The Welfare Effects of Bank Liquidity and Capital Requirements

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* The views expressed here do not necessarily represent the views of the Federal Reserve Board or its staff.
Introduction

Financial crisis spurred crucial regulatory reforms, including Basel III.

- Stronger capital requirements
- New liquidity requirements

Goal: Make banks and the financial system safer, limiting negative externalities from bank failures.

Is it enough? Too much? There is an ongoing debate. E.g.

- Some favor much higher capital requirements (e.g. Admati and Hellwig)
- Others have argued for versions of “narrow banking” (e.g. Cochrane, Friedman)
  - Similar to a 100% liquidity requirement
Introduction

Debate in large part reflects disagreement about the existence and magnitude of social costs of capital and liquidity requirements.

Possible cost – reduced (net) liquidity creation.

Key idea: High-quality liquid assets are in limited supply and have important alternative uses.

Introduction

This paper –

• Examines the welfare costs and benefits of:
  o bank liquidity requirements and
  o bank capital requirements

• Quantifies their welfare costs through a sufficient statistics approach.

Quantitative general equilibrium analysis

• Extends previous work on capital requirements
  (Van den Heuvel, 2008)
1. Basic Model
Households

\[ \text{Fin. wealth} = d + e + b \]

Banks

Firms

Non-bank Finance

Government

\[ \text{Tot. debt} = b + B \]

Deposits

Bank equity

Bonds
Households
Fin. wealth = \( d + e + b \)

Banks
Loans \( L \)
Equity \( E \)
Gov. Bonds \( B \)
Deposits \( D \)

Firms

Government

Bonds

Deposits

Bank equity

Loans
Households
Fin. wealth = \(d + e + b\)

Banks
- Loans \(L\)
- Gov. Bonds \(B\)
- Equity \(E\)
- Deposits \(D\)

Firms
- Physical Equity \(E^F\)
- Capital \(K\)
- Loans \(L\)

Non-bank finance
Loans

Government
Households
Fin. wealth = \( d + e + b \)

Banks
Loans \( L \)
Gov. Bonds \( B \)
Equity \( E \)
Deposits \( D \)

Firms
Physical Equity \( E^f \)
Capital \( K \)
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Government
Tot. debt = \( b + B \)
Households
Fin. wealth = d + e + b

Banks
Loans L
Gov. Bonds B
Equity E
Deposits D

Firms
Physical Capital K
Equity $E^f$
Loans L

Government
Tot. debt = b + B

Non-bank finance

Loans
Bonds
Deposits
Bank equity
Households

Households value liquidity:

\[ u(c, d, b) \]

- Derived utility function; Feenstra (1985).
- Increasing and concave
- Flexibility will let the data speak
Households

Infinite horizon, no aggregate uncertainty $\rightarrow$ Perfect foresight problem.

$$\max_{\{c_t, d_t, e_t, b_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t u(c_t, d_t, b_t)$$

s.t. $d_{t+1} + b_{t+1} + e_{t+1} + c_t = w_t 1 + R^D_t d_t + R^B_t b_t + R^E_t e_t - T_t$

(c) $R^E_t = \left( \frac{\beta u_c(c_t, d_t, b_t)}{u_c(c_{t-1}, d_{t-1}, b_{t-1})} \right)^{-1}$

(d) $R^E_t - R^D_t = \frac{u_d(c_t, d_t, b_t)}{u_c(c_t, d_t, b_t)}$ : convenience yield on deposits

(b) $R^E_t - R^B_t = \frac{u_b(c_t, d_t, b_t)}{u_c(c_t, d_t, b_t)}$ : convenience yield on Treasuries
Banks

<table>
<thead>
<tr>
<th>$L_t$</th>
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Liquidity Requirement: $B_t \geq \lambda D_t$

Capital Requirement: $E_t \geq \gamma L_t$ \textit{(risk-based)}

Bank maximizes shareholder value.

- Competitive banking: $R^L, R^B, R^D, R^E$ given
Banks: Moral Hazard and Benefits of Regulation

Additional assumptions to generate benefits of regulation:

Deposit Insurance / government guarantees

→ Moral hazard of excessive risk taking. Two risk choices:

1. Credit risk: excessively risky lending practices

2. Liquidity risk: insufficient liquid assets
Banks: Moral Hazard and Benefits of Regulation

Deposit Insurance / government guarantees

→ Moral hazard of excessive risk taking. Two risk choices:

1. **Credit risk**: excessively risky lending practices

   **Capital requirement** solves this, together with bank supervision, through “skin-in-the-game”.

   \[ \gamma \geq \phi \bar{\sigma} / R^E \]  \hspace{1cm} (IC1)

   - \( \bar{\sigma} \): ability of banks to hide excessively risky loans from supervision
   - Liquidity regulation does not ameliorate this problem.
     - Bank size is not fixed so increase in \( B \) does not imply a decrease in \( L \).
Banks: Moral Hazard and Benefits of Regulation

