

Production of Financial Services in the U.S. Economy: Completing the Picture of Credit Intermediation

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PRODUCTION OF FINANCIAL SERVICES IN THE U.S. ECONOMY: COMPLETING THE PICTURE OF CREDIT INTERMEDIATION

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In traditional credit intermediation, commercial banks and savings institutions use funding from deposits to make loans. Although this type of credit intermediation remains important, the organization of credit intermediation activities in the United States has changed dramatically since the 1970s, a time when the predecessors of today's savings institutions were known as "savings and loan associations."

Between the mid-1970s and the mid-2000s, credit intermediation shifted away from commercial banks and similar deposit-taking institutions towards less regulated financial intermediaries that do not benefit from the government and monetary authority protections backstopping depository institutions. The new intermediaries obtained funding from wholesale sources rather than deposits, and deposits, which were five times larger than credit market liabilities of nondepository financial institutions in the mid-1970s, fell in relative size to less than half as large as credit market liabilities of nondepository financial institutions by the mid-2000s. On the asset side, mortgages and loans were increasingly placed into pools that were used to create securities that benefitted from credit enhancements and that were structured to provide features desired by investors. By 2007, these types of the activities had become important enough that the intermediaries engaged in them (sometimes together with institutions engaged in credit derivatives transactions) came to be called the "shadow banking system" (Pozsar *et al.*, 2010 and 2013).

The migration of credit intermediation activity from traditional banking to shadow banking generated conditions that made a financial crisis possible, and a run on the shadow banking system played a central role in the financial crisis of 2007-2008 (Gorton and Metrick, 2012). The growth and relative size of the shadow banking sector are thus important research questions. Previous research, such as Pozsar *et al.*, (2010, 2013), Gorton, Lewellan and Metrick (2012) and Gallin (2013), has measured the size of the shadow banking system from its balance sheet.

To understand the importance of nonbank intermediaries to economic activity requires, however, a measure of the size of their output. In this paper we apply the approach used to measure the output of credit intermediation services of commercial banks in the U.S. National Income and Product Accounts (NIPAs) to determine the output of the nondepository credit intermediaries that make up the shadow banking sector. Our approach to defining shadow banking uses the Federal Reserve's Financial Accounts of the United States (or FAs) and is equivalent to that of

Gallin (2013). But by using output as our metric, we are able to provide insight into the sector's role in the recent cyclical behavior of the economy. In particular, we find that the shadow banking system made more important contributions to the recovery after the recession of 2001 and to the recession of 2007-2009 than would be evident from the balance sheet approach.

The finding that the output approach reveals the importance of the sector is consistent with some previous research on the shadow banking system. Ashcroft and Steindel (2008) measure the output from off-balance sheet MBSs and ABSs sponsored by commercial banks, while Greenwood and Scharfstein (2012) make a broader estimate of implicit output from all securitized mortgages and loans from 1980 to 2007. Greenwood and Scharfstein estimate that implicit output was miniscule in 1980, but equaled about 1 percent of GDP in 2007. We have a slightly narrower concept of output for securitized loans, so we get a slightly smaller estimate in that year. But our approach is comprehensive in that we cover all institutional sectors to the extent possible and find that services generated by the shadow banking system reached a peak of 1.43 percent of GDP in 2003 and stood at .81 percent of GDP in 2011.

The institutional sectors we consider are among those in the financial sector of the FAs, and thus a word about the nonfinancial business sector is in order. A complete picture of financial services output would consider whether corporate issuance of debt securities has substituted for business bank borrowing, creating a situation in which corporate treasury departments are generating self-produced financial services previously purchased from banks. Before 1991 the nonfinancial corporate sector obtained about 48 percent of its credit instrument funding by issuing bonds and commercial paper, but by 2003 this figure had reached almost 64 percent (table L.102 of the FAs) so such a situation is entirely possible. Credit intermediation performed by nonfinancial corporations largely takes place through finance company subsidiaries, and as these are recorded as a financial sector in the FAs, they are covered by the estimates reported herein. Other inter-business types of loans and credit (e.g., financial leasing) and other types financial services will not be included, however.

The paper has two basic sections: one reviews the approach, and the second reviews measurement, i.e., implementation of the approach. Because implementation occurs via institutional sector, we review the derivation of selected sectors—government sponsored enterprises (GSEs) and finance companies—to give a flavor of all that is involved. A technical appendix provides complete documentation. A third section concludes.

I. APPROACH

A. TRADITIONAL BANKING SERVICES

To gauge the relative size of the shadow banking sector, we first need to know how big the traditional banking sector is. In 2003 the US National Income and Product Accounts (NIPAs) adopted the user cost (or “reference rate”) approach to measure the implicitly-priced financial intermediation services that commercial banks provide to depositors and to borrowers (Fixler, Reinsdorf and Smith, 2003; Hood, 2013a). Under this approach the user cost for a loan is calculated as the interest rate paid by the borrower less a risk-free reference rate, and implicitly priced borrower services are measured by multiplying user cost of loans by loan balances.

The user cost of deposits equals the reference rate less that rate paid to depositors, and implicitly priced depositor services are measured as the user cost of deposits times the corresponding balances. The reference rate is based on rates that banks receive on their Treasury and Federal agency bonds and also market rates on Treasury bonds, and is now smoothed, as described in (Hood, 2013a, p. 12).

In 2013 the measure of implicitly priced borrower services of commercial banks was modified to take account of expected costs of credit losses (defaults). Expected default costs are estimated by loan type based on historical charge-off patterns. An adjustment for default costs is subtracted from the interest rate on loans, and the spread between the adjusted loan rate and the reference rate is used to measure implicit borrower services.

Besides commercial banks, depository institutions include savings institutions and credit unions. For these institutions, the NIPAs continue to use a simpler approach that includes no implicit borrower services. Under this approach, all of the institution’s net interest income is received by depositors and then used by them to purchase credit intermediation services. Techniques for measuring implicit borrower services of savings institutions and credit unions are, however, developed by Hood (2013b). We describe some details of this approach in the Technical Appendix.

Table 1 reports borrower and depositor intermediation services, including estimates for savings institutions and credit unions are based on the methods developed in Hood (2013b), for depository institutions. The sector’s cyclical behavior contributes to the recessions of 2001 and 2008-2009 and to the recovery in 2002-2003. As a share of GDP, the implicit output of depositor institutions has a downward trend from 1.95 percent of GDP in 1995 to 1.72 percent in 2009. Depositor services fall over the time period shown because falling interest rates were compressing margins earned on deposits.

B. SHADOW BANKING SERVICES

Borrower services

Our definition of shadow banking comprises transactions of nondepository credit intermediaries that are similar to, or close substitutes for, the credit intermediation activities of depository institutions. On the asset side, defining these transactions is relatively straightforward because the System of National Accounts (European Commission, *et al.*, 2009, paragraph 6.165) includes all loans made by nondepository financial institutions in its measure of implicit credit intermediation services.

A wide range of nondepository credit intermediaries engage in shadow bank lending. For example, the institutional sector for GSEs includes: Fannie Mae, Ginnie Mae and Freddie Mac, which pool and securitize home mortgages; the Federal Home Loan Banks, which provide advances (loans) to savings institutions and banks; the Farm Credit System; and formerly Sallie Mae. Other institutional sectors in the FAs that make or hold loans are GSE-backed pools, private issuers of asset-backed securities (ABS), finance companies, real estate investment trusts (REITs), securities brokers and dealers, bank holding company parents excluding their subsidiaries, and funding corporations.

We include trusts that hold pools of loans, and other similar vehicles for securitizing loans, in the shadow banking sector. The spread between the interest rate paid by the borrowers (adjusted for expected default costs) and the interest rate paid by the pool to the asset-backed security investors is used to calculate the implicitly priced borrower services produced by the pool.

