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The Internal Capital Markets of Global Dealer Banks

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Federal Reserve Board

Abstract

This study uncovers the existence of a trillion-dollar internal capital market that played a central role in the financing of dealer banks during the 2008 Global Financial Crisis. Hand-collecting a novel set of dealer microdata at the subsidiary level, I present the first set of facts on the evolution of interaffiliate loans between U.S. primary dealers and their (primarily foreign) siblings. First, the aggregate size of these dealer internal capital markets quadrupled from $335 billion in 2001 to $1.2 trillion by 2007. Second, 25 percent of total repurchase agreements and 61 percent of total securities lending reported on U.S. primary dealer balance sheets were sourced internally from sibling dealers by year-end 2007. Third, internal securities lending collapsed by 55 percent during the 2008 crisis. These facts suggest that incorporating internal capital market dynamics may be fruitful for future research on dealer behavior and market liquidity.

Keywords: Global financial institutions, Broker-dealers, Internal capital markets, Shadow banking, Securities Lending

JEL classification: E44, F23, G01, G20, G23, G24

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1 Introduction

The 2008 financial crisis highlighted the central role that dealer banks play in issues concerning market liquidity, global financial stability, and the real economy. Compared to the volume of empirical studies covering traditional commercial banks and nonfinancial firms, the academic literature is relatively young in its exploration of dealer bank behavior. To this end, it is important to establish a set of key observables and empirical patterns that characterize dealer balance sheets. Utilizing a novel set of hand-collected data, this paper uncovers that a surprisingly large share of dealer liabilities is funded through the internal capital markets. This comprises all forms of financing (e.g., repo, securities lending) that take place between the U.S. and foreign subsidiaries of global dealer organizations. To the best of my knowledge, there has been no prior literature on this topic.[2] In particular, the largest single counterparty of a U.S. primary dealer is its (typically foreign) dealer sibling—*not an external party, as is assumed a priori.* By year-end 2007, U.S. primary dealers, on average, financed 35 percent of their balance sheet using internal loans from sibling dealers. The majority of these internal loans took the form of securities lending and repurchase agreements, implying the cross-border transfer of collateral *inside* each dealer organization. These activities aggregate to a $1.2 trillion internal capital market (as of 2007:Q4) that was previously invisible to the academic literature due to netting in the consolidated 10-Q and 10-K reports filed by broker-dealers. I uncover these facts using disaggregated subsidiary-level balance sheets, presenting a fuller picture of the modern-day liquidity management practices of global dealer banks. Given the importance of U.S. primary dealers to various facets of the U.S. financial system (e.g., open market operations as well as market making of corporate bonds, money market instruments, derivatives, etc.), these facts suggest that studying the incentives, tradeoffs,

[2] Primary dealers are US broker-dealer subsidiaries (owned by either domestic or foreign parents) that act as market makers of US government securities in the context of open market operations.

and constraints driving internal capital market allocations within dealer organizations would be particularly fruitful for future research.

This paper contributes to two threads of literature. First, these facts add to a growing literature on dealer behavior. While there have been significant theoretical contributions (Stoll 1978, Amihud and Mendelson 1980, Ho and Stoll 1983, Brunnermeier and Pedersen 2009, Gorton and Ordoñez 2014, Gorton et al. 2020, Infante 2020), historical limitations on the availability of public data have restricted the ability to build empirical tests. In the past decade, however, several papers have made large empirical strides by employing proprietary data sources. For example, Gorton and Metrick (2012) utilized proprietary industry data to reveal that while fragilities in the housing market may have been a trigger, it was widespread runs on repurchase agreements at the largest dealer banks that transformed a housing crash into a global systemic crisis.[3] Goldberg (2020) utilizes confidential regulatory data to establish the connection between dealer banks and the real economy, showing that declines in dealer liquidity supply predict reduced debt issuance and investment by nonfinancial firms, in addition to reduced aggregate economic activity. Using similar confidential regulatory data, Carlson and Macchiavelli (2020) show that the 2008 emergency lending facilities alleviated dealers' funding pressures, helping avoid potential fire sales in addition to providing better liquidity to the bond markets. As a complement to this growing literature, I present several new stylized facts about dealer banks that are fundamental to their funding model. In particular, the hand-collected data presented in this paper reveal the surprising importance that internal capital markets hold for dealer banks. Given that roughly 25 percent of all repurchase agreements and 61 percent of all securities loans on U.S. primary dealer balance sheets are funded internally through sibling institutions, theories of dealer financing and liquidity would greatly benefit from an exploration of the dynamics driving dealer internal capital markets.

[3] In addition, Krishnamurthy et al. (2014), Copeland et al. (2014), and Martin et al. (2014) also provide additional empirical evidence that financial institutions can face run risk from their secured wholesale funding lenders.

Second, this paper contributes more generally to the literature on the internal capital markets of financial intermediaries and, in particular, highlights the need to differentiate the literature into two distinct categories: the internal capital markets of *branches* versus the internal capital markets of *subsidiaries.* Evidence on the existence of internal capital markets in deposit-taking commercial banks has been well documented, e.g., Campello (2002), Goldberg and Cetorelli (2012ab), and Strahan et al. (2016). These studies document the dynamics of internal flows *between branches within the same commercial bank.*[4] In this way, the commercial bank reallocates excess deposits between domestic and foreign branches based on local funding needs. These commercial bank internal capital markets tend to be frictionless, as evidenced by several distinct features:

- Unlike subsidiaries, branches are, by definition, not financed through equity and thus are legally the same entity as the commercial bank parent. Branches cannot fail independently from the parent.
- Internal loans between branches of the same commercial bank are subject to minimal regulatory interference.

In contrast, dealer internal capital markets comprise loans between *subsidiaries* (in other words, legally *distinct* entities). The internal capital markets of subsidiaries differ significantly from the internal capital markets of *branches within the same commercial bank subsidiary* in several ways:

- Unlike branches, subsidiaries of an organization each have their own subsidiary-level equity capital and are legally separate entities. As described in Bliss and Kaufman (2006) as well as

[4] Rather than internal lending, Houston et al. (1997) study the capital ratios of subsidiaries versus the consolidated organization.

Bliss (2003), each subsidiary can fail independently from the rest of the organization and can be subject to separate insolvency regimes.[5]

- The majority of dealer internal loans are *collateralized.*
- Subsidiaries that are located in different countries can be subject to varying degrees of regulatory costs based on local jurisdiction, such as regulatory capital charges and ring-fencing measures (Goldberg and Gupta, 2013).

The remainder of the paper is structured as follows. Section 2 covers the data source and description. Section 3 provides an overview of the institutional details surrounding the different types of holding company structures. Section 4 presents new stylized facts on the interaffiliate exposures between a U.S. primary dealer subsidiary and its (primarily foreign) siblings from 2001 to 2014. Finally, Section 5 concludes.