Deposit Insurance / government guarantees

→ Moral hazard of excessive risk taking. Two risk choices:

2. **Liquidity risk**: insufficient liquid assets
   - Small probability \((1 - p)\) of liquidity stress: Fraction \(w\) of depositors withdraws early.
   - Liquidity stress results in bank failure if \(B < wD\).
     - Bank goes into resolution with social costs that may exceed the private loss
Banks: Moral Hazard and Benefits of Regulation

Bank will choose a prudent liquidity risk profile \((B \geq wD)\) if

\[
\gamma \left( \frac{1-p}{p} \right) \geq (1-\gamma) \left( \frac{w}{1-w} - \frac{\lambda}{1-\lambda} \right) (R^D - R^B)
\]

A sufficient condition is: \(\lambda \geq w\).

**Liquidity requirement and capital requirement** can each mitigate the moral hazard of liquidity risk, but the liquidity requirement is more direct and efficient.

\[ \rightarrow \text{Division of Labor:} \]

- Capital regulation for solvency risk
- Liquidity regulation for liquidity risk.
Banks: Illustration of welfare implications

![Graph showing the relationship between capital requirement and welfare]

- **Welfare (λ = 0)**
- **Welfare (λ = w)**

The Welfare Effects of Bank Liquidity and Capital Requirements
Banks: Illustration of welfare implications
Summary of Bank’s Problem (no excessive risk)

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All-in cost of funding loans with deposits:

$$\tilde{R}^D(\lambda) \equiv R^D + \frac{\lambda}{1-\lambda}(R^D - R^B)$$

With (IC1) and (IC2), solution’s zero-profit condition:

$$R^L = \gamma R^E + (1-\gamma)\tilde{R}^D(\lambda)$$

A finite solution requires: $R^B \leq R^D \leq R^L \leq R^E$.

1. Liquidity requirements binds if and only if $R^B < R^D$ \( \text{(will be relaxed)} \)
2. Capital requirement binds if and only if $R^E > \tilde{R}^D(\lambda)$
Equilibrium with capital and liquidity regulation

- **Capital** requirement typically binds due to convenience yield on deposits.

- **Liquidity** requirement may or may not bind, depending on relative convenience yields of bank deposits and government bonds.
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- **Investment** is affected by *both* the capital requirement and the liquidity requirement, if binding.  
  \[ R^L = \gamma R^E + (1 - \gamma) \tilde{R}^D(\lambda) \]
Equilibrium with capital and liquidity regulation

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• **Investment** is affected by both the capital requirement and the liquidity requirement, if binding. \( R^L = \gamma R^E + (1 - \gamma) \tilde{R}^D(\lambda) \).

• Introducing binding liquidity regulation leads **government bonds** to flow out of the nonbank sector, so their convenience yield \( R^E - R^B \) rises.

• Adding a larger liquidity requirement \( \rightarrow \) can lead to **disintermediation or non-bank intermediation**: **Shadow banking**?
  
  o More likely if the demand for safe, liquid assets is high relative to the supply.
2. Gross Welfare Cost of the Policy Tools
Welfare Cost of the *Liquidity* Requirement

*If the economy is in steady state in the current period and IC1 and IC2 hold, then the marginal welfare cost of a permanent increase in $\lambda$ is:*

$$v_{LIQ} = \frac{d}{c} \left( R^D - R^B \right) (1 - \lambda)^{-1}$$

- As a first-order approximation, the welfare loss from $\Delta \lambda$ is equivalent to a permanent relative loss in consumption of $v_{LIQ} \Delta \lambda$.
- Takes into account gains and losses associated with move to a new steady state.
- Revealed preference logic + competitive banking.
Welfare Cost of the Capital Requirement

*Under the same assumptions, the marginal welfare cost of a permanent increase in $\gamma$ is:*

$$\nu_{CAP} = \frac{L}{c} \left( R^E - \tilde{R}^D (\lambda) \right)$$

Recall  
$$\tilde{R}^D (\lambda) \equiv R^D + \frac{\lambda}{1 - \lambda} (R^D - R^B)$$
3. Costly Financial Intermediation

So far we have assumed that no resource costs are involved with financial intermediation.

- For 86-13, net noninterest costs are 1.3% of total assets.

Before measuring costs, extend model:

\[
\text{Bank pays noninterest cost: } g(D, L)
\]

\(g\) is increasing, convex, constant returns to scale.

\[
\text{Dividends} = \max(0, (R^L_t + \sigma_t \varepsilon)L_t + R^B_t B_t - R^D_t D_t - g(D_t, L_t))
\]
Gross Welfare Costs with Costly Intermediation

Marginal welfare costs of increasing $\lambda$ and $\gamma$ with costly financial intermediation:

$$\nu_{LIQ} = \frac{d}{c} \left( R^D + g_D(d, L) - R^B \right) (1 - \lambda)^{-1}$$

$$\nu_{CAP} = \frac{L}{c} \left( R^E - \tilde{R}^D(\lambda) - (1 - \lambda)^{-1} g_D(d, L) \right)$$


