An Integrated Framework for Multiple Financial Regulation

Charles A. E. Goodhart, Anil K Kashyap, Dimitrios P. Tsomocos & Alexandros P. Vardoulakis

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Disclaimer: The views expressed in this paper are those of the authors and do not necessarily represent those of the European Central Bank, Banque de France or the Eurosystem
Model Characteristics

General equilibrium
- Incomplete Asset Markets
- Two goods
- Heterogeneous agents

\[ \text{Pareto Inefficient Competitive Equil.} \]
\[ \text{-Rationale for policy intervention} \]

Externalities from the financial system:
- Default, credit crunches and fire sales

Contracts and transactions in nominal currency
- Price for liquidity
Borrowers:
• Farmers
• Young and Old

Lenders:
• Homeowners

Financial Regulation

Central Bank

Houses

Goods Market

Bank

Money

Short-term loans

Mortgages

Deposits

Mortgage Backed Securities

Repurchase loan

Shadow Bank

Banks

Goods

Money
Model characteristics

- **Uncertainty:**
  - Relative quantity of potatoes vs. houses
  - Monetary endowments and banks’ capital
  - Central bank policy

- Households try to smooth consumption across goods within the period and total consumption over time

- Intermediaries improve smoothing but at the cost of amplifying shocks

- Regulations damp amplification of shocks but restrict smoothing
Non-financial benchmark

- Imagine no financial intermediation, just a CB with providing short-term liquidity/credit

- Home-owner can self-insure using both cash and holding houses, so he can smooth consumption across goods and across periods.

- Farmer can equate marginal utility of houses and potatoes in period 1. But cannot smooth between period 1 and 2.
Actions at $t=2$

- (Uncertainty revealed: Bad news $\Rightarrow$ house price crash, Good news $\Rightarrow$ a house price boom)
- Focus on the bad news case which includes default
- Financial flows:
  - $N$ defaults on repos, leaving $B$ with losses
  - $B$ partially defaults on long-term deposits, its capital is reduced and this leads to a reduction in lending
  - $B$ might also sell MBS to pay the depositors, but this will further depress house prices
  - Relative price of potatoes must rise
  - $F$ rents a house, $P$ moves to a smaller one
Model properties and questions

- Knock effects from house price collapse and subsequent repo default
  - Fire sale of MBS by banks
  - Deposit defaults
  - Potential margin spiral
Potential Policy Responses

Examined in the paper
- Capital requirement & countercyclical capital buffers
- Liquidity regulation (LCR)
- Loan-to-value ratios
- Haircut requirements
- Dynamic provisioning

Future agenda
- Central Bank policies: conventional & unconventional
- Taxes on: bank size, activity, deposits
- DTI, sectoral capital buffers, time-varying regulation

Off the table
- Net Stable Funding Ratio related to bank runs
Table 1: Impact of Alternative Regulations on Key Endogenous Variables (Change relative to baseline equilibrium)

<table>
<thead>
<tr>
<th></th>
<th>LTV</th>
<th>MR</th>
<th>CR₁</th>
<th>CR₂b</th>
<th>LCR₁</th>
<th>DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Securitization</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Relative price of potatoes to</td>
<td>-</td>
<td>≈0</td>
<td>≈0</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>housing-good state</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profits of the Bank period 1</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Profits of Bank good state</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
## Welfare effects

Table 2: Impact of Alternative Regulations on Household Utilities and Financial Institutions’ Welfare (Change relative to baseline equilibrium)

<table>
<thead>
<tr>
<th></th>
<th>LTV</th>
<th>MR</th>
<th>CR₁</th>
<th>LCR₁</th>
<th>CR₂b</th>
<th>DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>P’s Utility</td>
<td>-</td>
<td>≈0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>F’s Utility</td>
<td>-</td>
<td>≈0</td>
<td>≈0</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>R’s Utility</td>
<td>≈0</td>
<td>≈0</td>
<td>≈0</td>
<td>-</td>
<td>≈0</td>
<td>-</td>
</tr>
<tr>
<td>B’s Payoff</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>N’s Payoff</td>
<td>+</td>
<td>+</td>
<td>≈0</td>
<td>≈0</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
# Combination Regulatory Packages

Table 3: Impact of Combining Regulations on Household Utilities and Financial Institutions’ Welfare

(Change relative to baseline equilibrium)

