



**OFFICE OF
FINANCIAL RESEARCH**
U.S. DEPARTMENT OF THE TREASURY



Monitoring Financial Stability in a Complex World

Mark D. Flood

Research & Analysis Center

Office of Financial Research (OFR)

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Disclaimer

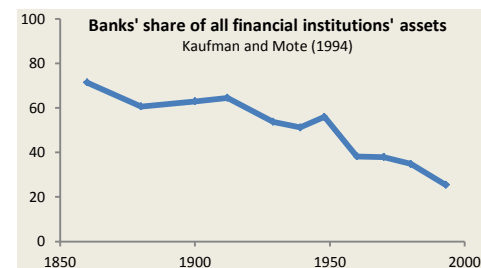
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Strategic Forces

- *Growth in financial **data volumes***
 - *Moore's law (CPUs) and storage capacity*
 - *Transaction throughput (e.g., HFT)*
 - *Implications for validation and processing capacity*
- *Systemic monitoring requires a focus on **financial relationships***
 - *Network of interconnections*
 - *Contrast GAAP accounting*
 - *Contrast microprudential supervision*
- *Complexity creates a need for regulatory "**cognitive capacity**"*
 - *Situational awareness*
 - *Decision support tools*
 - *Crisis-response ability*

Firm-level supervision and disintermediation

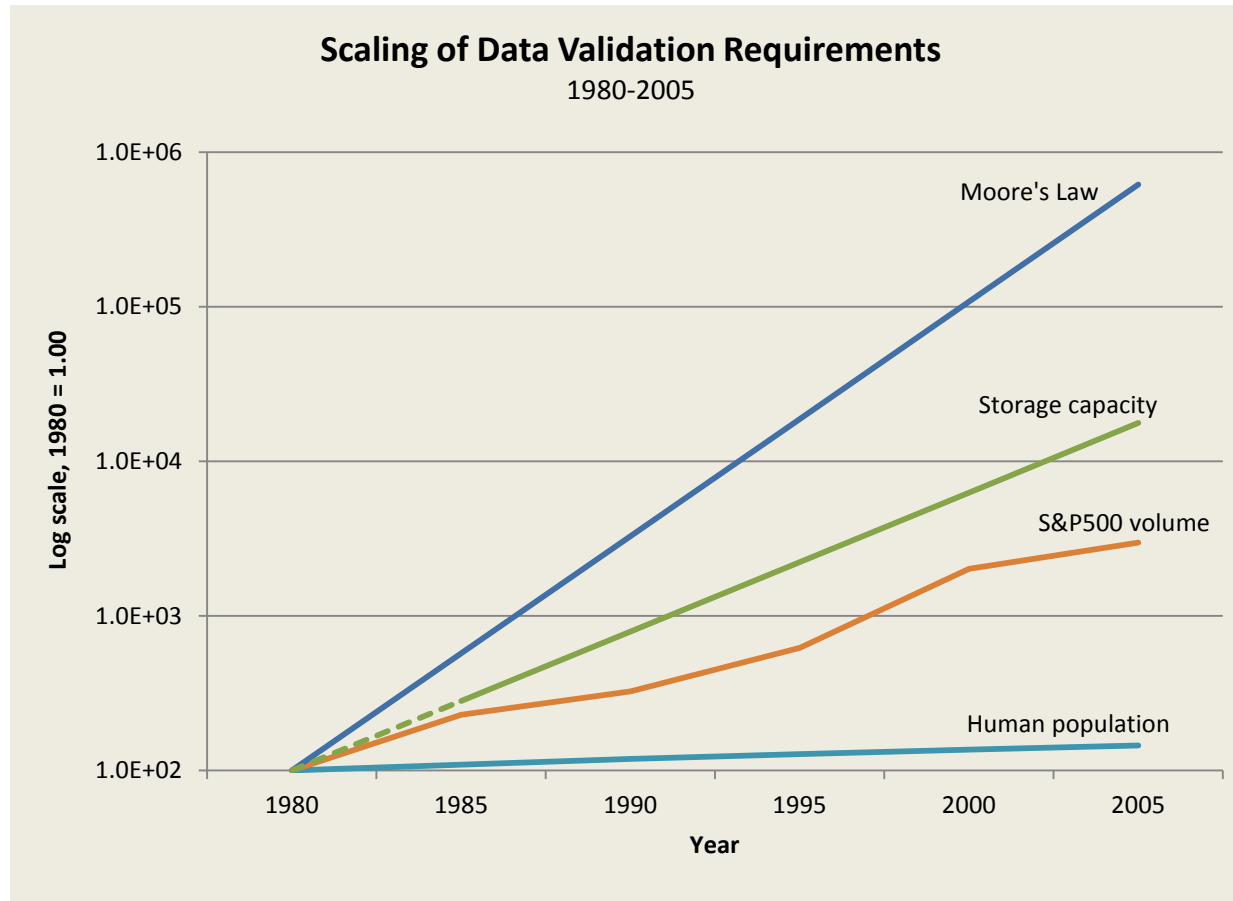
- **Firm as an island**
 - **Firm-centric risk management**
 - *Chief Risk Officer (CRO)*
 - *Value at risk (VaR), hedging policies*
 - *Exposure and concentration limits*
 - **Firm-centric risk supervision**
 - *On-site examinations*
 - *Risk-weighted assets (RWA) and capital requirements*
 - *Stress tests*
- **Inter- vs. intra-organization transaction costs**
 - **Boundaries of the firm**
 - *Coase (1937) , “The Nature of the Firm”*
 - *Williamson (1991), “Comparative Economic Organization”*
 - **Disintermediation**
 - *Banks fall from majority share of assets:*
 - *1860 = 71.4% vs. 1993 = 25.4%*
 - *Impact of technological advances*



