Federal Reserve Bank of New York
Staff Reports

Shadow Bank Monitoring

Tobias Adrian
Adam B. Ashcraft
Nicola Cetorelli

Staff Report No. 638
September 2013

Shadow Bank Monitoring

Tobias Adrian, Adam B. Ashcraft, and Nicola Cetorelli

Federal Reserve Bank of New York Staff Reports, no. 638
September 2013
JEL classification: E44, G00, G01, G28

Abstract

We provide a framework for monitoring the shadow banking system. The shadow banking system consists of a web of specialized financial institutions that conduct credit, maturity, and liquidity transformation without direct, explicit access to public backstops. The lack of such access to sources of government liquidity and credit backstops makes shadow banks inherently fragile. Shadow banking activities are often intertwined with core regulated institutions such as bank holding companies, security brokers and dealers, and insurance companies. These interconnections of shadow banks with other financial institutions create sources of systemic risk for the broader financial system. We describe elements of monitoring risks in the shadow banking system, including recent efforts by the Financial Stability Board.

Key words: shadow banking, financial stability monitoring, financial intermediation

---

Adrian, Ashcraft, Cetorelli: Federal Reserve Bank of New York (e-mails: tobias.adrian@ny.frb.org, adam.ashcraft@ny.frb.org, nicola.cetorelli@ny.frb.org). This paper was prepared for the *Oxford Handbook of Banking*.

Contents

1. What is shadow banking?

Traditional financial intermediaries are centralized entities brokering the flow of funds between households and borrowers. Households could certainly bypass intermediaries and directly invest in equity or debt of borrowers. However, direct finance requires dealing with well-known informational and liquidity frictions. In particular, it is usually costly to screen, select, monitor and diversify across investment projects. Moreover, direct investments may be constrained by the need by households for liquidity, i.e. the need to access funds before the investments comes to fruition, resulting in wasteful liquidation costs. Financial intermediaries exist to minimize on all of these costs. In the traditional model, intermediaries are centralized agents performing under one roof multiple roles of screening, selection, monitoring and diversification of risk, while simultaneously providing liquidity services to the providers of funds. The simultaneous provision of these services to multiple agents through maturity, liquidity and credit transformation provides for a better allocation of risk between households and firms.

While financial intermediation facilitates more efficient risk sharing between borrowers and the suppliers of funds, it does create new risks, the most relevant one being the well-known exposure to "runs" and premature liquidation of projects when the suppliers of funds pull out en masse. Hence, financial intermediation activity is intrinsically fragile, and most importantly it carries a significant social externality, represented by the risk of systemic disruptions in the case of contagion of run events.

The official sector has attempted to minimize this systemic risk through the use of its own balance sheet by providing credit guarantees on the liabilities of these intermediaries, as well as by providing contingent liquidity to these institutions from the lender of last resort. However, the risk-insensitive provision of credit guarantees and liquidity backstops creates well-known incentives for excessive risk-taking, leverage, and maturity transformation, motivating the need for enhanced supervision and prudential regulation. This traditional form of financial intermediation, with credit being intermediated through banks and insurance companies, but with the public sector standing close by to prevent destabilizing runs, dominated other forms of financial intermediation from the Great Depression well into the 1990s.

Over time, financial innovation has transformed intermediation from a process involving a single financial institution to a process now broken down among several institutions, each with their own role in manufacturing the intermediation of credit. With specialization has come significant reductions in the cost of intermediation, but the motive to reduce costs has also pushed financial activity into the shadows in order to reduce or eliminate the cost associated with prudential supervision and regulation, investor disclosure, and taxes. Over the course of three decades, the shadow banking system quickly grew to become equal in size to that of the traditional system, improving on the terms of liquidity traditionally offered to households and borrowers. However, it was only a matter of time before intermediation designed to evade public sector oversight would end badly, as occurred during the most recent credit cycle. Consequently, while financial innovation is naturally associated with the more efficient provision of financial services, it is this dark side of non-traditional intermediation which has come to define shadow banking.

The term "shadow banking" was coined by McCulley (2007) and was picked up by policymakers (see, for example, Tucker (2010)). The first articles on shadow banking are by Pozsar (2008) and Adrian and Shin (2009). In this chapter, we provide a structured overview of the literature to date. In section 2, we provide a definition of shadow banking, and review attempts to measure its size. In section 3, we explore reasons why shadow banking exists, and in section 4, discuss why regulators and academics should care about shadow banking. In section 5, we provide an approach for monitoring risks in the shadow banking system with a detailed discussion for each of agency MBS REITS, reinsurance, leveraged lending, tri-party repo, money market mutual funds, and off-balance sheet activity of Chinese banks. Concluding remarks are made in section 6.

2. How does one define and measure shadow banking?

The official definition of shadow banking was recently formulated by the Financial Stability Board (FSB) as "the system of credit intermediation that involves entities and activities outside the regular banking system". In the words of the FSB, "…This implies focusing on credit intermediation that takes place in an environment where prudential regulatory standards and supervisory oversight are either not applied or are applied to a materially lesser or different degree than is the case for regular banks engaged in similar activities." (FSB, 2011). This regulatory approach fully recognizes the complexity of the credit intermediation chain, as well as the fact that banks themselves may be an integral component in the shadow system. For that reason, the FSB approach also emphasizes examining the connections between bank and nonbank activities. At the same time, and in the interest of effective monitoring and regulation, while the FSB approach "casts a wide net", incorporating potentially any entity, market or activity at work along the credit intermediation chain, it also called for a narrower focus, calling attention on activities involving four key risk factors: maturity transformation, liquidity transformation, imperfect credit risk transfer and leverage.

An alternative definition of shadow credit intermediation is outlined by Pozsar, Adrian, Ashcraft, and Boesky (2010). This definition is focused on the nature of financial intermediary liabilities. In particular, liabilities which are explicitly guaranteed by the official sector are not part of shadow credit intermediation, as they benefit from the strongest form of official sector support.[i] Second, if an uninsured liability is consolidated onto the balance sheet of an institution with access to the lender of last resort, that uninsured liability is not part of shadow credit intermediation.[ii] The focus on accounting consolidation as part of the definition is important, as liabilities not consolidated are presumed to be structured to avoid regulatory taxes that would apply if showing directly on the intermediary's balance sheet. Uninsured liabilities are part of the shadow banking system since they do not benefit from access to official sector liquidity, thus making them vulnerable to concerns about credit as well as runs by investors.

While these two definitions appear quite different, they are in fact complementary. Each is focused on activities which evade regulatory taxes. The FSB approach focuses on intermediation activities outside of banks, while Pozsar et al. (2011) focuses on the funding of credit without official sector credit and liquidity support.

How large is the shadow banking system? And how do we measure it? The Financial Stability Board, as part of its mandate to investigate shadow banking and propose enhanced monitoring and regulation, has been conducting yearly global data mappings of the shadow banking system, in order to conduct surveillance of potential emergence of new shadow banking risks.

The mapping exercise is difficult for a number of reasons. First, by its own nature data on entities and activities that may be in the shadow of the regulator may just be missing. Second, and this perhaps less obvious, cross country aggregations are rendered arduous by the simple reason that the definition of certain entities or activities may have very different legal and/or regulatory meaning within each local confine.

Despite these difficulties, the FSB has conducted annual monitoring exercises since 2011. In the 2012 exercise it presented data coverage for 25 countries plus the euro area as a whole. In aggregate, coverage represented 90% of global financial system assets. According to the FSB exercise, the global shadow banking system, defined in the data as the aggregate total assets of "Other Financial Intermediaries", grew exponentially in the years prior to the crisis, rising from $26 trillion in 2002 to $62 trillion in 2007. The system shrunk during the crisis, but it is reported at $67 trillion in 2011. Moreover, the data indicates that the shadow banking system represents about 25% of total financial intermediation, down from its peak at 27% in 2007. Across countries, the largest share is for the U.S., with assets of $23 trillion in 2011, followed by the euro area ($22 trillion) and the UK ($9 trillion). Interestingly, the US' share has declined from 44% in 2005 to 35% in 2011, while Euro area and UK exhibited an equivalent increase in their share (

Figure). The global mapping also indicates significant heterogeneity across countries in terms of growth of non-bank FIs across countries, and also in terms of specific type of sub sectors within the population of non-bank FIs. As shown in Figure 2, the largest growth rates have been observed among certain emerging market economies. China is one of such examples, with substantial growth in money market mutual funds and finance companies. This is a clear indication that shadow banking is global and that its growth is associated with both overall economic growth (a natural response to the growing need for intermediated funds) but also that it may be fostered by weaker regulatory environments.[iii]

3. Why does shadow banking exist?

As a whole, the academic literature suggests that shadow credit intermediation is largely motivated by the confluence of specialization by financial intermediaries, financial innovation in the composition of money supply, and regulatory cost avoidance. We briefly review each of these explanations here, but refer to Ashcraft and Adrian (2012a,b) for an extended discussion.

a. Specialization

Through the shadow intermediation process, the shadow banking system transforms risky, long-term loans (subprime mortgages, for example) into seemingly credit-risk-free, short-term, money-like instruments. Unlike the traditional banking system, where the entire process takes place within the walls of a single institution, the shadow banking system decomposes the credit intermediation into a

chain of wholesale-funded, securitization-based lending. Shadow credit intermediation is performed through chains of nonbank financial intermediaries in a multistep process that can be interpreted as a "vertical slicing" of the traditional bank's credit intermediation process into seven steps. Pozsar, Adrian, Ashcraft, and Boesky (2010) explain the seven steps of shadow bank credit intermediation, illustrated in Figure 3:

1. Loan origination (auto loans and leases, nonconforming mortgages, etc.) is performed by non-bank finance companies.

2. Loan warehousing is conducted by single- and multi-seller conduits and is funded through asset-backed commercial paper (ABCP).

3. The pooling and structuring of loans into term asset-backed securities (ABS) is conducted by broker-dealers' ABS syndicate desks.

4. ABS warehousing is facilitated through trading books and is funded through repos, total return swaps, or hybrid and repo conduits.

5. The pooling and structuring of ABS into CDOs is also conducted by broker-dealers' ABS.

6. ABS intermediation is performed by limited-purpose finance companies (LPFCs), structured investment vehicles (SIVs), securities arbitrage conduits, and credit hedge funds, which are funded in a variety of ways including, for example, repo, ABCP, MTNs, bonds, and capital notes.

7. The funding of all the above activities and entities is conducted in wholesale funding markets by funding providers such as regulated and unregulated money market intermediaries (for example, 2(a)-7 MMMFs and enhanced cash funds, respectively) and direct money market investors (such as securities lenders). In addition to these cash investors, which fund shadow banks through short-term repo, CP, and ABCP instruments, fixed-income mutual funds, pension funds, and insurance companies also fund shadow banks by investing in their longer-term MTNs and bonds.

Why does the shadow banking system involve so many more institutions than the traditional banking system?

