How did Too Big to Fail become such a problem for broker-dealers?

Speculation by Andy Atkeson
March 2014
Proximate Cause

• By 2008, Broker Dealers had big balance sheets

• Historical experience with rapid contraction of broker dealer balance sheets and bank runs raised unpleasant memories for central bankers

• No satisfactory legal or administrative procedure for “resolving” failed broker dealers

• So the Fed wrestled with the question of whether broker dealers were too big to fail
Why do Central Bankers care?

• Historically, deposit taking “Banks” held three main assets
  • Non-financial commercial paper
  • Government securities
  • Demandable collateralized loans to broker-dealers

• Much like money market mutual funds (MMMF’s) today

• Many historical (pre-Fed) banking crises (runs) associated with sharp changes in the volume and interest rates on loans to broker dealers

• Similar to what happened with MMMF’s after Lehman?

• Much discussion of directions for central bank policy and regulation
  • New York Clearing House 1873
  • National Monetary Commission 1910
  • Pecora Hearings 1933
  • Friedman and Schwartz 1963
Questions I want to consider

• How would you fit Broker Dealers into the growth model?
  
  • What economic function do they perform in facilitating trade of securities and financing margin and short positions in securities?
  
  • What would such a theory say about the size of broker dealer value added and balance sheets?
  
  • What would be lost (socially) if we dramatically reduced broker dealer balance sheets by regulation?
  
  • Are broker-dealer liabilities the “right” asset for “banks” to hold?
  
  • Chari-Phelan/Farhi-Golosov-Tsyvinski/Jacklin on tradable assets in Diamond Dybvig
Example: how do we put real estate brokers into the growth model?

• Households have a motivation to trade houses

• Real Estate Broker adds value in facilitating transaction

• Measured in NIPA as broker’s commissions as part of residential investment

• Real estate brokers typically do not provide financing of transactions so they have small balance sheets

• Real Estate Developers do need to finance new construction (typically with bank loans)
Real Estate Brokers in NIPA

Components of Residential Investment as Percent of GDP

- Recession
- Single-family
- Improvements
- Brokers' commissions, transfer costs
- Multifamily
- Other

http://www.calculatedriskblog.com/
Securities Broker Dealers vs. Real Estate Brokers

• Traditional Investment Banking (underwriting and mergers and acquisitions)
• Brokerage commissions and fees
• Dealers bid-ask spreads
Value Added of Securities, Commodities Contracts, and Investments industry as a percentage of GDP
Facts to be presented today

• Since the founding of the Fed, most of the time, securities broker dealers have small balance sheets

• Two episodes of big increase and decrease in the size of the balance sheet of broker dealers
  • the past 20 years
  • Crash of 1929
Outline of the talk

• Structure of a modern big bank (Citibank and Goldman Sachs)

• Growth of balance sheets of Securities Broker Dealers (Flow of Funds 1952-now)

• A look at a broker dealer’s balance sheet by function (What does a broker-dealer do?)

• Comparison to data on broker dealer balance sheets, funding sources, and failures from 1918 - 1941 including the Crash of 1929
What do big banks do these days?

- Holding Company
  - Traditional Retail Banking
  - Traditional Investment Banking
- Asset Management
  - Securities Brokering and Dealing
What does a Big Bank do?

CITIGROUP SEGMENTS

Citicorp

Global Consumer Banking (GCB)
- Regional Consumer Banking (RCB) in:
  - North America
  - EMEA
  - Latin America
  - Asia
- Consisting of:
  - Retail banking, local commercial banking and branch-based financial advisors
  - Residential real estate
  - Asset management in Latin America
  - Citi-branded cards in North America, EMEA, Latin America and Asia
  - Citi retail services in North America

Institutional Clients Group (ICG)
- Securities and Banking
  - Investment banking
  - Debt and equity markets (including prime brokerage)
  - Lending
  - Private equity
  - Hedge funds
  - Real estate
  - Structured products
  - Private Bank
  - Equity and fixed income research
- Transaction Services
  - Treasury and trade solutions
  - Securities and fund services

Corporate/Other
- Treasury
- Operations and technology
- Global staff functions and other corporate expenses
- Discontinued operations

Citi Holdings
- Brokerage and Asset Management
  - Primarily includes Citi's remaining interest in the Morgan Stanley Smith Barney joint venture (MSSB)
  - Retail alternative investments
- Local Consumer Lending
  - Consumer finance lending: residential and commercial real estate; personal and consumer branch lending
  - Certain international consumer lending (including Western Europe retail banking and cards)
- Special Asset Pool
  - Certain institutional and consumer bank portfolios
As described above, Citigroup is managed pursuant to the following segments:

The following are the four regions in which Citigroup operates. The regional results are fully reflected in the segment results above.