<table>
<thead>
<tr>
<th></th>
<th>CR₁, CR₂ᵇ, MR</th>
<th>CR₁, LCR₁, MR</th>
<th>CR₁, CR₂ᵇ, LTV</th>
</tr>
</thead>
<tbody>
<tr>
<td>P’s Utility</td>
<td>+</td>
<td>+</td>
<td>≈0</td>
</tr>
<tr>
<td>F’s Utility</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>R’s Utility</td>
<td>≈0</td>
<td>≈0</td>
<td>≈0</td>
</tr>
<tr>
<td>B’s Payoff</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>N’s Payoff</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
Importance of Dynamics

- **Procyclicality**
  - Dynamically lower margins leading to higher default
  - Distinguish between leverage and credit
  - Marginal buyer / Marginal lender

- **Time-varying regulation**
  - Which indicators should we use?

- **Could give motive for bank runs and hence for NSFR and deposit insurance**

- **Computational difficulties**
  - Discontinuities in the policy and transition functions
  - Non-linearity probably important
Example of procyclicality

- Aggregate data for Globally Systemically Important Financial Institutions (G-SIFIs)
- Source: Bloomberg
Conclusions

- Need a full GE model to sort out these effects
  - Default in a key element: Can improve hedging, but can act as an amplifier of shocks

- Concentrate on the channels through which regulation operates and not on the agents on which rules bind

- Financial system acts as an amplifier of primitive shocks
  - Drop in the supply of credit due to loan losses further suppresses prices and income making default worse
  - Default by financial institutions results in shocks being transferred throughout the economy

- Two-way interaction between financial instability and the real economy
Conclusions ctd.

- Stabilizing bank and non-banks can improve welfare
- Structural vs. cyclical policy interventions
- Focus not only on credit, but also on leverage
- Multiple externalities require multiple tools: Are the complements or substitutes?
- But, be careful about combining tools, it is easy to design welfare-reducing policies
Extra Slides
Aside – Margin Spiral

\[
V_{2b}^{MORT} \equiv \frac{P_{2b,h}c_{1,h}^P}{MORT^B (1 + r^{MORT})} \quad \text{and arbitrage pins down MBS prices}
\]

\[
P_{2b,MBS} = \frac{V_{2b}^{MORT} (1 + r^{MORT})}{1 + r_{2b}^{CB}}
\]

∴ MBS and house prices must be connected

\[
P_{2b,MBS} = \frac{P_{2b,h}c_{1,h}^P}{MORT^B (1 + r_{2b}^{CB})} \quad \Leftrightarrow \quad P_{2b,h} = P_{2b,MBS} \frac{MORT^B}{c_{1,h}^P} (1 + r_{2b}^{CB})
\]

Plus cash-in-the-market pricing: \( P_{2b,MBS} MBS_{2b}^N \leq E_{2b}^N \)

So more fire sales mean lower house prices!
Household P’s Optimization Problem

\[
U^P = U^P \left( c_{1,p}^P, c_{1,h}^P \right) + \bar{\xi}_{2g} \left[ U^P \left( c_{2g,p}^P, (1 - \delta) c_{1,h}^P + c_{2g,h}^P \right) \right] + \\
\bar{\xi}_{2b} \left[ U^P \left( c_{2b,p}^P, c_{2b,h}^P \right) - \tau_{2b} P^P \left( MORT^P \left( 1 + r^{MORT} \right) - P_{2b,h} c_{1,h}^P \right) \right]
\]

where

\[
U^P \left( c_{ts,p}^P, c_{ts,h}^P \right) = \frac{1}{1 - \gamma^P} \left( c_{ts,p}^P \right)^{1 - \gamma^P} + \frac{1}{1 - \gamma^P} \left( c_{ts,h}^P \right)^{1 - \gamma^P}
\]
Household P’s budget constraints

\[ P_{1,h} c^P_{1,h} \leq Money^P_1 + MORT^P + LST^P_1 \]

\[ LST^P_1 \left(1 + r^{ST}_1\right) \leq P_{1,p} q^{P}_{1,p} \]

\[ MORT^P \left(1 + r^{MORT}\right) + P_{2g,h} c^P_{2g,h} \leq Money^P_{2g} + LST^P_{2g} \]

\[ LST^P_{2g} \left(1 + r^{ST}_{2g}\right) \leq P_{2g,p} q^{P}_{2g,p} \]