Part of the answer likely involves economies of scale. When it comes to the structuring and underwriting securities, it seems clear that this could be done at a lower cost in a specialized entity like a broker-dealer than by a non-bank originator, given the common components to structuring across issues, as well as the need to create relationships with investors to distribute, as well as a cheap funding source through tri-party repo to support market-making. When it comes to warehouse funding, Kashyap, Rajan, and Stein (2002) demonstrated that due to the imperfect correlation between deposit withdrawals and the demand for credit, banks have a cost advantage over non-banks in the provision of contingent liquidity necessary to make lines of credit work effectively.

Another part of the answer must be that transformation of risky loans on the balance sheet of a non-bank finance company with an investment grade bond rating into securities with AAA credit ratings requires bankruptcy remoteness. While the non-bank lender could issue commercial paper directly to fund loans on its balance sheet, there will be a significant cost advantage to selling loans to a special purpose vehicle which is independent of the credit risk profile of the sponsor through securitization. As bankruptcy remoteness is an essential component of securitization, shadow credit intermediation naturally involves a larger number of entities than traditional credit intermediation through depository institutions.

A final part of the answer is likely related to the unique opaqueness of traditional credit intermediaries, which combine lots of different types of financial activities into a single financial intermediary. The relative opaqueness of banks to other types of firms has been well-documented in the academic literature. See Flannery, Kwan, and Nimalendran (2002) for analysis and literature review. It seems reasonable to suspect that the relative opaqueness of banks is facilitated in part through explicit and implicit support of bank liabilities by the official sector, permitting banks to engage in a wider range of activities which would not be possible if funded entirely by the market without such support. As an example, money market mutual funds, which also offer demandable debt, typically have a significantly smaller range and higher quality assets than the typical commercial bank. Along this line of thinking, the specialization which exists outside of the traditional banking system might be a more natural order.

b. Innovation in composition of money

Gorton and Metrick (2011) portray shadow credit intermediation as financial innovation in the composition of aggregate money supply. Money plays a crucial role in the economy, acting not only as a store of value, but also as a unit of account and means of exchange. The rapid loss of confidence in the value of money has been a root cause of financial panics across countries and over time. See Reinhart and Rogoff (2008) for a review of financial panics across the globe over eight centuries. In particular, the shift from commodity money to fiat money was an important innovation, but for decades it was associated with panics driven by speculation over its convertibility into commodities, which only ended in the US with the full backing of the taxpayer through the National Banking Acts in 1863 and 1864. As continued innovation prompted the replacement of fiat money by deposits, the threat of large-scale banking panics returned, and was only mitigated through the backing of deposits through federal deposit insurance through the FDIC and the Federal Reserve as Lender of Last Resort.

Despite the effectiveness of these policy interventions in creating financial stability for decades following the Great Depression, significant innovations in the composition of the aggregate money supply have made the financial system more vulnerable to a loss of confidence by the holders of money. This is illustrated by Figure , which illustrates the composition of liabilities of financial business from the Flow of Funds into four major categories: 1) traditional maturity transformation, including bank deposits and interbank liabilities; 2) traditional credit transformation including term debt issued by banks and bank holding companies as well as reserves of pensions and life insurance companies, in addition to depository loans not elsewhere classified; 3) shadow maturity transformation, including MMMFs, repo, open market paper, and security broker-dealer credit and payables; and 4) shadow credit

transformation, including GSEs, term debt issued by nonbanks, mutual fund shares, REIT mortgage debt, and loans categorized as "other."

The figure suggests several striking patterns. First, the amount of maturity transformation in the financial system has been declining significantly since backing by the official sector. While almost 75 percent of intermediated credit was funded by short-term bank liabilities in the mid-1940s, including both banks and non-banks, that number has fallen as low as 15 percent in recent years before rebounding to 21 percent in 2011. The decline in maturity transformation, which largely occurred in banks, is offset by the increased role of term debt markets in funding credit. In particular, the amount of shadow credit transformation increased from zero in 1945 to as much as 36 percent of total financial sector liabilities in 2007 before declining to 31 percent in 2011. The increase in market funding for credit is driven not only by the GSEs and securitization, but also by the increased importance of mutual funds and REITs. Shadow credit transformation increased from only 5 percent of total credit transformation in 1945 to a peak amount of 60 percent in 2008 before declining to 55 percent in 2011.

Second, while maturity transformation by banks has declined significantly in line with the overall financial sector, maturity transformation by non-banks has increased significantly. The consequence is that the fraction of the aggregate money supply issued by shadow intermediaries has increased significantly, peaking at 45 percent in the early 2000s before declining sharply to 28 percent in 2011, a level not seen since 1993. The increased amount of maturity transformation is explained in party by the development of money market mutual funds in the 1970s in response to limits on the ability of depository institutions to pay interest on checking accounts, as well as in response to a need for limits on deposit insurance, which left large depositors exposed to bank risk. While the figure illustrates that the amount of credit funded through shadow intermediation even at the peak was never larger than 10 percent, the growing importance of shadow money in the aggregate supply of money was an important factor in amplifying the shocks to the financial system more broadly.

The role of shadow liabilities in the overall money supply is beginning to be explored in the academic literature. Sunderam (2012) analyses the extent to which shadow banking liabilities constitute substitutes for high-powered money. He shows in a simple model that shadow banking liabilities should constitute substitutes for money in the private sector's asset allocation. Empirically, Sunderam shows that shadow banking liabilities respond to money demand, extrapolating that heightened money demand can explain about half of the growth of ABCP in the mid-2000s. He also confirms that regulatory changes to ABCP played a significant role in the growth of the shadow banking system.

Moreira and Savov (2012) study the impact of shadow money creation on macroeconomic fluctuations. Intermediaries create liquidity in the shadow banking system by levering up the collateral value of their assets. However, the liquidity creation comes at the cost of financial fragility as fluctuations in uncertainty cause a flight to quality from shadow liabilities to safe assets. The collapse of shadow banking liquidity has real effects via the pricing of credit and generates prolonged slumps after adverse shocks.

c. Regulatory arbitrage

One clear motivation for intermediation outside of the traditional banking system is for private actors to evade regulation and taxes. The academic literature documents that motivation explains part of the growth and collapse of shadow banking over the past decade. In particular, Acharya, Schnabl, and Suarez (2011) document that the rapid expansion of ABCP since 2004 resulted in part from changes in regulatory capital rules. In particular, FASB issued a directive in January 2003 (FIN 46) and updated the directive in December 2003 (FIN 46A) suggesting that sponsoring banks should consolidate assets in ABCP conduits onto their balanced sheets. However, U.S. banking regulators clarified that assets consolidated onto balance sheets from conduits would not need to be included in the measurement of risk-based capital and instead used a 10 percent credit conversion factor for the amount covered by a liquidity guarantee. The authors documented that the majority of guarantees were structured as liquidity-enhancing guarantees aimed at minimizing regulatory capital, instead of credit guarantees, and that the majority of conduits were supported by commercial banks subject to the most stringent capital requirements. Moreover, the authors documented that conduits were sponsored by banks with low economic capital as measured by the ratio of the book value of equity to assets. Finally, the authors find that investors in conduits with liquidity guarantees were repaid in full, while investors in conduits with weaker guarantees suffered small losses, suggesting there the absence of risk transfer despite the capital relief.

The motivation for capital arbitrage is consistent with the mispricing of explicit credit and liquidity put options associated with deposit insurance and access to official liquidity, as well as the presence of a perception that large banks are "too big to fail," which permits them to engage in excessive leverage maturity transformation. As discussed by Ashcraft and Adrian (2012a), the presence of minimum capital and liquidity standards mitigates these incentives, and the ability of banks to evade binding standards permits them to maximize the value of these put options.

4. What is the Role of Banks in Shadow Banking?

The standard narrative of shadow banking is that traditional banks lose their centrality in the process of intermediation, and they get replaced by specialized providers of intermediation services along the chain. It seems possible that incumbent intermediaries (the banks) could in fact adapt to the changing "technology" of intermediation. As described earlier, asset securitization allows the development of new markets and activities, a longer intermediation chain and the emergence of---or strengthened role of already existing---specialized intermediaries. In light of this evolution, we should at least allow for the possibility that banks adapt to the change to maintain a central role in the intermediation system. A way to do that is by engaging in a process of organizational restructuring: if modern intermediation requires an enhanced role for, say, specialty lenders, underwriters, asset managers, money market funds, insurance companies, etc., then an existing banking organization may adapt by incorporating such entity types under common ownership and control. This conjecture thus suggests that as the concept of intermediation is redefined, banks adapt by expanding the traditional boundaries of the intermediation firm. Consequently, the locus of intermediation activity is not confined within the balance sheet of a

commercial bank, but it is to be found within the broader footprint of more complex bank holding company organizations.

Understanding the extent to which banks adapt to the changing environment is crucial as it allows a better understanding of the actual transformations that have occurred in the industry. Moreover, it highlights from a different perspective the connections between the regulated world and what developed in the shadow. Finally, it really informs the debate on the concept of what really should be defined as shadow banking.

Defining shadow banking from an organizational perspective requires drawing an alternative map of the credit intermediation chain. Instead of describing the steps of the intermediation chain as in Figure 3 above, it highlights the roles that are needed along the intermediation chain to allow the match between supply and demand. The map is shown in Figure 5 and illustrates that there is a loan originator at the beginning of the chain. However, also needed is an issuer of securities, an underwriter that is in charge of the placement of the securities, a servicer that takes care of the revenue stream associated with the securities, a trustee, which is essentially a delegated monitor for the ultimate investors of the securities, and an entity providing the role of enhancer, providing liquidity and/or credit guarantees to boost the quality of these issuances.

This alternative mapping is complementary to that focused on the steps of the chain, but it allows a quantification of what – from an organizational perspective – lies in the shadow. In the U.S. the Federal Reserve Bank is the regulator of bank holding companies, implying that the extent to which one can actually assess the role of bank holding companies in modern financial intermediation allows potentially important quantifications about the degree of shadiness of shadow banking. Cetorelli and Peristiani (2012) provided for the first time such quantification. Using data from the universe of non-agency asset-backed securitization activity from 1978 to 2008, the authors were able to identify for each tranche in each security the role of issuer, underwriter, servicer and trustee. Subsequently, they matched the identity of the entities providing these services to bank holding company identifiers. Still Figure illustrates, in percentage of dollar amount securitized, the extent to which bank holding companies played one or multiple roles played by their subsidiaries along the credit intermediation chain. The main result is that there was very little securitization activity that was been done without some roles played by regulated bank entities.[iv]

Regulated bank entities also maintained an important role in "feeding" the shadow banking systems, in their role at loan origination. Bord and Santos (2012) show this in their study of the role of banks in the originate-to-distribute model of credit intermediation. The authors document that more than 75 percent of syndicated credit lines are bought by syndicate participant banks and that they stay with those banks after three years. The share of term loans owned by syndicate banks has fallen from around 75 percent in the mid-1990s to around 30 percent in the mid-2010s. For term loans, shadow banking organizations have thus emerged as more and more important investors over the past twenty years. Buyers of term loans that are particularly important are investment managers and collateralized loan obligations (CLOs). Bord and Santos conclude that the share of term loans sold to the shadow banking system amounted to less than 10 percent in 1993 and rose to over 30 percent by 2007. While

loan originations were conducted almost exclusively by commercial banks, the ultimate owners of term loans were thus split among banks and shadow banks.

