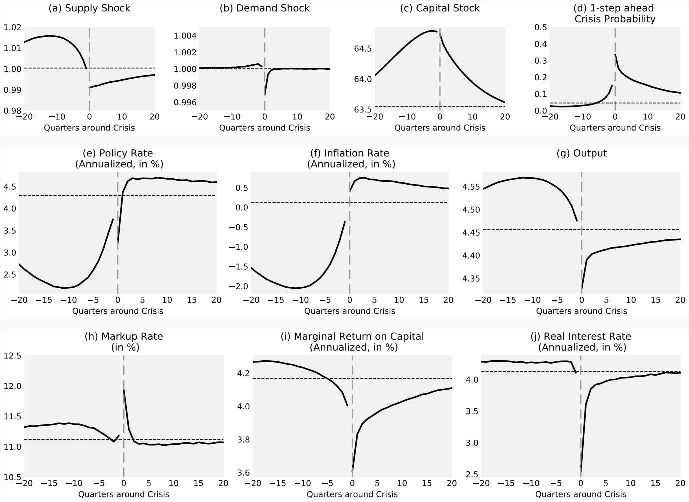
▶ **Parametrization**

| Parameter | Target | Value |
|---|---|---|
| *Aggregate risk–premium shocks* | | |
| $\rho_z$ | As in Smets and Wouters (2007) | 0.220 |
| $\sigma_z$ | | 0.230 |
| *Proportion of unproductive firms* | | |
| $\mu$ | The economy spends 8% of the time in a crisis | 2.39% |

◂ Back to parametrization

# AS and AD shocks

## ▶ Anatomy of the average crisis

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# With AS and AD shocks

- Crisis statistics

| | Crisis time (%) | Output loss (%) |
|---|---|---|
| Economy with both shocks | [8.00] | -3.20 |
| Economy with TFP shocks only | 3.42 | -4.76 |
| Economy with demand shocks only | 0.00 | -2.90 |

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# AS and AD shocks

## ▶ Welfare

| Rule | $\phi_y$ | Frictionless: Welfare loss $CEV^{FB}$ (%) | Frictional credit market: Welfare loss $CEV^{FB}$ (%) | Crisis time (%) | Length (quarter) | Output loss (%) | $\mathbb{E}(\pi_t^2)$ |
|---|---|---|---|---|---|---|---|
| SIT | – | 0 | 0.1114 | 9.85 | 5.91 | -5.78 | 0.0000 |
| Taylor rules ($\phi_\pi = 1.5$) | 0.025 | 0.0116 | 0.1566 | 13.11 | 1.75 | -4.06 | 0.0006 |
| | 0.050 | 0.0093 | 0.1396 | 11.74 | 1.77 | -3.77 | 0.0014 |
| | 0.125 | 0.0062 | 0.0980 | [8.00] | 1.78 | -3.20 | 0.0065 |
| | 0.250 | 0.0064 | 0.0583 | 3.93 | 1.75 | -2.71 | 0.0200 |
| | 0.500 | 0.0126 | 0.0298 | 0.46 | 1.46 | -2.10 | 0.0524 |
| | 0.750 | 0.0203 | 0.0337 | 0.04 | 1.18 | -1.53 | 0.0834 |

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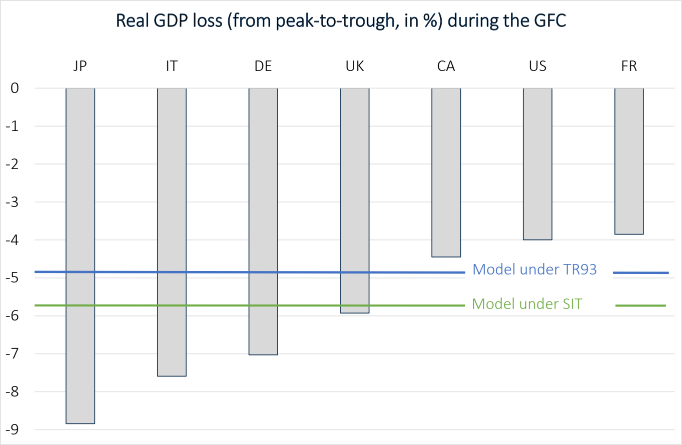
# Peak–to–trough GDP fall during the GFC