(1) North America includes the U.S., Canada and Puerto Rico, Latin America includes Mexico, and Asia includes Japan.
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And Goldman Sachs

Table of Contents
THE GOLDMAN SACHS GROUP, INC. AND SUBSIDIARIES
PART I
Item 1.    Business
Introduction
Goldman Sachs is a leading global investment banking, securities
and investment management firm that provides a wide range of
financial services to a substantial and diversified client base that
includes corporations, financial institutions, governments and high-
net-worth individuals.
When we use the terms "Goldman Sachs," "the firm," "we," "us"
and "our," we mean The Goldman Sachs Group, Inc. (Group Inc.),
a Delaware corporation, and its consolidated subsidiaries.
References to "this Form 10-K" are to our Annual Report on
Form 10-K for the year ended December 31, 2012. All references
to 2012, 2011 and 2010 refer to our years ended, or the dates, as the
context requires, December 31, 2012, December 31, 2011 and
December 31, 2010, respectively.
Group Inc. is a bank holding company and a financial holding
company regulated by the Board of Governors of the Federal
Reserve System (Federal Reserve Board). Our U.S. depository
institution subsidiary, Goldman Sachs Bank USA (GS Bank USA),
is a New York State-chartered bank.

As of December 2012, we had offices in over 30 countries and 49%
of our total staff was based outside the Americas (which includes
the countries in North and South America). Our clients are located
worldwide, and we are an active participant in financial markets
around the world. In 2012, we generated 41% of our net revenues
outside the Americas. For more information on our geographic
results, see Note 25 to the consolidated financial statements in
Part II, Item 8 of this Form 10-K.

Our Business Segments and Segment
Operating Results
We report our activities in four business segments: Investment
Banking, Institutional Client Services, Investing & Lending and
Investment Management. The chart below presents our four
business segments.

Firmwide

- Investment Banking
  - Financial Advisory
  - Underwriting
    - Equity Underwriting
    - Debt Underwriting
  - Equity
  - Fixed Income, Currency and Commodities Client Execution
  - Commissions and Fees
  - Securities Services

- Institutional Client Services
  - Equities
  - Equities Client Execution

- Investing & Lending
  - Industrial and Commercial Bank of China Limited (ICBC)
  - Equity Securities (ex. ICBC)
  - Debt Securities and Loans
  - Other

- Investment Management
  - Management and Other Fees
  - Incentive Fees
  - Transaction Revenues
Traditional I-Banking

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Asset Management

![Diagram of Asset Management]

The diagram illustrates the various segments and subsegments within Asset Management, including Investment Banking, Institutional Client Services, Investing & Lending, and Investment Management. Each segment is further divided into specific roles and functions, such as Financial Advisory, Underwriting, Equity Underwriting, Debt Underwriting, Fixed Income, Currency and Commodities Client Execution, Equities, Equities Client Execution, Securities Services, Equity Securities (ex. ICBC), Debt Securities and Loans, and Other. Investment Management includes Management and Other Fees, Incentive Fees, and Transaction Revenues.
Securities Brokering and Dealing
How has the scale of these businesses changes since 1952

• A look at balance sheets in the Flow of Funds
The growth of balance sheets in Securities B-D

Securities B-D Assets/GDP (L 128)
Traditional I-Banking did not need a balance sheet
Summary of Broker Dealer Balance Sheet

Table 1
Stylized Balance Sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities and Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>Equity</td>
</tr>
<tr>
<td>Instruments owned</td>
<td>Instruments sold but not yet owned</td>
</tr>
<tr>
<td>Reverse repo/securities borrowing</td>
<td>Repo/securities lending</td>
</tr>
<tr>
<td>Brokerage receivables</td>
<td>Brokerage payables</td>
</tr>
</tbody>
</table>
Cash will generally include the dealer’s own funds that are held in an account with a bank, such as a deposit with a bank within the same bank holding company, a Federal Reserve Bank, or a third-party bank. Cash will also include funds deposited with a bank that are fully segregated on behalf of a customer of the dealer.