2 Data

Data on U.S. primary dealer (subsidiary-only) balance sheets are hand-collected from public Annual Audited Report Form X-17A-5 PDFs, which all registered U.S. broker-dealers file annually and which are publicly searchable on the SEC EDGAR database.[6] Individual dealer filings can be found by entering CIK identifiers provided on the SEC webpage titled "Company Information about Active Broker-Dealers."[6] Note that this should not be confused with an entirely different confidential data set that has the same name (X-17A-5 report) and which features a completely different set of reporting fields. It is also different from the well-known 10-K and 10-

[5] Though post-2008 regulations have made the independent failure of subsidiaries less clear.
[6] https://www.sec.gov/edgar/searchedgar/companysearch.html [6] https://www.sec.gov/help/foiadocsbdfoiahtm.html

Q filings, which represent (netted) financial information for the *consolidated* organization (as opposed to subsidiary-level).

I define "affiliates," "related parties," or "sibling institutions" as subsidiaries that are wholly owned by the same parent holding company. Financial securities in the internal capital market consist of any form of lending extended between siblings within the same organization. Examples include repurchase agreements, securities loans, short-term uncollateralized loans, long-term subordinated debt, and brokerage receivables/payables. The public X-17A-5 reports publish panel information on each U.S. broker-dealer subsidiary's outstanding loan and borrowing exposures vis-à-vis affiliates as of the end of each year. In this study, I focus on the 10 largest *primary* dealers, which have significant international operations. *Primary* dealers are U.S. broker-dealer subsidiaries (possibly owned by domestic or foreign parents) that act as market makers of U.S. government securities during the open market operation process. Although these reported sibling exposure figures could technically be vis-à-vis any sibling (U.S. or foreign), they are most likely with respect to foreign siblings since the balance sheets of U.S. non-primary dealer siblings are not large enough to account for the large internal exposures being reported on U.S. primary dealer filings. While it is not possible to know which foreign siblings are the internal counterparties, London tends to house a large presence of dealer operations for the major global dealer banks (other locations could span financial hubs like Hong Kong, Frankfurt, Singapore, Zurich, etc.).

Please note that all numbers presented in Section 4 are stock variables, not flows. This means, for example, that dealer internal capital markets consisted of $1.2 trillion of internal debt *outstanding* (U.S. primary dealers' liabilities that face sibling counterparties) as of December 31, 2007. Also, due to its 2008 bankruptcy, Lehman Brothers Inc. has been excluded from the sample in order to ensure that all figures in Section 4 represent balance sheet adjustments, as opposed to filers dropping out of the sample. Aside from this, the panel is mostly balanced except for Credit Suisse, which did not file in 2001, and J.P. Morgan, which did not file in 2002, 2004, 2005, or 2006.

3 Holding Company Level

In this section, I provide an overview of the internal capital markets of a typical global financial institution, in addition to outlining the variety of regulatory restrictions imposed on internal lending flows. These U.S. primary dealer subsidiaries can be housed inside organizations with differing corporate structures:

1. Bank Holding Companies (BHCs): Citigroup, JPMorgan Chase, Bank of America

   U.S. global BHCs are typically composed of (at least) a parent holding company, an FDIC-insured U.S. commercial bank subsidiary, a U.S. broker-dealer subsidiary, and a foreign broker-dealer subsidiary. Section 23A of the Federal Reserve Act (details provided at end of section) imposes strict limitations on the ability of commercial banks to provide internal loans to their non-bank siblings and their parent holding company. The purpose behind this is to restrict a leak of the federal subsidy into non-depository institutions.[7]

2. Investment Banks (IBs): Goldman Sachs, Merrill Lynch, Bear Stearns, Morgan Stanley

   U.S. global IBs are typically composed of (at least) a parent holding company, a U.S. broker-dealer subsidiary, and a foreign broker-dealer subsidiary. In the pre-crisis period, there were minimal regulatory restrictions on internal funding flows between dealer siblings. Although Goldman Sachs and Morgan Stanley became bank holding companies post-crisis, I categorize them as IBs due to the fact that their business model is still predominantly that of an investment bank.

3. Foreign Banking Organizations (FBOs): Barclays, BNP Paribas, Credit Suisse

[7] https://www.federalreserve.gov/aboutthefed/section23a.htm

FBOs have historically followed the universal banking model, where no regulatory ring fence historically existed between insured commercial bank deposits and broker-dealer siblings. This has begun to change post-crisis (Goldberg and Gupta, 2013).

Each organization typically has thousands of subsidiaries in its organizational hierarchy, of which the vast majority are special purpose vehicles and other shell corporations. In this study, I will focus on the main *operating* subsidiaries, which I have outlined later in Figure 1.

Ultimately, all internal capital market funds derive from *external* funds entering at different points in the organization. These entry points are as follows:

1. Publicly traded stock at the parent holding company
2. Commercial paper and long-term unsecured debt issued at the parent holding company
3. Collateralized and other wholesale funding at the U.S. and foreign broker-dealer subsidiaries
4. FDIC-insured domestic deposits or uninsured foreign deposits at the commercial bank subsidiary

Mirroring the aforementioned external funding categories, internal funds (comprising the internal capital markets of BHCs) can be categorized into four types:

Type	Internal Loan Type	Secured?	Sourced from Which External Funding?	Notes
(1)	Internal capital allocation	No	Equity shares issued to market	Corporate treasury controls this
(2)	Parent hold co. loans to subs	No	Parent comm. paper and corp bonds	Corporate treasury controls this
(3)	Internal repo and sec lending between dealer siblings	Yes	External repo and sec lending at each dealer sibling	Driven by clients
(4)	Inter-branch loans	No	Commercial bank deposits	Section 23A of FR Act places a ring fence between bank deposits and non-bank siblings

Table 1. Four Segments of the Bank Internal Capital Markets. This table summarizes the four major segments of the internal capital market within a banking organization.

