

The Value of Internal Sources of Funding Liquidity: U.S. Broker-Dealers and the Financial Crisis

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The views expressed herein are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York, the Federal Reserve Board, the Federal Reserve System, or the Swiss National Bank.

Overview

We study how the access to internal sources of liquidity affects financial firms' trading behavior during time of stress.

- ① How broker-dealers adjust their balance sheet in response to an exogenous aggregate liquidity shock (2007-09 financial crisis)?
 - ▶ Broker-dealers are highly levered, sensitive to changes in market and funding liquidity
- ② Is the organizational form chosen by the broker-dealer important for the adjustment?
 - ▶ If 'stand-alone' then rely solely on markets for funding

 - ▶ If 'BHC-affiliated' then can source funding liquidity from BHC.

Findings

The organizational form (BHC vs non-BHC affiliation) is crucial in explaining the balance sheet changes

- **The response to a liquidity shock depends on the access to internal funding sources.**
 - ▶ Non-BHC broker-dealers had a larger shift toward the use of repo compared to BHC broker-dealers
 - ▶ Non-BHC broker-dealers increased significantly more the share of Treasuries in their inventory than BHC broker-dealers
- **Different dynamics on the asset and liability side of balance sheet**
 - ▶ Asset-side: Effect shows up in the first year and strengthen over time
 - ▶ Liability-side: Effect manifests after Lehman bankruptcy

Outline of talk

- Data and sample construction

- Empirical approach and results

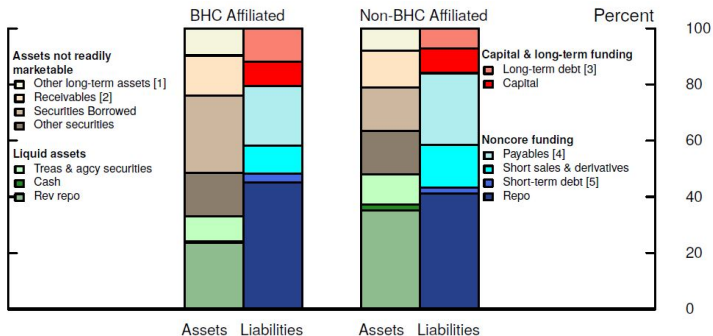
Data and Sample

- Quarterly filing from Financial and Operational Combined Uniform Single (FOCUS) report forms from 2004 to 2011.
- Organizational hierarchy data available from the National Information Center to identify the broker-dealers affiliated with BHCs.
- We filter the data in three ways:
 - ▶ Remove broker-dealers subsidiaries of thrift holding companies.
 - ▶ Exclude broker-dealers that submit FOCUS data for less than six consecutive quarters.
 - ▶ Remove broker-dealers which change affiliation during the financial crisis.
- Sample period centered around the financial crisis: 2004-2011.

Broker-dealers Funding model

- They rely heavily on debt and typically maintain a high leverage ratio
 - ▶ Three main components of debt: long and short term unsecured debt and secured funding (repo and securities lending activities)

Figure: Balance Sheet Structure (BHC and Non-BHC Broker Dealers Q12005)

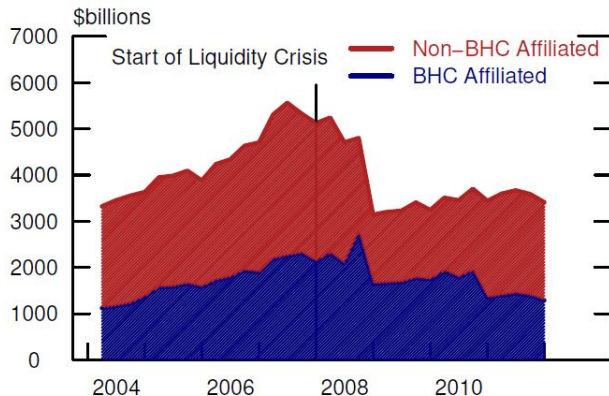


Notes: [1] Non-marketable securities and investments, subordinated securities borrowed, investment in affiliates, seg. cash, secured demand notes, membership in exchanges, and other fixed assets; [2] Derivative and trade date receivables as well as receivables from broker dealers, clearing organizations, customers and non-customers; [3] Bank loans, notes, and subordinated debt; [4] Derivative and trade date payables as well as payables to broker dealers, clearing organizations, customers, and non-customers; [5] Account payables and accrued liabilities