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Financial instruments owned will reflect the fair value of risky positions owned by the bank, such as securities, physical commodities, principal investments, and derivative contracts. In concept, the fair value reflects the cash that could be obtained upon sale of the instrument.

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</tbody>
</table>

Table 1: Stylized Balance Sheet
Instruments sold but not yet owned reflect the dealer’s own short positions in a financial instrument, such as a security, physical commodity, or derivative contract.

**Table 1**

**Stylized Balance Sheet**

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Reverse repurchase agreements (reverse repo)/securities borrowing generally reflects a cash outlay and a receipt of a financial instrument as collateral, such as a security. The reverse repo is recorded on the balance sheet as the value of the cash outlay, not the collateral.

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</tbody>
</table>
Repurchase agreements (repos)/securities lending generally reflects a cash receipt and a pledge of a financial instrument, such as a security. These are similar to the reverse repo/securities borrowing transactions described above, but in these the dealer bank takes the opposing side of the trade.

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Table 1: Stylized Balance Sheet
Brokerage receivables are economically similar to reverse repos/securities borrowing, but are generally related to other forms of collateralized lending, such as brokerage customer margin loans and collateral posted in connection with derivatives.

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Brokerage payables are economically similar to repos/securities lending, but are generally related to other collateralized borrowings, such as brokerage customer credit balances and collateral received in connection with derivative transactions.

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</tbody>
</table>
Main Liabilities: Collateralized Borrowings

Securities BD Repo and Securities Credit/GDP (L 128)

Total Assets/GDP
Two different data slices to compare to 1914-1940 data

- Gross versus net balance sheet
  - Flow of Funds L 128 shows only net repo liabilities
  - Underlying detail show gross repo
  - Gross data comparable to data 1914-1940
- Scale of financing coming from deposit taking institutions and money market mutual funds
Broker Dealer Gross Collateralized Assets and Liabilities/GDP

Assets
Liabilities
Net
Total Assets
Securities BD holdings of securities and short positions
Flow of Funds data on securities owned/GDP
Summary

- Big growth of broker dealer intermediation of credit to facilitate investors buying securities on margin and selling short
- Big change from old business of fee income and no balance sheet
- Big drop in gross balance sheets in fall of 2008
Have we seen this movie before?

- Maybe. 1925-1929 big growth and collapse in the balance sheets of securities broker dealers and non-bank lending to broker dealers.

- But few apparent systemic consequences from all of this turmoil (Neither brokers nor New York banks failed in 1929/30)
NYSE Brokers’ Borrowings
Historical Banking and Monetary Statistics 1914-1941

Broker's Loans by Groups of Lenders
in billions of dollars

- Total
- NY City Banks
- Total from banks
NYSE Brokers’ Borrowings
Historical Banking and Monetary Statistics 1914-1941

Broker's Loans by Groups of Lenders
in billions of dollars

Borrowings reported by members of the NYSE

Broker's Loans by Groups of Lenders
in billions of dollars

Lending to Call Market reported by banks

Total
NY City Banks
Total from banks
NYSE Brokers’ Borrowings
Historical Banking and Monetary Statistics 1914-1941

Broker's Loans by Groups of Lenders
in billions of dollars

Run on Shadow banking?

Total
NY City Banks
Total from banks
No run on New York Banks with Crash of 1929

Broker's Loans and Deposits in New York Money Center Banks
in billions of dollars

- Brokers' Loans
- Deposits in New York City Banks
Bank runs came later

Broker's Loans and Deposits in billions of dollars

- Brokers' Loans
- Deposits in New York City Banks
- All Fed Member Banks
- All Banks

Bank Runs Come Later
What was different in 1929?