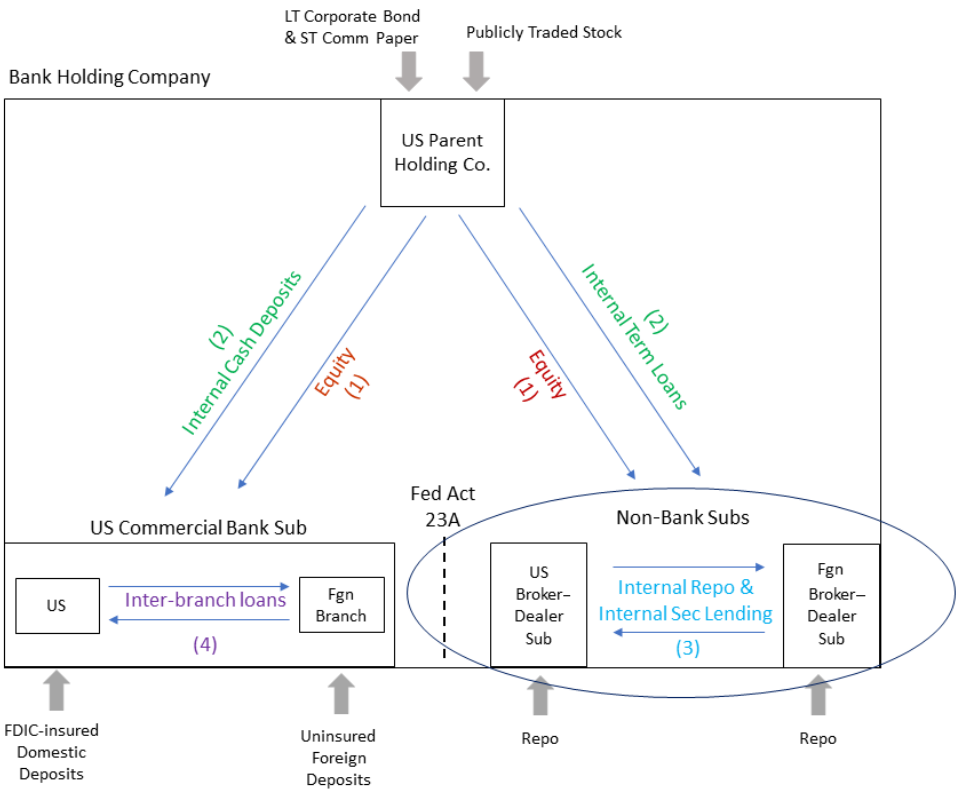

Figure 1. Stylized Diagram of the Bank Internal Capital Markets. This diagram provides a stylized illustration of the various segments of the internal capital market within a banking organization.

In reference to segments (1) and (2) in Table 1 and Figure 1, parent holding companies do not typically perform any external business on their own but raise a variety of non-deposit unsecured funding (commercial paper, long-term corporate bonds, and equity) from wholesale markets and downstream them to subsidiaries.[8] Parent holding companies present a single face to the debt and equity markets, allowing market stakeholders to have a claim on the full organization (deriving income from all subsidiaries). While the parent holding company may appear like a trivial shell

[8] Section 23B of the Federal Reserve Act requires that internal rates for BHCs follow arm's-length pricing.

corporation at first glance, studying its behavior is key to understanding segments (1) and (2) of the internal capital market. That is because the CFO resides at the parent holding company and can implement policy affecting operations in all subsidiaries downstream (however, the degree of centralized versus decentralized control can vary across institutions).

Regarding segment (3), the gross amount of internal repo and securities lending between U.S. primary dealers and their siblings expanded tremendously pre-crisis. While the reasoning is difficult to identify, existing narratives suggest that, prior to the 2007–08 crisis, U.S. primary dealers were known to take collateral posted by their U.S. clients and finance it wherever was globally cheapest. Due to the lax leverage limits and cheap funding available in locations like the UK (Singh and Aitken 2010), U.S. clients gave permission for their collateral to be internally rehypothecated anywhere, which likely contributed to the rise in internal repo and securities lending pre-crisis.

Lastly, with respect to segment (4), the use of commercial bank deposits to finance any *non-bank* siblings is strictly limited by Section 23A of the Federal Reserve Act, which imposes a strict one-way ring fence. Enacted in 1933 in the aftermath of the Great Depression, regulators implemented Section 23A of the Federal Reserve Act to prevent the transfer of the federal subsidy to non-depository financial institutions. This law imposes quantitative limitations and collateral requirements on commercial bank extensions of credit to non-bank subsidiaries. Specifically, it states the following:

- The aggregate amount of internal loans to any one non-bank sibling of the member bank should not exceed 10 percent of the tier 1 and 2 capital of the member bank.
- The aggregate amount of internal loans to all non-bank siblings of the member bank should not exceed 20 percent of the tier 1 and 2 capital of the member bank.

Member banks can, however, utilize two particularly useful exemptions to circumvent these

limits:

- Any internal loan collateralized by U.S. government and agency securities is exempt.
- Any internal loan collateralized by highly liquid, marketable securities is exempt. Prior to the crisis, AAA-rated asset-backed securities were considered to fit this definition.

4 U.S. Primary Dealer Subsidiary Level

This section presents novel facts on the dynamics of dealer internal capital markets from the perspective of a U.S. primary dealer (New York) subsidiary. Included in the sample are 10 large U.S. primary dealer subsidiaries, listed in Table 2.

Owned by an Investment Bank	Owned by a U.S. Bank Holding Co.	Owned by a Foreign Banking Org
Bear Stearns & Co. Inc.	J.P. Morgan Securities LLC	BNP Paribas Securities Corp.
Merrill Lynch, Pierce, Fenner & Smith	Banc of America Securities LLC	Credit Suisse Securities (USA) LLC
Goldman Sachs. & Co.	Citigroup Global Markets Inc.	Barclays Capital Inc.
Morgan Stanley & Co. LLC		

Table 2. U.S. Primary Dealer Subsidiaries. This table presents the identities of the U.S. primary dealer subsidiaries that constitute the reporting sample.

Fact 1. Internal liabilities of U.S. primary dealers nearly quadrupled over the pre-crisis period to $1.2 trillion in 2007:Q4. On average, dealer subsidiaries financed 35 percent of their balance sheet via-à-vis sibling counterparties.