The rate that the pool pays to the investors is likely to exceed a risk-free reference rate like the commercial bank reference rate. We do not include the margin between the interest rate paid to the investors in the pool and this reference rate in the calculations of the implicit output of the shadow banking sector because holding asset-backed securities does not make an investor become a shadow bank. An alternative approach would be to measure all the credit intermediation services associated with loans that have been securitized, including those produced by the investors holding the securities. In particular, Greenwood and Scharfstein (2012) use the commercial bank reference rate, so these services are included in their measure of implicit output from securitized loans. Whether to count these services in GDP could be a contentious issue, however, because in the SNA holders of debt securities generally do not produce credit intermediation services.

Depositor services

To define the shadow bank analog to the depositor services produced by traditional banks, we treat liabilities incurred through short-term and current credit instruments as substitutes for deposits. These instruments permit the creditor to obtain cash from the debtor promptly should a

need arise, so the creditor is obtaining liquidity and cash management services from the debtor in much the way as a depositor does. Gallin (2013) defines liabilities of the shadow banking sector to include credit instruments subject to runs during a panic, so his approach to defining shadow banking identifies the same set of liabilities that we do.

For convenience, we will refer to the implicit services furnished to providers of funds in connection with the short-term or current liabilities of the shadow banking sector as implicit depositor services. The types of instruments or liabilities that we include in calculating these services are commercial paper, repurchase agreements (repos), and customer credit balances with securities brokers and dealers. The SNA (11.59 and 17.254) includes short-term repurchase agreement liabilities of depository institutions in its measures of depositor services, and other deposit-like short-term instruments that are intended to yield spread income for a financial institution would also seem to qualify.¹ However, it excludes securities from its measures of financial intermediation services, so commercial paper could be viewed as excludable from a measure of these services in GDP.

Besides liabilities of nondepository institutions incurred through these instruments, we include money market mutual funds (MMMFs) as an institutional sector in measuring the depositor services of shadow banks. MMMFs invest in highly liquid assets with stable values because their shares are supposed to have a constant value and be continuously available for withdrawal, often just by writing a check, so we treat all of their financial assets as short-term. The margin between the reference rate and the rate paid on these assets is included in calculating depositor services of shadow banks (though not double counted if asset is as a liability of another shadow bank). We also include the MMMFs themselves as producers of depositor services because MMMFs are an important part of the shadow banking sector. Note, however, that the output of the MMMFs is included explicit (fee based) services in the NIPAs. Our measure of depositor services of shadow banks cannot, therefore, be interpreted as a measure of output of nondepository financial institutions that is currently missed by the NIPAs.²

Intermediation chains

Handling the intermediation chains created by shadow banks lending to each other is an important part of the measurement problem considered by Gallin (2013).³ Gallin's objective is

¹ The NIPAs include banks' repo liabilities in their measure of banks' implicit depositor services. Bank customers may put their money in repurchase agreements instead of deposits because the repos pay a higher yield or because the repos are safer than a deposit account that exceeds the deposit insurance maximum.

² The output of the MMMFs is relatively small, but some other services of shadow banks that are paid for by spread income may also already be included in GDP. Another problem with interpreting our depositor services as output that is missed by the NIPAs is that commercial paper might not belong in a measure of GDP because the SNA does not impute intermediation services in connection with securities.

³ Gallin traces the sourcing of long-term lending to those outside the shadow banking sector through the intermediation chain to find out how much of this lending comes from short-term final funders. In effect, shadow

to avoid double counting, so claims of one shadow bank on another are netted out. We wish to measure the intermediation services produced by a consolidated shadow banking sector, so we also want to include only transactions that cross the sector boundary. In calculating borrower services, we only include loans from a shadow bank to outside the sector. Similarly, in calculating depositor services we ignore liabilities of a shadow banks that are held as assets of other shadow banks. Ignoring transactions between shadow banks means that we do not have a picture of the value added produced by each class of institution along the intermediation chains within the shadow banking sector. However in the case of MMMFs, we add the services paid for by the small margin charged by the MMMF manager to depositor services from the issuers of credit instruments held by MMMFs. Unlike asset and liability positions, output flows can be divided into value added of different institutions and then totaled across all institutions, including intermediate producers. Our treatment of MMMFs in effect totals up value added from two different links in the intermediation chain.

Although funding long-term assets with short-term liabilities is a core part of credit intermediation, some institutions in the shadow banking sector have short-term credit instruments on both the asset side and the liability side of their balance sheet. If the counterparties to both positions are outside the shadow banking sector, we use the institution's net short term liabilities to calculate its output of depositor services. (In principle, it would be preferable to calculate the spread income generated by the leveraged lending, but we generally lack the data to do so.) Apart from this netting, however, we do not account for or measure inputs of credit intermediation services used by the shadow banking sector.

bank liabilities that are not used for maturity transformation are excluded from his measure. An analogous procedure in our case would be to net out the borrower services received by the shadow banking sector on short-term instruments that are liabilities of issuers outside the sector from the output of the shadow banking sector.

II. MEASUREMENT

Measurement of implicit credit intermediation services produced by shadow banks requires data on asset and liability positions together with estimates of the associated margins between their interest rate and the reference rate. The source data and assumptions used to estimate the interest rate margin depends on the instrument and institutional sector, and requires case by case documentations and discussion. Data on assets and liabilities of nondepository credit intermediaries are readily available in the FAs, however.⁴

The FA data do have a few noteworthy limitations. They do not decompose credit market instruments by term to maturity, so we have to assume that all commercial paper (CP), repurchase agreements, and assets of money market mutual funds represent short-term funding that has deposit-like characteristics. Also, in the case of repurchase agreements, the FAs often just show an institutional sector's *net* position (or even ignore the asset side—see Krishnamurthy and Nagel, 2013). This netting of positions has little effect on the estimate of the “depositor” services to sellers of repos from the shadow banking system as a whole, but it prevents a decomposition the aggregate flows of shadow banks into flows from particular types of institutions. For example, mortgage REITs obtain their repo funding from securities dealers, who in turn finance their positions with repo funding from outside investors. The offsetting positions of the securities dealers are invisible in the FAs, so the borrowing by the REITs appears to come directly from outside the shadow banking sector. Finally, the FAs have some gaps in coverage of sectors and transactions. They do not cover leasing companies; so much of the lending that takes the form of financial leases cannot be included in our analysis. Also, some income-oriented closed-end mutual funds use leverage and maturity transformation to boost their yield. This shadow banking activity cannot be included in our analysis because the FA table on closed-end funds has no data on liabilities.

The limitations of the available data on positions are minor, however, compared to the challenges in finding data on interest rates and spreads for shadow banks. With the exception of bank holding company parents, the institutions in our shadow banking sector do not file the kind of reports on condition that depository institutions do.

⁴ The FAs have separate tables on the institutional sectors that make up the broad financial corporations sector. The nondepository institutional sectors that we include are covered by the tables L.120 and L.123-L.130. The FAs also have tables that are organized by instrument, which are convenient for identifying the transactions between the shadow banking sector and other sectors in the instruments that we include in our analysis. The relevant tables are L.206-L.208, L.210, L.216 and L.224.

A. PROCEDURES FOR BORROWER SERVICES

In this section we use two institutional sectors to illustrate our estimation procedures. One is the GSEs and GSE-backed pools, and the other is finance companies. Further details of our estimation procedures are provided in the technical appendix.

We base our measures of borrower services from mortgages on GSE-backed pools and GSEs, and we base most of the other measures of borrower services on finance companies. We have already measured the borrower services output of finance companies in a previous paper (Corrado, Hood and Reinsdorf, 2012), but this time our procedures are slightly different and we add measures of their depositor services.

Borrower services from mortgages

The shadow banking financial institutions and vehicles that directly hold mortgage loans include the mortgage GSEs, the GSE-backed mortgage pools, finance companies, mortgage REITs, and private issuers of asset backed securities (ABSs). The mortgages underlying mortgage-linked securities are considered in the calculation of the implicit output of mortgage pools and ABSs, so to avoid double counting, financial institutions' holdings of mortgage-linked securities like MBSs and CMOs are excluded from the calculation of their output of borrower services.