- Sprague (1910): pre-Fed banking crises had their origination in the New York Call Money Market
  
  - 1873 Failure of Jay Cooke underwriting railroad bonds spread to banks. Concern about similar exposure to railroads
  
  - 1907 Run on Trust Companies spread to banks through call market
  
  - National Monetary Commission advocated creation of central bank in part to eliminate the transmission of crises from the call money market to banks
  
  - Common Hypothesis: The experience in the Crash of 1929 was different due to intervention of New York Fed
  
- So why didn’t this work in 2008?
Motivations for Borrowing and Lending Securities

• Some investors want to go short a particular security
  • Dispersion in beliefs drives size dispersion of positions

• Security-Market line / Two-fund theorem
  • Some investors want a levered position in the market as a whole
  • Others want mostly cash
  • Volume of margin lending driven by differences in risk aversion and margin requirements

• Could consider asset pricing and welfare considerations of margin requirements
### L.120 Money Market Mutual Funds (1)

Billions of dollars; amounts outstanding end of period, not seasonally adjusted

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</tr>
</thead>
<tbody>
<tr>
<td>1. Total financial assets</td>
<td>3258.6</td>
<td>2755.4</td>
<td>2642.5</td>
<td>2649.6</td>
<td>2678.3</td>
<td>2506.9</td>
<td>2649.6</td>
<td>2554.0</td>
<td>2541.9</td>
<td>2637.4</td>
<td>2678.3</td>
<td>2541.9</td>
<td>2637.4</td>
<td>2678.3</td>
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<td>2. Foreign deposits</td>
<td>97.1</td>
<td>105.9</td>
<td>42.9</td>
<td>43.3</td>
<td>33.7</td>
<td>40.2</td>
<td>43.3</td>
<td>48.7</td>
<td>37.1</td>
<td>36.3</td>
<td>33.7</td>
<td>1</td>
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<tr>
<td>3. Checkable deposits and currency</td>
<td>17.9</td>
<td>14.2</td>
<td>20.1</td>
<td>16.5</td>
<td>13.3</td>
<td>11.3</td>
<td>16.5</td>
<td>10.9</td>
<td>27.5</td>
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<tr>
<td>4. Time and savings deposits</td>
<td>566.6</td>
<td>458.9</td>
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<td>435.4</td>
<td>494.9</td>
<td>396.9</td>
<td>435.4</td>
<td>429.4</td>
<td>444.3</td>
<td>494.4</td>
<td>494.9</td>
<td>4</td>
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</tr>
<tr>
<td>5. Security repurchase agreements</td>
<td>480.0</td>
<td>479.4</td>
<td>490.5</td>
<td>544.7</td>
<td>493.0</td>
<td>513.2</td>
<td>544.7</td>
<td>470.7</td>
<td>450.4</td>
<td>489.1</td>
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</tr>
<tr>
<td>6. Credit market instruments</td>
<td>2070.0</td>
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<td>1663.6</td>
<td>1580.9</td>
<td>1611.8</td>
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<tr>
<td>7. Open market paper</td>
<td>510.5</td>
<td>394.2</td>
<td>354.2</td>
<td>340.8</td>
<td>352.1</td>
<td>319.4</td>
<td>340.8</td>
<td>351.1</td>
<td>356.6</td>
<td>357.9</td>
<td>352.1</td>
<td>7</td>
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</tr>
<tr>
<td>8. Treasury securities</td>
<td>406.4</td>
<td>335.4</td>
<td>443.3</td>
<td>457.8</td>
<td>488.2</td>
<td>456.3</td>
<td>457.8</td>
<td>470.5</td>
<td>449.0</td>
<td>466.5</td>
<td>488.2</td>
<td>8</td>
<td></td>
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</tr>
<tr>
<td>9. Agency- and GSE-backed securities</td>
<td>543.0</td>
<td>402.8</td>
<td>403.7</td>
<td>343.5</td>
<td>361.1</td>
<td>331.4</td>
<td>343.5</td>
<td>325.6</td>
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<td>354.0</td>
<td>361.1</td>
<td>9</td>
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</tr>
<tr>
<td>10. Municipal securities</td>
<td>440.1</td>
<td>386.7</td>
<td>357.3</td>
<td>336.7</td>
<td>308.3</td>
<td>320.1</td>
<td>336.7</td>
<td>312.5</td>
<td>309.6</td>
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<td>308.3</td>
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</tr>
<tr>
<td>11. Corporate and foreign bonds</td>
<td>169.9</td>
<td>154.2</td>
<td>105.1</td>
<td>102.1</td>
<td>102.1</td>
<td>93.0</td>
<td>102.1</td>
<td>103.0</td>
<td>90.7</td>
<td>89.1</td>
<td>102.1</td>
<td>11</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12. Miscellaneous assets</td>
<td>26.9</td>
<td>23.5</td>
<td>22.7</td>
<td>28.8</td>
<td>31.7</td>
<td>25.1</td>
<td>28.8</td>
<td>31.5</td>
<td>31.9</td>
<td>33.8</td>
<td>31.7</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>13. Total shares outstanding (liabilities)</td>
<td>3258.6</td>
<td>2755.4</td>
<td>2642.5</td>
<td>2649.6</td>
<td>2678.3</td>
<td>2506.9</td>
<td>2649.6</td>
<td>2554.0</td>
<td>2541.9</td>
<td>2637.4</td>
<td>2678.3</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Open-end investment companies; excludes funding vehicles for variable annuities, which are included in the life insurance sector (table L.115).