Financial Innovation and the Complexity of Data Management

- ***E.g., new derivative products***
 - ***Improvements in portfolio management and hedging***
 - ***“Short put” problem***
 - *Ingersoll, Spiegel, Goetzmann, and Welch (2007)*
 - ***Opaqueness of the firm***
 - *Flannery, Kwan, and Nimalendran (2004, 2010)*
- ***Innovation-begotten complexity***
 - ***Failure to account for back-office costs***
 - *Too much of a good thing – Gottfredson and Aspinall (2005)*
 - *Inframarginal cost of complexity*
 - *Instrument type (à la SKU) count as a complexity metric*
- ***Hard and soft information***
 - ***Securitization loses soft information***
 - *When is this okay?*
 - ***Ignorance creep***

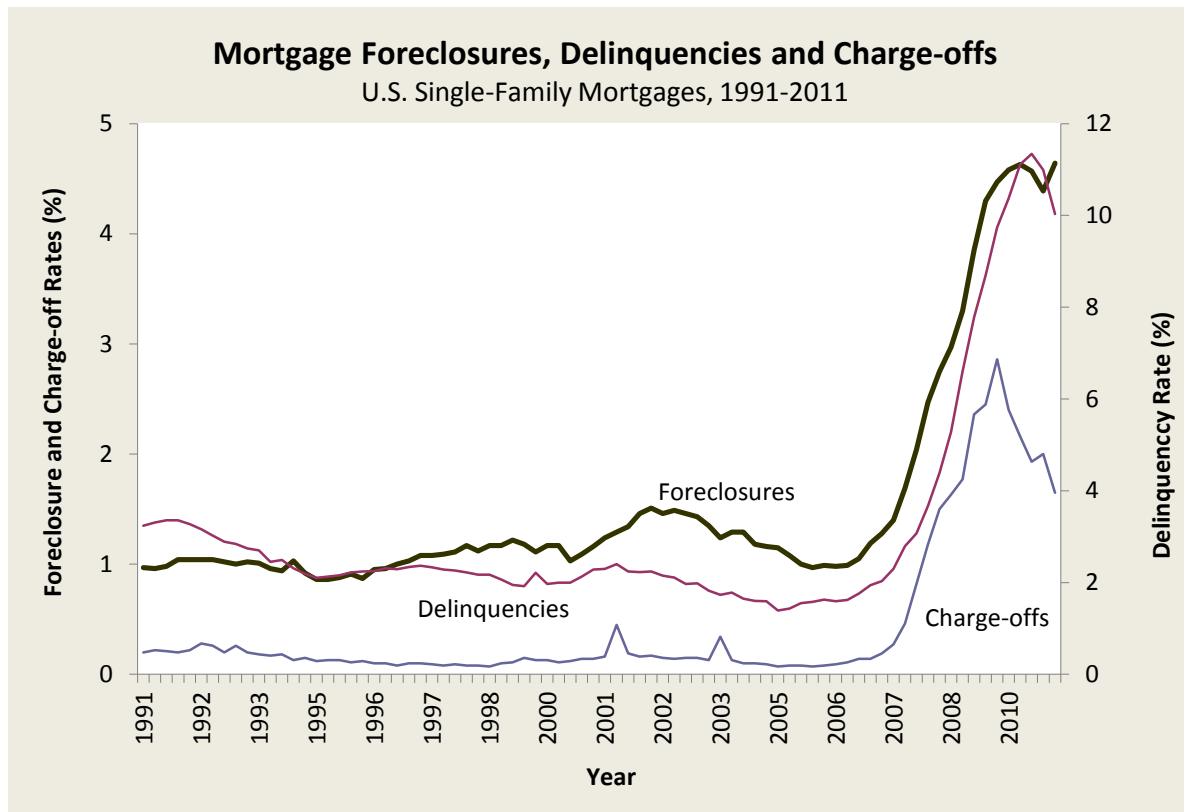
Differential Growth Rates for Data Validation Requirements



Source: M. Flood, A. Mendelowitz and W. Nichols, 2012, "Monitoring Financial Stability in a Complex World," (SSRN abstract ID #1989033).

Moore's Law is estimated as a linear regression of transistor densities (in logarithms) against year of introduction over the 1971-2011 period; data were downloaded from Wikipedia (2011). **Storage capacity** is based on the average annual growth estimate (23% per year) of Hilbert and López (2011a) for the 1986-2007 period, extrapolated back to cover the 1980-1985 interval. **S&P500 trading volume** was downloaded from Yahoo Finance (2011). **Human population** is based on total midyear world population, from the U.S. Census Bureau (2011).

Overwhelming the Foreclosure-Processing Infrastructure



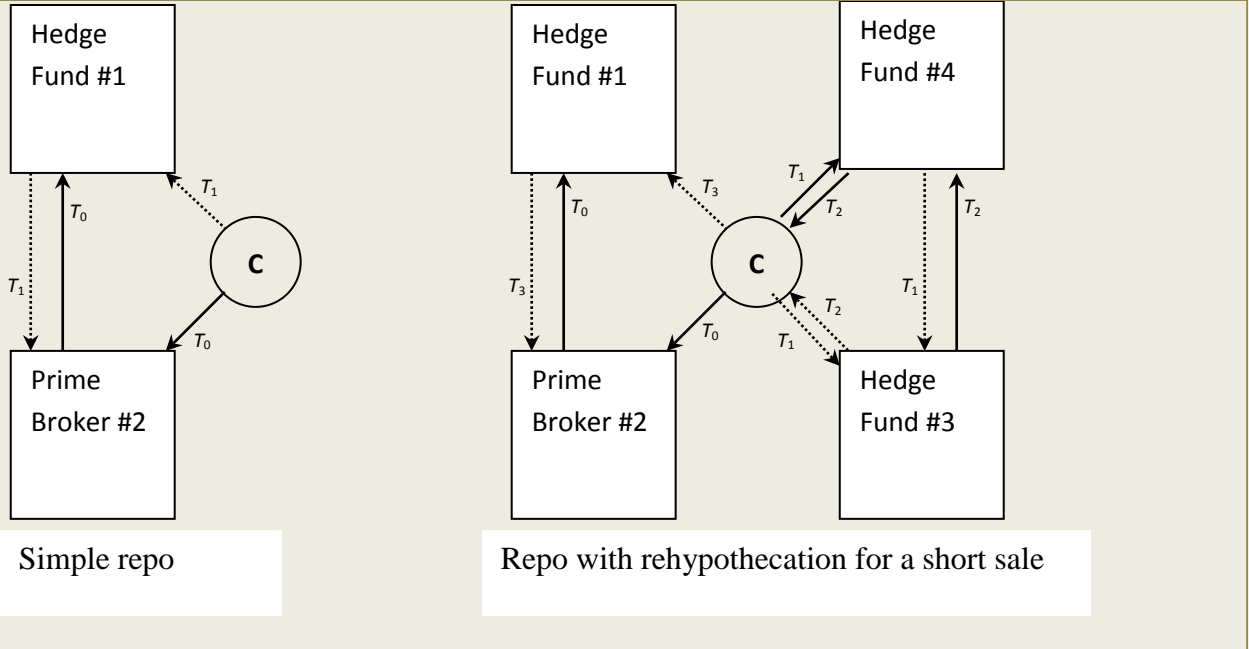
Source: M. Flood, A. Mendelowitz and W. Nichols, 2012, "Monitoring Financial Stability in a Complex World," (SSRN abstract ID #1989033).