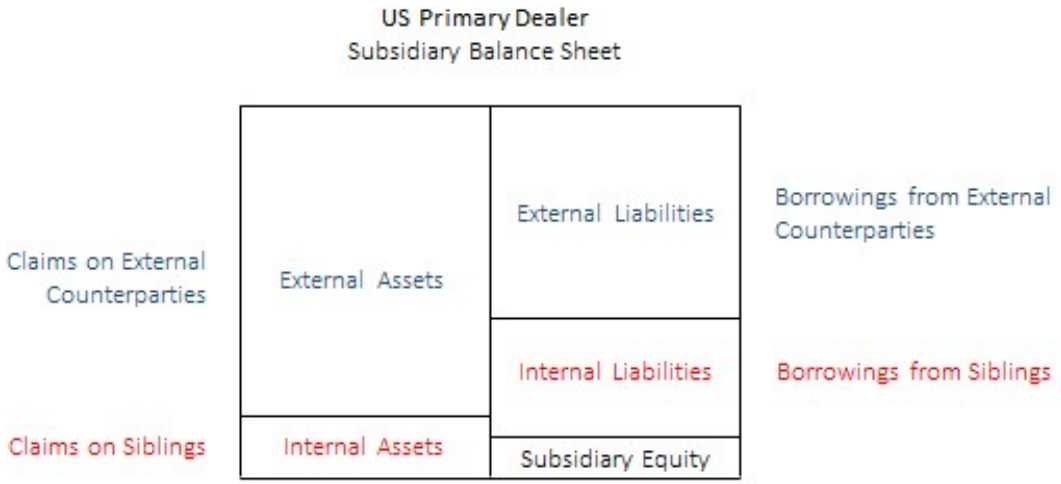

Figure 2. Simplified Balance Sheet View, U.S. Primary Dealer Subsidiaries

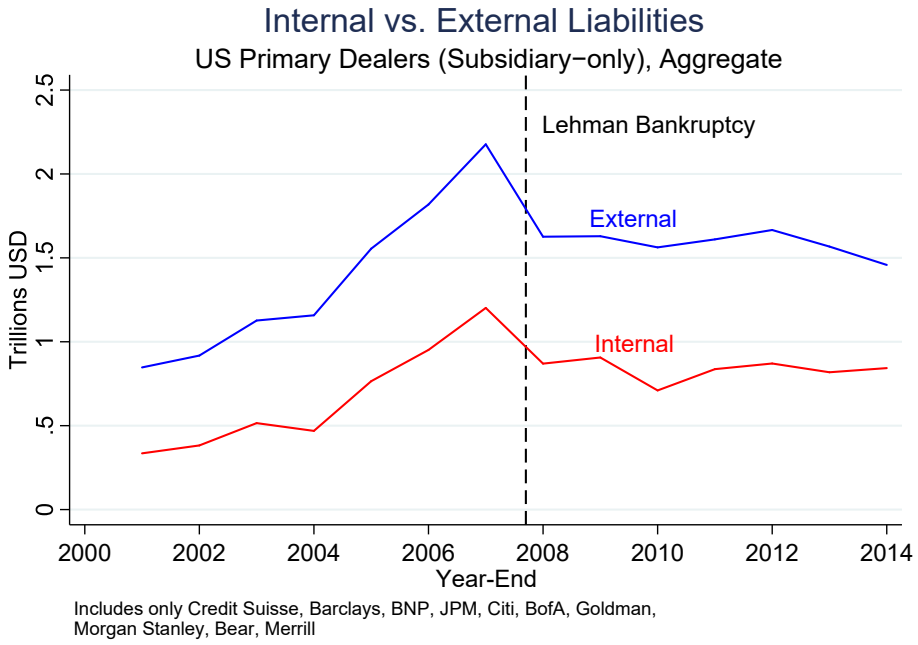

Figure 3a. Funding Model, U.S. Primary Dealer Subsidiaries. This figure presents the dollar amount of liabilities that face external counterparties versus internal counterparties, aggregated across U.S. primary dealer subsidiaries.

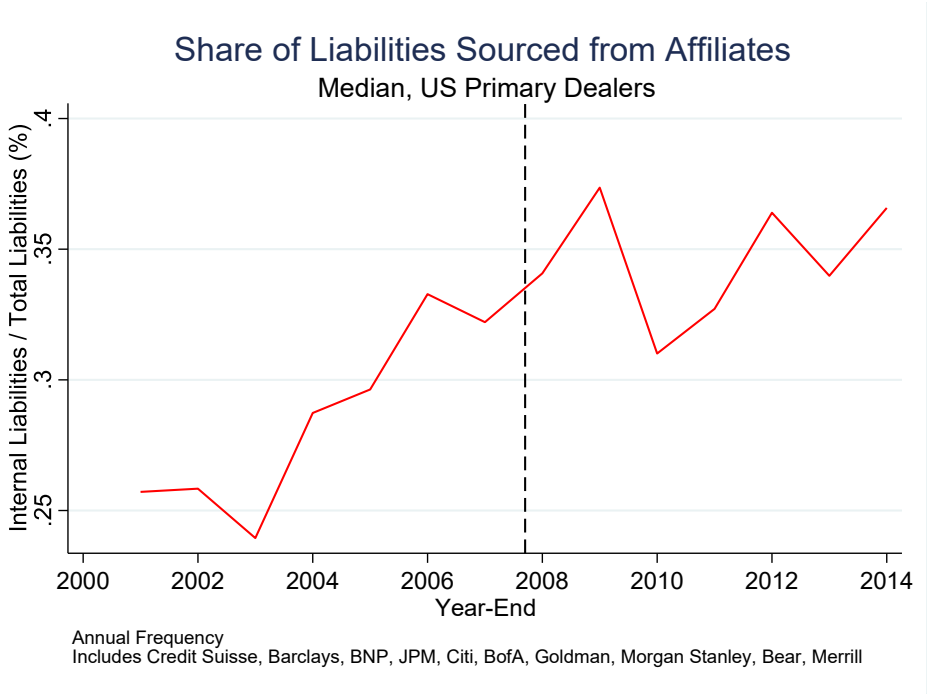

Figure 3b. Internal Liability Share, U.S. Primary Dealer Subsidiaries. This figure presents interaffiliate liabilities as a share of total liabilities, aggregated across U.S. primary dealer subsidiaries.

Type	Internal Asset Share	Internal Liability Share
I-Banks	16%	32%
U.S. BHCs	23%	34%
FBOs	24%	39%
Average	**20%**	**35%**

Table 3. Internal Assets (Liabilities) as a Share of Total Assets (Liabilities). This table presents the average share of internal assets (liabilities) for U.S. primary dealer subsidiaries as of 2007:Q4.

A new contribution to the literature is that internal liabilities made up a surprisingly large share of the U.S. primary dealer subsidiary's funding model. Looking at more traditional sources of dealer data, such as the SEC 10-Q/10-K report, hides this surprising statistic (due to the netting of internal exposures in the consolidated balance sheet). Figure 2 illustrates a simplified view of the U.S. primary dealer subsidiary balance sheet, where all assets and liabilities can be categorized as "internal" or "external," depending on whether the counterparty is a sibling institution or not. These internal assets and liabilities in red constitute financial instruments in the internal capital market for global dealer bank organizations. Table 3 shows a consistent pattern across all organization types that U.S. primary dealers typically maintained a net borrowing relationship vis-à-vis their affiliates. Figure 3a takes the liability (right-hand) side of the balance sheet and aggregates the internal and external liabilities outstanding across the 10 U.S. primary dealers in the sample. I find that, previously unknown to the literature, internal liabilities make up a surprisingly large share of the U.S. primary dealer funding model. Figure 3b shows that U.S. primary dealers' reliance on interaffiliate funds for financing gradually increased from 26 percent in 2001 to 37 percent by 2014, suggesting that the importance of internal capital markets to the funding of dealer banks is not a pre-crisis phenomenon.

As Gorton and Metrick (2012) show evidence that a run on external repurchase agreements occurred during the 2008 financial crisis, Figure 3 (and, later, Figure 4) shows that internal

liabilities collapsed in a very similar stride. While rising uncertainty about the true value of housing collateral underlying these external repo explains the collapse in external liabilities (blue line, Figure 3a), a separate narrative may be needed to explain the complementary collapse in *internal* liabilities. In particular, it is not clear why siblings' counterparties would reduce exposures to each other since both are wholly owned by the same ultimate parent and set of shareholders. A few possible narratives (though not exhaustive) are introduced in the text after Fact 3.

Fact 2. Nearly 66 percent of internal capital market instruments came in the form of repo and securities lending.

