Bank Runs, Fragility, and Credit Easing

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Motivation

- Financial crises typically involve bank runs
- Short-term debt can make a bank vulnerable to a self-fulfilling run
- Empirically, runs more likely with weak aggregate fundamentals
  - General equilibrium feedbacks potentially important

★ Macroeconomic model essential to understand feedbacks

Q: What are the implications for government policy?

A Macroeconomic Model of Bank Runs

- Dynamic portfolio and equity decisions for banks
  - Depend on asset prices, determined in equilibrium
- Limited commitment and endogenous strategic default
  - Defaults triggered by fundamentals or runs
- Fragility linked to fundamentals, as in Gertler-Kiyotaki model, but key differences:
  - Runs on individual banks
  - Maturity critical for fragility
- Normative analysis

Preview of Main Normative Results

- Desirability of **credit easing** depends on source of the crisis
  - Bad if driven by fundamentals. Good if driven by runs

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- Desirability of **credit easing** depends on source of the crisis

  - Bad if driven by fundamentals. Good if driven by runs

- Repaying banks are net buyers during fundamental crisis, but are net sellers in the event of a run.

  ⇒ Increases in asset prices hurt repaying banks in a fundamental driven crisis, but benefit them in the case of runs

Outline of the Talk

1. Environment without runs

2. Model with bank runs

3. Policy analysis

Environment

- Discrete time, infinite horizon, no aggregate risk
- Continuum of banks, preferences $\sum_{t=0}^{\infty} \beta^t \log(c_t)$.
- Creditors have linear utility, discount rate R
- Technology
  - Production of consumption good: $y = zk$
  - Capital in fixed supply $\overline{K}$
- Competitive market for assets and deposits

Banks' Budget Constraints

All banks start at $t = 0$ with portfolio $(b_0, \overline{K})$

- If repay at time t:

$$c = (\bar{z} + p_t)k - Rb + q_t(b', k')b' - p_t k'.$$

  - q_t price schedule of deposits
  - p_t price of capital

- Deposits are one-period non-state contingent claims
  - Without loss for now, but will matter with runs

Banks' Budget Constraints

- If default at time t:

$$c = (\underline{z} + p_t)k - p_t k'$$

  - Permanent financial exclusion $b' = 0$
    - Restriction on saving w/o loss
  - Productivity loss $y = \underline{z}k$
    - Evidence on losses of firms exposed to defaulting banks

Strategic Bank Default

$$
\begin{aligned}
V_t^R(b,k) &= \max_{k',b',c} \log(c) + \beta V_{t+1}(b',k') \\
& \quad \text{s.t.} \quad c = (\bar{z}+p_t)k - Rb + q_t(b',k')b' - p_t k' \\
& \qquad\quad\;\; \text{No-Ponzi}
\end{aligned}
$$

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- If $V_t^R(b,k) > V_t^D(k)$: repay

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Repayment decision:

- If $V_t^R(b,k) = V_t^D(k)$: indifferent
  - Repay for $t > 0$
  - **Default with probability ϕ for $t = 0$**

Equilibrium Consistent Borrowing Limit

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Otherwise, $q = 0$.

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- Guess and verify borrowing constraint

$$b_{t+1} \leq \gamma_t p_{t+1} k_{t+1}$$

where $\{\gamma_t\}$ is an eqm. object characterized analytically in the paper

General Equilibrium

$$\phi K_t^D + (1 - \phi) K_t^R = \overline{K}$$

General Equilibrium

Stationary values:

$$p^R = \frac{\beta \bar{z}}{1 - \beta - (1 - \beta R)\gamma^R} \qquad p^D = \frac{\beta}{1-\beta}\underline{z}$$

$$\gamma^R = H(\gamma^R, p^R) \qquad \gamma^D = H(\gamma^D, p^D)$$

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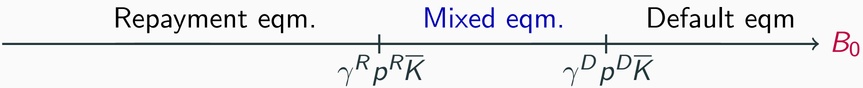
Result: $\gamma^D p^D > \gamma^R p^R \rightarrow$ Uniqueness

General Equilibrium



Within thresholds, a degenerate equilibrium does not exist

- Fraction ϕ defaults and $1 - \phi$ repay
  - Generalize Kehoe-Levine, by allowing initial defaults

General Equilibrium

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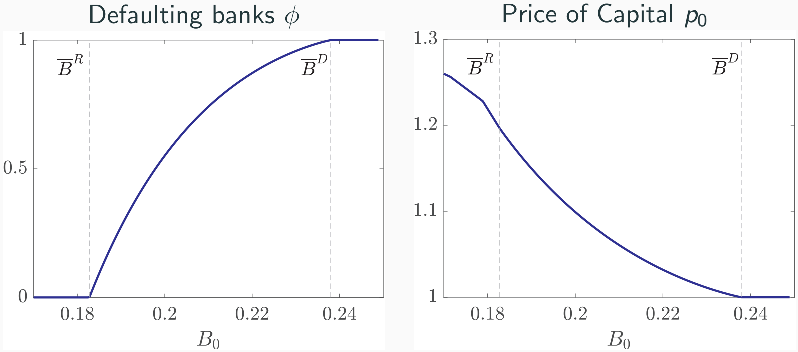
    - Generalize Kehoe-Levine, by allowing initial defaults