- From 1986-2000, Treasuries/Assets exceed 1 percent → Use this period to estimate $g_D$ through the condition: $R^B = R^D + g_D \rightarrow g_D = 1.22\%$

- Alternative estimate based Hanson, Schleifer, Stein, Vishny (2015): $g_D = 0.81\%$

- Use 2001-2007 to estimate average returns and ratios.
  - Treasuries < 1% of assets
  - Provides an estimate of the cost of a liquidity requirement for a period when it would likely have been binding.
  - Current environment: high level of reserves could reflect phase-in of LCR, or could mean that a modest liquidity requirement entails little *immediate* economic costs.
U.S. Treasuries and excess reserves held by U.S. depository institutions

**Measurement of the Welfare Cost: Liquidity**

\[ d = \text{Total Deposits} \quad \quad d/c = 0.67 \]

\[ c = \text{Personal Consumption Expenditures} \]

\[ R^D = \frac{\text{(Interest on Total Deposits)}}{\text{(Total Deposits)}} = 2.04\% \]

Including marginal noninterest cost:

\[ R^D + g_D = 3.26\% \]

\[ R^B = 3\text{-month Treasury yield} = 2.80\% \]

\[ \lambda = \text{liquidity requirement} = 0 \]

\[
\nu_{LIQ} = \frac{d}{c} \left( R^D + g_D - R^B \right) (1 - \lambda)^{-1}
\]

\[ = 0.67 \times (0.0326 - 0.0280) \times 1 = 0.0031 \]
Measurement of the Welfare Cost: Liquidity

Interpretation of $\nu_{LIQ} = 0.003$.

• The gross welfare cost of imposing a 10 percent liquidity requirement is equivalent to a **permanent loss in consumption of** $\nu_{LIQ} \times 0.1 \times 100\% = 0.031\%$.

• About $3.5$ billion per year.

• With HSSV-based estimate ($g_D = 0.81\%$): welfare cost = **0.003\%**.
Measurement of the Welfare Cost: Capital

A risk-adjusted measure of the required return on equity is needed.

I use the required return on subordinated bank debt.

- Sub-debt counts towards regulatory capital, within certain limits.
- Defaults on bank sub-debt have been rare.

Limits:

- Part of tier 2 capital
- Until recently, limited to at most 50% of tier 1 capital.
- Same tax treatment as deposits

The required return on sub-debt may be less than the risk-adjusted pre-tax required return on regular bank equity.

→ conservative measure.
Measurement of the Welfare Cost: Capital

Sample: 1993-2010

\[ L = \text{Total Assets} - (\text{Treasuries} + \text{Ex. Reserves}) \quad L/c = 0.96 \]

\[ c = \text{Personal Consumption Expenditures} \]

\[ R^E = \frac{(\text{Interest on Subordinated debt})}{(\text{Sub-debt})} = 5.45\% \]

\[ R^D = \frac{(\text{Interest on Total Deposits})}{(\text{Total Deposits})} = 2.43\% \]

Including marginal noninterest cost: \[ R^D + g_D = 3.65\% \]

\[ v_{CAP} = \frac{L}{c} \left( R^E - (R^D + g_D) \right)(1 - \lambda)^{-1} \]

\[ = 0.96 \times 0.0180 \times (1 - 0)^{-1} = 0.017 \]
Measurement of the Welfare Cost: Capital

Interpretation of $\nu_{CAP} = 0.017$.

- The gross welfare cost of increasing capital requirements by 10 percentage points is equivalent to a permanent loss in consumption of $\nu \times 0.1 \times 100\% = 0.17\%$.

- About $20 billion per year.

- With HSSV-based estimate ($g_D = 0.81\%$): welfare cost = 0.21\%.
Measurement of the Welfare Cost: Summary

<table>
<thead>
<tr>
<th>10% Liquidity requirement</th>
<th>10% Capital requirement</th>
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</thead>
<tbody>
<tr>
<td>0.003</td>
<td>0.031</td>
</tr>
<tr>
<td>gD = 0.81%</td>
<td></td>
</tr>
<tr>
<td>gD = 1.22%</td>
<td>0.213</td>
</tr>
<tr>
<td></td>
<td>0.173</td>
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</table>
Conclusions

Liquidity and capital requirements reduce the ability of banks to create net liquidity in equilibrium and impact investment and economic activity.

- Cost of *capital* requirement scales with the *convenience yield on bank deposits*
- Cost of *liquidity* requirement scales with the *difference in the convenience yields on HQLA assets and on bank deposits* (adjusted for noninterest costs)

Quantitative result: Welfare cost of liquidity requirement is modest and much lower than the welfare cost of similarly-sized capital requirements.

Financial stability benefits of liquidity requirements are narrower than capital, yet liquidity regulation is part of the optimal policy mix → division of labor:

- Capital regulation addresses credit risk;
- Liquidity regulation addresses liquidity risk.