\[ P_{2b,h} c^P_{2b,h} \leq Money^P_{2b} + LST^P_{2b} \]

\[ LST^P_{2b} \left(1 + r^{ST}_{2b}\right) \leq P_{2b,p} q^{P}_{2b,p} \]
Household F’s Optimization Problem

\[ \overline{U}^F = \omega_{2g} \left[ U^F \left( c_{2g,p}^F, c_{2g,h}^F \right) \right] + \omega_{2b} \left[ U^F \left( c_{2b,p}^F, c_{2b,h}^F \right) \right] \]

where

\[ U^F \left( c_{2p}^F, c_{2h}^F \right) = \frac{1}{1 - \gamma^F} \left( c_{2p}^F \right)^{1 - \gamma^F} + \frac{1}{1 - \gamma^F} \left( c_{2h}^F \right)^{1 - \gamma^F} \]

and

\[ P_{2s,h} c_{2s,h}^F \leq Money_{2s}^F + LST_{2s}^F \]

\[ LST_{2s}^F \left( 1 + r_{2s}^{ST} \right) \leq P_{2s,p} q_{2s,p}^F \]
Household R’s Optimization Problem

\[ \bar{U}^R = U^R\left(c_{1,p}^R, c_{1,h}^R\right) + \bar{\xi}_{2g} \left[U^R\left(c_{2g,p}^R, (1-\delta)(c_{1,h}^R + c_{2g,h}^R)\right) + \bar{\xi}_{2b} \left[U^R\left(c_{2b,p}^R, (1-\delta)(c_{1,h}^R + c_{2b,h}^R)\right)\right]\right] \]

where

\[ U^R\left(c_{s,p}^R, c_{s,h}^R\right) = \frac{1}{1-\gamma^R} \left(c_{s,p}^R\right)^{1-\gamma^R} + \frac{1}{1-\gamma^R} \left(c_{s,h}^R\right)^{1-\gamma^R} \]

and

\[ P_{1,p} c_{1,p}^R + D^R \leq Money_1^R + LST_1^R \]

\[ LST_1^R \left(1 + r_{1}^{ST}\right) \leq P_{1,h} q_{1,h}^R \]

\[ P_{2s,p} c_{2s,p}^R \leq Money_{2s}^R + LST_{2s}^R + V_{2s}^D D^R \left(1 + r^D\right) \]

\[ LST_{2s}^R \left(1 + r_{2s}^{ST}\right) \leq P_{2s,h} q_{2s,h}^R \]

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Bank B’s Optimization Problem

\[
\text{Prof}^B = \text{Prof}^B \left( \pi^B_1 \right) \\
+ \xi \sum_s \omega_{2s} \left[ \text{Prof}^B \left( \pi^B_{2s} \right) - \tau^B_{2s} \left[ 1 - \nu^B_{2s} \right] D^B \left( 1 + r^D \right) \right]
\]

where

\[
\text{Prof} \left( \pi^B_{ts} \right) = \frac{1}{1 - \gamma^B} \left( \pi^B_{ts} \right)^{1 - \gamma^B}
\]

and period 1 budget constraints

\[
LST^B_1 + REPO^B + CC^B \leq E^B_1 + DISC^B_1 + D^B
\]

\[
MORT^B \leq CC^B + P^M_{1,MBS}MBS^B_1
\]

\[
DISC^B_1 \left( 1 + r^{CB}_1 \right) + cash^B_1 \leq LST^B_1 \left( 1 + r^{ST}_1 \right)
\]
Bank B’s Second Period Constraints

$$\text{LST}^B_{2g} + v^B_{2g} D^B (1 + r^D) \leq \text{cash}^B_1 + E^B_{2g} + \text{DISC}^B_{2g} + P_{2g, \text{MBS}} \sigma^B_{2g} \left( \text{MORT}^B - \text{MBS}_1^B \right)$$

$$\pi^B_{2g} \leq \text{LST}^B_{2g} \left( 1 + r^\text{ST}_{2g} \right) + \text{REPO}^B \left( 1 + r^\text{REPO} \right) + (1 - \sigma^B_{2g}) \left( \text{MORT}^B - \text{MBS}_1^B \right) \left( 1 + r^\text{MORT} \right) - \text{DISC}^B_{2g} \left( 1 + r^\text{CB}_{2g} \right)$$