Avraham, Selvaggi and Vickery (2012) provide evidence that bank holding companies are transforming with the advent of shadow credit intermediation. Figure compares the organizational structure, by simple count of subsidiaries, of the top U.S. BHCs in 1990, arguably a time when the traditional model of intermediation was the most relevant, to that in 2012. BHCs, at least the largest, are shown to have increased many times over the number of entities for which they retain control. For example, each of the five largest BHCs in the U.S. had over 1,500 subsidiaries in 2012, with the largest one owning more than 3,000. The majority of these subsidiaries are funds, trusts, and financial vehicles that are typically engaging in shadow banking activities.[v]

A more in depth study of organizational adaptation by BHCs, by Cetorelli, McAndrews and Traina (Forthcoming), focuses on the full dynamics of mergers and acquisitions observed in the entire U.S financial industry from the early 1990s. Table 1, reproduced from their paper, summarizes such dynamics, capturing by year the extent of cross-type consolidation initiated by financial firms over time, that is the extent to which, say, banks have been buying nonbank targets such as asset managers, insurance underwriters, insurance brokers, etc., and the extent to which these other entity types have engaged in similar organizational changes. As the table indicates, banks represented the bulk of such expansion.

Besides the subsidiaries associated with BHC involvement in securitization activities, the largest nonbank BHC subsidiaries consist of finance companies, broker-dealers, and wealth management units including mutual, hedge, and money market mutual funds. While the two decades in the run-up to the financial crisis saw the emergence of a shadow banking system that was partially independent from BHCs, the financial crisis led, perhaps paradoxically, to a migration of independent shadow banking activity into BHCs. Cetorelli (2012) shows that, as of 2011, BHCs controlled about 38 percent of the assets of the largest insurance companies, 41 percent of total money market mutual fund assets, and 93 percent of the assets of the largest brokers and dealers. Moreover, very little securities lending and related cash collateral reinvestments take place without the services provided by the main custodian banks.

The takeaway from these contributions is that at closer inspection, regulated bank entities have kept a considerable footprint in modern financial intermediation. This is not to say that the risks associated with intermediation activities have not migrated in the shadow. Taking an organizational perspective, however, does underscore the necessity to give weight to forms of adaptation of regulated intermediaries and it does suggest a key to complement a forward-looking oversight approach (Cetorelli, 2012): regulated bank entities have proven to be resilient and adaptable in the face of innovation. Following their evolution may offer insights on the ways intermediation activities, and the related risks, evolve as well. The trend toward consolidation of shadow banking in BHCs since the crisis is, however, counteracted by a powerful force: the enhanced prudential standards of BHCs. Tighter capital and liquidity requirements will arguably lead to an increased incentive for some forms of credit intermediation to migrate out of BHCs and into the shadow banking system.

5. Why should we care about shadow banking?

While intermediation of credit in the shadows is different than intermediation through traditional banks, it is worth highlighting how shadow credit intermediation can lead to inefficient outcomes.

a. Regulatory arbitrage

Regulation typically forces private actors to do something which they would otherwise not do: pay taxes to the official sector, disclose additional information to investors, or hold more capital against financial exposures. Financial activity which has been re-structured to avoid taxes, disclosure, and/or capital requirements, is referred to as arbitrage activity. While arbitrage generally refers to the simultaneous buying and selling of instruments for a riskless profit, regulatory arbitrage is generally a change in structure of activity which does not change the risk profile of that activity, but increases the net cash flows to the sponsor by reducing the costs of regulation.

There is a small literature investigating the impact of taxes and tax avoidance activity on the recent financial boom and bust. Alworth and Arachi (2010) provide a broad discussion of the role of the tax advantages of home ownership, the use of debt in mergers and acquisitions by private equity, the use of hybrid debt instruments as capital by financial institutions, and the use of tax havens to structure securitization vehicles. Mooij, Keen, and Orihara (2013) documents an empirical link between corporate tax rates and the probability of crises. Finally, Davis and Stone (2004) document that the severity of crises is larger when pre-crisis leverage is higher, suggesting that tax policy could have effects both on incidence and severity of financial stress.

While high corporate taxes can have adverse effects on financial stability, it appears that low corporate taxes can also have adverse effects. In an attempt to attract foreign capital and create jobs, several jurisdictions have enacted relatively low corporate income tax rates. Corporations in high tax countries have worked to re-structure their activity in order to take advantage of these low tax rates, to the frustration of the official sector in those regimes. Beyond shifting the burden of taxes, it is likely that differences in corporate tax rates can lead to global financial instability related to rapid and short-term capital flows to those countries. For example, many of the developed countries with the lowest tax rates, including Ireland, Iceland, and Cyprus, have recently experienced significant boom and bust cycles related to inflows of hot money. The relationship between capital mobility and banking crises is not a new phenomenon, and has been discussed extensively by Reinhart and Rogoff (2010).

b. Neglected risks

Because they are tailored to take advantage of mispriced tail risk, shadow banking institutions accumulate assets that are particularly sensitive to tail events. At a deep level, the question becomes, how can the mispricing of tail risk exist in a world with fully rational actors? Shouldn't financial market participants be able to calculate tail risk probabilities, implicit guarantees, and various tail risk enhancements? And shouldn't these calculations lead to the proper assessment of tail risk? The literature has provided two distinct, complementary answers. The first relies on the behavioral explanation of "neglected risk." The second relies on information opacity in a rational world. We will discuss each of these explanations in turn.

Evidence from psychology and behavioral finance argues that market participants are fundamentally biased against the rational assessment of tail risk. Gennaioli, Shleifer, and Vishny (2012a) develop a theory of individual decision making based on the behavioral evidence, positing that actors neglect risk. In a later paper, Gennaioli, Shleifer, and Vishny (2012b) apply this theory to the economics of the shadow banking system. They model a world where investors systematically ignore the worst state of the world, generating overinvestment and overpricing during the boom and excessive collapse of real activity and the financial sector during the bust.

Their theory is possibly the most parsimonious narrative of the boom and bust of the shadow banking system. In fact, much empirical evidence is consistent with such a theory. Credit rating agencies modeled only small or no declines in aggregate housing prices, and investors in securitized products often did not understand the amount of risk exposure that was embedded in the products. Meanwhile, the prices of tail risk far into the future, far out of the money options relating to mortgage credit, were surprisingly cheap. An early paper warning of the financial system's exposure to such tail risk was presented by Rajan (2005), who pointed to precisely this phenomenon by asking whether financial innovation had made the world riskier.

Neglected risks are one way to interpret the widely perceived risk-free nature of highly rated structured credit products, such as the AAA tranches of ABS. Coval, Jurek, and Stafford (2009) point out that these AAA tranches behave like catastrophe bonds that load on a systemic risk state. In such a systemic risk state, assets become much more correlated than in normal times. The underestimation of correlation enabled financial institutions to hold insufficient amounts of liquidity and capital against the puts that underpinned the stability of the shadow banking system, which made these puts unduly cheap to sell. As investors tend to overestimate the value of private credit and liquidity enhancement purchased through these puts, the result is an excess supply of cheap credit. Neglected risk can manifest itself through over-reliance on credit ratings by investors. For example, Ashcraft et al. (2011) document that subprime MBS prices are more sensitive to ratings than ex post performance, suggesting that funding is excessively sensitive to credit ratings relative to informational content.

Dang, Gorton, and Holmström (2009) present an alternative theory where, in a world with fully rational market participants, assets are highly exposed to tail risk. Theirs is a theory of information opacity that can serve as a rationalization of credit problems for the shadow banking system. According to this theory, debt contracts are optimal because they generate opacity. Opacity, in turn, minimizes adverse selection and provides the least possible incentives to collect information. This insight justifies the growth of relatively opaque securitized products in the run-up to the crisis. Mortgages and loans were packaged into MBS and ABS and funded by CDOs, SIVs, and MMMFs that had relatively little information about the underlying credit quality. However, Dang, Gorton, and Holmström show that systemic risk is exacerbated once a bad shock hits informationally-opaque, debt-funded economies. The intuition is that a bad shock leads to an increase in private information collection, which exacerbates the incorporation of adverse information in market prices. As a result, adverse selection starts to accumulate as systemic crises deepen.

The above theory complements the explanation by Gennaioli, Shleifer, and Vishny (GSV) discussed earlier. While Dang, Gorton, and Holmström (DGH) emphasize adverse selection as an amplification mechanism, GSV emphasize awareness of risk. In GSV, the riskiness of the worst state of the world is simply neglected, and this neglect is based on behavioral arguments. In contrast, in DGH's model, the opacity of financial contracts in good times is an equilibrium outcome that maximizes the liquidity of financial contracts. The commonality between the two theories is that the severity of financial crisis is neglected, either rationally or behaviorally. As a result, the tail risk embedded in debt securities is underpriced from an ex post point of view. In both DGH and GSV, the assets that are accumulated during the boom experience large asset price declines during times of crisis. Such theories of neglected risk thus provide a rationalization for the accumulation of risk exposure to the housing market that was the major aggregate risk of the shadow banking system. In the theories of DGH and GSV, securities such as ABS and CDOs that obscure the underlying credit risks arise naturally. Such securities, in turn, generate large losses in times of crisis.

c. Funding fragilities

The financial frictions that lead to excessive risk taking and exacerbated credit losses during downturns also interact with the fragility of funding. Per definition, funding sources for shadow banking activities are uninsured and thus runnable. In many ways, the fragility of shadow banks due to the run-ability of liabilities resembles the banking system of the 19th century, prior to the creation of the Federal Reserve and the FDIC. During that time, bank runs were common, and they often had severe consequences for the real economy.

The shadow banking system's vulnerability to runs bears resemblance to bank runs as modeled by Diamond and Dybvig (1983). Shadow banks are subject to runs because assets have longer maturities than liabilities and tend to be less liquid as well. While the fundamental reason for commercial bank runs is the sequential servicing constraint, for shadow banks the effective constraint is the presence of fire sale externalities. In a run, shadow banking entities have to sell assets at a discount, which depresses market pricing. This provides incentives to withdraw funding—before other shadow banking depositors arrive.