Broker-dealers Funding model

- Before GFC, secured funding was believed to be robust: the cash lender is protected from the costs of the default by the securities posted as collateral.
- The GFC revealed the fragility of the funding model and the risk of runs (Martin et al. 2014)
- Special actions were taken to guarantee that broker-dealers could access liquidity
 - ▶ temporary exemption from limits imposed on lending between bank and broker-dealer units
 - ▶ Federal Reserve authorized 3 facilities to provide temporary funding to primary dealers: the Primary Dealer Credit Facility (PDCF), and the Term Securities Lending Facility (TSLF), including the TSLF Option Program (TOP).

Size distribution of broker-dealers



Roughly, the two types of broker-dealers have equal market share, BHC broker-dealers are larger than non-BHC broker-dealers

Number of Broker-Dealers by Type

	Repo	Securities Lending	Reverse Repo	Securities Borrowing	Govt Sec	Cash
BHC	57	52	70	69	101	374
nonBHC	160	190	270	242	448	7,960

- An important difference across our analysis of the various balance sheet variables is the number of broker-dealers in the sample.
- Whereas almost all broker-dealers maintain cash holdings, a much smaller set of firms enter into repo and securities lending agreements.
- Mitigates somewhat the concerns about comparing apples and oranges bc many small nonBHC broker-dealers do not report repo and securities lending activity

Means and (Standard Deviations), by Broker-Dealer Type

	Pre-crisis		Crisis	
	non-BHC	BHC	non-BHC	BHC
Repo	0.407 (0.293)	0.453 (0.276)	0.434 (0.316)	0.300 (0.247)
Securities lending	0.318 (0.287)	0.126 (0.133)	0.258 (0.274)	0.165 (0.208)
Reverse repo	0.319 (0.283)	0.332 (0.228)	0.379 (0.312)	0.216 (0.177)
Securities borrowing	0.276 (0.288)	0.170 (0.179)	0.249 (0.272)	0.213 (0.221)
Govt Sec Share	0.502 (0.390)	0.456 (0.319)	0.547 (0.393)	0.425 (0.327)

Source: FOCUS reports and authors calculations.

Pre-Crisis: Q1 2004 - Q3 2007.

Crisis: Q4 2007 - Q4 2011.

- All variables are shares, to account for deleveraging over crisis & differences in firm sizes.

Empirical methodology

- We use Difference-in-Differences

$$Y_{it} = \beta_0 + \beta_1 \text{crisis}_{it} + \beta_2 \text{BHC}_{it} + \delta \text{crisis}_{it} \cdot \text{BHC}_{it} + \varepsilon_{it}, \quad (1)$$

where ε is an error term.

- ▶ BHC_{it} is a binary variable equal 1 if broker-dealer i is affiliated with a BHC at time t
- ▶ crisis_{it} is a binary variable equal to 1 if date t is equal to or later than the fourth quarter of 2007.
- ▶ Y_{it} :
 - ★ Repo
 - ★ Securities lending
 - ★ Reverse Repo
 - ★ Securities borrowing
 - ★ Govt securities held in long inventory

Threats to inference

- GFC is an exogenous event.
- Parallel trend assumption satisfied. [here](#)
- BHC affiliation: exogenous to GFC.
 - ▶ organizational decision made before
 - ▶ remove the handful of broker-dealers that adopted BHC structure during crisis
- Results are not driven by differences in business models across broker-dealer type.
 - ▶ Propensity score matching

Effect of Liquidity Shock on Broker-dealers' Balance sheet

	Repo	Securities Lending	Reverse Repo	Securities Borrowing	Govt Sec
BHC	0.013 (0.055)	-0.228*** (0.035)	0.072* (0.037)	-0.112*** (0.040)	0.065 (0.049)
Crisis	0.018 (0.032)	-0.072*** (0.023)	0.040** (0.018)	-0.035* (0.019)	0.047* (0.027)
BHC x Crisis	-0.117** (0.055)	0.123** (0.055)	-0.124*** (0.035)	0.077* (0.045)	-0.155*** (0.053)
Constant	0.415*** (0.032)	0.352*** (0.030)	0.172*** (0.019)	0.295*** (0.025)	0.369*** (0.032)
Observations	2,536	3,072	5,425	4,321	4,039
R ²	0.015	0.070	0.010	0.016	0.008

Note: *p<0.1; **p<0.05; ***p<0.01, standard errors clustered by broker-dealers.