---

**Assets in Banks**
**L.120 Money Market Mutual Funds (1)**
Billions of dollars; amounts outstanding end of period, not seasonally adjusted

<table>
<thead>
<tr>
<th>1</th>
<th>Total financial assets</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2012 Q3</th>
<th>2012 Q4</th>
<th>2013 Q1</th>
<th>2013 Q2</th>
<th>2013 Q3</th>
<th>2013 Q4</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Foreign deposits</td>
<td>97.1</td>
<td>105.9</td>
<td>42.9</td>
<td>43.3</td>
<td>33.7</td>
<td>40.2</td>
<td>43.3</td>
<td>48.7</td>
<td>37.1</td>
<td>36.3</td>
<td>33.7</td>
</tr>
<tr>
<td>3</td>
<td>Checkable deposits and currency</td>
<td>17.9</td>
<td>14.2</td>
<td>20.1</td>
<td>16.5</td>
<td>13.3</td>
<td>11.3</td>
<td>16.5</td>
<td>10.9</td>
<td>27.5</td>
<td>11.0</td>
<td>13.3</td>
</tr>
<tr>
<td>4</td>
<td>Time and savings deposits</td>
<td>566.6</td>
<td>458.9</td>
<td>402.7</td>
<td>435.4</td>
<td>494.9</td>
<td>396.9</td>
<td>435.4</td>
<td>429.4</td>
<td>444.3</td>
<td>494.4</td>
<td>494.9</td>
</tr>
<tr>
<td>5</td>
<td>Security repurchase agreements</td>
<td>480.0</td>
<td>479.4</td>
<td>490.5</td>
<td>544.7</td>
<td>493.0</td>
<td>513.2</td>
<td>544.7</td>
<td>470.7</td>
<td>450.4</td>
<td>489.1</td>
<td>493.0</td>
</tr>
<tr>
<td>6</td>
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<td>2070.0</td>
<td>1673.4</td>
<td>1663.6</td>
<td>1580.9</td>
<td>1611.8</td>
<td>1520.2</td>
<td>1580.9</td>
<td>1562.7</td>
<td>1550.9</td>
<td>1572.8</td>
<td>1611.8</td>
</tr>
<tr>
<td>7</td>
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<td>510.5</td>
<td>394.2</td>
<td>354.2</td>
<td>340.8</td>
<td>352.1</td>
<td>319.4</td>
<td>340.8</td>
<td>351.1</td>
<td>356.6</td>
<td>357.9</td>
<td>352.1</td>
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<td>443.3</td>
<td>457.8</td>
<td>488.2</td>
<td>456.3</td>
<td>457.8</td>
<td>470.5</td>
<td>449.0</td>
<td>466.5</td>
<td>488.2</td>
</tr>
<tr>
<td>9</td>
<td>Agency- and GSE-backed securities</td>
<td>543.0</td>
<td>402.8</td>
<td>403.7</td>
<td>343.5</td>
<td>361.1</td>
<td>331.4</td>
<td>343.5</td>
<td>325.6</td>
<td>345.0</td>
<td>354.0</td>
<td>361.1</td>
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<tr>
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<td>357.3</td>
<td>336.7</td>
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<td>320.1</td>
<td>336.7</td>
<td>312.5</td>
<td>309.6</td>
<td>305.1</td>
<td>308.3</td>
</tr>
<tr>
<td>11</td>
<td>Corporate and foreign bonds</td>
<td>169.9</td>
<td>154.2</td>
<td>105.1</td>
<td>102.1</td>
<td>102.1</td>
<td>93.0</td>
<td>102.1</td>
<td>103.0</td>
<td>90.7</td>
<td>89.1</td>
<td>102.1</td>
</tr>
<tr>
<td>12</td>
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<td>26.9</td>
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<td>28.8</td>
<td>31.7</td>
<td>25.1</td>
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(1) Open-end investment companies; excludes funding vehicles for variable annuities, which are included in the life insurance sector (table L.115).
## L.120 Money Market Mutual Funds (1)