However, the analogy between bank runs and shadow bank runs goes only so far. The reason is that shadow banking entities do not offer demand deposits, but instead obtain funding in wholesale money markets such as commercial paper or repo. Martin, Skeie, and von Thadden (2011) provide a model for a run in repo markets that takes the empirical facts of the Bear Stearns and Lehman crises as a starting point. In their model, repo borrowers face constraints due to the scarcity of collateral and the liquidity of collateral. Under sufficiently adverse conditions, self-fulfilling runs can occur. The model focuses in particular on the differences between the tri-party repo market and the bilateral repo market (see Adrian, Begalle, Copeland, and Martin (2013) for an overview of both markets). Arguably, runs occurred in both markets, but they were of very different natures. While the run in the bilateral market was characterized by a sharp increase in haircuts (as documented by Gorton and Metrick (2012)), the run in the tri-party repo market materialized as a simple withdrawal of funding with a rather limited impact on the level of haircuts (see Copeland, Martin, and Walker (2011)). Runs in the ABCP market were equally characterized by a withdrawal of funding (see Covitz, Liang, and Suarez (2012)).

Gallin (2013) provides a comprehensive map of the amount of short term funding from the shadow banking system to the real economy, based on the flow of funds statistics. Gallin's framework shows that much of the decline in credit supply in the crisis was due to the decline of short term shadow bank funding. Gallin's work can be used to quantify the amount of fragility in shadow bank funding over time.

d. Leverage cycles

The fragility of shadow banking institutions can also be interpreted as the result of the leverage cycles of market-based financial institutions. Such leverage cycles refer to equilibrium outcomes, where asset values and balance sheet capacity of intermediaries are determined endogenously. The friction in models of leverage cycles is due to the funding constraints of intermediaries, which reflect the incentive problems discussed earlier. Theories of intermediary leverage cycles have been proposed by Fostel and Geanakoplos (2008), Brunnermeier and Pedersen (2009), Brunnermeier and Sannikov (2011), Garleanu and Pedersen (2011), and Adrian and Boyarchenko (2012). Such theories of leverage cycles have the commonality that intermediaries are subject to collateral constraints, as is the case for repo and ABCP funding. The tightness of the collateral constraints depends on the underlying risk of assets, the liquidity of assets, and the collateral values. As economic conditions deteriorate, the leverage cycle acts as an amplification mechanism to underlying shocks.

Adrian and Boyarchenko (2012) show that their theory of intermediary leverage cycles has strong empirical support. Intermediary balance sheets exhibit strongly procyclical leverage, meaning that leverage expands in booms. This procyclical behavior of leverage is a hallmark of shadow banking, as documented by Adrian and Shin (2009). Shadow bank leverage tends to be high when balance sheets are large and credit intermediation is expanding. Furthermore, equity is countercyclical, both in the theory and in the data, as intermediaries tend to hold as little equity as possible during booms, but are forced to raise equity during downturns when the market risk increases. Adrian and Boyarchenko (2012) also document the close link between intermediary balance sheets and asset prices. Over time, expanding leverage tends to coincide with compressed risk premia and inflated asset prices. In busts, risk premia widen, generating asset price busts. In addition, market volatility is countercyclical. As a result, the funding of intermediaries tends to collapse during times of crisis. Similarly, Meeks, Nelson and Alessandri (2012) show that a macroeconomic model with shadow credit intermediation via asset backed securities exacerbates fluctuations due to the increased amplitude in the leverage cycle of the shadow banking entities.

e. Agency problems

The splitting up of intermediation activity across multiple institutions, as is done in the shadow banking system, has the potential to aggravate underlying agency problems. In particular, it is typically costly to convey complete and accurate private information about the credit quality of a borrower between financial institutions, and the transfer of credit risk without a complete transfer of this information creates agency problems leading to inefficient outcomes. Ashcraft and Schuermann (2008) describe seven important informational frictions that existed in the securitization of subprime mortgage credit prior to the financial crisis, although these frictions can be generalized to all securitization transactions. They include asymmetric information problems between the lender and originator (predatory lending

and borrowing), between the lender and investors, between the servicer and investors, between the servicer and borrower, between the beneficiary of invested funds and asset managers, and between the beneficiary of invested funds and credit rating agencies. In addition, asymmetric information between investors and issuers results in risk-insensitive cost of funding. For example, Keys et al. (2010) document that mortgage borrowers with FICO scores just above a threshold of 620 perform significantly worse than borrowers with FICO scores just below 620. As it is more difficult to securitize loans below that threshold, the authors argue that this result is consistent with issuers exploiting asymmetric information, disrupting the otherwise monotone relationship between borrower credit scores and performance.

Although securitization has a relatively short history, it is a troubled one. The first known securitization transactions in the United States occurred in the 1920s, when commercial real estate (CRE) bond houses sold loans to finance CRE to retail investors through a vehicle known as CRE bonds. Wiggers and Ashcraft (2012) document the performance of these bonds, which defaulted in large numbers following the onset of the Great Depression. Although the sharp deterioration in economic conditions played an important part in explaining their poor performance, so did aggressive underwriting and sales of the bonds in small denominations to unsophisticated retail investors.

Over-reliance on credit ratings can create problems when the rating agencies face their own agency problems. For example, Mathis, McAndrews, Rochet (2009) analyze a dynamic model of ratings where reputation is endogenous and the market environment may vary over time. The authors' model predicts that a rating agency is likely to issue less accurate ratings in boom times than it would during recessionary periods. Moreover, the authors demonstrate that competition among rating agencies yields similar qualitative results. Xia and Strobl (2012) document that the conflict of interest caused by the issuer-pays rating model leads to inflated corporate credit ratings. Finally, Cohen (2010) documents significant relationships between variables that should not affect a CRA's view of the credit risk of conduit/fusion CMBS transactions issued during 2001-07, but that would affect issuers' and CRAs' incentives in an environment where rating shopping was present.

6. How Can Risks in the Shadow Banking System be Monitored?

In this section, we are providing examples of monitoring particular shadow banking activities and entities. These examples are for illustrative purposes. Shadow banking activities are ever evolving, and what appears important at some point might lose importance over time. For example, many of the activities listed in Pozsar, Adrian, Ashcraft, Boesky (2010) are no longer in existence: ABCP conduits are being unwound due to changes in regulations and accounting standards, structured investment vehicles have disappeared due to changes in capital requirements, and the CDS wraps for subprime mortgages that played an important role as tail risk repository are either extinct (in the case of large insurance companies) or have shrunk dramatically (in the case of monoline insurers).

However, many shadow banking activities continue to exist, and new activities have emerged, or have gained in importance. Agency mortgage REITS, leveraged finance intermediation, and captive insurance companies have, arguably, gained in importance since the financial crisis. The repo market and money

market mutual funds continue to represent major building blocks of the shadow banking system. Shadow bank intermediation is thus constantly evolving, partly in reaction to regulatory changes.

In order to provide for a more dynamic framework to identify shadow banking, the FSB has formulated a functional approach to shadow bank monitoring means that activities---which might be conducted by a variety of different institutions---are being constantly monitored according to their location in the intermediation chain. The functional approach is particularly important as there are significant differences in legal and regulatory frameworks across countries. The FSB(2012) identifies five broad economic functions that are meant to capture the broad spectrum of intermediation activities:

1) Management of client cash pools with features that make them susceptible to runs such as credit investment funds, credit mutual funds, and mortgage REITs;
2) Loan provisions that depend on short-term funding such as finance companies;
3) Intermediation of market activities that depend on short-term funding or on secured funding of client assets;
4) Facilitation of credit creation such as insurance guarantors; and
5) Securitization-based credit intermediation and funding of financial entities such as securitization vehicles.

In the remainder of this section, we provide examples of particular entities and activities, and outline the way in which they can be monitored for the buildup of risk.

a. Agency Mortgage REITS

Real estate investment trusts (REITs) are investment vehicles that primarily invest in real estate related assets. Agency mortgage REITs (agency REITs) are specialized REITs that invest in mortgage backed securities (MBS) issued by U.S. government sponsored agencies, particularly the government sponsored enterprises. While REITs can generally be either public or private, agency REITs are publicly traded. While U.S. REITs are regulated by the SEC, agency REITs structure their operations in a way to be excluded from specific regulations in the Investment Company Act. As a result, agency REITs have virtually no prudential regulation, though, as publicly listed entities, they are subject to the SEC's investor protection rules and have to file reports such as 10Qs.

While there are several hundred publicly listed REITs in the U.S., the agency REIT market consists of only a handful of companies, the majority of which were created since the financial crisis (though the oldest agency REIT was created in the mid-1980s). The sector holds over $350 Billion of agency MBS, which corresponds roughly to seven percent of the total agency MBS market. The size of agency MBS has been growing rapidly in recent years.

The business model of agency REITs relies on liquidity and leverage, but not credit transformation. Mortgage REITs obtain leverage in the bilateral repo market, from the security broker-dealer sector. The repo contracts limit the amount of leverage that REITs can obtain. Since the financial crisis, haircuts for agency MBS have increased dramatically, so that leverage of the largest mortgage REITs is currently less than 10 percent according to their 10K filings. The current leverage of agency REITs is in contrast to pre-crisis levels, when lower haircuts allowed for considerably higher leverage, often above 15.

The rapid growth of agency REITs since the financial crisis can be primarily attributed to the interest rate environment. As expansionary monetary policy has resulted in low yields across the maturity spectrum, levered investments have attracted outsized funds under management. In addition to agency REITs, high yield mutual funds and ETFs as well as collateralized loan obligations have grown rapidly in size in recent years. The relatively high degree of leverage of agency REITs allows them to generate dividend yields that are among the highest among traded stocks. The largest agency REITs have achieved dividend yields around 20 percent in recent years, despite longer term interest rates that are only around two percent. An additional reason for the success of the REIT industry in general is the special tax treatment. Earnings are not taxed at the corporate level, but only when equity holders receive earnings in the form of dividends. In order to maintain REIT status, agency REITs return in excess of 90 percent of their earnings to equity holders.

Agency REITs are exposed to two main sources of risk, duration risk and liquidity risk. Duration risk arises as their assets are longer term MBS, while liabilities are repos. Hence when the slope of the yield curve steepens, agency REITs experience mark to market looses on their mortgage holdings, which translates into a falling equity value. Historically, the return on assets of agency REITs correlates tightly with the slope of the yield curve. In addition to slope risk, agency REITs hold convexity risk. Convexity risk arises also in a rising yield environment. As agency mortgage pools consist of mortgages that can be prepaid, rising interest rates makes prepayment less likely, extending the duration of mortgages. The duration extension in a rising yield environment generates "negative convexity", meaning that the price of MBS is more and more sensitive to increasing rates, the higher rates are. Negative convexity has been linked to past bond market selloffs, particularly in 1994 and 2003.

Liquidity risk arises for agency REITs because their repo funding is short term, typically with either an overnight or a month long maturity. If money market investors suddenly withdraw funding to dealers, those can no longer pass funding onto agency REITs, exposing the REITs to liquidity risk. In addition, dealers might increase haircuts when liquidity and rate risk of agency MBS is judged higher, exposing REITs to the possibility of forced deleveraging. In fact, during the financial crisis, repo funding of agency MBS became severely distorted, leading the Federal Reserve to start a special financing program called "Term Securities Lending Facility."