GSEs or GSE-backed mortgage pools hold over half of the mortgages in the shadow banking system. We combine the GSEs and GSE pools into a single aggregate. The first step in computing the implicitly priced output from mortgages held by GSEs and GSE-backed pools is to estimate the spreads that the pools earn. We define the services spread of a mortgage pool as the weighed average coupon (WAC) rate on the underlying mortgages less pass-through rate paid to investors in the pool ("the pool's coupon") less an adjustment for the expected default losses associated with the loans in the pool. The expected default costs are factored into the pass-through rate, with tail protection against unexpected default costs provided by the GSE that is backing the pool.

The interest rate spread before the adjustment for expected default costs is sometimes referred to as the guarantee fee. We do not have good data on guarantee fees in historical periods, but we do have data on the average spread between WACs and pass-through rates on pools outstanding in 2012-2013. These data come from eMBS, which compiles information on WACs, pass-through rates, and remaining principal balances (RPBs) by type of mortgage pool and origination year. This allows us to compute the average guarantee fee on the mortgages outstanding today that were issued in a given prior year. From this, we infer the average guarantee fee for all mortgages outstanding in each prior year by weighting the mortgage pools originated in that and earlier years appropriately. Suppose, for example, that we found that 25 percent of mortgage balances outstanding in 2013 were originated in 2012. Then we would assume that in all the prior years, 25 percent of mortgage balances outstanding had been originated in the preceding

year. We do separate calculations for the three mortgage GSEs, and then average using the data on remaining principal balances for weighting purposes. Unfortunately, these calculations are only possible for fixed-rate mortgages, so we have to assume that guarantee fees are the same for fixed and variable rate mortgages. Our estimates of guarantee fees range from above 0.61 percentage points in the late 1990s to around 0.5 percentage points at the time of the financial crisis.

After computing guarantee fees, we develop a measure of expected losses in principal due to borrower default, as discussed by Hood (2013a). The method uses as a measure of anticipated default rate a geometrically weighted moving average of the net rates at which losses of principal have been recognized (charged-off) by the mortgage holders. For this paper, we assume that the average life of a mortgage loan is 10 years, and use geometric smoothing parameter of 0.1, which implies rather gradual adjustment of expectations to surprises. The data on charge-off rates come from 10-K filings of Fannie Mae. (The accounting rules for charge-offs have occasionally changed, so to handle the discontinuities and arrive at an estimate of what past charge off rates would have been under today's definition we chained together the growth rates of charge-off rates based on the previous definitions.)

Figure 1 shows the breakdown of the treatment of the interest paid by borrowers on mortgages held by GSE-backed pools and a small amount of mortgages held directly by GSEs. Most of this interest is passed through to investors in mortgage-backed securities either as pure interest income or as an implicit payment for borrower services that they produce. However, as mentioned above, we do not treat any of the interest flowing to investors in asset-backed securities as implicit payments for borrower services produced by them. A relatively small part of the mortgage interest paid to the GSE-backed pools or the GSEs treated as a payment for the implicit services produced by them. Finally, a small portion of the interest received from the borrowers is used to cover losses of principal due to defaults (adjusted charge-offs).

Borrower services from non-mortgage loans

Our estimates of margins for most loans other than mortgages held by shadow banks are based on data for the types of loans made by finance companies. The Federal Reserve Board (FRB) provides information for finance companies on three types of non-mortgage loans in the G.20 release of its household finance statistics series: consumer credit excluding automobiles, auto loans, and business loans and leases. (The FRB compiles the data in table G.20 from a benchmark survey of finance companies conducted every five years and indicator data from the Domestic Finance Company Report of Consolidated Assets and Liabilities, FR 2248.) Besides the G.20 data, our estimates for finance companies also use table L.125 of the FAs. The methods used will be discussed separately by loan category: non-auto consumer credit, auto loans, and business loans.

(a) Non-auto consumer credit from finance companies. Non-auto consumer credit may be divided into two sub-categories: revolving and non-revolving consumer credit. Revolving consumer credit consists mostly of non-bank credit cards, and non-revolving consumer credit consists mostly of consumer term loans other than auto loans. Finance company loan balances along with terms of credit (interest rates and maturity) are reported for these categories in the G.20 release.

We use commercial bank charge-off data for credit cards as a proxy for charge-off rates on revolving consumer credit from finance companies. Bank credit card charge-off rates in Call Report data are similar to total credit card charge-off rates, which are tracked in the S&P/Experian default index for credit cards. For non-revolving consumer loans from finance companies, we use an average of the bank charge-off rate on non-revolving consumer loans and the bank charge-off rate on revolving consumer credit. The adjustment for expected default costs based on this average generates a margin on non-revolving consumer loans that is close to the margin on credit card loans.⁵

After subtracting our measure of the expected default rate on each type of loan from the contract interest rate on that type of loan, we estimate a user cost margin taking the 2-year Treasury rate (based on an assumption that average consumer loans are rather short) as the reference rate. The user cost margins range between 4.5 and 7.5 percentage points, higher than margins for other types of finance company or bank loans. These user cost margins are multiplied by the outstanding balance of the corresponding loan type to measure implicit borrower services.

(b) Auto loans from finance companies. Auto loans from finance companies are shown as a separate category in the FRB G.20 statistical release. Separate data on terms of auto loans are provided for captive lenders and independent lenders (and also for new car loans and used car loans). The loans of the captives, which have more than twice the market share of the independent finance companies, are concentrated in new autos. The independent finance companies concentrate on used autos and make riskier loans: their 30-day delinquency rates are double those of captives, and their 60-day delinquency rates that are three times higher.

Both the default rate and the gross interest rate present source data challenges in the case of auto loans. Default information is available only as an overall national average in the S&P/Experian auto loan default index (accessed at <http://us.spindices.com/indices/specialty/sp-experian-auto-default-index>). A search of auto finance news suggests that the captive auto finance companies experience defaults that are close to the overall national average default rate reported by

⁵ We cannot use charge-off rates on non-revolving consumer loans of banks by itself as a proxy for non-revolving consumer loans of finance companies because personal non-revolving loans are aggregated together with auto loans in the Call Reports filed by banks. The bank auto loans have lower credit costs because they are collateralized and tend to go to consumers with better credit scores.

S&P/Experian. We make the assumptions that the default probability for finance company loans as a whole is 20 percent higher than the national average from S&P/Experian, that the difference between default rates on new and used car loans is 40 basis points, and that the average size of the loss on a defaulted auto loan is 40 percent of the outstanding principal balance. Altering these assumptions would affect the estimated level of implicit services, but have minimal effect on the shape of its profile over time.

Estimating average interest rates on the outstanding stock of auto loans presents another challenge. Direct information on the average interest rate of the outstanding loan balances is unavailable; the source data cover only the lending terms of auto loans that are originated in each month. Assuming that the rate on currently offered loans is the same as the average rate on outstanding loans would produce a volatile and noisy measure of borrower services. To estimate the average rate being paid today on loans that were originated in a given month, we use data on average maturities of new and used vehicle loans originated in that month (from the G.20 release), data on the number of new and use car purchases in that month (from the U.S. Department of Transportation), and data on average default rates (above), to predict the run off of the principal balances of these loans over their lifetime. We maintain a constant user cost margin for each cohort of loans over its lifetime based on the new and used auto loan rates at the time of birth of the cohort, our estimated default rates, and a reference rate based on Treasury bonds that corresponds to the average maturity of those loans. In any given month, then, we compute a weighted average user cost based on the principal balances of the different loan vintages and their associated user costs. We then multiply this weighted average user cost by total outstanding loan balances from the FRB G.20 release. These procedures produce smooth measures of user costs, and further steps to smooth the reference rate (as done for commercial banks) are unnecessary.