Delinquencies represent balances on delinquent loans for single-family residential mortgages held by all U.S. commercial banks as a percent of all such loans; data are taken from Federal Reserve Bank of St. Louis (2011a), series DRSFRMACBS. **Charge-offs** represent balances on charged-off loans for single-family residential mortgages held by all U.S. commercial banks, as a percent of all such loans; data are taken from Federal Reserve Bank of St. Louis (2011b), series CORSFRMACBS. **Foreclosures** represent total foreclosed loans as a percent of all mortgage loans, and are taken from Bloomberg, series DLQTFOR Index (PX_LAST).

Networks and Information

- ***The full financial system***
 - ***Large data volumes***
 - ***Broad range of data types***
 - ***Accounting, terms and conditions (T&C), macroeconomic, etc.***
 - ***Equities, bank loans, OTC derivatives, securitizations, etc.***
 - ***Changing nature of risk***
 - ***Network complexity***
 - ***Contagion***
 - ***Deleveraging cycles and fire sales***
 - ***Aggregate funding imbalances and credit crunches***
- ***Firm-level myopia***
 - ***Role for supervision***
 - ***Black swans***
 - ***Securitization and fragmentation nodes***
 - ***Computational complexity***
 - ***Arora, Barak, Brunnermeier and Ge (2011)***

The Impact of Rehypothecation on Interconnectedness



Source: M. Flood, A. Mendelowitz and W. Nichols, 2012, "Monitoring Financial Stability in a Complex World," (SSRN abstract ID #1989033).

Collateral is indicated by the circle containing a "C" in both examples. For a **simple repo**, the prime broker pays cash at T_0 and receives the collateral; at T_1 , the collateral is returned to the hedge fund, which repays the cash with interest. In **repo with rehypothecation for a short sale**, the prime broker lends the collateral at time T_1 to hedge fund #3, who promptly sells it to hedge fund #4. At time T_2 , the short sale is reversed, and the collateral returned to the prime broker. At time T_3 , the original repo is unwound.

Technical Challenges

- *Growth in data volumes*
 - *Validation*
 - *Storage/access*
- *Monitoring financial relationships*
 - *Contractual relationships*
 - *Forward-looking cash-flow and risk analysis*
 - *Ownership hierarchies*
 - *Network topology*
- *Complexity*
 - *Network complexity*
 - *Contractual complexity*
- **➔** *Need for “cognitive capacity”*
 - *Situational awareness of the financial system*
 - *Decision support for policymakers*
 - *Crisis response capability*