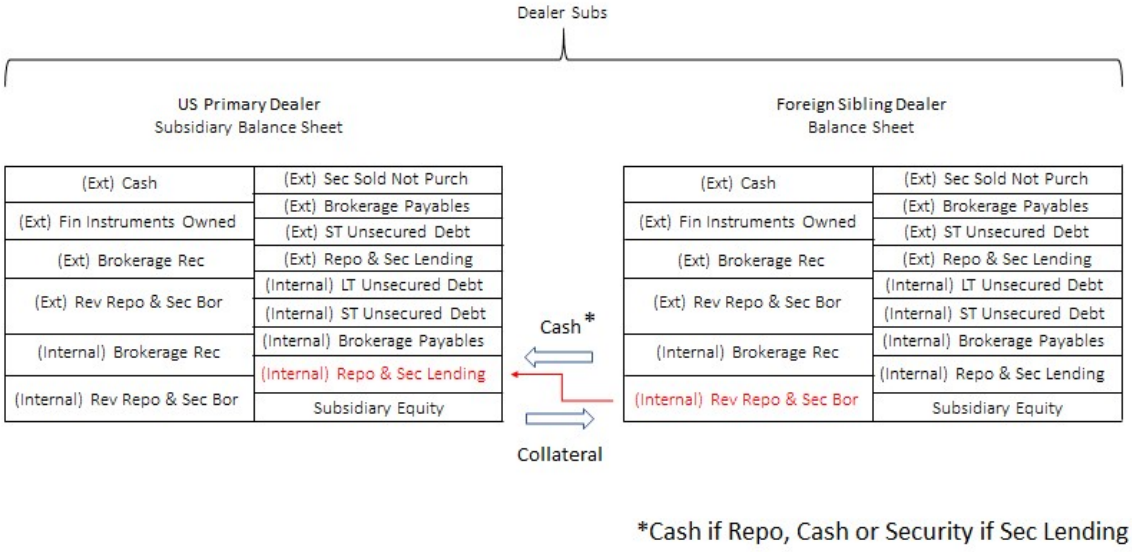

Figure 4. Internal Repo and Securities Lending, Detailed Balance Sheet View

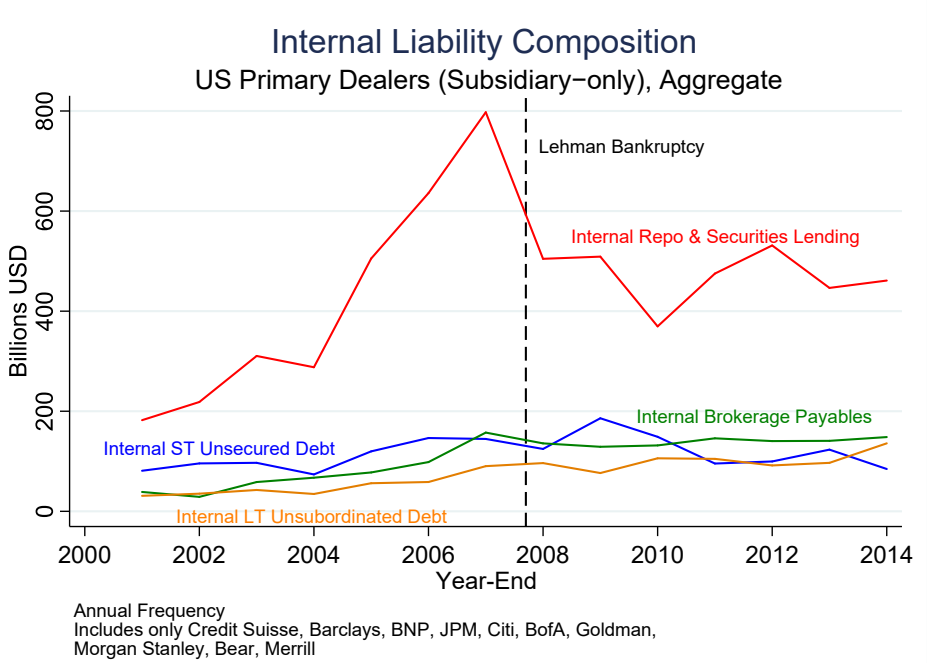

Figure 5. Composition of Internal Liabilities, U.S. Primary Dealer Subsidiaries. This graph provides a time series of the dollar amounts for each type of internal liability from figure 4, aggregated across U.S. primary dealer subsidiaries.

In Figure 4, I provide a more elaborate view of the subsidiary-level balance sheets within a global dealer bank. Internal liabilities can be broken down into internal repo and securities lending, internal brokerage payables, internal short-term unsecured debt, and internal long-term unsubordinated debt. Figure 5 aggregates each internal liability subcategory across the sample and finds that the majority of these internal liabilities took the form of internal repo and securities lending instruments. The remaining categories, such as long- and short-term unsecured internal loans between siblings as well as internal brokerage payables, were unaffected during the crisis.[9]

Fact 2 shows that dealer subsidiaries reduced internal exposures to each other during the crisis. Goldberg and Cetorelli (2012b) find the opposite effect in the context of commercial bank branches

[9] Internal brokerage accounts refer to the case when a dealer owns its own proprietary hedge fund or asset management operation.

(represented in the bottom-left box in Figure 1), where foreign branches sacrificed local loan opportunities in order to provide emergency (internal) loans to U.S. branches during the crisis. This difference is likely due to the fact that the majority of internal dealer financing decisions are derived from activities driven by clients/creditors.

Fact 3. During the crisis, 25 percent of primary dealers' total repo and 62 percent of their total securities lending activities occurred with siblings. This makes siblings their largest counterparty exposure. Interaffiliate securities lending collapsed by 55 percent during the 2008 crisis.

Type	Internal Repo Share	Internal Securities Lending Share
I-Banks	23%	73%
U.S. BHCs	23%	46%
FBOs	31%	63%
Average	**25%**	**62%**

Table 4. Internal Repo (Sec Lending) as a Share of Total Repo (Sec Lending). This table presents the average share of interaffiliate repo (securities lending) for U.S. primary dealer subsidiaries as of 2007:Q4.