(c) Business loans from finance companies. The final category of loans in the FRB's G.20 release is business loans. Unfortunately, little information is available on this category of loans. The FRB does not survey finance companies that serve businesses regarding the lending terms of these loans, so we have no information on interest rates or maturity. We therefore are forced to assume that the interest rate on business loans that is earned by commercial banks. This likely underestimates the margin on these loans: business loans have some of the lowest margins that banks earn. We compute the user cost margin for business loans by dividing bank interest income on business loans by net business loan balances, subtracting the expected net charge-off rate on business loans (where as above, expected charge-off rates are computed using a 4-quarter geometrically declining weighted average of past charge-off rates), and subtracting a two-year moving average of the 2-year US Treasury rate.

B. IMPLICIT OUTPUT BY INSTITUTIONAL SECTOR

To have internally consistent measures of implicit borrower services and implicit depositor services we calculate a single overall reference rate for each institutional sector that we use to measure both kinds of services. An institutional sector's overall reference rate is computed as a weighted average rate of risk free rates that match the maturities of the loan types on the balance sheet of that institutional sector. The weights reflect the values of the institutional sector's holdings of each loan type. In most cases the risk free rate is computed as an average of Treasury and GSE bond rates that resembles the mix of these bonds used for the commercial bank reference rate in the NIPAs. For certain loan types, however, the asset-specific risk-free rate is computed as the rate earned on the loan type less our estimate of the average interest rate margin on that category, and sometimes a few loan types had to be omitted from the calculation of the reference rate of an institutional sector.

GSEs and GSE-backed mortgage pools

GSEs play a key role in mortgage markets, securitizing or directly holding substantial portion of outstanding mortgages. According to the FAs, in 2012 GSEs and GSE mortgage pools held 47.5 percent of all mortgages and 58 percent of home mortgages, up from about 33 percent and 40 percent, respectively, in 2006. Mortgage losses were at the heart of the financial crisis, and in 2008 the mortgage GSEs, Fannie Mae and Freddie Mac, were placed into conservatorship. In 2010 a large fraction of the mortgages in the pools that these GSEs sponsored moved back onto the balance sheet of the pool sponsor. Because of the porous boundary between the accounts of the GSEs and those of the GSE-sponsored pools, we consolidate these two sectors of the FAs and treat them as a single institutional sector.

Besides the mortgage GSEs, the GSE sector includes institutions that make direct loans to a diverse set of borrowers. For example, Sallie Mae was formerly a GSE that made consumer loans, the FHLBs make advances to depository institutions, and the Farm Credit System (FCS)

makes loans to farmers. Consumer credit plays a disproportionate role in the level of implicitly priced borrower services compared to its share of the assets of the GSEs and GSE pools because spreads on mortgages are smaller than spreads on consumer credit (figure 2). Like FHLB advances, mortgage loans have a services spread near 0.55 percentage points up until the financial crisis, when rising defaults cause a fall in their adjusted spread. Nevertheless, mortgages consistently make up more than 80 percent of the assets of the GSEs and GSE pools (figure 3), so the variation in the growth rate of the implicitly priced borrower services furnished by GSEs and GSE-backed pools largely reflects changes in mortgage charge-off rates and outstanding balances.

Figure 4 shows the evolution of implicitly priced borrower services of GSEs and GSE-backed pools by type of loan over 1994 to 2012. Before the crisis, there was a sharp run-up in these services, but after the crisis the outstanding balances of mortgages in GSE and GSE-backed pool mortgage stopped rising and even began to fall, and the services spread on mortgages narrowed. These developments caused the implicit borrower services of the GSEs to decline, and by 2011 they had fallen in nominal terms to a level not seen since the 1990s.

Finance companies

Finance companies hold all of the categories of loans discussed above in the instruments section (figure 5). From the late 1990s to 2006, mortgages grow rapidly as a proportion of the balance sheets of finance companies, but during and after the crisis their importance drops substantially. Another change in the mid 2000s was that consumer loans (which comprise revolving loans, non-revolving non-auto loans and auto loans) became more important than loans to nonfinancial businesses.

Figure 6 shows the spreads earned by finance companies on each type of loan over the period of 1994 to 2012. Their margins on mortgage loans are larger and more volatile than those of the GSEs, but their margins on consumer loans show less volatility than for the GSEs. Margins on business loans and revolving consumer loans fall during the recessions of 2001 and 2008-2009 because their interest rates fall faster than the reference rate, while auto loans and mortgages have the relatively slow moving interest rates and margins that move in a counter-cyclical fashion.

Figure 7 shows the implicit services associated with each type of loan of the finance companies. The implicit borrower services of finance companies grew steadily in the 1990s. The behavior of margins on business loans shown in figure 6 makes the estimate of services to business collapse during the downturn in 2000-2002, rebound a few years later, and then collapse again in the Great Recession. Although total implicit borrower services declined from 2007 to 2009, they had a strong recovery starting in 2010 as the average margin earned by finance companies widened.

Total implicit borrower services

Figure 8 shows the breakdown of implicit borrower services by institutional sector. Nondepository financial intermediaries produce implicit borrower services of \$43 billion in 1995, but about triple that amount at slightly under \$130 billion in 2007. The financial crisis causes a decline in borrower services of approximately one third over the next three years. After 2010, borrower services experienced a weak recovery, with private ABS issuers in particular remaining at a very low level.

C. PROCEDURES FOR DEPOSITOR SERVICES

The calculations of implicit depositor services of the shadow banking sector include financial liabilities of other shadow banking institutions that are held by MMMFs, other financial assets of MMMFs, and all repo and commercial paper liabilities of shadow banks not already counted in the holdings of MMMFs. The values of these categories of liabilities are shown in Figure 9. The instrument with the most dramatic growth before the financial crisis and most dramatic fall in 2008 is repos. The MMMFs also grow before the crisis, but they are relatively stable after the crisis because of support from government guarantees.

To estimate the interest rate on the assets of the MMMFs, we use 1-month Treasuries rates from the Federal Reserve Board's H.15 release, except in 1994-2000, when we use 1-month commercial paper yields.⁶ We estimate commercial paper yields from the 1-month yields of financial commercial paper (prime commercial paper before 1997), also from the H.15 release. For interest rates on repos, we use the average yields on repurchase agreement assets and liabilities of commercial banks in Call Report data. The reference rate for calculating the implicit depositor services of an institutional sector is derived as part of measuring its borrower services, as described above. These rates imply the average user cost margins for the depositor services produced by each institutional sector that are shown in figure 10. After a recession begins in 2001 the margins become larger because short term rates fall faster than long term rates, increasing the slope of the yield curve. The margins then fall as rates paid on repos and CP rise sharply between 2004 and 2007. In 2008 they begin to rebound with the help of the Federal Reserve's Commercial Paper Funding Facility, which supported credit markets during the crisis.

These changes in user costs are reflected in the volatile behavior of the values of implicit depositor services shown in figure 11. In the early years, there is a steady increase in depositor services driven by growth in the value of shadow bank liabilities. In 2002 an added kick from falling rates on these liabilities produces a spike in depositor services. Later on, in 2004-2007,

⁶ We plan to estimate depositor services provided by MMMFs using NIPA data, which are based on fees paid by shareholders reported in the Economic Census. For this paper we use a margin calculated as ?

depositor services fall dramatically as rising rates on shadow bank liabilities severely compress spreads. Then, after the crisis, GSEs have a strong and sustained recovery, while ABS issuers and have a partial rebound and fade in importance. Funding corporations, which include FRB facilities related to the crisis and an AIG subsidiary, also rebound and then fade even faster than ABS issuers. The spike in depositor services of shadow banks in 2008-2009 is thus heavily driven by various sorts of interventions by the FRB to stabilize financial markets during and after the crisis. Interestingly, the mortgage REITs have a very different fate from the ABS issuers after the crisis has passed, and show strong growth in 2011-2012.