In the paper: ▸ Details

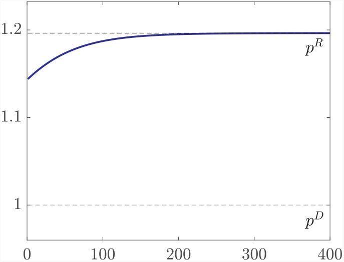
- Unique stationary eqm. and unique transition
- Repaying banks are net buyers of k in the mixed eqm.

Equilibrium ϕ and p_0 as a function of B_0

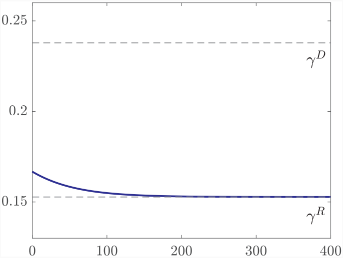


Mixed Equilibrium Simulations

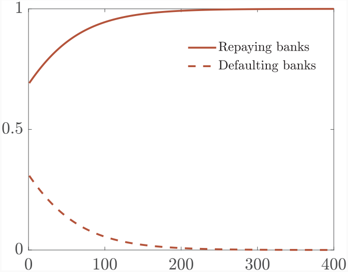
Price of Capital p_t



Leverage Threshold γ_t



Capital Holdings



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Self-Fulfilling Bank Runs

We model bank runs following Cole-Kehoe:

- If creditors refuse to rollover $\Rightarrow$ repayment more costly
- In turn, if optimal to default during a run $\Rightarrow$ a bank run happens

Coordination problem between creditors give rise to multiplicity

Self-fulfilling Bank Runs

- Bank facing a run needs to de-lever:

$$\hat{V}_t^{Run}(n) = \max_{k' \geq 0, c} \log(c) + V_{t+1}\left((\bar{z} + p_{t+1})k'\right)$$

$$s.t \quad c = n + \cancelto{0}{b'} - p_t k'$$

- A bank that can borrows faces tighter constraint:

$$\hat{V}_t^{Safe}(n) = \max_{b', k' \geq 0, c} \log(c) + \beta \hat{V}_{t+1}^{Safe}((\bar{z} + p_{t+1})k' - Rb')$$

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$$\hat{V}_{t+1}^{Run}(n') \geq V_{t+1}^{D}(k') \qquad \text{[If vulnerable, run happens]}$$

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Three regions depending on (b, k):

- Safe: $\hat{V}_t^{Run}(n) > V_t^D(k)$: run does not happen

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Three regions depending on (b, k):

- Default: $\hat{V}_t^{Safe}(n) < V_t^D(k)$: default due to fundamentals

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Financial Fragility

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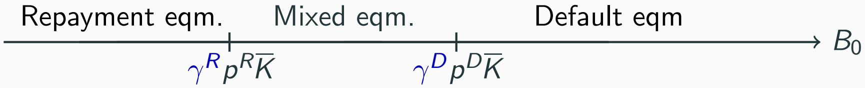
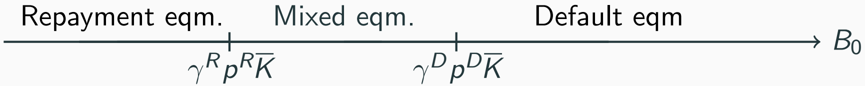


Financial Fragility



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Credit Easing

- Government purchases assets K^g at $t = 0$
  - Financed with lump sum taxes and bond issuances
  - Assets sold at $t = 1$
- Assume that govt. return $R^g = \frac{p_1 + z^g}{p_0} < R$:

$\Rightarrow$ Investors don't want to buy k (if same return as gov.)

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Q: How does credit easing affect ϕ and welfare?

Welfare effects of Credit Easing $\phi > 0$

$$\frac{dW}{dK_g} = \left[\phi \frac{dV^D}{dK_g} - (1-\phi)\frac{dV^R}{dK_g}\right] - \left(V^R - V^D\right)\frac{d\phi}{dK_g}$$

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Without runs:

- $V^R = V^D \;\Rightarrow\; d\phi$ irrelevant

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With runs:

- $V^R = V^{Safe} > V^{Run} = V^D$

$\Rightarrow$ If $d\phi < 0$, possibility that $\Uparrow W$

A repaying banks facing a run is a net seller of assets

$\Rightarrow$ benefits from intervention that $\Uparrow p_0 \;\Rightarrow d\phi < 0$