From a systemic point of view, the main concern is that a significantly larger agency REIT sector might contribute to the magnitude of selloffs in rising rate environment. Rising interest rates might force REITs to fire sale agency MBS, increasing slope and duration risk. In addition, agency MBS liquidity might become impaired. The adverse rate and liquidity effects might in turn spill over to other institutions, such as MBS mutual funds, money market funds, insurance companies, and pension funds. The evidence form the bond market selloff of the spring of 2013 did not show significant forced deleveraging by agency REITs. However, if the sector grew significantly, endogenous adverse feedback loops in the agency MBS market might be exacerbated by the presence of leveraged investment vehicles that do not have access to lender of last resort facilities.

d. Reinsurance

Reinsurance is the sale of risk from an insurance company to a reinsurance company. There are several motivations for reinsurance. First, reinsurance helps an insurer avoid concentrations in its own portfolio, permitting it to underwrite larger insurance policies by relaxing regulatory and economic capital constraints. Second, solicitation of third-party evaluation and pricing of risk can supplement the insurer's own evaluation and pricing, reducing uncertainty about the risk. Third, when markets are segmented, the insurer can earn arbitrage profits. Segmentation can be driven by reinsurers who have more expertise or better diversification, permitting them to have better pricing. However, reinsurers can have a cost advantage for other reasons, including lower taxes and/or regulatory costs, as well as a greater risk appetite.[vi]

One particular form of reinsurance is captive reinsurance, where an insurance company purchases reinsurance from an affiliate, reducing the cost of regulation of the insurer. In particular, captives are subject to different accounting rules which facilitate lower reserves, do not face regulatory capital requirements, do no face restrictions on assets which permit greater risk and less liquidity, face weaker transparency requirements which limit market and regulatory discipline, and unlike insurance companies are able to back reinsurance with low cost letters of credit or parental guarantees instead of more expensive capital. In a typical captive insurance arrangement, risk is simply transferred from the insurance company to the parent, which reduces the insurance company's regulatory capital requirements. The arrangement permits the consolidated organization to evade binding regulatory capital requirements, and instead face market capital requirements by investors and credit rating agencies on the parent. Note that insurance company regulators do have the authority to reject transactions with a captive, but typically approve as they are focused on regulation of the insurance company, not the broader holding company, and these transactions reduce risk in the regulated entity. Insurance companies argue that captive insurance is used to reduce the cost of excessively conservative regulation, which require them to hold reserves above the actuarial risk of their insurance policies. Moreover, captive reinsurance helps to protect the insurance company from the capital market volatility of variable-rate annuities. As the insurer provides a guaranty on the principal value of these investments, they are required to increase reserves when the market value of those investments declines in value, which reduces earnings and capital of the insurance company. The use of a captive insurance reduces volatility in regulatory capital ratios of the regulated entity.[vii]

Life insurers' reinsurance to captives has grown significantly in recent years, from $130 billion in 2006 to an estimated $394 billion in 2012, and this growth is starting to attract attention of regulators. The New York State Department of Financial Services recently issued a report (June 2013) highlighting findings from a reinsurance captives.[viii] The regulators have referred to the activity as "shadow insurance," noting broader financial stability concerns, and calling for a moratorium on new activity. In the report, the regulators note significant volume of activity, significant reductions in regulatory capital ratios, inconsistent and incomplete disclosure to the market and regulators, and evidence of a regulatory race to the bottom. NYS is working on disclosure requirements for captives of New York based insurers and their affiliates, is pressing the National Association of Insurance Commissioners to develop enhanced disclosure requirements for all jurisdictions, has called for the Federal Insurance Office to conduct

similar investigations in order to help understand the aggregate picture across states, and finally has called for an immediate national moratorium on approvals of shadow insurance transactions until investigations are complete.

e. Leveraged Finance

Loans to firms with non-investment grade credit ratings are generally referred to as leveraged lending, and include two broad loan purposes. The first is regular corporate lending, including the funding of capital expenditures and working capital. The second is event-driven financing, for example to fund a leveraged buyouts of a publicly-traded company by a private equity firm. Leveraged loans are typically structured as five to seven year floating-rate balloon loans with limited amortization, which makes their performance highly dependent on refinancing conditions and the state of equity markets. Defaults on leveraged lending are highly sensitive to the macroeconomic conditions, varying at an annual rate from as low as 1 percent to as high as 12 percent. However, recoveries on loans, which average 70 percent, are generally much higher than on bonds, which average 50 percent, given the seniority and collateral of the lender.

While leveraged lending collapsed in 2008 from a peak of $680 billion in 2007, it has rebounded very quickly, and is now at record levels of volume, projected to be larger than $1 trillion in 2013. However, as of this writing, the total amount of leveraged loans outstanding has remained flat since 2007, suggesting that the flow is largely related to refinancing of loans, in part due to lower interest rates, but also due to maturities. The level of overall LBO activity in the economy has remained muted, and there has been very little leveraged lending to support new LBOs. Credit metrics of LBOs have not deteriorated, with average Debt-to-EBITA and EBITA-to-debt service within historical norms.

One area of concern, however, is the significant increase in the fraction of covenant lite loans, which have increased dramatically from 0 percent in 2010 to 60 percent in 2013. This deterioration in loan underwriting has come hand-in-hand with an increased presence of retail investors in the leveraged loan market, through both CLOs and prime funds, as relatively sophisticated investors, like banks and hedge funds, are exiting the asset class. The funding of long-term opaque and risky loans through mutual funds and exchange-traded funds, which engage in liquidity and maturity transformation, help to define this activity clearly as shadow credit intermediation.

Banking agencies have recently issued new regulatory guidance on leveraged lending through SR 13-03.[ix] This guidance provides specific guidance to examiners when criticizing leveraged lending, including standards for underwriting of specific loans, as well as overall risk management. The underwriting guidelines will raise scrutiny in the face of excessive leverage, limited amortization, and over-reliance on refinancing. Importantly, these underwriting standards apply both to loans intended for distribution as well as for the bank's own portfolio. Guidance related to risk management requires institutions to have a clearly articulated risk appetite, limits for pipeline and commitments, as well as for the aggregate book and individual borrower concentration. Banks must stress test both the pipeline and retained portfolio, and hold adequate capital against all positions.

f. Tri-party Repo

A repurchase agreement (repo) is the sale of securities together with an agreement that the seller will buy back the securities at a later date. Most repo contracts are short term—between one and 90 days—although there are repos with much longer maturities. Repos are over-collateralized, and the difference between the value of the collateral and the sale price is called the repo haircut. In addition, the repurchase price is greater than the sale price, the difference constituting the repo rate, which is, in economic terms, an interest rate on a collateralized loan. In a repo transaction, the party buying the collateral acts as a lender.

The distinguishing feature of a tri-party repo is that a clearing bank acts as an intermediary between the two parties to the repo. The clearing bank is responsible for the administration of the transaction, including collateral allocation, marking to market, and substitution of collateral. The tri-party structure ensures that both the borrower and the lender are protected against the default of the other, as the collateral resides with a third party. The U.S. tri-party repo market represents a major source of funding for security broker-dealers. The market peaked at slightly above $2.8 trillion in 2008 and is currently slightly below $1.7 trillion.

Investors in tri-party repo are primarily money market mutual funds and other cash-rich investors such as corporate treasury functions, while the borrowers are large securities dealers with inventories of securities to finance. Clearing banks unwind these trades each afternoon and return the cash to the investors. But because the dealers retain a portfolio of securities that need financing on a 24-hour basis, they must extend credit to the other dealers against these securities for several hours between that afternoon unwind and the settlement of new repos in the early evening. That way, those dealers can repay their investors and avoid defaulting on the obligations.

Since the enactment of the Bankruptcy Amendments and Federal Judgeship Act of 1984, repos on Treasury, federal agency securities, bank certificates of deposits, and bankers' acceptances have been exempted from the automatic stay in bankruptcy. The bankruptcy exemption ensures the liquidity of the repo market by assuring lenders that they would get speedy access to their collateral in the event of a dealer default. In 2005, the safe harbor provision was expanded to repos written on broader collateral classes, including certain mortgage-backed securities. This broadening of acceptable collateral for the exemption from the automatic stay for repos allowed the repo market to fund credit collateral—and thus directly fund the shadow banking system.

It should be noted that the tri-party repo market is only a subset of other repo and short-term, collateralized borrowing markets. While broker-dealers conduct their funding primarily in the tri-party repo market, their lending occurs mainly in DVP (delivery versus payment) repo or GCF (general collateral finance) repo. In contrast to a tri-party repo, DVP repos are bilateral transactions that are not settled on the books of the clearing banks. Instead, settlement typically occurs when the borrower delivers the securities to the lender. Adrian, Begalle, Copeland, and Martin (2013) discuss various forms of repo and securities lending.

Copeland, Martin, and Walker (2011) document the collateral composition in the tri-party market, as well as the repo market conventions, using data from July 2008 to early 2010. They show that, during this period, several hundred billion dollars of collateral in the tri-party repo market consisted of collateral such as equities, private-label ABS, and corporate credit securities without any eligibility for public sources of liquidity or credit backstops. Krishnamurthy, Nagel, and Orlov (2011) complement this finding by looking directly at the collateral of MMMFs. While they find that the majority of the $3.5 trillion MMMFs' collateral is of high quality, they do document several hundred billion dollars of private-label ABS securities funded by MMMFs. However, the overall amount of private-label ABS funded in the repo market by MMMFs is less than 3 percent of total outstanding.

g. Money Market Funds

Money market mutual funds are open-ended mutual funds that invest in short-term securities such as Treasury bills, commercial paper (including ABCP), and repo. MMMFs were first created in 1971 in response to Regulation Q, which restricted the interest that commercial banks can pay on deposits. Since then, money market funds have represented an alternative to bank deposits from investors' point of view, with yields that are typically more attractive than bank deposits. The money market sector peaked at around $3.5 trillion in 2008. MMMFs are regulated by the SEC under the Investment Company Act of 1940.

Money market funds seek a stable net asset value (NAV), which is generally $1.00, meaning that they aim never to lose money. If a fund's NAV drops below $1.00, it is said to "break the buck." In September 2008, the day following the Lehman Brothers bankruptcy, the Reserve Primary Fund broke the buck and triggered a run on MMMFs. Other fund managers reacted by selling assets and investing at only the shortest of maturities or by reallocating to Treasury bills, thereby exacerbating the funding difficulties for other instruments such as commercial paper and repo.