D. TOTAL IMPLICIT OUTPUT OF SHADOW BANKS

Table 2 and figure 12 shows the total implicitly priced services and the borrower services of the shadow banking sector from 1995 to 2011. The shadow banking sector's output of implicit borrower services peaks at 0.9 percent of GDP in 2007, the year when subprime mortgage markets became severely troubled. Its output of borrower services manages to stabilize by 2010 at about 0.5 percent of GDP, lower than in 1995.

Total implicit credit intermediation services of shadow banks behave a bit differently from borrower services alone because of the volatile influence of implicit depositor services. Total implicit output of shadow banks rises rapidly from 1995 to 2003, to a peak of 1.43 percent of GDP. Total implicit services of shadow banks decline four years earlier than borrower services because rising yields on shadow bank liabilities squeeze the user cost margins for depositor services starting in 2004. Implicit depositor services also play a key role in what might seem to be a surprisingly rapid recovery from the crisis. The implicit output of shadow banks rebounded from 0.94 of GDP in 2007 to 1.15 percent of GDP in 2008, growing to 1.18 percent in 2009. Many of the stabilization measures taken by the FRB during the crisis were directed at or channeled through the shadow banking sector.

For comparison purposes, figure 13 also shows the output of credit intermediation services of the depository institutions sector. The total credit intermediation services produced by the shadow banking sector match or oscillate around the level of the implicit borrower services component of the output of the depository institutions. At its peak in 2003, the production of credit intermediation services by the shadow banking sector was about three-fourths of that produced by the traditional banking sector. However even in 2011, services produced by shadow banks were larger relative to production by traditional banks sector than they were in the 1990s. The interventions undertaken by the FRB after the financial crisis indirectly increased the deposit services output of shadow banking by lowering short-term interest rates and directly increased the sector's output by providing credit through nondepository financial institutions. This helped to stabilize the decline in the shadow banking sector. Credit intermediation by the traditional banking sector, on the other hand, accelerated its downward trend after the crisis.

III. CONCLUSION

The growth of the shadow banking sector was a key development in the U.S. economy, one that made it vulnerable to a financial crisis. If viewed and measured by the value of the short-term liabilities of nondepository financial institutions that support long-term lending to nonfinancial sectors, its size seems too modest to cause so great an economic dislocation (Gallin 2013).

On an output basis, however, shadow banking emerges as more than three-fourths the size of traditional banking in 2002-2003. Furthermore, our estimates show a drop in shadow banking output from 2003 to 2007 that amounts to 1/2 percent of GDP—a notable drag on the economy unseen at the time due to gaps in measurement that we attempt to fill in this paper.

Note, also, that the estimates in this paper of the value of services produced by nondepository institutions, collectively known as shadow banks, should be viewed as conservative. In particular, our measure of borrower services is based on relatively high reference rates that were selected to match the average maturity of assets, it excludes expected credit losses from the interest rates paid by borrowers, and for securitized loans, only the interest spread retained by the pool operator is considered.

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Table 1: Credit Intermediation Services of Depository Institutions, as a percent of GDP

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|--|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Credit intermediation services of depository institutions | 1.95 | 1.93 | 1.92 | 1.91 | 1.86 | 1.86 | 1.81 | 1.87 | 1.90 | 1.84 | 1.87 | 1.93 | 1.92 | 1.83 | 1.72 |
| Borrower services | 0.68 | 0.73 | 0.78 | 0.86 | 0.91 | 0.98 | 1.00 | 1.00 | 1.01 | 1.00 | 1.04 | 1.13 | 1.21 | 1.15 | 1.05 |
| Commercial banks | 0.50 | 0.55 | 0.61 | 0.67 | 0.72 | 0.79 | 0.79 | 0.75 | 0.73 | 0.73 | 0.78 | 0.89 | 0.99 | 0.94 | 0.85 |
| Savings Institutions | 0.12 | 0.12 | 0.11 | 0.12 | 0.12 | 0.12 | 0.15 | 0.17 | 0.19 | 0.19 | 0.18 | 0.18 | 0.16 | 0.14 | 0.13 |
| Credit unions | 0.07 | 0.06 | 0.06 | 0.06 | 0.07 | 0.06 | 0.06 | 0.08 | 0.09 | 0.08 | 0.07 | 0.07 | 0.06 | 0.06 | 0.08 |
| Depositor services | 1.27 | 1.19 | 1.14 | 1.05 | 0.95 | 0.88 | 0.80 | 0.87 | 0.88 | 0.84 | 0.83 | 0.79 | 0.71 | 0.68 | 0.67 |
| Commercial banks | 1.04 | 0.97 | 0.94 | 0.88 | 0.79 | 0.71 | 0.64 | 0.69 | 0.70 | 0.66 | 0.65 | 0.61 | 0.54 | 0.54 | 0.53 |
| Savings Institutions | 0.16 | 0.16 | 0.14 | 0.12 | 0.11 | 0.12 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.10 | 0.08 | 0.07 |
| Credit unions | 0.06 | 0.06 | 0.06 | 0.06 | 0.05 | 0.05 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |

Table 2: Credit Intermediation Services of Nondepository Institutions, as a percent of GDP

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Credit intermediation services of nondepository institutions | 0.64 | 0.76 | 0.77 | 0.86 | 0.93 | 0.88 | 1.06 | 1.42 | 1.43 | 1.34 | 1.14 | 0.96 | 0.94 | 1.17 | 1.18 |
| Borrower services | 0.57 | 0.58 | 0.59 | 0.67 | 0.67 | 0.73 | 0.79 | 0.78 | 0.85 | 0.84 | 0.84 | 0.87 | 0.88 | 0.78 | 0.66 |
| Depositor services | 0.08 | 0.18 | 0.18 | 0.19 | 0.26 | 0.14 | 0.28 | 0.64 | 0.58 | 0.50 | 0.30 | 0.10 | 0.06 | 0.39 | 0.52 |