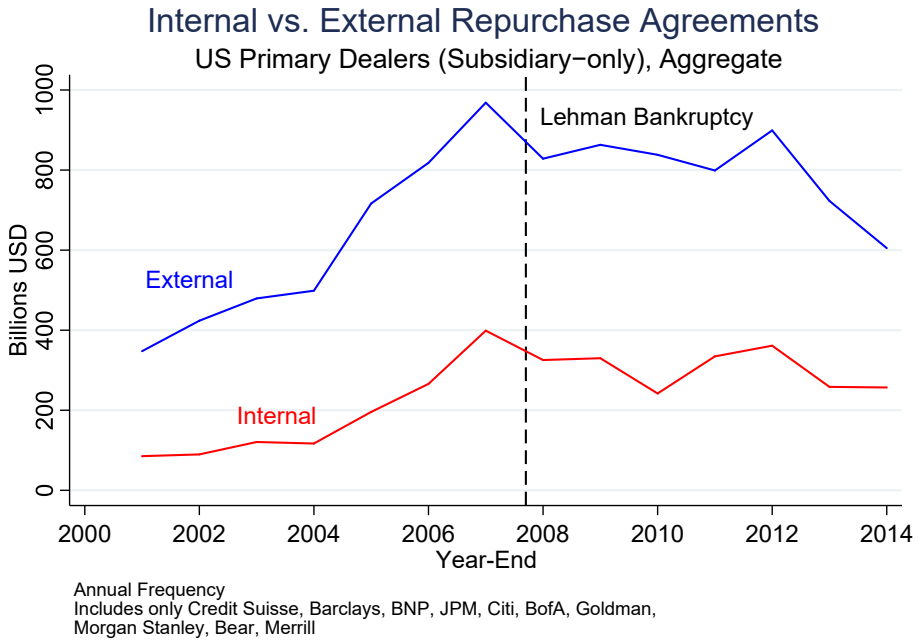

Figure 6a. Internal versus External Repo. This figure presents the dollar amount of interaffiliate versus external repo, aggregated across U.S. primary dealer subsidiaries.

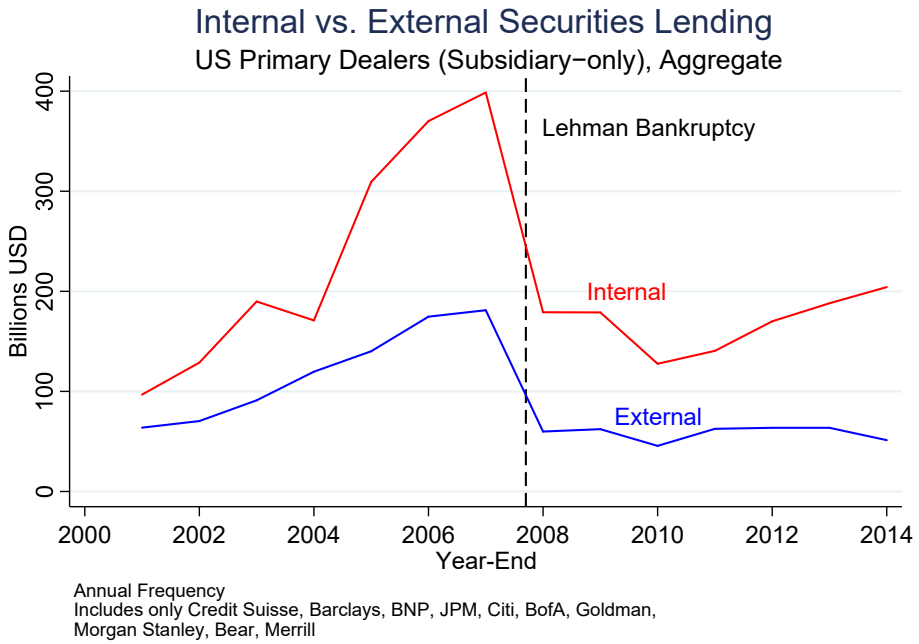

Figure 6b. Internal versus External Securities Lending. This figure presents the dollar amount of interaffiliate versus external securities lending, aggregated across U.S. primary dealer subsidiaries.

Consistent with this, the Lehman Brothers examiner report (Valukas 2010) confirms that, prior to entering bankruptcy, Lehman's U.S. dealer subsidiary obtained as much as 63 percent of its repo and securities lending from siblings. Facts 2 and 3 establish that internally sourced repo and securities lending was an industry-wide practice. Several interesting trends emerge. First, securities lending vis-à-vis affiliates outpaced those vis-à-vis external counterparties pre-crisis (figure 6b), though it was vice versa for repurchase agreements (figure 6a). Second, these interaffiliate securities loans collapsed by 55 percent in 2008, while interaffiliate repo remained relatively stable. One difference between these two types of collateralized lending is that repurchase agreements tend to involve (safer) fixed-income securities, while securities lending typically involves equities in addition to fixed income. Without more granular information on the type of collateral underlying this interaffiliate lending, the conclusions one can make from this are conjectural at best. However, given its association with riskier asset classes, one possibility is that interaffiliate securities lending may have been driven by the cross-border demand for speculative trading activities, as opposed to a demand for safe assets.

An alternative narrative that may relate to these facts is documented by Singh and Aitken (2010). Although Singh and Aitken (2010) does not explicitly attribute this to interaffiliate versus external issues, one reason behind the cross-border rehypothecation of collateral is due to the differences in regulatory regimes across the United States and United Kingdom. In particular, the United Kingdom allowed for an unlimited amount of customer assets to be rehypothecated, whereas in the United States, broker-dealers were capped by Rule 15c3–3 when using customer securities to finance proprietary activities. However, the United States provides a defined set of customer protection rules for rehypothecated assets, whereas the United Kingdom does not. This

difference meant that when Lehman's UK dealer subsidiary filed for insolvency, customers who allowed reuse of their collateral received little statutory protection.

A general theme is that in the pre-crisis period, dealer banks maintained global settlement systems, e.g., the collateral of U.S. dealer clients was funded globally wherever cheapest during the pre-crisis period. This was implemented by internally rehypothecating U.S. client collateral from the U.S. to foreign dealer siblings. As quoted in Braithwaite (2014),

". . . the group [Lehman] was 'organised in functional and market areas, rather than by legal entity' and on a day to day basis it was 'managed and run mainly along global product lines, rather than as separate entities' . . . LBIE [Lehman's UK dealer sub] also played a pivotal role in proprietary trading and diverse intra-group transactions. Moreover, 'it was a main repository for the property of its affiliates in connection with their activities in Europe' . . . In the ordinary course of events, dealings between LBIE and affiliates and clients took place, it seemed, without a great deal of attention often being paid to the precise ownership or location of property. This all changed with the onset of insolvency. Now, LBIE's counterparties rushed to establish their proprietary rights in order to extract their assets from the administration and thereby avoid the fate facing unsecured creditors. As the Court of Appeal pointed out in the 'Rascals' decision, complex arrangements whose legal effects had mattered little when the group was solvent were now subject to interpretation on a 'strict' basis. . . The Lehman Brothers group's collapse triggered a global scramble to establish property rights, so that counterparties could avoid the fate of unsecured creditors."

Connecting this narrative to the figures in Fact 3, one conjecture is that U.S. clients may have become concerned with the financial condition of their own non-Lehman dealer after learning about the bankruptcy of Lehman, and thus wanted to internally shift their collateral back within U.S. borders as a preemptive measure. In this way, global rehypothecation chains would have broken along geographical borders. While the collapse of interaffiliate securities lending in figure 6b is consistent with this, it is unclear why interaffiliate repurchase agreements remained stable

during the crisis (figure 6a). Resolving this discrepancy would be fruitful for future research, as it could reveal more about the economic mechanisms driving interaffilate instruments, as well as dealer funding decisions more generally. An interesting research question is whether this collapse in interaffiliate securities lending further exacerbated troubles at U.S. primary dealers during the crisis.