$$\text{LST}^B_{2b} + v^B_{2b} D^\beta \left( 1 + r^D \right) \leq \text{cash}^B_1 + E^B_{2b} + \text{DISC}^B_{2b}$$

$$+ P_{2b, \text{MBS}} \left[ \vartheta^B_{2b} \text{MBS}_1^B + \sigma^B_{2b} \left( \text{MORT}^B - \text{MBS}_1^B \right) \right]$$

$$\pi^B_{2b} \leq \text{LST}^B_{2b} \left( 1 + r^\text{ST}_{2b} \right) + V^\text{MORT}_{2b} \left( \text{MORT}^B - \vartheta^B_{2b} \text{MBS}_1^B - \sigma^B_{2b} \left( \text{MORT}^B - \text{MBS}_1^B \right) \right) \left( 1 + r^\text{MORT} \right)$$

$$- \text{DISC}^B_{2b} \left( 1 + r^\text{CB}_{2b} \right)$$
Non-Bank N’s Optimization Problem

\[
\overline{\text{Prof}}^N = \tilde{\xi}_{2g} \text{Prof}^N \left( \pi^N_{2g} \right) \\
+ \tilde{\xi}_{2b} \left[ \text{Prof}^N \left( \pi^N_{2b} \right) - \tau^N_{2b} \left[ \text{REPO}^N (1 + r^{\text{REPO}}) - V^{\text{MORT}}_{2b} MBS_1^N (1 + r^{\text{MORT}}) \right] \right]
\]

where

\[
\text{Prof} \left( \pi^N_{2s} \right) = \frac{1}{1 - \gamma^N} \left( \pi^N_{2s} \right)^{1 - \gamma^N}
\]
Non-Bank N’s Budget Constraints

\[ P_{1,MBS} MBS_1^N \leq E_1^N + REPO^N \]

\[ P_{2s,MBS} MBS_{2s}^N \leq E_{2s}^N \]

\[ \pi_{2g}^N \leq \left( MBS_1^N + MBS_{2g}^N \right) \left( 1 + r^{MORT} \right) \]

\[ - REPO^N \left( 1 + r^{REPO} \right) \]

\[ \pi_{2b}^N \leq V_{2b}^{MORT} MBS_{2b}^N \left( 1 + r^{MORT} \right) \]
Loan to Value and Haircut Regulation

\[ LTV^P = \frac{MORT^B}{P_{1,h} c_{1,h}^P} \]  (mortgage divided by house price value)

\[ MR^N = \frac{E^N_1}{P_{1,MBS} MBS_{1}^N} \]  (N's equity relative to its borrowing)
B’s Middle of Period 1 Balance Sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>$LST_1^B$</td>
<td>$E_1^B$</td>
</tr>
<tr>
<td>$REPO^B$</td>
<td>$\pi_1^B$</td>
</tr>
<tr>
<td>$MORT^B - MBS_1^B$</td>
<td>$D^B$</td>
</tr>
<tr>
<td>$r_1^{ST} LST_1^B$</td>
<td>$DISC_1^B$</td>
</tr>
<tr>
<td>$r_1^{CB} DISC_1^B$</td>
<td></td>
</tr>
</tbody>
</table>

$$\pi_1^B = r_1^{ST} LST_1^B - r_1^{CB} DISC_1^B + (P_{1,MBS} - 1) MBS_1^B$$
Liquidity and Capital Regulation

\[ CR_{mid}^B = \frac{E_1^B + \pi_1^B}{r \omega_1^{MORT} \cdot (MORT^B - MBS_1^B) + r \omega_1^{REPO} \cdot REPO^B} \]

(riskless assets get zero risk weight)

\[ LCR_{mid}^B = \frac{LST_1^B}{LST_1^B + REPO^B + MORT^B - MBS_1^B} \]
# B’s Middle of Period 2 Balance Sheet

(Good state)

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>$LST^B_{2g}$</td>
<td>$E^B_1 + E^B_{2g} + \pi^B_1$</td>
</tr>
<tr>
<td>$REPO^B$</td>
<td>$P - L^B_{mid\ 2g}$</td>
</tr>
<tr>
<td>$(1 - \sigma^B_{2g})(MORT^B - MBS^B_1)$</td>
<td>$DISC^B_{2g}$</td>
</tr>
</tbody>
</table>

$$LCR^B_{mid\ 2g} = \frac{LST^B_{2g}}{LST^B_{2g} + REPO^B + (1 - \sigma^B_{2g})(MORT^B - MBS^B_1)}$$
**B’s Middle of Period 2 Balance Sheet**  
(Bad state, before deposit default)