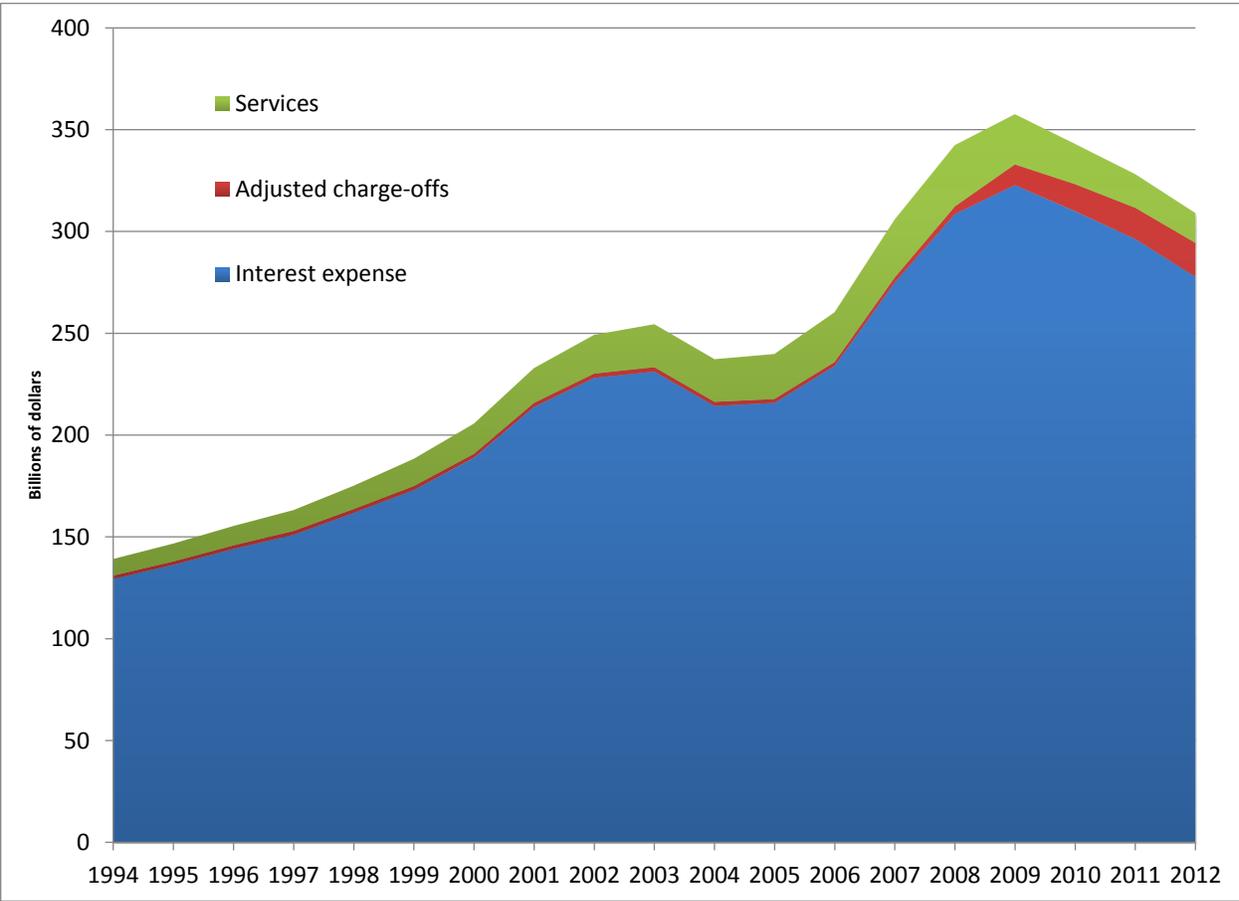


Figure 1. Services margin, adjustment for default costs, and interest distributed to investors from loans in GSE-backed mortgage pools or owned by GSEs