- nonBHC BD: Increased share of both repo and reverse repo (by 1.8 and 4 pp) and decreased share of both sec lending and borrowing (by 7 and 4 pp)
- BHC BD: Decreased share of both repo and reverse repo (by 10 and 8 pp) and increased share of both sec lending and borrowing (by 5 and 4 pp)

Results

In a liquidity crisis,

- 1 BHC broker-dealers shifted away from trades involving Treasuries
- 2 nonBHC broker-dealers maintained or moved towards trades involving Treasuries
 - We estimate that nonBHC BD would have entered only into \$681 bil repo and \$393 bil reverse repo if they had access to internal liquidity (instead of \$771 and \$449)

→ Direct obs of Treasuries with govt sec share of inventory

- 1 BHC BDs decreased by over 10 pp
- 2 nonBHC BDs increased by 5 pp
 - With access to internal liquidity, they would have held \$84 bil instead of \$99 bil of gov securities

Robustness - propensity score matching

- We use propensity-score method to match BHC and non-BHC affiliated broker-dealers, using size and the information about their business models.
- From the FOCUS Part II and IIA Income Statement sections, we create four revenue categories:
 - ① *Commission based*: commissions, commodities revenue, and other revenue related to the securities business;
 - ② *Trading*, revenue from securities trading, derivative trading, and investment accounts;
 - ③ *Investment Banking Asset Management*: revenue from sale of investment company shares, research services, and fees for account supervision, investment advisory, and administrative services; and
 - ④ *Other*.
- Find that results continue to hold quantitatively

Dynamic Difference-in-Difference

- We re-estimate difference-in-differences regressions allowing for different effects in the first, second, and third year of the crisis, to capture how the evolution in liquidity effects broker-dealers:

$$Y_{it} = \beta_0 + \beta_1 \text{crisis}_{it} + \beta_2 \text{BHC}_{it} \\ + \alpha_1 \text{DID 1}_{it} + \alpha_2 \text{DID 2}_{it} + \alpha_3 \text{DID 3}_{it} + \epsilon_{it}, \quad (2)$$

where ϵ is an iid error term.

- ▶ DID 1: 2007Q4 to 2008Q3
- ▶ DID 2: 2008Q4 to 2009Q3
- ▶ DID 3: 2009Q4 to 2010Q3

Effect of Liquidity Shock on Broker-dealers' Balance sheet, Dynamic Impact

	Repo	Securities Lending	Reverse Repo	Securities Borrowing	Govt Sec
BHC	-0.032 (0.049)	-0.190*** (0.033)	0.038 (0.033)	-0.089** (0.037)	0.030 (0.045)
Crisis	-0.012 (0.027)	-0.056*** (0.020)	0.025 (0.016)	-0.026 (0.016)	0.029 (0.025)
DID year 1	-0.011 (0.033)	0.028 (0.026)	-0.076*** (0.026)	0.020 (0.022)	-0.086** (0.041)
DID year 2	-0.040 (0.038)	0.087* (0.052)	-0.082*** (0.024)	0.049 (0.040)	-0.157*** (0.045)
DID year 3	-0.075* (0.042)	0.093* (0.048)	-0.090*** (0.025)	0.069* (0.037)	-0.127*** (0.045)
Constant	0.431*** (0.031)	0.345*** (0.029)	0.179*** (0.019)	0.290*** (0.024)	0.378*** (0.031)
Observations	2,536	3,072	5,425	4,321	4,039
R ²	0.009	0.067	0.005	0.014	0.006

Note: *p<0.1; **p<0.05; ***p<0.01; standard errors clustered by broker-dealers.