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>$MORT^B - \vartheta_2^B MB_1^B$</td>
<td>$E_1^B + E_2^B + \pi_1^B$</td>
</tr>
<tr>
<td>$\text{cash}_{2s}^B$</td>
<td>$P - L_{mid2b}^B = REPO^B - (1 - \vartheta_2^B)MB_1^B$</td>
</tr>
<tr>
<td></td>
<td>$- P_{2b,MB} \vartheta_2^B MB_1^B$</td>
</tr>
<tr>
<td></td>
<td>$D^B$</td>
</tr>
</tbody>
</table>

$$CR_{mid2b}^B = \frac{E_1^B + E_2^B + \pi_1^B + P - L_{mid2b}^B}{rw_{2b}^{MORT} \cdot (MORT^B - \vartheta_2^B MB_1^B)}$$
b’s Middle of Period 2 Balance Sheet  
(Bad state, after deposit default)

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>$LST_{2b}^B$</td>
<td>$E_1^B + E_{2b}^B + \pi_1^B$</td>
</tr>
<tr>
<td>$MORT^B - \varphi_{2b}^B MBS_{1b}^B$</td>
<td>$P - L_{mid 2'b}^B$</td>
</tr>
</tbody>
</table>

$$LCR_{mid 2b}^B = \frac{LST_{2b}^B}{LST_{2b}^B + MORT^B - \varphi_{2b}^B MBS_{1b}^B}$$
Dynamic Provisioning

Define Real Estate Related Credit Growth as

\[ g\% = \left( \frac{LST_{2g}^P + LST_{2g}^F}{MORT^B + LST_1^P} - 1 \right) \% \]

Provision \( \kappa \) per dollar of lending whenever \( g > "x" \)

\[
LST_{2g,p}^B + LST_{2g,h}^B + \nu_{2g}^B D^B \left( 1 + r^D \right) + \left( g\% - x\% \right) \kappa
\]

\[
\leq cash_1^B + E_{2g}^B + DISC_{2g}^B + P_{2g,MBS} \sigma_{2g}^B \left( MORT^B - MBS_{1}^B \right)
\]