Fact 4. During the crisis, U.S. primary dealer internal claims on sibling institutions collapsed far less than their internal liabilities.

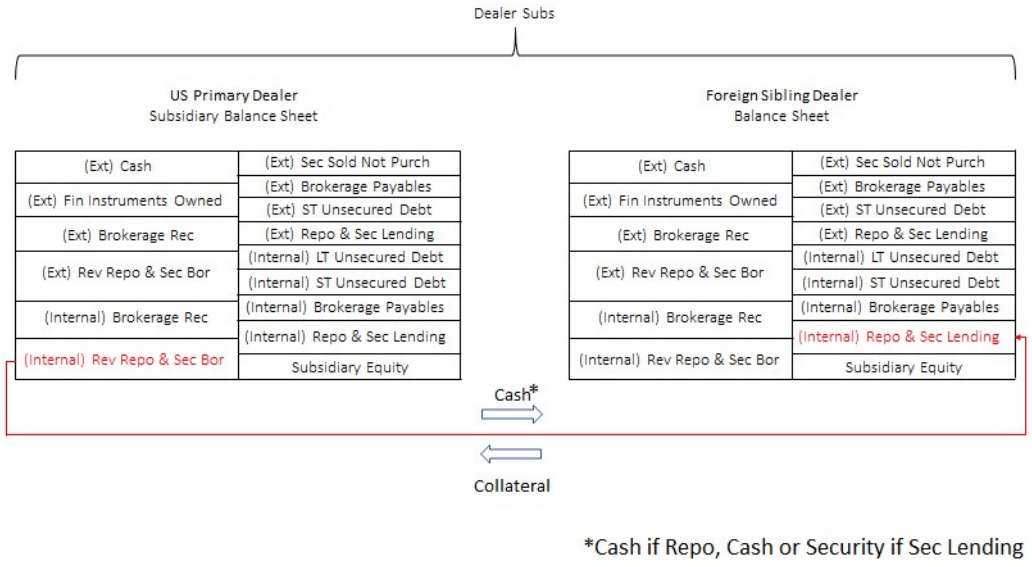

Figure 7. Internal Reverse Repo and Securities Borrowing, Detailed Balance Sheet View

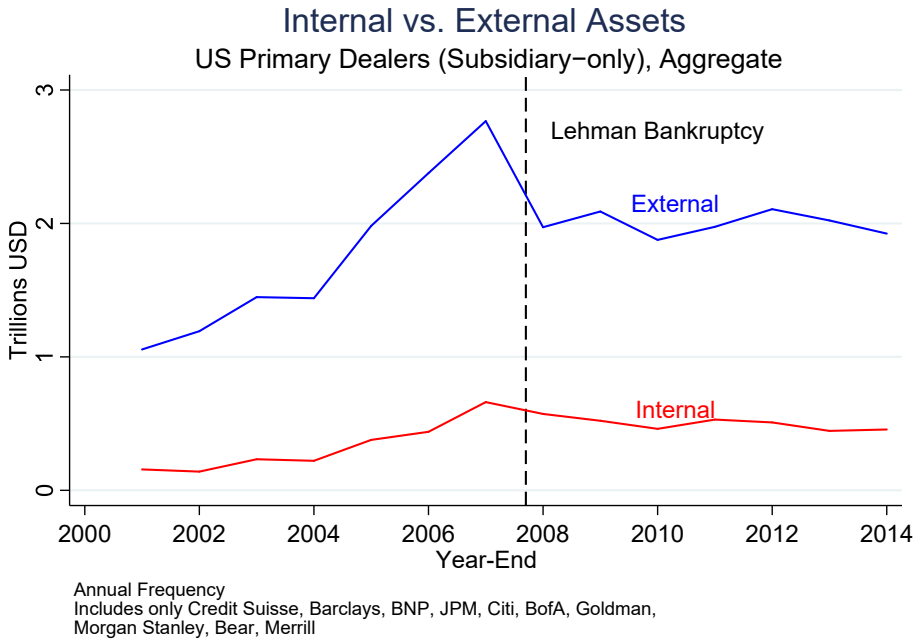

Figure 8. Internal versus External Assets. This figure presents the dollar amount of assets that face external counterparties versus internal counterparties, aggregated across U.S. primary dealer subsidiaries.

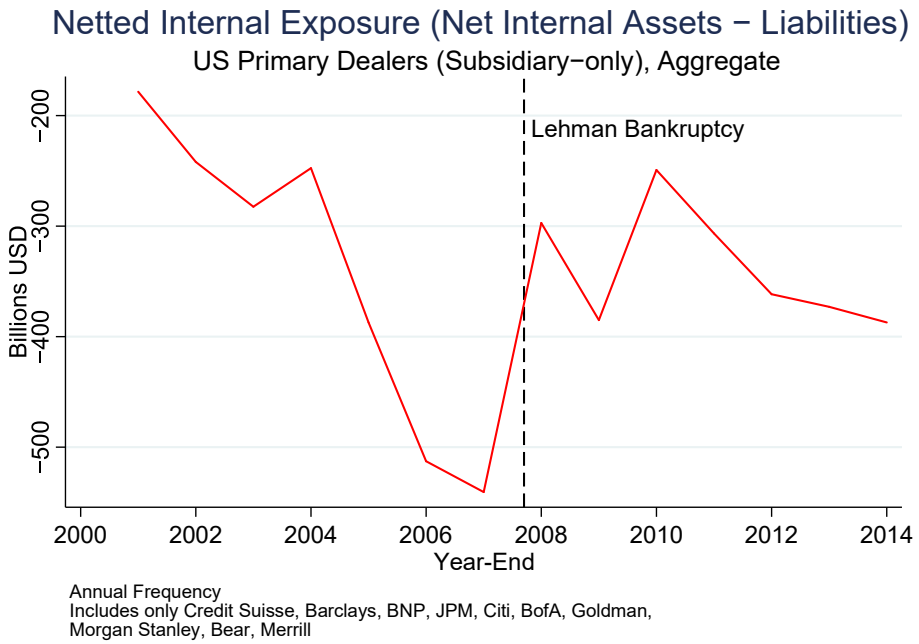

Figure 9. Net Internal Exposure. This figure presents the netted amount of internal assets (a.k.a. internal assets – internal liabilities), aggregated across U.S. primary dealer subsidiaries. As the majority of this is collateralized, a negative value implies that collateral travels, on net, from the U.S. primary dealer outward to affiliates.