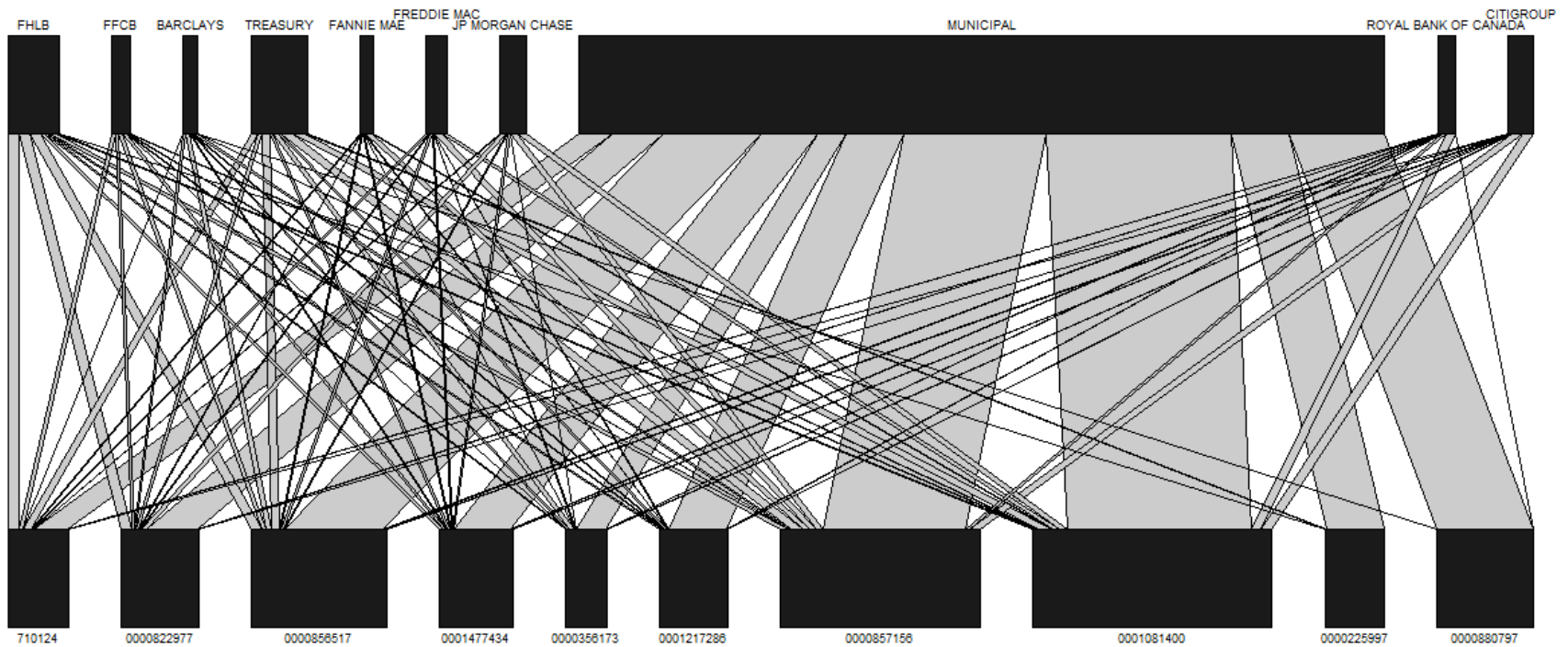
The Thin Graph

- *Position-level information on the full system*
 - *Avoids data aggregation/disaggregation burden*
 - *Facilitates data validation and reconciliation*
- *Four attributes per contract:*
 - *Position identifier*
 - *Counterparties*
 - *Size (e.g., notional value or par value)*
 - *Contract type (points to a data schema)*
- *Coverage:*
 - *Full balance sheet? All financial contracts? All traded contracts?*
- *Scope:*
 - *All participants? All firms?*
 - *Largest participants?*
 - *Duffie (2011), “Systemic Risk Exposures A 10-by-10-by-10 Approach”*

State-Contingent Data Collection

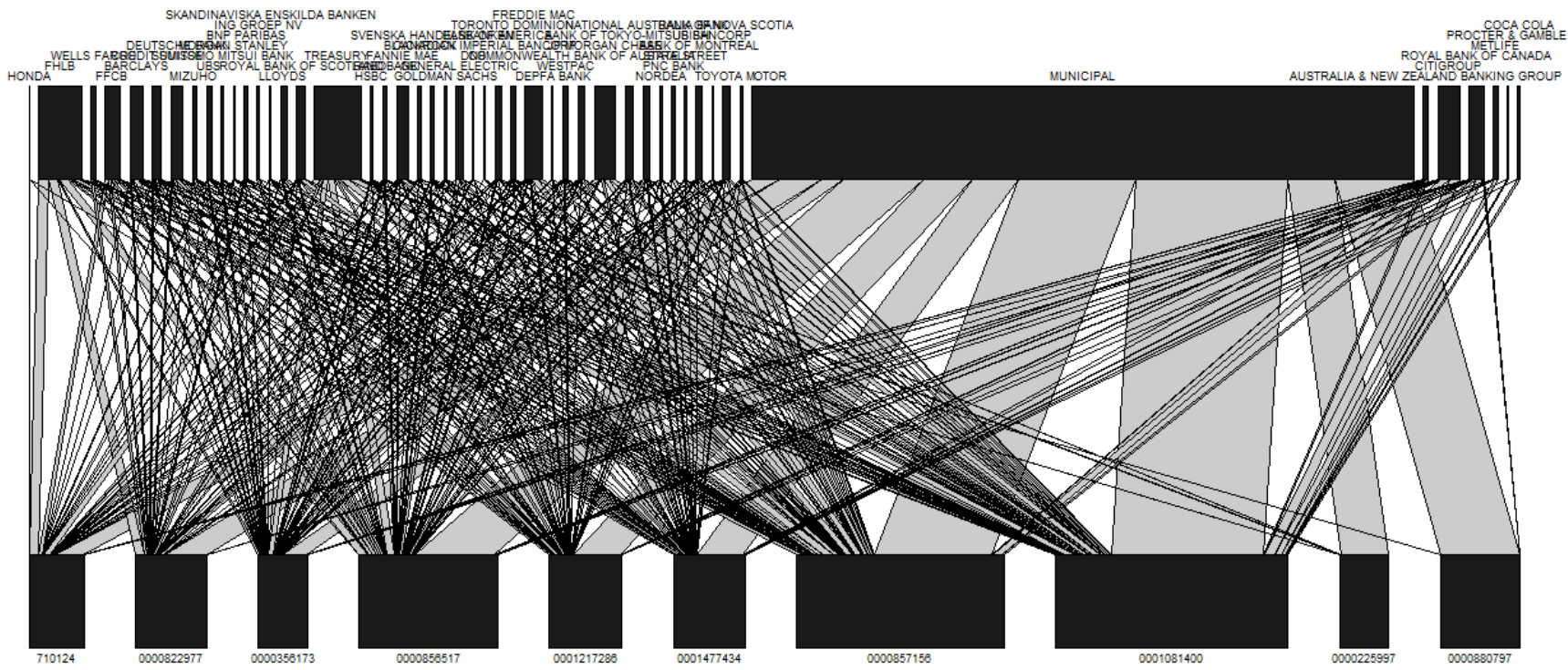
- ***Two modes:***
 - ***Default mode: collect only the thin graph***
 - *Active sectors*
 - *Growing/shrinking sectors*
 - *Novel contracts and markets*
 - ***Crisis mode: enhanced resolution***
 - *Dereference the schemas (selectively)*
 - *Populate position-level terms and conditions as necessary and appropriate*
- ***Confidentiality issues addressed***
 - *Privacy / PII*
 - *Business confidentiality*
 - *Safe harbor*
- ***Data management***
 - *Data validation and reconciliation burden*
 - *Data access burden*
 - *General abstraction to cover all contract types*