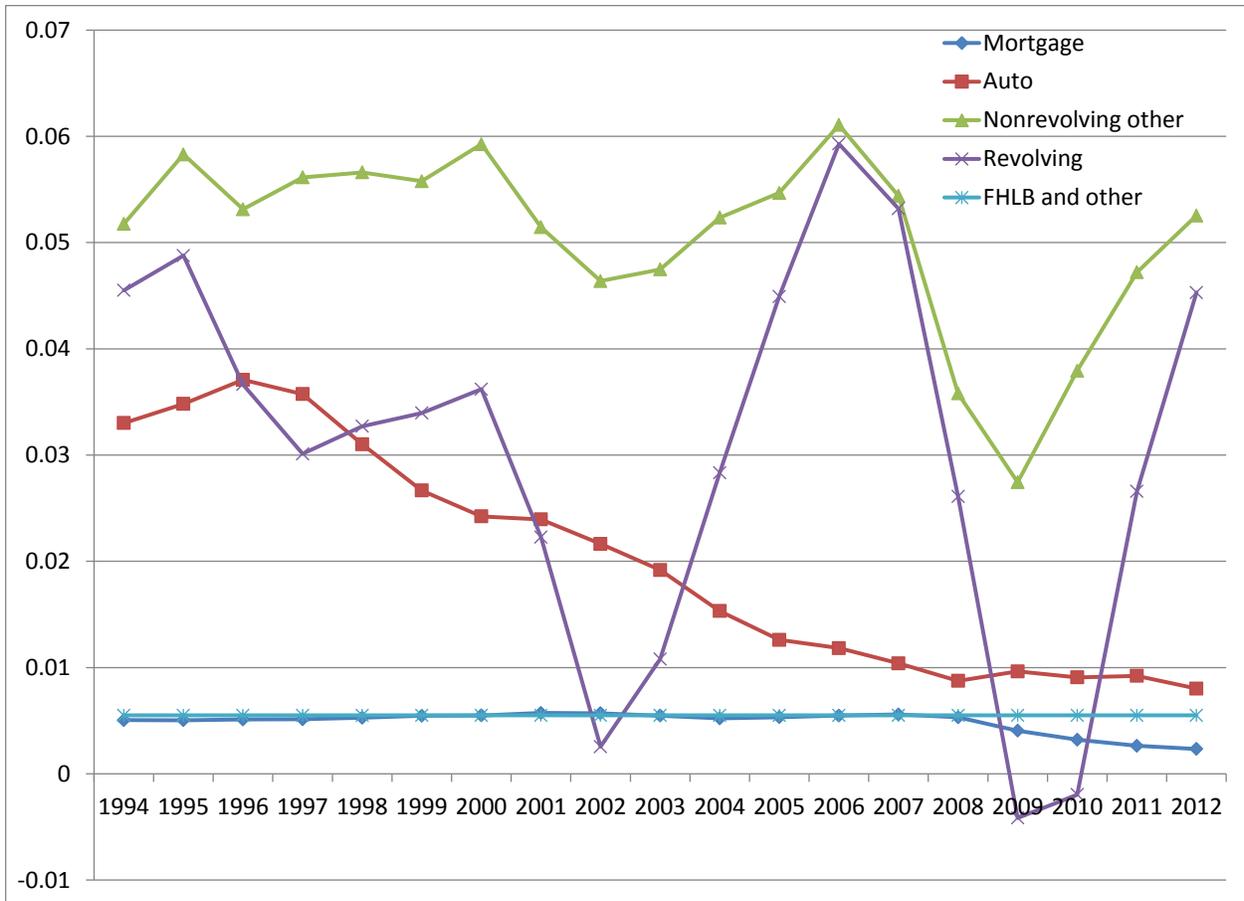


Figure 2: Interest rate spreads on GSE loans

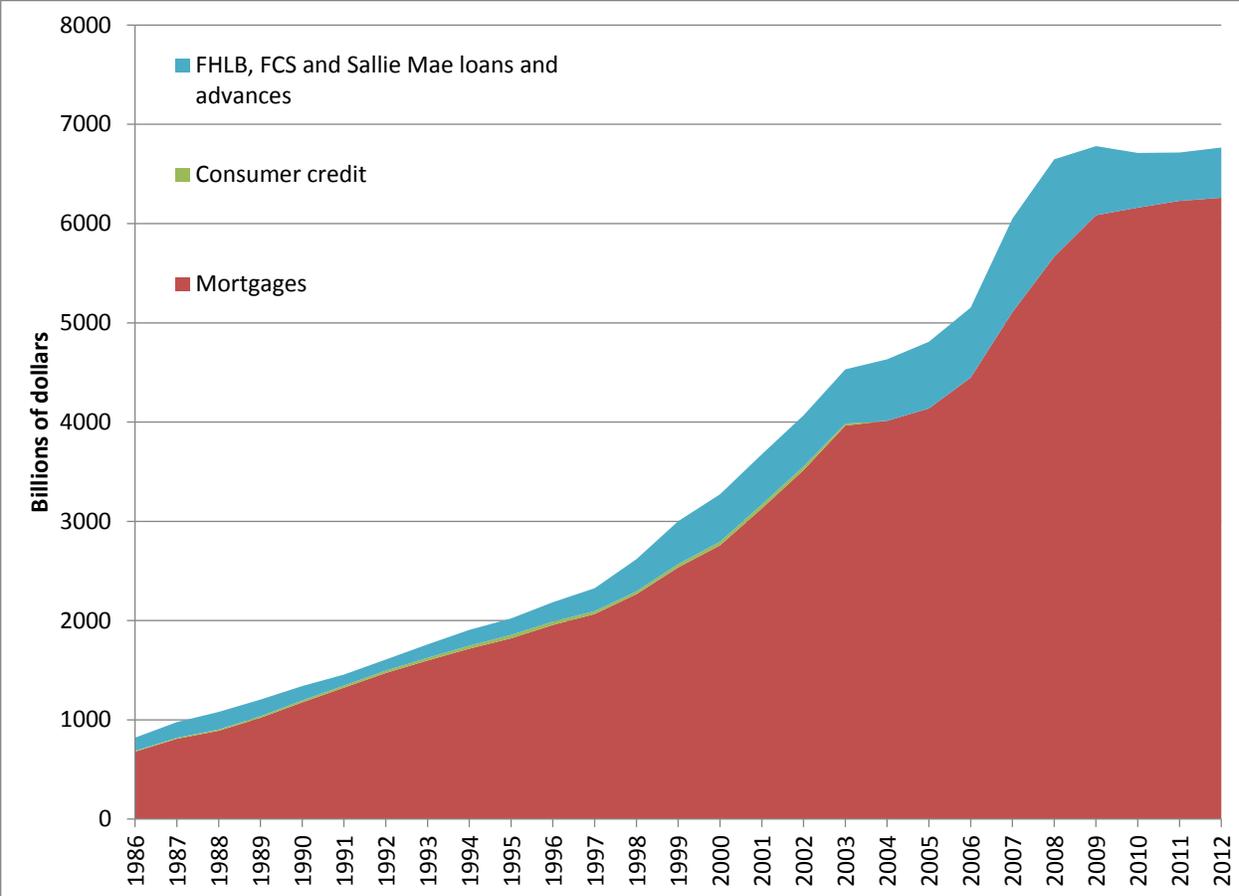


Figure 2. GSE loan balances

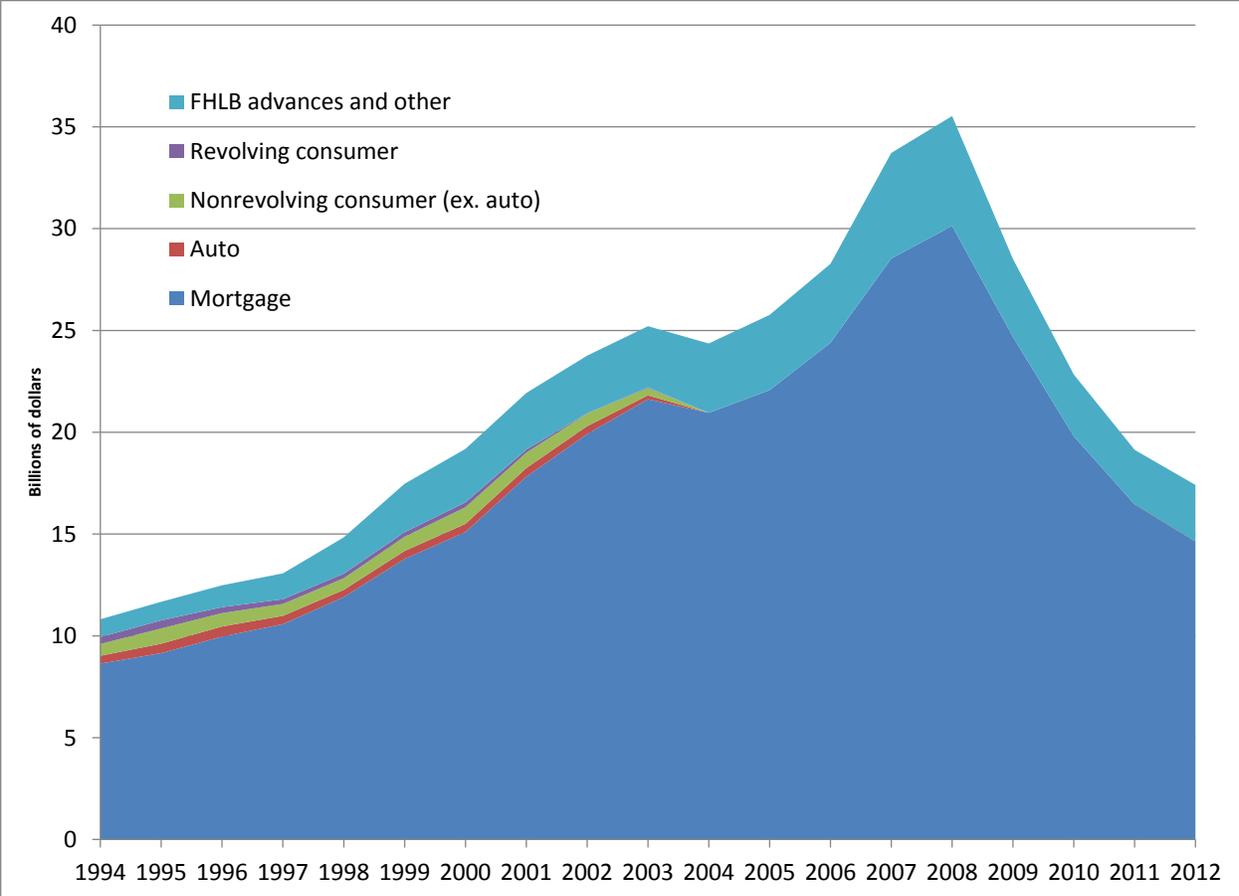


Figure 3: Output of borrower services from GSEs and GSE-backed mortgage pools