Figure 7 provides a disaggregated balance sheet view of an internal reverse repurchase agreement or securities borrowing transactions between siblings. Figure 8 demonstrates that the asset side of a U.S. primary dealer subsidiary balance sheet has historically had higher exposure to external counterparties as compared to the liability side. Most of the collateral rehypothecated into U.S. primary dealer books on the asset side comes from external counterparties (i.e., likely U.S.-based clients), while far less collateral is being internally rehypothecated from sibling subsidiaries. Instead, as shown in Figure 9, the direction of collateral movement pre-crisis was typically going abroad, consistent with the regulatory arbitrage story (Singh and Aitken 2010). Figure 9 also shows a strong reversal post-crisis, where collateral is internally repatriated back onto U.S. shores.

Fact 5. The median subsidiary-level leverage reached as high as 87 and has historically been much higher than the leverage of the consolidated organization. This discrepancy can be partly explained by the large size of dealer internal capital markets from Fact 1, suggesting that the growth (and fall) in primary dealer size was partly fueled by internal leveraging (and subsequent deleveraging).

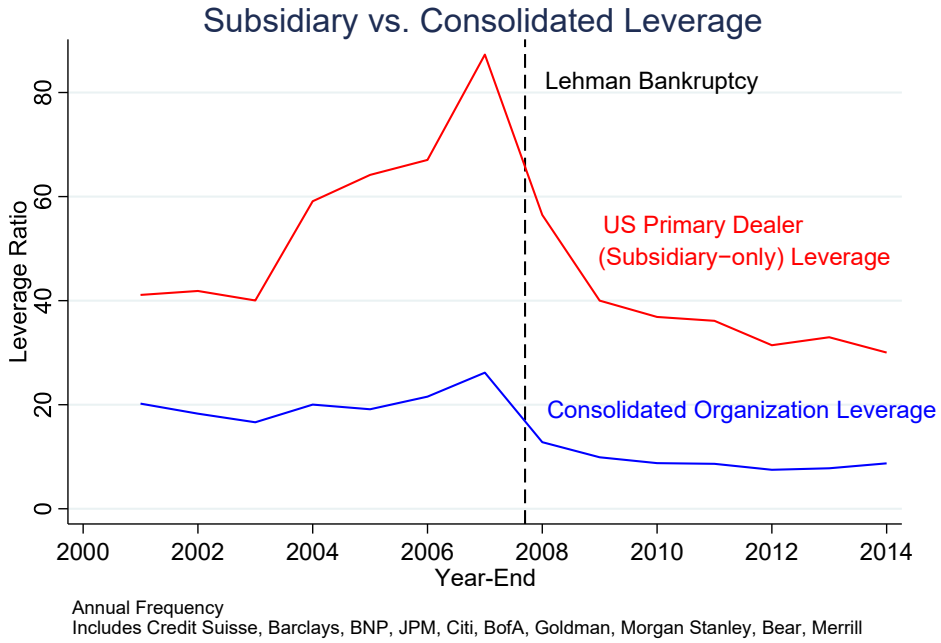

Figure 10. Subsidiary-only versus Consolidated Leverage. This figure shows the median amount of leverage on the subsidiary-level balance sheet versus that on the consolidated organization balance sheet. Note that organization leverage is represented as Risk-Weighted Assets (RWA) / Tier 1 Capital for BHCs and FBOs and as Total Assets / Total Equity for IBs (since IBs did not report tier 1 capital and RWAs pre-crisis), while subsidiary leverage is Total Assets / Total Equity (since dealers do not report tier 1 capital and RWAs).

Because internal capital markets net out in consolidation when reported in the SEC 10-Q/10-K filings, the leverage of the consolidated dealer organization masks the actual leverage of its operating dealer subsidiaries. Given that subsidiaries could fail independently from the rest of the firm pre-crisis and that subsidiaries are typically not liable for the external debt of any other non-bank sibling (unlike with commercial bank branches), subsidiary-only leverage ratios do matter

for understanding the riskiness of the dealer. As illustrated in Fact 1, U.S. primary dealer subsidiaries raised a significant portion of their liabilities from internal sources, partly explaining why the *actual* leverage of the primary dealer subsidiary (which includes internal and external debt) has traditionally been higher than that of the entire organization (Figure 10).

To illustrate how the discrepancy between subsidiary and organizational leverage ratios can arise through simple reallocation of existing resources, take an example where two sibling subsidiaries exist. Each subsidiary has financed itself through $1 of equity capital and $1 of external debt, and has invested these $2 (on the asset side) with external counterparties. Thus, the leverage ratio of subsidiary A, subsidiary B, and the consolidated firm are all identically 2. Let's say subsidiary A reallocates one of its two dollars on the asset side and internally lends it to B. In this case, subsidiary A's leverage ratio is still 2, and the leverage ratio of the consolidated firm is also still 2 (as this $1 of internal lending gets netted out in consolidation). However, the leverage ratio of subsidiary B has now grown to 3, as B's fixed equity of $1 is now supporting $1 of external debt and $1 of internal debt. The subtle point here is that, since dealer subsidiaries can fail independently from the rest of the organization, internal debt is not really that different from external debt. Especially if subsidiary A and B exist in different jurisdictions, they will be subject to competing bankruptcy proceedings and pools of creditors if the global organization were to ever fail. While an internal loan may have been treated differently from external debt before the bankruptcy, the creditors of subsidiary A will exercise their legal claim on B's assets as if it were an external claim. Given that an average of 35 percent of U.S. primary dealer subsidiary balance sheets were internally financed via sibling counterparties in 2007, the example just provided is by no means a trivial phenomenon in the liquidity management practices of global dealer bank organizations.[10]

[10] Adrian et al. (2014) use an aggregate subsidiary-level dealer leverage measure taken from Flow of Funds to explain a significant amount of variation in asset prices. The dynamics of interaffiliate exposures, which drive the difference between consolidated and subsidiary-level leverage, may have significant implications for variation in asset prices.

The results of my study also have implications for the cross-border resolution of dealer banks as well as ongoing policy debates surrounding regulatory actions that place ring fences along business line and geographical borders. Goldberg and Gupta (2013) overview some measures of regulatory "home bias" and financial protectionism being implemented internationally. As stated in Gorton and Muir (2015), "regulatory changes to the financial architecture in the post-crisis era have aimed to make collateral immobile, most notably with the BIS Liquidity Coverage Ratio for banks." Figure 9 suggests that, during the pre-crisis period, a surprisingly large volume of collateral was being intermediated across geographical borders within each dealer organization. The economic importance of these large yet invisible global flows (as well as the unintended consequences of regulatory restrictions on them) should be understood prior to the implementation of new regulations. These issues pose many open questions for future research.

5 Conclusion

This is the first study to uncover details on the internal capital markets of global dealer banks. This paper's key contribution to the literature on shadow banking is that a substantial volume of cash and collateral is being intermediated entirely inside holding companies, which nets out in consolidated balance sheet data. Unraveling these sibling flows reveals a number of new findings about the funding decisions, liquidity management practices, and nature of sibling relationships inside dealer bank organizations. Many open questions arise as to the implications of subsidiary-level funding dynamics on dealer default risk, asset prices, and the real economy.

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