Money Fund Positions (counts) Top 10 Issuers, Top 10 Funds



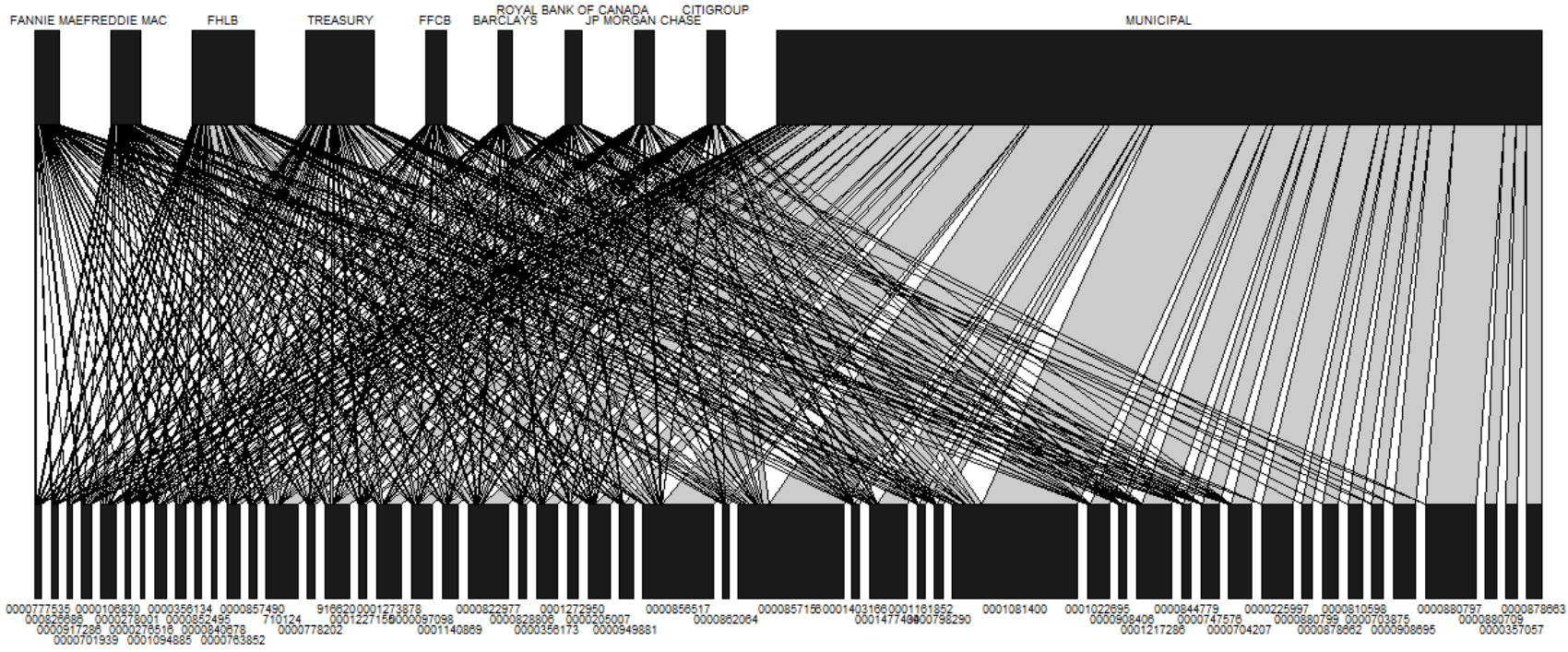
Source: Data from Securities and Exchange Commission (SEC) schedule N-MFP, 31 Dec 2011

Money Fund Positions (counts) Top 50 Issuers, Top 10 Funds



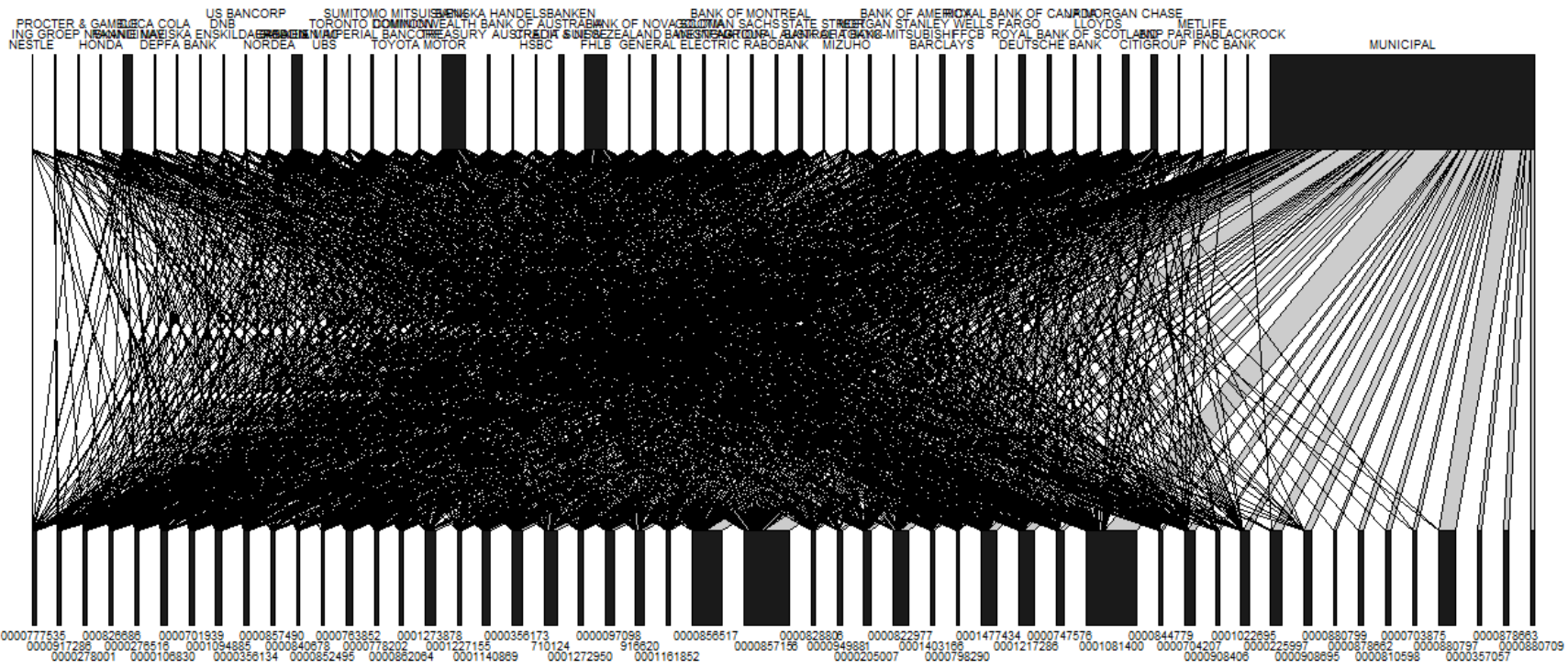
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Money Fund Positions (counts) *Top 10 Issuers, Top 50 Funds*