Dynamic Effects Discussion

- Differences between asset and liabilities effects
 - ▶ Assets: reverse repo & gov sec are significant all three years
 - ★ gradually strengthening of the effect
 - ▶ Liabilities: repo and sec lending significant later in crisis
- What to make of this difference?
 - ▶ BHC BDs shifted towards riskier assets with crisis
 - ★ likely in response to pricing (and liquidity access)
 - ▶ Only after Lehman bankruptcy, with introduction of various facilities, BHC BDs shifted liabilities towards riskier assets

Effect of Small vs Large BHC affiliation

	Repo	Securities Lending	Reverse Repo	Securities Borrowing	Cash	Long Inventory	Govt Sec
Small BHC	0.049 (0.136)	-0.09 (0.096)	0.015 (0.084)	-0.23 (0.058)	-0.025 (0.033)	0.065 (0.039)	0.224 (0.133)
Large BHC	0.232 (0.068)	-0.206 (0.060)	0.106 (0.051)	-0.078 (0.065)	-0.102*** (0.030)	-0.013 (0.033)	0.167 (0.066)
Crisis	0.032 (0.033)	-0.062 (0.044)	-0.019 (0.026)	-0.063 (0.040)	-0.008 (0.012)	-0.015 (0.015)	0.014 (0.049)
Crisis x Large BHC	-0.101* (0.053)	0.063 (0.053)	-0.030 (0.040)	0.060 (0.046)	-0.028 (0.023)	-0.005 (0.027)	-0.072 (0.072)
Crisis x Small BHC	-0.237* (0.133)	-0.126 (0.089)	-0.085 (0.075)	0.106* (0.061)	-0.022 (0.026)	0.0003 (0.030)	-0.266* (0.157)
Constant	0.177 (0.045)	0.321 (0.057)	0.167 (0.036)	0.282 (0.053)	0.271 (0.016)	0.41 (0.020)	0.269 (0.048)
Observations update	2,536	3,072	5,425	4,321	156,381	71,954	4,039
R ² update	0.009	0.067	0.005	0.014	0.015	0.002	0.006

- BD small BHC reacted to the crisis by dramatically reducing their repo activity (from 22.6% pre-crisis to 2.1% - decline of (0.032-0.237) and government securities' share of long inventory (decline by 25.2% (0.266-0.014)
- BD small BHC substantially increasing securities borrowing's share of total assets, and so increasing the riskiness of their portfolio of assets

Heterogeneity among BHC-BD Discussion

- Why the effect of access to internal liquidity is more pronounced for BD affiliated with smaller BHCs?
 - ▶ Smaller BHCs might have faced less supervisory scrutiny during the crisis, and so their broker-dealer subsidiaries could have faced lower costs to tilting their portfolio of assets towards riskier securities.
 - ▶ BD affiliated with small BHCs are on average smaller in absolute size, as such, they might have been able to exit or substantially reduce their presence in trading Treasuries more easily, with less of an adverse effect on client relationships.

Discussion

- Our results are relevant to the policy debate regarding access to Federal Reserve liquidity.
 - ▶ NY-FED president Dudley (2013): *“If we believe activities [outside banking sector n.d.r.] provide essential credit intermediation services to the real economy that could not be easily replaced by other forms of intermediation, then the same logic that leads us to backstop commercial banking with a lender of last resort might lead us to backstop the banking activity taking place in the markets in a similar way.”*
 - ▶ Liang and Parkinson (2020) suggest that Federal Reserve should create “a new repo facility to support market liquidity on time of stress”.
 - ▶ Fed’s Standing Repo Facility
 - ★ eligible participants are primary dealers (almost all BHC) and banks
 - ★ to address differential behavior highlighted here, need broader access
- This would require expanding the regulatory perimeter and introduce substantial prudential regulation of entities such as broker-dealers to mitigate moral hazard problems.
 - ▶ Similar issues arise with mandating expanded central clearing

Conclusions

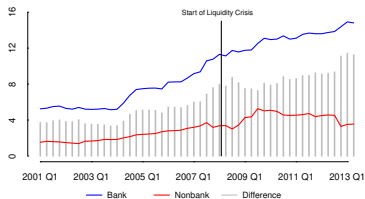
- Broker-dealers not affiliated with BHC dramatically restructured their balance sheet during the GFC.
- They shifted towards trading liquid securities (Treasury) much more relative to BHC-affiliated broker-dealers
- Our results provides micro-economic evidence in support of having access to liquidity during time of market stress.
- And so are relevant to the policy debate regarding access to Federal Reserve liquidity.

