Liquidity and Asset Prices: A New Monetarist Approach

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Motivation

- A monetary economy in which lenders cannot force borrowers to repay their debts, and financial assets are used as collateral to secure loans.
- Explicitly derive loan-to-value ratios, from the condition that lenders offer to loan only as much as borrowers are willing to repay.
- Endogenizing loan-to-value ratios can help relax the assumption of the exogenously given, constant loan-to-value ratios that have been made in the previous literature.
- Evidence: typical loan-to-value ratios vary significantly across countries, and this may partly reflect differences in the technology and institutions to deter default.
**Observation**

**Table:** Loan-to-value ratios and foreclosure cost

<table>
<thead>
<tr>
<th>Country</th>
<th>BE</th>
<th>DE</th>
<th>GR</th>
<th>ES</th>
<th>FR</th>
<th>IT</th>
<th>NL</th>
<th>AT</th>
<th>PT</th>
<th>FI</th>
<th>UK</th>
</tr>
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<tbody>
<tr>
<td>LTV</td>
<td>80</td>
<td>70</td>
<td>70</td>
<td>72.5</td>
<td>91</td>
<td>65</td>
<td>101</td>
<td>84</td>
<td>71</td>
<td>81</td>
<td>85</td>
</tr>
<tr>
<td>Duration</td>
<td>18</td>
<td>9</td>
<td>24</td>
<td>8</td>
<td>20</td>
<td>56</td>
<td>5</td>
<td>9</td>
<td>24</td>
<td>2.5</td>
<td>&lt;12</td>
</tr>
<tr>
<td>cost</td>
<td>18.7</td>
<td>7.5</td>
<td>16</td>
<td>10</td>
<td>9.5</td>
<td>n/a</td>
<td>4</td>
<td>7.5</td>
<td>8</td>
<td>1.5</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Objectives

- Model main features: Borrowers lose their collateral once they renege on debts, and exclusion of defaulters occurs probabilistically, with a higher probability implying better enforcement.
- Determine simultaneously the asset prices, credit limits, and loan-to-value ratios.
- Key findings: Increased efficiency of the enforcement technology induces higher loan-to-value ratios, while inflation raises loan-to-value ratios only when enforcement is efficient enough.
Related literature

• credit market imperfections:

• recognizability of assets and endogenous liquidity constraints:
  • Lester, Postlewaite and Wright (2012)
  • Rocheteau (2011)
  • Li, Rocheteau, and Weill (2012)

• endogenous credit constraints:
  • Berentsen, Camera and Waller (2007)
  • Ferraris and Watanabe (2008)
Model

- Two assets
  - fiat money, grows at the rate $\gamma$
  - real asset that yields a dividend of $\rho$ units of general good each period, constant supply $A$

- The first subperiod
  - preference shock:
    \[
    \text{Prob( an agent is a seller) } = n \cdot c(q) \\
    \text{Prob( an agent is a buyer) } = 1 - n \cdot u(q).
    \]

- The second subperiod
  - All agents can produce and consume a good.
  - Agents adjust portfolio $(m, a)$.
  - competitive banks: loan rate = deposit interest rate
Model: mechanisms to deter default

- Collateral mechanism: requires borrowers to pledge some assets to secure their loans, and banks are entitled to the collateral once borrowers renege on debts.
- Reputation mechanism: punishes defaulters by permanent exclusion.
- Our model combines the collateral mechanism and the reputation mechanism, in which exclusion occurs with probability $\zeta \in [0, 1]$; a higher probability implies better enforcement.
Subperiod 2: Maximization Problem

\[ W(m, a, \ell, d) = \max_{x, h, m+1, a+1} U(x) - h + \beta V_{m+1}(m+1, a+1) \]

s.t. \[ x + \phi m_{+1} + \psi a_{+1} = h + \phi (m + T) + (\psi + \rho) a \]
\[ + \phi (1 + i_d) d - \phi (1 + i) \ell. \]

F.O.C.

\[ U'(x) = 1, \]
\[ \phi \geq \beta V_{m+1}(m+1, a+1), \text{“=} \text{ if } m_{+1} > 0. \]
\[ \psi \geq \beta V_{a+1}(m+1, a+1), \text{“=} \text{ if } a_{+1} > 0. \]
Envelope conditions

\[ W_m = \phi, \]
\[ W_a = \psi + \rho, \]
\[ W_\ell = -\phi(1 + i), \]
\[ W_d = \phi(1 + i_d). \]
Subperiod 1: Maximization Problem

\[ V(m, a) = (1 - n) \left[ u(q_b) + W(m + \ell - pq_b, a, \ell) \right] \\
+ n \left[ -c(q_s) + W(m - d + pq_s, a, d) \right]. \]

Sellers’ maximization problem:

\[
\max_{q_s, d} \quad -c(q_s) + W(m - d + pq_s, a, d) \\
\text{s.t.} \quad d \leq m.
\]