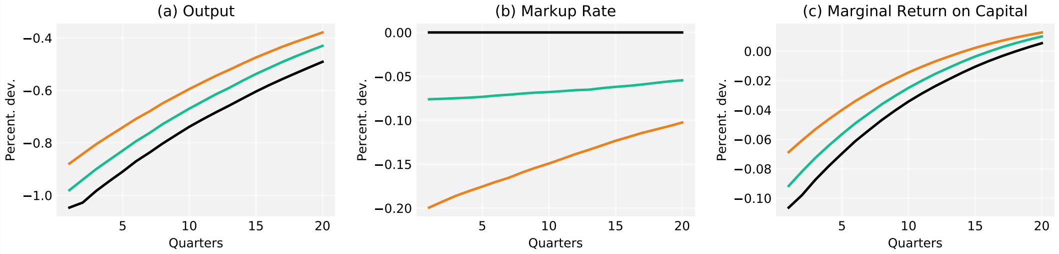
▶ A success of the model




*Source: FRED*

# Short Run Effects

- Impulse Response Function to a Negative TFP shock



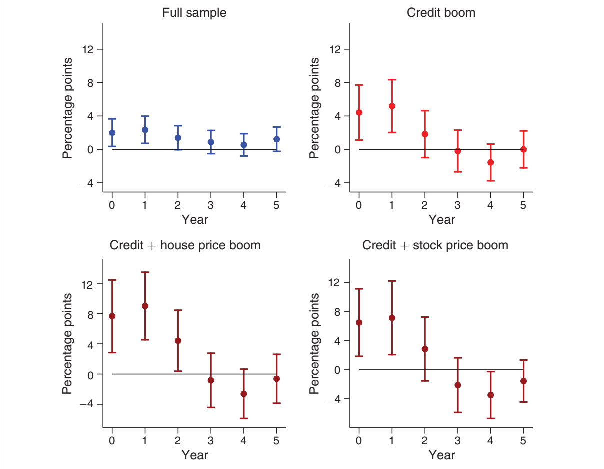

SIT  $\phi_y = 0.125$ (TR93)  $\phi_y = 0.25$

Back to counterfactuals and IRFs

# Schularick at al (2021)

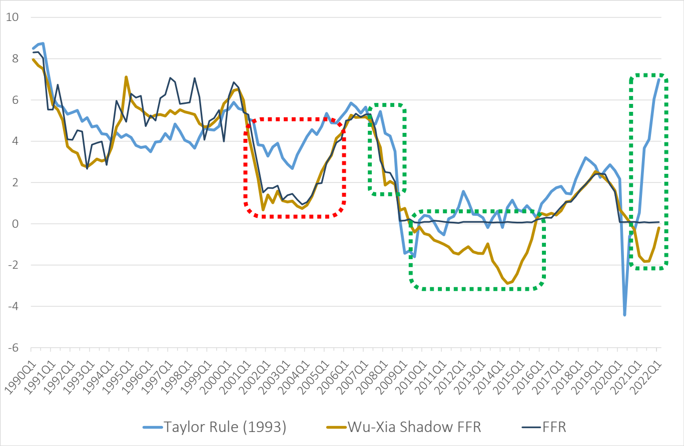
▶ **Leaning against the wind and crisis risk**

Effect on annual crisis probability of an unexpected 1 pp policy rate hike




*"Based on the near-universe of advanced economy financial cycles since the nineteenth century, we show that* ***discretionary*** *leaning against the wind policies during credit and asset price booms are more likely to trigger crises than prevent them".*

# Deviation from Taylor (1993) rule and shadow policy rate

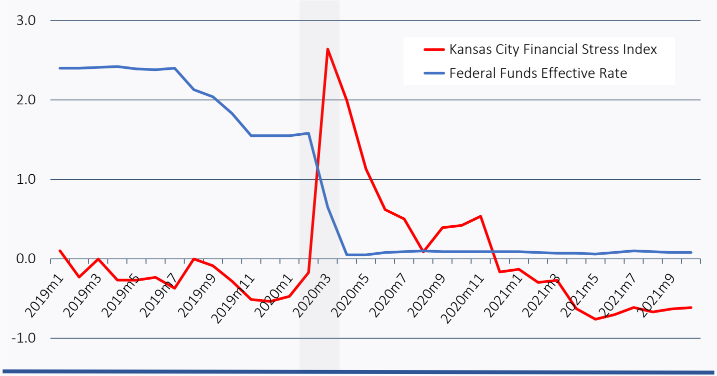



*Source: Federal Reserve Bank of Atlanta*

# MP has likely prevented a financial crisis during the Covid-19 pandemic

**Figure 1**

**Financial stability risk and monetary policy during Covid-19**




Source: FRED