Wermers (2011) investigates in more detail the role of investment flows into and out of money market mutual funds, focusing particularly on the period of the financial crisis. Wermers shows that institutional investors were more likely to run than retail investors, and institutional investors tended to spread such run behavior across various MMMF families. Institutional MMMF investors can thus be viewed as a transmission channel for contagious runs. Kacperczyk and Schnabl (2011) analyze the impact of the organizational structure of MMMFs on their risk-taking behavior. In particular, they ask how the risk-taking differs between stand-alone funds and the funds that are owned by larger holding companies, such a bank holding companies. Kacperczyk and Schnabl find significant differences in the risk-taking of stand-alone MMMFs relative to the funds that have implicit guarantees from financial conglomerates. During the financial crisis of 2008, when systemic risk increased and conglomerates became relatively more exposed to systemic risk, stand-alone mutual funds increased their risk-taking behavior relatively more. Conversely, in the run-up to the crisis, when measured systemic risk was low, MMMFs that were part of conglomerates took on relatively more risk.

h. Chinese Shadow Banking

While shadow credit intermediation in the United States and Europe has been contracting since the onset of the recent global financial crisis in 2007, one area were shadow banking has been growing significantly is in China. In response to rapid growth in bank credit and concerns about inflation, the Chinese government put in place significant restrictions in 2010 on the traditional banking system through higher interest rates, tougher reserve requirements, and more conservative credit quotas. Combined with reductions on the maximum permitted LTV on second home purchases, the intervention had a significant impact in slowing the growth rate of credit on bank balance sheets. However, it did not take long for the banking system to find ways to continue to originate credit off balance sheet. In particular, while bank credit growth has slowed from a peak of 35 percent in 2010 to 15 percent in recent years, the slowdown in total financing, including off-balance sheet credit, has been less, falling to only 20 percent.

The difference is largely off-balance sheet lending by banks, which is broken into three large components. First, there are trust loans. Here, bank loans are sold into trust companies, which in turn sell wealth management products to retail depositors. Banks earn fees on the origination of loans and management of these products, but since they are off balance sheet, they do not have to hold capital against them. While some of these products have principal guaranteed balances, most do not, and instead benefit from perception of implicit support by the banks, and in turn by the official sector. Consequently this activity appears to fall squarely within the definition of shadow banking outlined above. Second, there are undiscounted banker's acceptances. These instruments are obligations of a bank customer to pay a third party on a future date which are guaranteed by the bank, like a post-dated check. The third party can redeem this acceptance with the bank for a discount to its face value, at which point the bank needs to advance funds not yet advanced to it by the original customer, effectively extending credit to that customer. To protect itself from the risk of customer default, the bank requires cash collateral from the customer in the form of deposits. In the end, undiscounted acceptances are contingent liabilities of the bank, while discounted liabilities are extensions of credit. However, only the latter are subject to capital requirements and count towards loan quota, making this activity shadow credit intermediation. Finally, there are entrusted loans. These are loans originated by non-banks, but sold to trust companies, and serviced by banks. Banks which are restricted by loan quotas can also use entrusted loans to continue origination but fund off balance sheet. Consequently, banks have increased their ownership stakes in trust companies to facilitate this distribution channel.

The rise of shadow credit intermediation in China thus seems less the result of financial innovation and more driven by the response of the regulated sector to heightened restrictions to traditional intermediation activity, in an environment no less where official monitoring is still in early stages of development. Chinese shadow banking also seems to have a more local nature than what was observed in the years prior to the financial crisis. This is not to imply that disruptions to Chinese intermediation infrastructure would not generate global ripple effects, but it does suggest different implications regarding global monitoring and regulation. For instance, containment of potential global propagation of shocks in this instance might be better addressed through enhanced monitoring of activities of the largest Chinese financial intermediaries. This would be achieved applying the current methodologies for

the identification of global, systemically important financial institutions. Such methodologies have been developed for the identification of global systemically important banks (G-SIBs) and for insurance companies (G-SIIs) and it is work in progress at the time of publication of this Handbook for other type of institutions.[x]

7. Conclusion

In this chapter, we have provided for definition of shadow credit intermediation, and provided an overview of a recent attempt by the FSB to measure it. We have drawn on existing literature to explain motivations for this activity, which include specialization, innovation in the composition of money, and regulatory arbitrage. We review literature on the role of banks in shadow banking, then explore reasons why academics and regulators should care. These include regulatory arbitrage, neglected risks, funding fragilities, leverage cycles, and agency problems. Finally, we provide an overview of recent developments in shadow credit markets: Agency mortgage REITS, reinsurance, tri-party repo, money market mutual funds, and shadow banking in China.

Literature

Acharya V, Schnabl P, Suarez G. 2010. Securitization Without Risk Transfer. NBER Working Paper 15730.

Acharya V, Richardson M, Nieuwerburgh SV, White LJ. 2011. Guaranteed to Fail: Fannie Mae, Freddie Mac, and the Debacle of Mortgage Finance. Princeton University Press.

Adrian T, Ashcraft AB. 2012a. Shadow Bank Regulation. *Annual Review of Financial Economics*. Vol. 4, pp. 99-140.

Adrian T, Ashcraft AB. 2012b. Shadow Banking: A Review of the Literature. *Palgrave Dictionary of Economics*, 2012.

Adrian T, N Boyarchenko. 2012. Intermediary Leverage Cycles and Financial Stability. *Federal Reserve Bank of New York Staff Reports* 567.

Adrian T, Begalle B, Copeland A, Martin A. 2013. Repo and Securities Lending. In *Quantifying Systemic Risk Measurement: NBER Research Conference Report Series*, ed. JG Haubrich, AW Lo. University of Chicago Press. Forthcoming.

Adrian T, Burke C, McAndrews J. 2009. The Federal Reserve's Primary Dealer Credit Facility. Federal Reserve Bank of New York *Current Issues in Economics and Finance* 15(4):1—12.

Adrian T, Fleming M. 2005. What Financing Data Reveal About Dealer Leverage. Federal Reserve Bank of New York *Current Issues in Economics and Finance* 11(3):1—7.

Adrian T, Moench E, Shin HS. 2009. Financial Intermediation, Asset Prices, and Macroeconomic Dynamics. Federal Reserve Bank of New York *Staff Report* 422.

Adrian T, Kimbrough K, Marchioni D. 2011. The Federal Reserve's Commercial Paper Funding Facility. Federal Reserve Bank of New York *Economic Policy Review* 17(1):25—39.

Adrian T, Shin HS. 2009. The Shadow Banking System: Implications for Financial Regulation. *Banque de France Financial Stability Review* 13:1–10.

Adrian T, Shin HS. 2010a. Liquidity and Leverage. *Journal of Financial Intermediation* 19(3):418–37.

Armantier O, Krieger S, McAndrews J. 2008. The Federal Reserve's Term Auction Facility. Federal Reserve Bank of New York *Current Issues in Economics and Finance* 14(5).

Ashcraft A, Goldsmith-Pinkham P, Hull P, Vickery J. 2011. Credit Ratings and Security Prices in the Subprime MBS Market. *American Economic Review* 101(3):115–19

Ashcraft AB, Schuermann T. 2008. Understanding the Securitization of Subprime Mortgage Credit. *Foundations and Trends in Finance* 2(3):191—309.

Ashcraft AB, Malz A, Pozsar Z. 2012. The Federal Reserve's Term Asset-Backed Securities Loan Facility. Federal Reserve Bank of New York *Economic Policy Review*. Forthcoming.

Avraham D, Selvaggi P, Vickery J. 2012. A Structural View of Bank Holding Companies. Federal Reserve Bank of New York *Economic Policy Review* 18(2):65—82.

Bord, V, Santos JC. 2012. The Rise of the Originate-to-Distribute Model and the Role of Banks in Financial Intermediation. Federal Reserve Bank of New York *Economic Policy Review* 18(2):21—34.

Brunnermeier, MK , LH Pedersen. 2009. Market Liquidity and Funding Liquidity. *Review of Financial Studies* 22(6):2201—2238.

Brunnermeier, MK, Y Sannikov. 2012. A Macroeconomic Model with a Financial Sector. Working Paper. Princeton University.

Cetorelli N. 2012. A Principle for Forward-Looking Monitoring of Financial Intermediation: Follow the Banks! Federal Reserve Bank of New York *Liberty Street Economics Blog*, July 23, 2012.

Cetorelli, N., McAndrews J. and Traina J. Forthcoming, Evolution in Bank Complexity. Federal Reserve Bank of New York *Economic Policy Review*.

Cetorelli N, Peristiani S. 2012. The Role of Banks in Asset Securitization. Federal Reserve Bank of New York *Economic Policy Review* 18(2):47—64.

Cohen A. 2011. Rating shopping in the CMBS market. Presented at Regulation of Systemic Risk, Washington, DC, Sep. 15—16.

Copeland A, Martin A, Walker M. 2011. Repo Runs: Evidence from the Tri-party Repo Market. Federal Reserve Bank of New York *Staff Report* 506.

Copeland A. 2012. Evolution and Heterogeneity among Larger Bank Holding Companies: 1994 to 2010. Federal Reserve Bank of New York *Economic Policy Review* 18(2), pp. 83—93.

Coval J, Jurek J, Stafford E. 2009. The Economics of Structured Finance. *Journal of Economic Perspectives* 23(1):3—25.

Covitz D, Liang N, Suarez G. 2012. The Evolution of a Financial Crisis: Panic in the Asset-backed Commercial Paper Market. *Journal of Finance*. Forthcoming

Dang TV, Gorton G, Holmström B. 2009. Opacity and the Optimality of Debt for Liquidity Provision. Yale/MIT Working Paper.

Diamond D, Dybvig P. 1983. Bank Runs, Deposit Insurance, and Liquidity. *Journal of Political Economy* 91:401–19.

Duffie, D. 2012. Market Making Under the Proposed Volcker Rule. Working Paper. Stanford University.

Fiaschi, D; Kondor, I; and Marsili, M. 2013. The Interrupted Power Law and the Size of Shadow Banking. Unpublished manuscript.

Financial Accounting Standards Board. 2012. Briefing Document: FASB Statement 166 and 167.

Financial Stability Board. 2011. Shadow Banking: Strengthening Oversight and Regulation.

Financial Stability Board. 2012. Progress Report to the G20 on Strengthening the Oversight and Regulation of Shadow Banking.

Flannery, Kwan, and Nimalendran (2002)

Fleming, M, Hrung WB, and Keane FM. 2010. Repo Market Effects of the Term Securities Lending Facility. *American Economic Review: Papers and Proceedings* 100, pp. 591—6.

Fostel A, Geanakoplos J. 2008. Leverage Cycles and the Anxious Economy. *American Economic Review* 98(4), 1211—1244.

Frame WS and White LJ. 2005. Fussing and Fuming over Fannie and Freddie: How Much Smoke, How Much Fire? *Journal of Economic Perspectives* 19(2), 159—184.

Gallin, J. 2013. Shadow Banking and the Funding of the Nonfinancial Sector. Federal Reserve Board Finance and Economics Discussion Series 2013-50.

Garleanu N, LH Pedersen. 2011. Margin-Based Asset Pricing and Deviations from the Law of One Price, *Review of Financial Studies*, 24(6), 1980—2022.

Gennaioli, N, Shleifer A, and Vishny R. 2012a. Neglected Risks, Financial Innovation, and Financial Fragility. *Journal of Financial Economics.* Forthcoming.