Buyers’ maximization problem:

\[
\max_{q_b, \ell} \quad u(q_b) + W(m + \ell - pq_b, a, \ell) \\
\text{s.t.} \quad pq_b \leq m + \ell, \\
\lambda_{\ell} : \quad \ell \leq \bar{\ell}
\]
Subperiod 1: First order conditions

\[
\frac{u'(q_b)}{c'(q_s)} = 1 + i + \frac{\lambda_\ell}{\phi}.
\]

- Credit constraint does not bind, \( \lambda_\ell = 0 \): 
  \[
  \frac{u'(q_b)}{c'(q_s)} = 1 + i.
  \]

- \( \lambda_\ell > 0 \) and credit constraint binds: 
  \[
  \frac{u'(q_b)}{c'(q_s)} > (1 + i).
  \]
The optimal portfolio choices

• The marginal values of holding money and assets:

\[ V_m(m, a) = (1 - n) \frac{u'(q_b)}{p} + n\phi(1 + i_d) \]

\[ V_a(m, a) = (1 - n)\phi\left[\frac{u'(q_b)}{c'(q_s)} - (1 + i)\right] \frac{\partial \ell}{\partial a} + (\psi + \rho). \]

• optimal portfolio choices:

\[ \frac{\gamma - \beta}{\beta} = (1 - n)\left[\frac{u'(q_b)}{c'(q_s)} - 1\right] + ni_d, \]

\[ \frac{1 - \beta}{\beta} \psi = \rho + (1 - n)\phi\left[\frac{u'(q_b)}{c'(q_s)} - (1 + i)\right] \frac{\partial \ell}{\partial a}. \]
Equilibrium with full enforcement

- $\bar{l} = \infty$.
- $i = \gamma - \beta \frac{\beta}{\beta}$

With full enforcement, the equilibrium value of real asset is the present value of dividends; that is, $\psi = \psi^u$ where

$$\psi^u = \frac{\beta \rho}{1 - \beta}.$$
Collateral mechanism

- \( \hat{W}(m, a) \): a deviating buyer’s expected discounted utility
- Existence of eqm with credit requires that borrowers voluntarily repay loans:
  \[
  W(m, a) \geq \hat{W}(m, a).
  \]
- The real borrowing constraint \( \phi \bar{\ell} \) satisfies
  \[
  (1 + i)\phi \bar{\ell} = (\psi + \rho)a. \tag{1}
  \]
Loan-to-value ratio under the collateral mechanism

- The loan-to-value ratio is

\[ \theta_1 = \frac{1 + r_p}{1 + i}, \]

where \( r_p = \frac{\rho}{\psi} \) is the dividend-price ratio.

- The loan-to-value ratio is the rate at which the assets can generate liquidity to the economy.
Asset price under the collateral mechanism

\[ \psi_1 = \frac{\beta B \rho}{1 - \beta B} \]

where

\[ B = 1 + (1 - n) \left[ \frac{u'(q_b)}{c'(q_s)} \frac{1}{1 + i} - 1 \right] \]

- \( \beta B \) is the ‘effective’ discount factor by taking into account the credit market imperfections.
- credit constraint binds:
  \[ \frac{u'(q_b)}{c'(q_s)} > 1 + i \Rightarrow B > 1 \Rightarrow \psi_1 > \psi^u . \]
- The ‘liquidity premium’ is higher when credit rationing is more severe.
Effects of monetary policy

- Monetary policy has similar effects on the loan rate, allocations, and prices in a constrained and unconstrained equilibrium:
  \[
  \frac{\partial i}{\partial \gamma} > 0, \quad \frac{\partial q_b}{\partial \gamma} < 0, \quad \frac{\partial \phi}{\partial \gamma} < 0, \quad \frac{\partial p}{\partial \gamma} > 0.
  \]

- In a constrained equilibrium, \( \frac{\partial \theta_1}{\partial \gamma} < 0 \) and \( \frac{\partial \psi}{\partial \gamma} \leq 0 \) iff \( \frac{-u'' q_b}{u'} \geq 1 \).
Effects of changes in $A$ and $\rho$

- A change in the asset supply does not affect the loan rate and allocations in an unconstrained equilibrium, but it has real effects in a constrained equilibrium: $\frac{\partial q_b}{\partial A} > 0$, $\frac{\partial i}{\partial A} > 0$, $\frac{\partial \psi}{\partial A} < 0$, $\frac{\partial \phi}{\partial A} > 0$, $\frac{\partial p}{\partial A} < 0$, $\frac{\partial \theta_1}{\partial A} = 0$.