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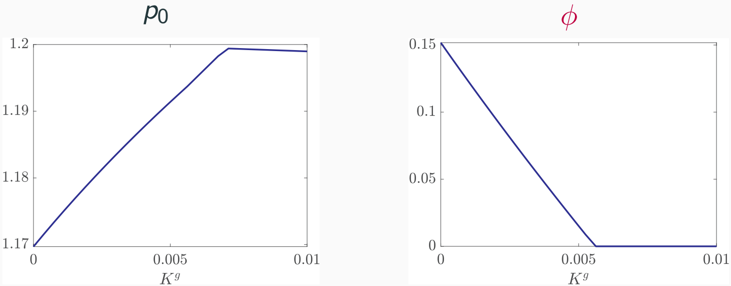
Credit Easing: Self-Fulfilling vs. Fundamentals

Self-Fulfilling Runs



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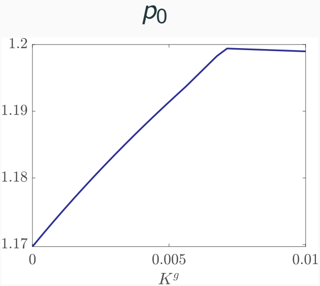
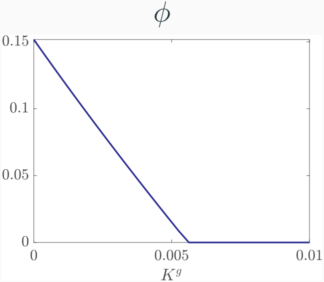
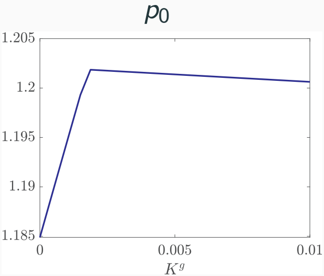
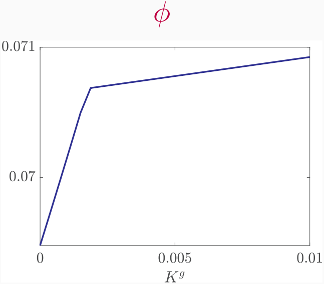




Fundamentals





Conclusions

- A dynamic macroeconomic model of self-fulfilling bank runs
- General equilibrium effects crucial to assess govt. policies
- Desirability of credit easing depends on whether a crisis is diriven by fundamentals or self-fulfilling runs
- Agenda:
  - Anticipation effects of credit easing
  - Use framework for other policies, such as macroprudential

Government picks ϕ at $t = 0$

Banks' welfare

$$W = (1 - \phi)V^R + \phi V^D$$

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Banks' welfare

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- *Assume only p_0 changes in response to policy:*

$$\left.\frac{dW}{d\phi}\right|_{\phi=\phi^E} = (V^D(p_0^E) - V^R(p_0^E)) + \left[(1-\phi)\left.\frac{dV^R(p_0)}{dp_0}\right|_{p_0=p_0^E} + \phi \left.\frac{dV^D(p_0)}{dp_0}\right|_{p_0=p_0^E}\right]\frac{dp_0}{d\phi}$$

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$$\left.\frac{dV^R(p_0)}{dp_0}\right|_{\phi=\phi^E} = u'(c^R)(\overline{K} - k^R(p_0^E)), \quad \left.\frac{dV^D(p_0)}{dp_0}\right|_{\phi=\phi^E} = u'(c^D)(\overline{K} - k^D(p_0^E)).$$

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$\uparrow \phi$ reduces p_0 and helps repaying banks that have high u'

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- Without runs: optimal to have more banks defaulting

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$$- \ (1-\phi)\overbrace{[u'(c^R(p_0^E)) - u'(c^D(p_0^E))]}^{>0}\overbrace{(k^R(p_0^E) - \bar{K})}^{>0}\overbrace{\frac{dp_0}{d\phi}}^{<0}$$

$\uparrow \phi$ reduces p_0 and helps repaying banks that have high u'

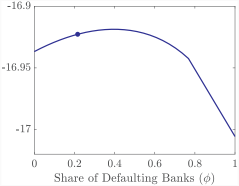
- Without runs: optimal to have more banks defaulting
- With runs: may be optimal to reduce defaults back

Simulations: Socially Optimal Default

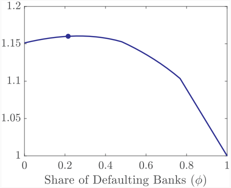
Back

Fundamentals

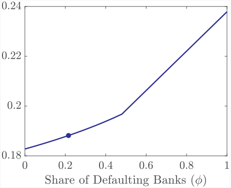
(a) Welfare



(b) p_0

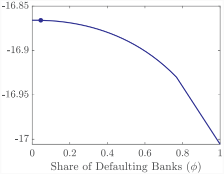


(c) $\gamma_0 p_1$

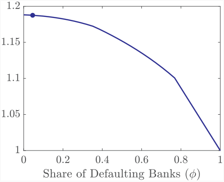


Self-Fulfilling Runs

(d) Welfare



(e) p_0



(f) $\gamma_0 p_1$