Billions of dollars; amounts outstanding end of period, not seasonally adjusted

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<th>1</th>
<th>Total financial assets</th>
<th>3258.6</th>
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<th>2578.3</th>
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</tr>
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<tr>
<td>2</td>
<td>Foreign deposits</td>
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<td>2649.6</td>
<td>2554.0</td>
<td>2541.9</td>
<td>2578.3</td>
<td>13</td>
</tr>
</tbody>
</table>

(1) Open-end investment companies; excludes funding vehicles for variable annuities, which are included in the life insurance sector (table L.115).
Bank and MMMF lending to Broker Dealers / GDP
### L.207 Federal Funds and Security Repurchase Agreements

Billions of dollars; amounts outstanding end of period, not seasonally adjusted

<table>
<thead>
<tr>
<th>1</th>
<th>Total liabilities</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
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<td>2</td>
<td>Rest of the world</td>
<td>530.5</td>
<td>731.8</td>
<td>808.0</td>
<td>847.7</td>
<td>733.1</td>
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<tr>
<td>3</td>
<td>Monetary authority</td>
<td>77.7</td>
<td>59.7</td>
<td>99.9</td>
<td>107.2</td>
<td>315.9</td>
</tr>
<tr>
<td>4</td>
<td>Private depository institutions (net)</td>
<td>859.0</td>
<td>694.7</td>
<td>619.8</td>
<td>499.6</td>
<td>438.4</td>
</tr>
<tr>
<td>5</td>
<td>U.S.-chartered depository institutions (net)</td>
<td>681.3</td>
<td>462.3</td>
<td>355.0</td>
<td>212.4</td>
<td>150.1</td>
</tr>
<tr>
<td>6</td>
<td>Foreign banking offices in U.S. (net)</td>
<td>177.8</td>
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<td>280.7</td>
<td>296.9</td>
<td>288.4</td>
</tr>
<tr>
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<td>Credit unions (net)</td>
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<td>-0.1</td>
</tr>
<tr>
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<td>0.4</td>
<td>0.8</td>
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</tr>
<tr>
<td>9</td>
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<td>10.4</td>
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<td>12.7</td>
</tr>
<tr>
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<td>Government-sponsored enterprises</td>
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<td>1.3</td>
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<td>Brokers and dealers (net)</td>
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<td>14</td>
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<td>10.3</td>
<td>9.2</td>
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<td>16</td>
<td>State and local governments</td>
<td>125.5</td>
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<td>117.6</td>
<td>110.7</td>
<td>111.6</td>
</tr>
<tr>
<td>17</td>
<td>Rest of the world</td>
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<td>763.1</td>
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<td>0.0</td>
<td>0.0</td>
</tr>
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<td>Property-casualty insurance companies</td>
<td>4.5</td>
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<td>1.8</td>
<td>1.8</td>
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<td>20</td>
<td>Life insurance companies</td>
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<td>10.1</td>
<td>8.5</td>
<td>6.2</td>
</tr>
<tr>
<td>21</td>
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<td>2.6</td>
<td>2.5</td>
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<td>State and local govt. retirement funds</td>
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<td>3.6</td>
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<td>3.4</td>
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<td>Money market mutual funds</td>
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<td>Mutual funds</td>
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</tr>
<tr>
<td>25</td>
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<td>112.3</td>
<td>150.8</td>
<td>155.9</td>
</tr>
<tr>
<td>26</td>
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<td>50.3</td>
<td>50.5</td>
<td>11.5</td>
<td>8.7</td>
</tr>
<tr>
<td>27</td>
<td>Funding corporations</td>
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<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>28</td>
<td>Discrepancy--unallocated assets</td>
<td>522.9</td>
<td>413.9</td>
<td>297.3</td>
<td>103.8</td>
<td>-54.1</td>
</tr>
</tbody>
</table>
Two Fund Theorem
Treasury Repo Rates Often Exceed T-Bill Rates
At short horizons, Treasuries are risky:
Daily returns on iShares 7-10 year Treasury ETF (IEF)
A Theory of Repo Haircuts and Rates