- A change in the asset’s dividend flows affects only the asset price in an unconstrained equilibrium: $\frac{\partial \psi}{\partial \rho} > 0$; however, it also affects the loan rate and allocations in a constrained equilibrium: $\frac{\partial i}{\partial \rho} > 0$, $\frac{\partial q_b}{\partial \rho} > 0$, $\frac{\partial \phi}{\partial \rho} > 0$, $\frac{\partial p}{\partial \rho} < 0$, $\frac{\partial \psi}{\partial \rho} > 0$ if $\left| \frac{\partial B}{B/\rho} \right| < 1 - \beta B$, $\frac{\partial \theta_1}{\partial \rho} = 0$. 
Combined collateral and reputation mechanism

- At the end of each period after banks have seized defaulters' collateral, an agent’s default record is updated with probability $\zeta$, and the updating does not occur with probability $1 - \zeta$.

$$\overline{W}(m, a) = \zeta \tilde{W}(m, a) + (1 - \zeta) \hat{W}(m, a).$$

- From $W(m, a) = \overline{W}(m, a)$, we solve for the real borrowing constraint:

$$\phi^\ell = \frac{(1 - \beta + \beta \zeta) \rho a + (1 - \beta)(1 - \zeta)\psi a}{(1 - \beta)(1 + i)} + \frac{\beta \zeta}{(1 - \beta)(1 + i)}$$

$$\{(1 - n) \Psi + \frac{\gamma(1 - \beta)}{\beta} c'(q_s)[\tilde{q}_b - (1 - n)q_b]\}, \quad (2)$$

where

$$\Psi = u(q_b) - u(\tilde{q}_b) - c'(q_s)(q_b - \tilde{q}_b) \geq 0.$$
Definition

Under a combined mechanism, a monetary equilibrium with constrained credit is \((q_b, \tilde{q}_b, i, \psi)\) satisfying (1) and

\[
\begin{align*}
\frac{\gamma - \beta}{\beta} &= (1 - n)\left[\frac{u'(\tilde{q}_b)}{c'(q_s)} - 1\right], \\
\frac{1 - \beta}{\beta} \psi &= \rho + (1 - n)\left[\frac{u'(q_b)}{c'(q_s)} - (1 + i)\right] \\
&\quad \frac{(1 - \beta + \beta \zeta)\rho + (1 - \beta)(1 - \zeta)\psi}{(1 - \beta)(1 + i)},
\end{align*}
\]

such that \(nc'(q_s)q_b = \phi \ell\), where \(\phi \ell\) satisfies (2), and \(q_s = \frac{1-n}{n} q_b\).
Asset price and loan-to-value ratio

\[ \psi_2 = \frac{\beta B_2 \rho}{1 - \beta B_3}, \]

where

\[ B_2 = 1 + (1 - n)(1 + \frac{\beta \zeta}{1 - \beta})[u'(q_b) \frac{1}{c'(q_s) 1 + i} - 1] \]

\[ B_3 = 1 + (1 - n)(1 - \zeta)[u'(q_b) \frac{1}{c'(q_s) 1 + i} - 1], \]

\[ \theta_2 = \frac{(1 - \beta + \beta \zeta)r_p + (1 - \beta)(1 - \zeta)}{(1 - \beta)(1 + i)} + \frac{\zeta \beta}{(1 - \beta)(1 + i)\psi_a} \]

\[ \{(1 - n)\Psi(q_b, \tilde{q}_b) + \frac{\gamma(1 - \beta)}{\beta}c'(q_s)\tilde{q}_b - (1 - n)q_b\}. \]
Effects of efficiency of enforcement
Key insight: enforcement

- Increased efficiency of the enforcement technology raise loan-to-value ratios, while reducing the asset price, because collateral becomes a less important commitment device for borrowing.

- Result: when the technology’s efficiency is above some threshold, the punishment of exclusion is substantial enough to make the rise in the loan-to-value ratio a dominant effect. As a result, aggregate liquidity, output, and welfare increase with advances in the technology.
Key insight: inflation

- Higher inflation exerts adverse effects on output by reducing the incentive to produce.

- An additional transmission channel: binding credit constraints.
  - Inflation raises the loan rate and, thus, the repayment cost.
  - If exclusion is feasible, inflation relaxes the credit constraint by increasing the cost of default, because defaulters need to bring enough money to self-insure against consumption shocks.

- Result: when enforcement is strong enough for inflation to impose a sufficient penalty, loan-to-value ratios, liquidity, and output rise.
Comparisons among mechanisms

- When equilibria under the collateral mechanism, the reputation mechanism, and the combined mechanism coexist, the one under the combined mechanism entails the highest welfare, if the probability of exclusion is not too low.

- Three arrangements—borrowing money from banks under the collateral mechanism, selling assets to banks, and selling assets in the financial market—result in the identical asset price and allocation.
  - A bank’s asset portfolio, whether it consists of loans or securities, is irrelevant to economic activity.
  - The institutions that provide liquidity—banks or asset markets—do not matter.
Conclusion

• This paper combines the collateral mechanism and the reputation mechanism with probabilistic exclusion to illustrate how loan-to-value ratios and monetary policy implications depend on enforcement.

• Key findings: high loan-to-value ratios are driven by sufficient efficiency in enforcement, while inflation may raise loan-to-value ratios only if the enforcement ability is high enough.

• Imposing restrictions on the access to future credit may improve liquidity and allocations only when they constitute a substantial punishment on defaulters.