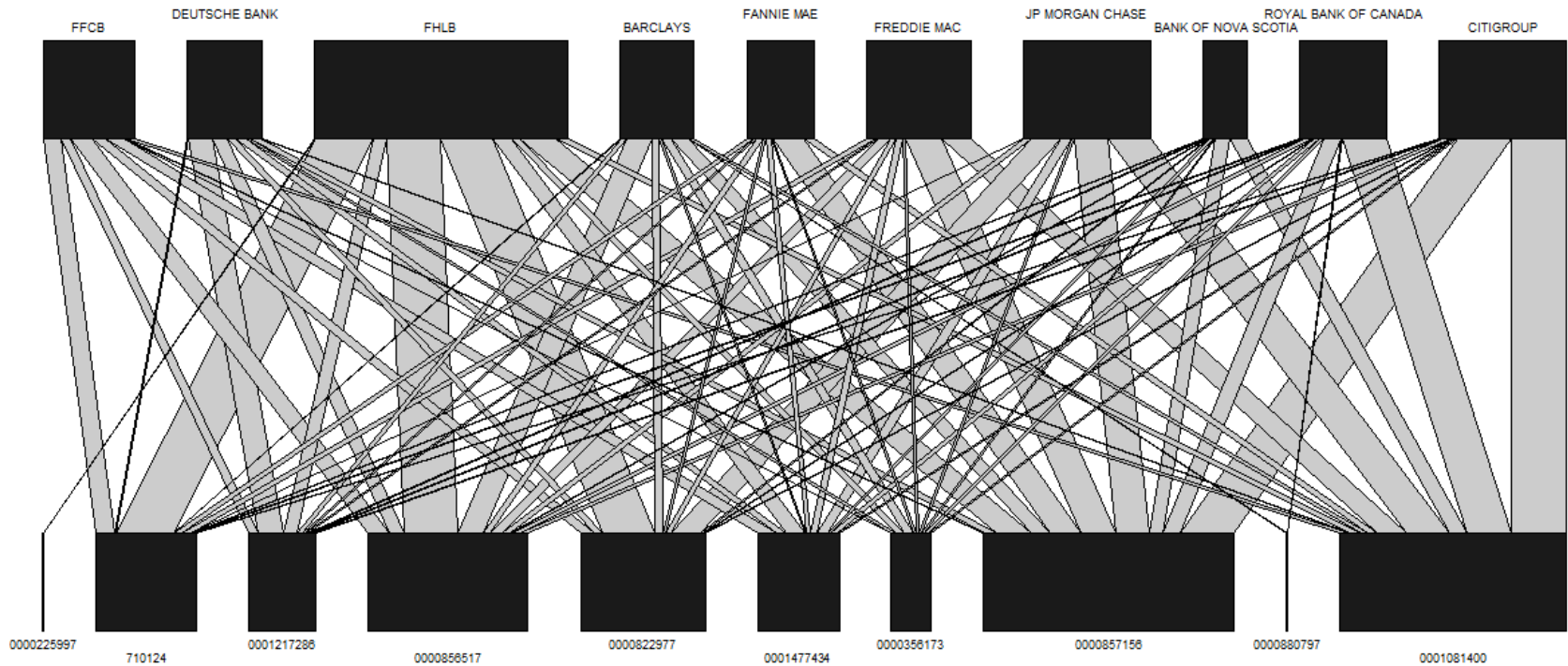
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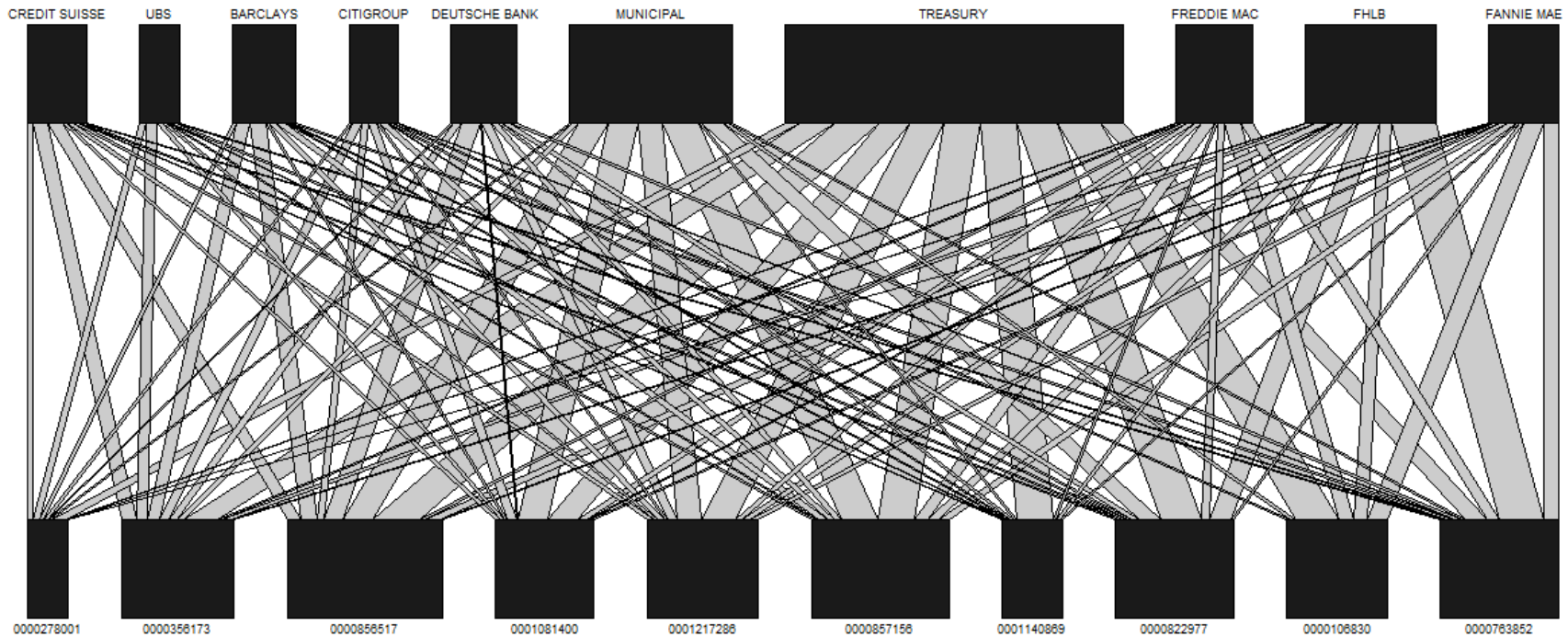
Source: Data from Securities and Exchange Commission schedule N-MFP, 31 Dec 2011