- Collateralized borrowing is limited (rationed) by haircut
- Constrains how far out capital market line risk tolerant investor can go
- Repo lender faces credit risk in event of double default
  - Collateral falls in value
  - Borrower defaults
- Repo terms split the surplus to be shared from high shadow value of borrowing for risk tolerant investor versus high concern about credit risk in lending from risk averse lender
- Repo terms should depend on both the counterparty and the collateral
Missing elements from the theory

• A theory of the investment horizon
  • Overnight Repo vs. Five year swaps

• A theory of the instruments used
  • The market portfolio should be the only risky portfolio repo’d
  • Equities vs. Fixed Income

• General Equilibrium
General Equilibrium

- Focus on the allocation of consumption
- Allocate aggregate endowment of consumption
- Agents have different utility functions
- Solve a social planning problem
- Lagrange multipliers on the resource constraints correspond to equilibrium state prices for consumption
- What portfolios implement the optimal outcome?
A two period model

States:

\[ z \in Z = \{z_1, z_2, \ldots \} \]

Probabilities:

\[ \pi(z) \]

Utilities

\[ u^i(c_0^i) + \beta^i \sum_z u^i(c_1^i(z)) \pi(z) \]
A Social Planning Problem

\[
\max_{c_0^i, c_1^i(z)} \sum_i \eta_i \left[ u^i(c_0^i) + \beta^i \sum_z u^i(c_1^i(z)) \pi(z) \right]
\]

subject to:

\[
Y_0 \geq \sum_i c_0^i
\]

and, for all \( z \),

\[
Y_1(z) \geq \sum_i c_1^i(z)
\]
Optimal allocation of consumption

• Equate MRS across states and dates across agents

• With quadratic or negative exponential utility, optimal consumption allocation is linear in aggregate consumption with different slope and intercept depending on agent’s risk aversion

• General Equilibrium version of the Two-Fund Theorem: Risk tolerant investors hold a levered claim on aggregate consumption, risk averse agents hold riskless claim and small exposure to aggregate consumption

• Basic insight should generalize except portfolio implementation may be messier

• Optimal consumption is simple because it is done state-by-state
GE Example Linear Sharing Rule

\[ u_i(c_i) = -\frac{\alpha_i}{\rho} \exp\left(-\frac{\rho}{\alpha_i} (c_i - \gamma_i)\right) \]

\[ \exp\left(-\frac{\rho}{\alpha_i} (c_i - \gamma_i)\right) = \exp\left(-\frac{\rho}{\alpha_j} (c_j - \gamma_j)\right) \]

\[ \sum_i n_i c_i = Y \]

\[ c_i = \frac{\alpha_i}{\sum_k n_k \alpha_k} (Y - \sum_k n_k \gamma_k) + \gamma_i \]
Implement with Constant Portfolios of Consol Bond and Share of Aggregate Endowment

\[ B_i = \gamma_i - \frac{\alpha_i}{\sum_k n_k \alpha_k} \sum_k n_k \gamma_k \]

\[ S_i = \frac{\alpha_i}{\sum_k n_k \alpha_k} \]

But what about credit risk?
Bounds on Consumption

- Optimal allocation with linear consumption sharing rules has negative consumption for risk tolerant agents in bad aggregate states.

- If planner faces lower bounds on consumption (and finite marginal utility at those bounds), these bounds will bind for risk tolerant agents in bad aggregate states.

- In optimal allocation, further downside aggregate consumption risk is pushed onto risk averse agents.
Implications for Repo/Financial Crises

• Use standard Lucas-tree logic to price any asset given optimal allocation of consumption and Lagrange multipliers on state-by-state resource constraints.

• Interpret agent’s hitting the lower bound on consumption as default (refusing to take further losses as aggregate consumption falls)

• Repo failure: double default of levered (risk tolerant agents) and fall in value of claim on aggregate consumption perfectly correlated

• Financial Crisis: Optimal allocation has perfectly correlated default across all risk tolerant agents at once when aggregate consumption falls

• Shift further losses in aggregate consumption onto risk averse agents

• Repo looks safe until it isn’t
Research Directions

• How do broker dealers fit into the growth model framework?

  • What is the appropriate size of broker-dealer balance sheets?

  • What would be lost (socially) if we dramatically reduced their balance sheets by regulation?

• Are broker-dealer liabilities the right asset for “banks” to hold?

  • Chari-Phelan/Farhi-Golosov-Tsyvinski on tradable assets in Diamond Dybvig