Additional material

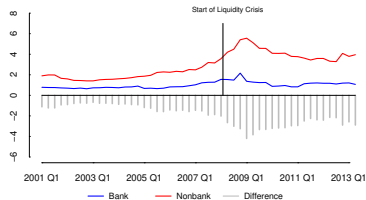
Evidence of internal liquidity support by BHC

- We use FR Y-9LP data, which provides information on equity and non-equity subsidies for bank to non -bank subsidiaries.

(a) Equity subsidies

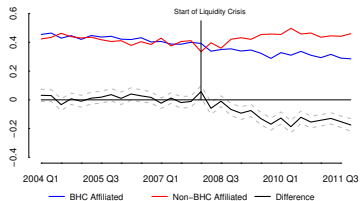


(b) Non-equity subsidies

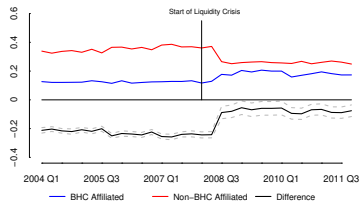


Average Shares by Broker-Dealer Type

(c) Repo

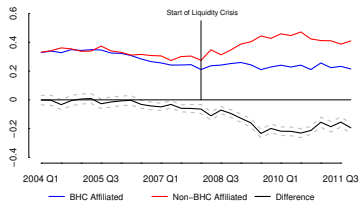


(d) Sec Lending

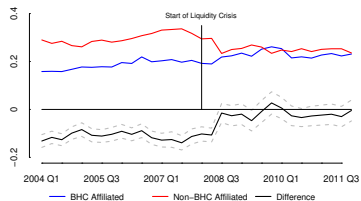


Average Shares for Broker-Dealer Type

(e) Reverse Repo



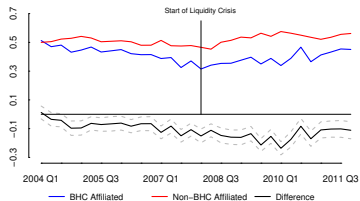
(f) Sec Borrowing



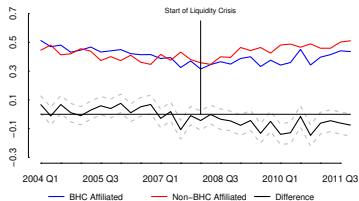
Average Govt Securities' Share of Long Inventory by Broker-Dealer Type

main

(g) Full sample



(h) Propensity score sample



Effect of Liquidity Shock on Broker-dealers' Balance sheet, Propensity Score

	Repo	Securities Lending	Reverse Repo	Securities Borrowing	Govt Sec
BHC	0.201*** (0.064)	-0.205*** (0.060)	0.068 (0.049)	-0.103 (0.064)	0.162*** (0.059)
Crisis	0.057 (0.037)	-0.085** (0.043)	0.007 (0.029)	-0.061 (0.039)	0.029 (0.047)
BHC x Crisis	-0.139** (0.057)	0.095* (0.056)	-0.077* (0.042)	0.065 (0.050)	-0.114* (0.062)
Constant	0.174*** (0.048)	0.329*** (0.058)	0.177*** (0.038)	0.286*** (0.056)	0.273*** (0.050)
Observations	1,650	1,239	1,985	1,615	1,630
R ²	0.070	0.119	0.019	0.028	0.041

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; standard errors clustered by broker-dealers.

Results, propensity score sample

Results are largely confirmed – can dismiss concerns about differences in business models

- Effect are confirmed for repo, reverse repos and securities lending. Magnitude is reduced but results are still economically significant.
- Result on securities borrowing disappears
- Result remain economically significant for gov sec share.

PSM