Money Fund Positions (counts) *Next 10 Issuers (after Top 2), Top 10 Funds*



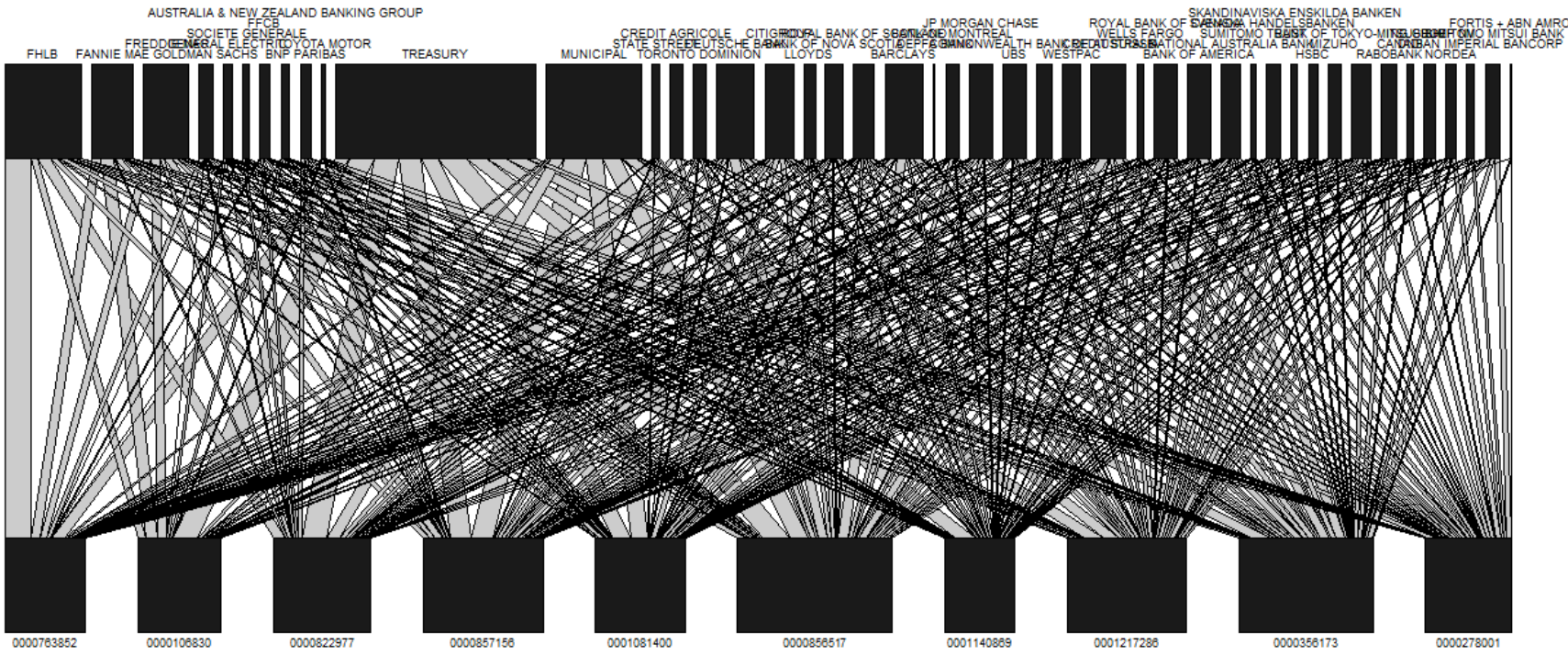
Source: Data from Securities and Exchange Commission schedule N-MFP, 31 Dec 2011