Gennaioli N, Shleifer A, Vishny R. 2012b. A Model of Shadow Banking. *Journal of Finance*. Forthcoming.

Gorton G. 1985. Clearinghouses and the Origin of Central Banking in the United States. *Journal of Economic History* 4(2) pp. 277-283.

Gorton G, Metrick A. 2011. Regulating the Shadow Banking System. Brookings Paper on Economic Activity 261—312.

Gorton G, Metrick A. 2012. Securitized Banking and the Run on Repo. *Journal of Financial Economics* 104:425—51.

Holmström B, Tirole J. 1998. Private and Public Supply of Liquidity. *Journal of Political Economy* 106(1), pp. 1-40.

International Institute of Finance. 2012. Shadow Banking: A Forward-Looking Framework for Effective Policy.

Jaremski M. 2010. Free Bank Failures: Risky Bonds Versus Undiversified Portfolios. *Journal of Money, Credit, and Banking* 42(8), pp. 1565—1587.

Kacperczyk M, Schnabl P. 2011. Does Organizational Form Affect Risk Taking? Evidence from Money Market Mutual Funds. New York University Working Paper.

Kashyap, Rajan, and Stein (2002)

Keys B, Mukherjee T, Seru A, Vig V. 2010. Did Securitization Lead to Lax Screening? Evidence from Subprime Loans. *Quarterly Journal of Economics* 125(1), pp. 307—62.

Krishnamurthy A, Nagel S, Orlov D. 2011. Sizing Up Repo. NBER/CEPR/Stanford/Northwest Working Paper.

Levitin A, Wachter S. 2011. Explaining the Housing Bubble. Research Paper 10-15, Institute for Law and Economics, University of Pennsylvania.

Mandel B, Morgan D, Wei C. 2012. The Role of Bank Credit Enhancements in Securitization. Federal Reserve Bank of New York *Economic Policy Review* 18(2), pp. 35—46.

Martin A, Skeie D, von Thadden E. 2011. Repo Runs. Federal Reserve Bank of New York *Staff Report* 444.

Mathis J, McAndrews J, Rochet JC. 2009. Rating the raters: Are reputation concerns powerful enough to discipline rating agencies? *Journal of Monetary Economics* 57(5):657—74.

McCabe P. 2011. An A-/B-share capital buffer proposal for money market funds. Working Paper.

McCabe PE, Cipriani M, Holscher M, Martin A. 2012. The Minimum Balance at Risk: A Proposal to Mitigate the Systemic Risks Posed by Money Market Funds. Federal Reserve Bank of New York *Staff Report* 564.

McCulley, P. 2007. Teton Reflections. *PIMCO Global Central Bank Focus*.

Meeks R, Nelson B, Alessandri P. 2012. Shadow banks and macroeconomic instability. *Bank of England Working Paper*.

Merton RC. 1977. An Analytical Derivation of the Cost of Deposit Insurance and Loan Guarantees. *Journal of Banking and Finance* 1, pp.3—11.

Merton RC, Bodie Z. 1993. Deposit Insurance Reform: A Functional Approach. Carnegie-Rochester Conference Series Public Policy 38, pp. 1—34.

Moreira, A, A Savov. 2013. The Macroeconomics of Shadow Banking. *Yale University Working Paper*.

Passmore W, Sherlund SM, Burgess G. 2005. The Effect of Housing Government-Sponsored Enterprises on Mortgage Rates. *Real Estate Economics* 33(3), pp. 427–463.

Pozsar, Zoltan. 2008. The Rise and Fall of the Shadow Banking System.

Pozsar Z, Adrian T, Ashcraft AB, Boesky H. 2010. Shadow Banking. Federal Reserve Bank of New York *Staff Report* 458.

Rajan R. 2005. Has Financial Development Made the World Riskier? Proceedings of the Federal Reserve Bank of Kansas City Economics Symposium, pp. 313—69.

Ricks, M. 2010. Shadow Banking and Financial Regulation. Columbia Law and Economics Working Paper 370.

Rockoff, H. 1991. "Lessons from the American Experience with Free Banking" in Unregulated Banking: Chaos or Order?" edited by Forrest Capie and Geofrey Wood. London: Macmillan Academic and Professional.

Schwarcz, S. 2012. Regulating Shadow Banking. Boston University *Review of Banking and Financial Law*.

Squam Lake Group. 2011. Reforming Money Market Funds. Squam Lake Group Staff Report.

Stein J. 2010. Securitization, Shadow Banking, and Financial Fragility. *Daedalus* 139(4), pp.41—51.

Sunderam A. 2012. Money Creation and the Shadow Banking System. Harvard Business School Working Paper.

Tucker P. 2010. Shadow banking, financing markets and financial stability. Remarks by Mr Paul Tucker, Deputy Governor for Financial Stability at the Bank of England, at a Bernie Gerald Cantor (BGC) Partners Seminar, London, 21 January 2010.

Wermers R. 2011. Runs on Money Market Mutual Funds. University of Maryland Working Paper.

Wiggers T, Ashcraft AB. 2012. Defaults and Losses on Commercial Real Estate Bonds during the Great Depression Era. Federal Reserve Bank of New York *Staff Report* 544.

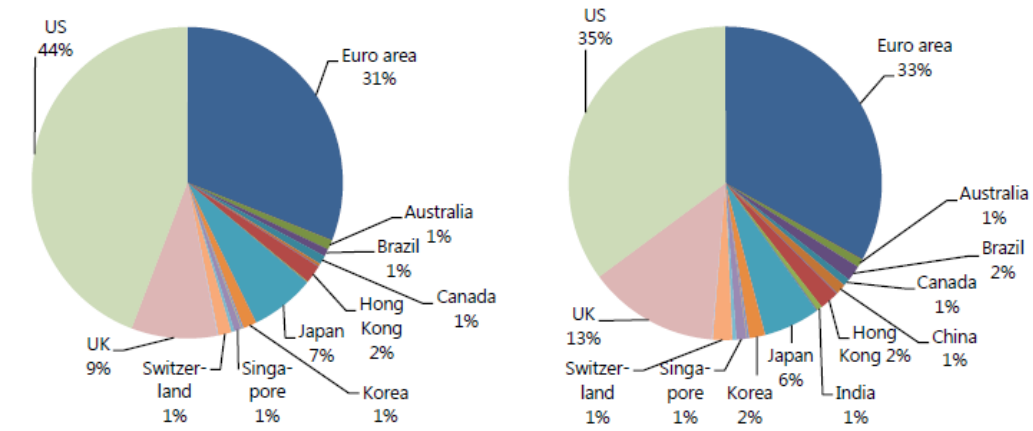
Xia H, Strobl G. 2012. The Issuer-Pays Rating Model and Ratings Inflation: Evidence from Corporate Credit Ratings.

Figures and Tables

Figure 1

Share of assets of non-bank financial intermediaries

20 jurisdictions and euro area — Exhibit 2-4

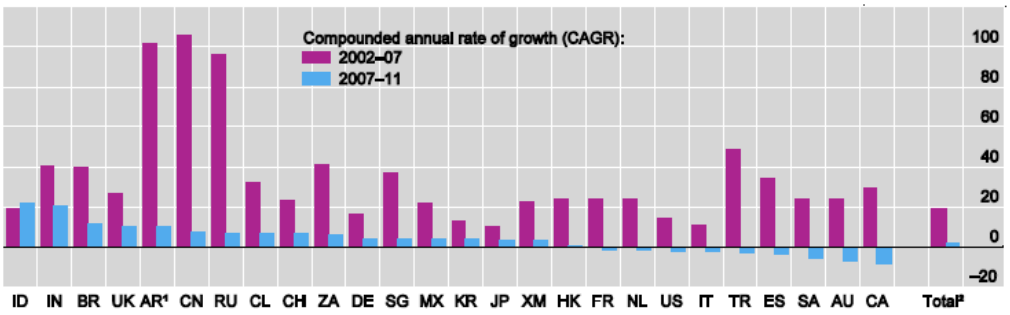


Source: National flow of funds data.

Figure 2

Average annual growth of OFI sector pre- and post-crisis

By jurisdiction, in per cent — Exhibit 3-3

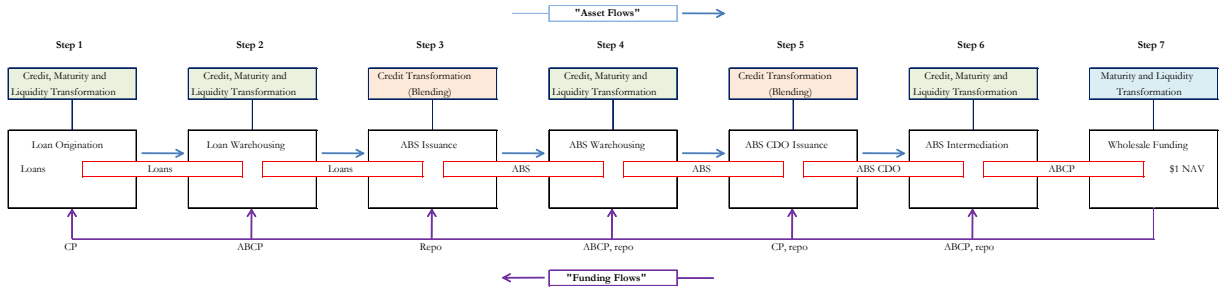


AR = Argentina; AU = Australia; BR = Brazil; CA = Canada; CH = Switzerland; CL = Chile; CN = China; DE = Germany; ES = Spain; FR = France; HK = Hong Kong; ID = Indonesia; IN = India; IT = Italy; JP = Japan; KR = Korea; MX = Mexico; NL = Netherlands; RU = Russia; SA = Saudi Arabia; SG = Singapore; TR = Turkey; UK = United Kingdom; US = United States; XM = Euro area; ZA = South Africa.

[1] The unusually high growth rate over the period 2002–2007 for Argentina (101% per year) reflects the strong recovery after the very deep financial crisis that affected the Argentine economy in 2001–2002, and is therefore not comparable with other countries. Besides this, the aforementioned variation is affected by the inclusion of intermediaries with incomplete information for the entire reference period. Considering only those intermediaries, among OFIs, with complete information for the entire 2002–2007 period, the average annual change goes down from 101% to 67%. [2] 20 jurisdictions plus euro area.