Makes it possible to lean against the boom without directly distorting the allocations in the bust
<table>
<thead>
<tr>
<th>Endowments of goods</th>
<th>Households’ wealth</th>
<th>F.I. capital</th>
<th>CB rates</th>
<th>Default penalties</th>
<th>Risk aversion</th>
<th>Other parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>$e_{1,p}^P = 10$</td>
<td>Money$_1^P = 4.1$</td>
<td>$E_1^B = 0.5$</td>
<td>$r_1^{CB} = 0.12$</td>
<td>$\tau_{2b}^P = 4$</td>
<td>$\gamma^P = 2.1$</td>
<td>$\omega_{2b} = 0.1$</td>
</tr>
<tr>
<td>$e_{2g,p}^P = 32$</td>
<td>Money$_{2g}^P = 4.1$</td>
<td>$E_{2g}^B = 0.5$</td>
<td>$r_{2g}^{CB} = 0.12$</td>
<td>$\tau_{2g}^B = 1.2$</td>
<td>$\gamma^F = 2.1$</td>
<td>$\xi = 0.85$</td>
</tr>
<tr>
<td>$e_{2b,p}^P = 5.8$</td>
<td>Money$_{2b}^P = 0.1$</td>
<td>$E_{2b}^B = 0$</td>
<td>$r_{2b}^{CB} = 0.20$</td>
<td>$\tau_{2b}^\beta = 1.2$</td>
<td>$\gamma^R = 2.4$</td>
<td>$\delta = 0.15$</td>
</tr>
<tr>
<td>$e_{2g,p}^F = 11$</td>
<td>Money$_{2g}^F = 4.1$</td>
<td>$E_1^N = 1$</td>
<td></td>
<td>$\tau_{2b}^N = 0.2$</td>
<td>$\gamma^B = 1.4$</td>
<td></td>
</tr>
<tr>
<td>$e_{2b,p}^F = 11$</td>
<td>Money$_{2b}^F = 0.1$</td>
<td>$E_{2g}^N = 2$</td>
<td></td>
<td></td>
<td>$\gamma^N = 0.7$</td>
<td></td>
</tr>
<tr>
<td>$e_{1,h}^R = 1$</td>
<td>Money$_1^R = 6.5$</td>
<td>$E_{2g}^N = 1$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$e_{2g,h}^R = 0$</td>
<td>Money$_{2g}^R = 0$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$e_{2b,h}^R = 0$</td>
<td>Money$_{2b}^R = 0$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prices</td>
<td>Interest rates/Money supply</td>
<td>Aggregate Consumption</td>
<td>Loans</td>
<td>Securitization</td>
<td>Repayment rates</td>
<td>F.I. profits</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------</td>
<td>-----------------------</td>
<td>-------</td>
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</tr>
<tr>
<td>$P_{2g,p} = 1.39$</td>
<td>$r_{2g}^{ST} = 0.12$</td>
<td>$c_{1,p}^P = 0.859$</td>
<td>$c_{1,p}^R = 9.141$</td>
<td>$LST_1^P = 8.81$</td>
<td>$LST_1^R = 42.06$</td>
<td>$MBS_1^R = 21.52$</td>
</tr>
<tr>
<td>$P_{2b,p} = 1.48$</td>
<td>$r_{2b}^{ST} = 0.20$</td>
<td>$c_{2b,p}^P = 1.126$</td>
<td>$c_{2b,p}^R = 41.478$</td>
<td>$LST_{2b}^P = 38.41$</td>
<td>$LST_{2b}^R = 67.05$</td>
<td>$\sigma_{2g}^B = 0.456$</td>
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<tr>
<td>$P_{1,h}$</td>
<td>$r^D = 0.42$</td>
<td>$c_{1,h}^P = 0.285$</td>
<td>$c_{1,h}^R = 15.997$</td>
<td>$MORT_1^P = 6.82$</td>
<td>$DISC_1^B = 19.76$</td>
<td>$\sigma_{2b}^B = 0$</td>
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<tr>
<td>$P_{2g,h}$</td>
<td>$r^{MORT} = 0.75$</td>
<td>$c_{2g,h}^P = 0.055$</td>
<td>$c_{2g,h}^R = 0.945$</td>
<td>$LST_{2g}^P = 24.32$</td>
<td>$DISC_{2g}^B = 35.00$</td>
<td>$\vartheta_{2b}^B = 0.068$</td>
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<tr>
<td>$P_{2b,h}$</td>
<td>$r^{REPO} = 0.74$</td>
<td>$c_{2b,h}^P = 0.047$</td>
<td>$c_{2b,h}^R = 0.788$</td>
<td>$LST_{2g}^P = 13.20$</td>
<td>$DISC_{2g}^B = 99.00$</td>
<td>$MBS_{2g}^N = 1.28$</td>
</tr>
<tr>
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<td>Period 1</td>
<td>Period 2, State g</td>
<td>Period 2, State b</td>
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<tr>
<td>Potatoes Prices</td>
<td>1.08</td>
<td>1.39</td>
<td>1.48</td>
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<tr>
<td>Housing Prices</td>
<td>676.96</td>
<td>1,111.41</td>
<td>362.73</td>
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<tr>
<td>MBS Prices</td>
<td>0.97</td>
<td>1.56</td>
<td>0.68</td>
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<tr>
<td>Relative price of</td>
<td>0.0016</td>
<td>0.0013</td>
<td>0.0041</td>
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<tr>
<td>potatoes to housing</td>
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<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Beginning of bad state</th>
<th>Middle of bad state</th>
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<tbody>
<tr>
<td>Capital adequacy ratio</td>
<td>9.91%</td>
<td>3.46%</td>
<td>8.24%</td>
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<tr>
<td>Liquidity ratio</td>
<td>64.94%</td>
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<td>46.36%</td>
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<tr>
<td>Margin on repos</td>
<td>4.78%</td>
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<tr>
<td>Loan-to-value ratio</td>
<td>65.32%</td>
<td>-</td>
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</tbody>
</table>

Note: No dynamic provisions required in the good state. Pick $\kappa$ to require 0.1 per dollar of reserves for loan growth above 20 percent.