Money Fund Positions (values) Top 10 Issuers, Top 10 Funds



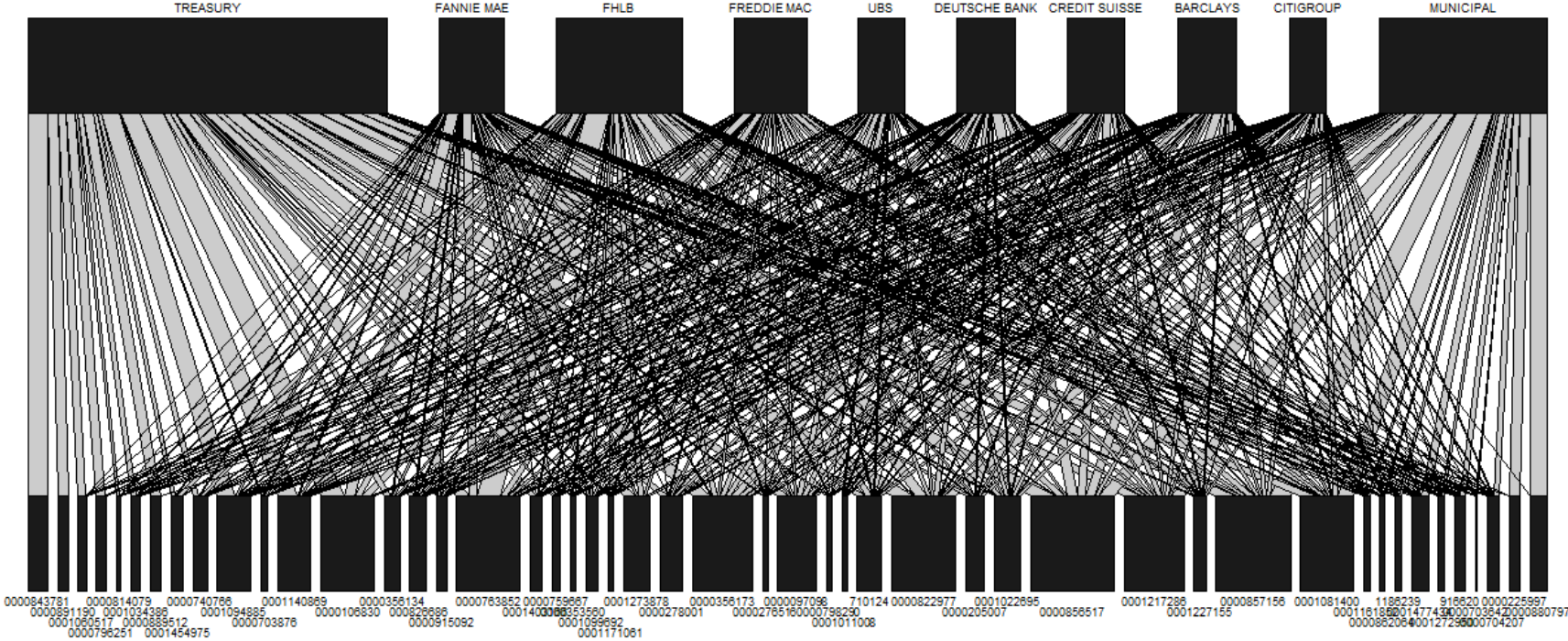
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Money Fund Positions (values) Top 50 Issuers, Top 10 Funds



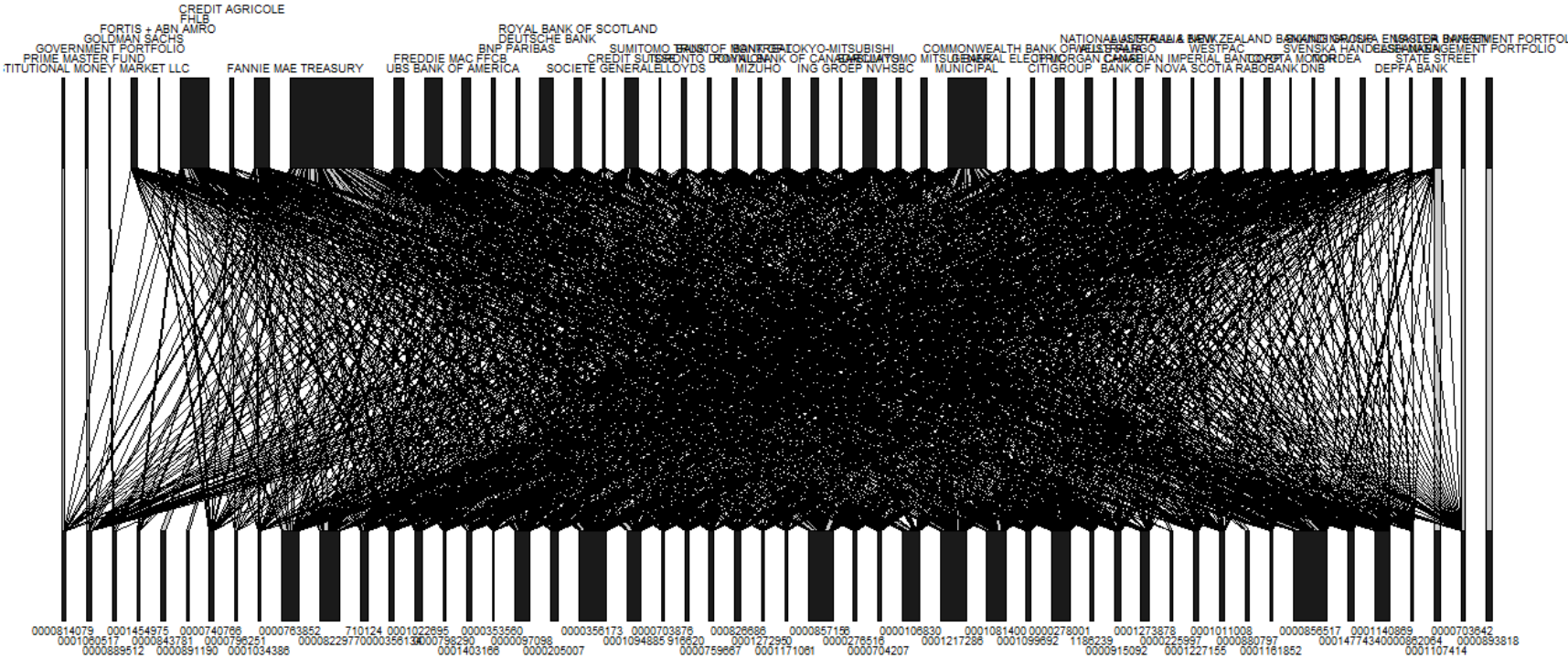
Source: Data from Securities and Exchange Commission schedule N-MFP, 31 Dec 2011

Money Fund Positions (values) Top 10 Issuers, Top 50 Funds



Source: Data from Securities and Exchange Commission schedule N-MFP, 31 Dec 2011

Money Fund Positions (values) Top 50 Issuers, Top 50 Funds



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