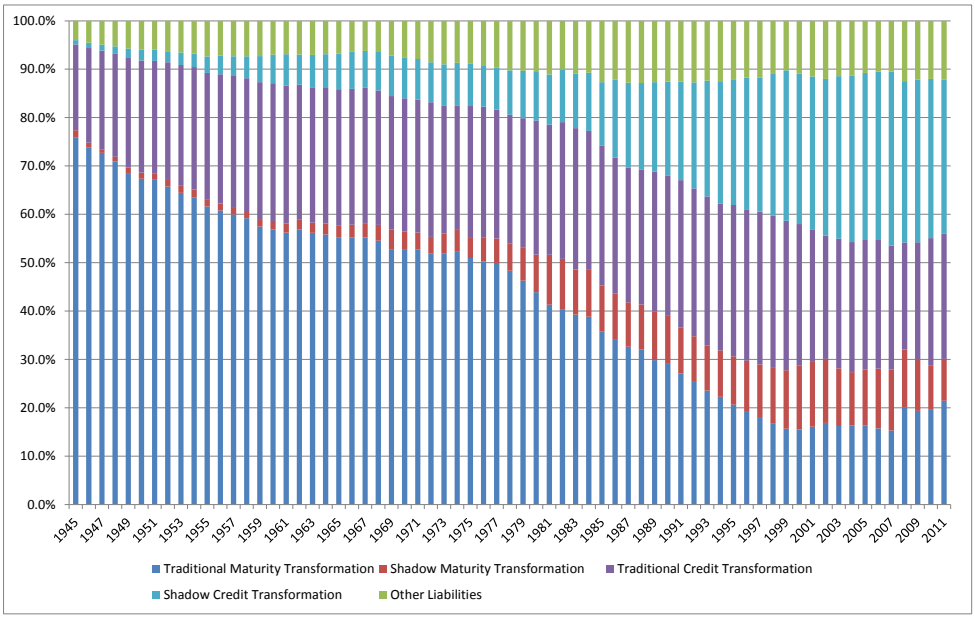
Source: National flow of funds data.

Figure 3



Source: Pozsar, Adrian, Ashcraft, and Boesky (2010)

Figure 4



Source: Federal Reserve Flow of Funds, Tables L107 and L212. Traditional maturity transformation includes net interbank liabilities (line 28) plus checkable (line 29) and savings (line 30) deposits of depository institutions. Traditional credit transformation includes reserves of life insurance companies (line 43) and pensions (line 44) plus corporate debt issued by banks and holding companies plus loans from depository institutions NEC (line 37). The latter is calculated by subtracting from total corporate debt (line 36) the amount issued by holding companies (line 10) and banks (line 5) from L212. Shadow maturity transformation includes from L107 MMMFs (line 31), repo (line 32), commercial paper (line 34), and security broker-dealer credit (line 41) and payables (line 42). Shadow credit transformation includes GSEs (line 35), REITs (line 39), mutual fund shares (line 40), and other loans (line 38).

Figure 5

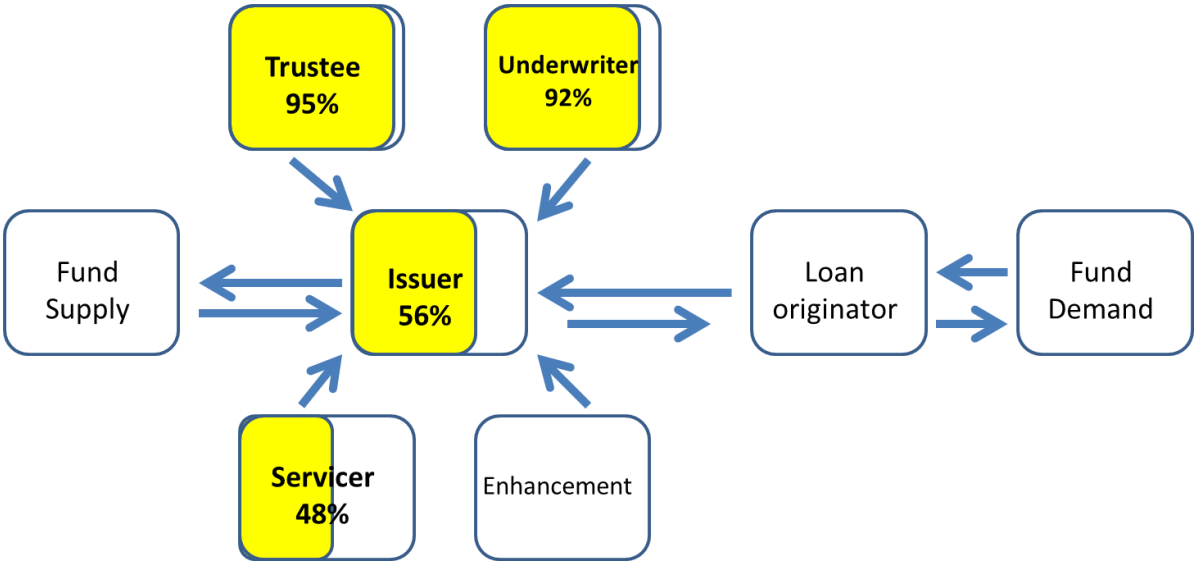


Figure 6

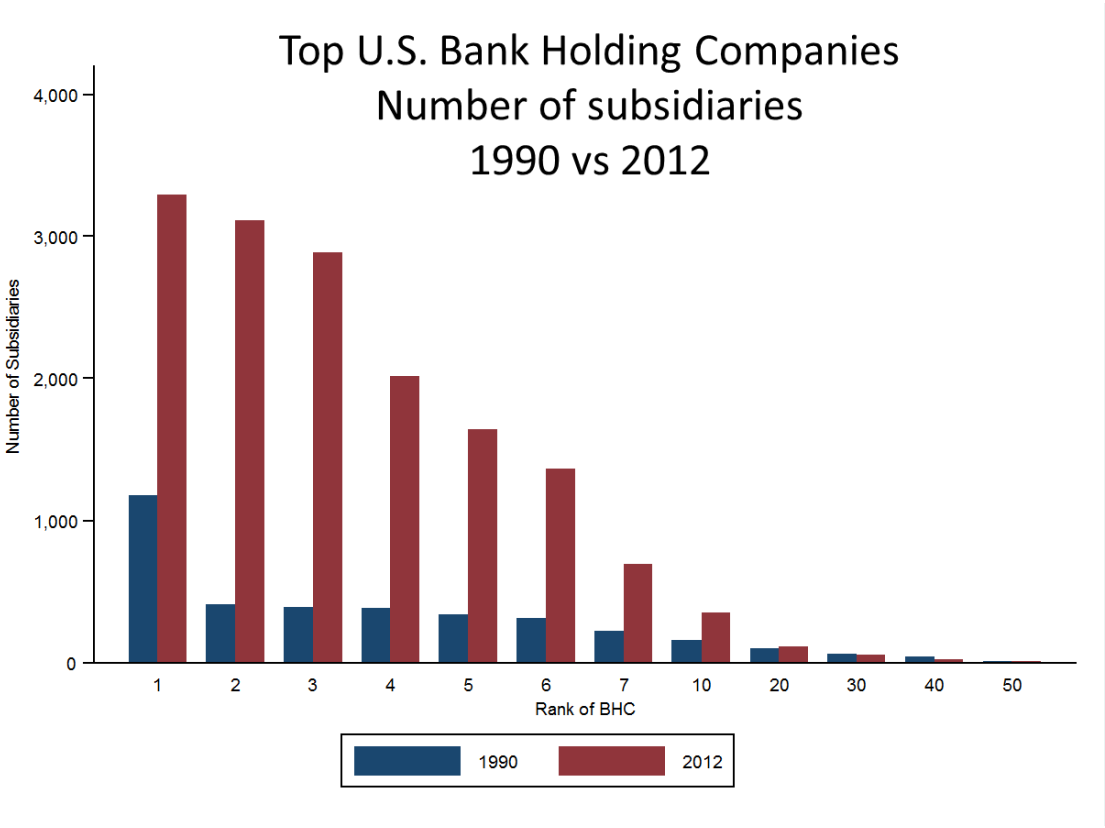


Table 1

Consolidation dynamics in the U.S. financial industry, 1983-2012

Target / Buyer	Asset Manager	Bank	Broker-Dealer	Finance Tech	Insure Broker	Insure Uwriter	Invest Co	Real Estate	Savings/ Thrift	Special Lender	Total	On Diagonal	Off Diagonal
Asset Manager	459	2	38	110	27	24	6	17	1	51	735	459	276
Bank	518	6067	291	164	759	38	3	1	1304	664	9809	6067	3742
Broker-Dealer	127	6	613	78	59	9	4	9	6	42	953	613	340
Finance Tech	13	2	23	1123	60	8	0	0	0	13	1242	1123	119
Insure Broker	31	4	12	35	1760	20	0	0	1	6	1869	1760	109
Insure Uwriter	138	14	55	126	533	1451	0	4	18	54	2393	1451	942
Invest Co	19	2	4	4	4	2	11	4	1	42	93	11	82
Real Estate	3	1	3	0	0	1	0	111	1	12	132	111	21
Savings/Thrift	45	359	28	8	114	21	0	2	704	140	1421	704	717
Special Lender	10	19	26	20	11	5	3	2	21	771	888	771	117
Total	1363	6476	1093	1668	3327	1579	27	150	2057	1795	19535	19535	19535
On Diagonal	459	6067	613	1123	1760	1451	11	111	704	771	13070		
Off Diagonal	904	409	480	545	1567	128	16	39	1353	1024	6465		

[i] This class of liabilities includes insured deposits and guaranteed amounts of insurance contracts, mortgage-backed securities issued by Ginnie Mae, as well as coin and currency in circulation. This definition clearly excludes liabilities which benefit from implicit official sector support, like the liabilities of the Government Sponsored Enterprises or Federal Home Loan Banks. It also excludes liabilities which do not benefit from explicit or implicit support, like corporate bonds or private-sector bond insurance.

[ii] This class of liabilities includes uninsured deposits and trading liabilities of depository institutions. While these activities are associated with fragility, they are subject to capital and liquidity regulation, and the holders of those liabilities benefit from the institution's access to contingent official liquidity, reducing the scope for runs. This second standard clearly excludes securitization or asset management activities sponsored by institutions with access to the lender of last resort which is not consolidated onto their balance sheet. It also excludes liabilities issued by non-bank finance companies, which do not benefit from access to the lender of last resort.

[iii] A different approach is taken by Fiaschi et al. (2013), estimating the size of the shadow banking system using differences in the size of the financial sector and that predicted by a power law.

[iv] This view is reinforced through work by Mandel, Morgan, and Wei (2012), suggesting that traditional banks were also intimately involved in shadow credit intermediation activity through the provision of credit enhancements to securitization trusts.

[v] Copeland (2012) shows that these shadow banking activities of bank holding companies have been increasing over time and represent a quantitatively important share of the holding companies' total earnings.

[vi] Wikipedia entry for "Reinsurance"

[vii] Julia Gouny and Robert McMenamin: "Life Insurers use Captive Reinsurance for Regulatory Arbitrage," Marketsource, 3 July 2013.

[viii] http://www.dfs.ny.gov/reportpub/shadow_insurance_report_2013.pdf

[ix] http://www.federalreserve.gov/bankinforeg/srletters/sr1303.htm

[x] See http://www.bis.org/publ/bcbs207.pdf for G-SIBs and www.iaisweb.org/view/element_href.cfm?src=1/15384.pdf for G-SIIs.