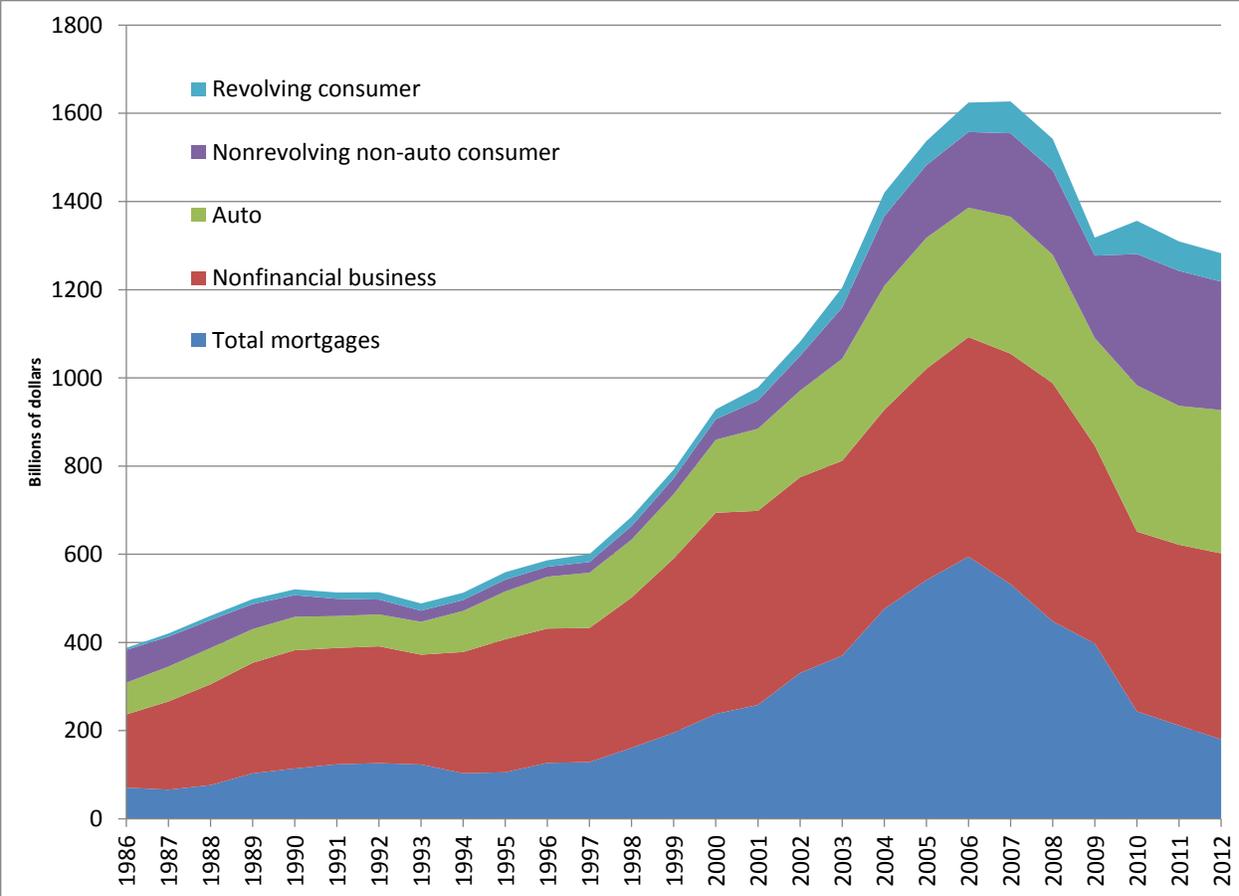


Figure 4: Finance company loan balances

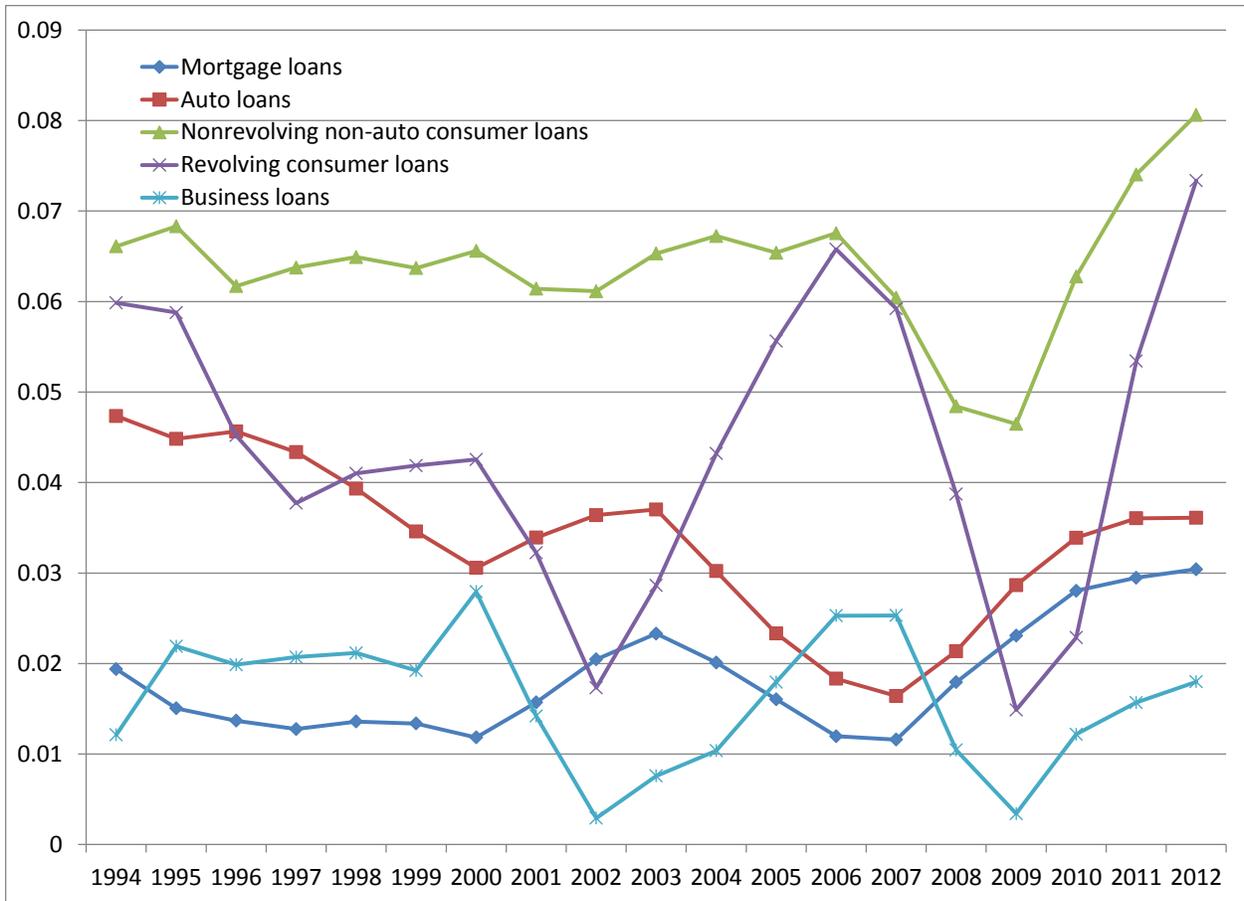


Figure 5: Finance company interest rate spreads

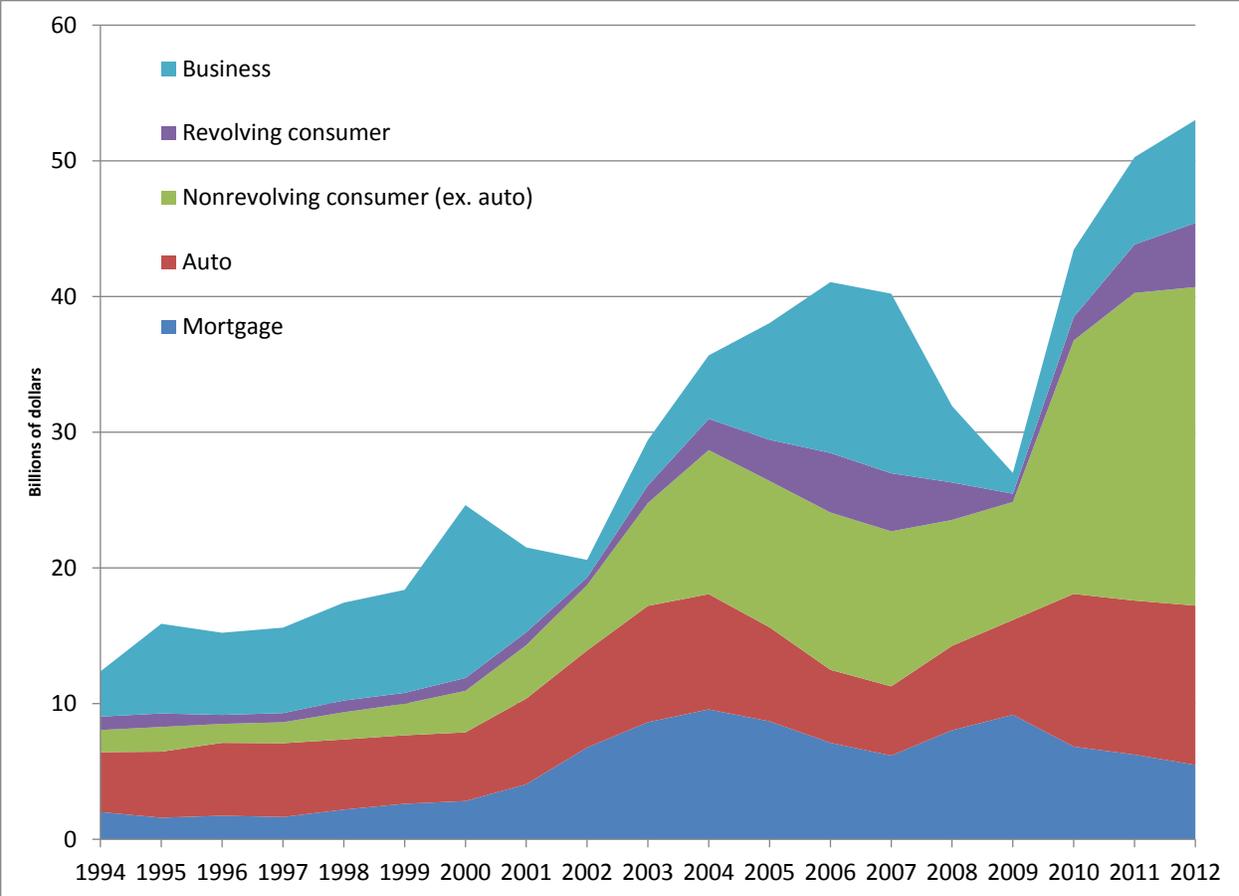


Figure 6: Finance company borrower services

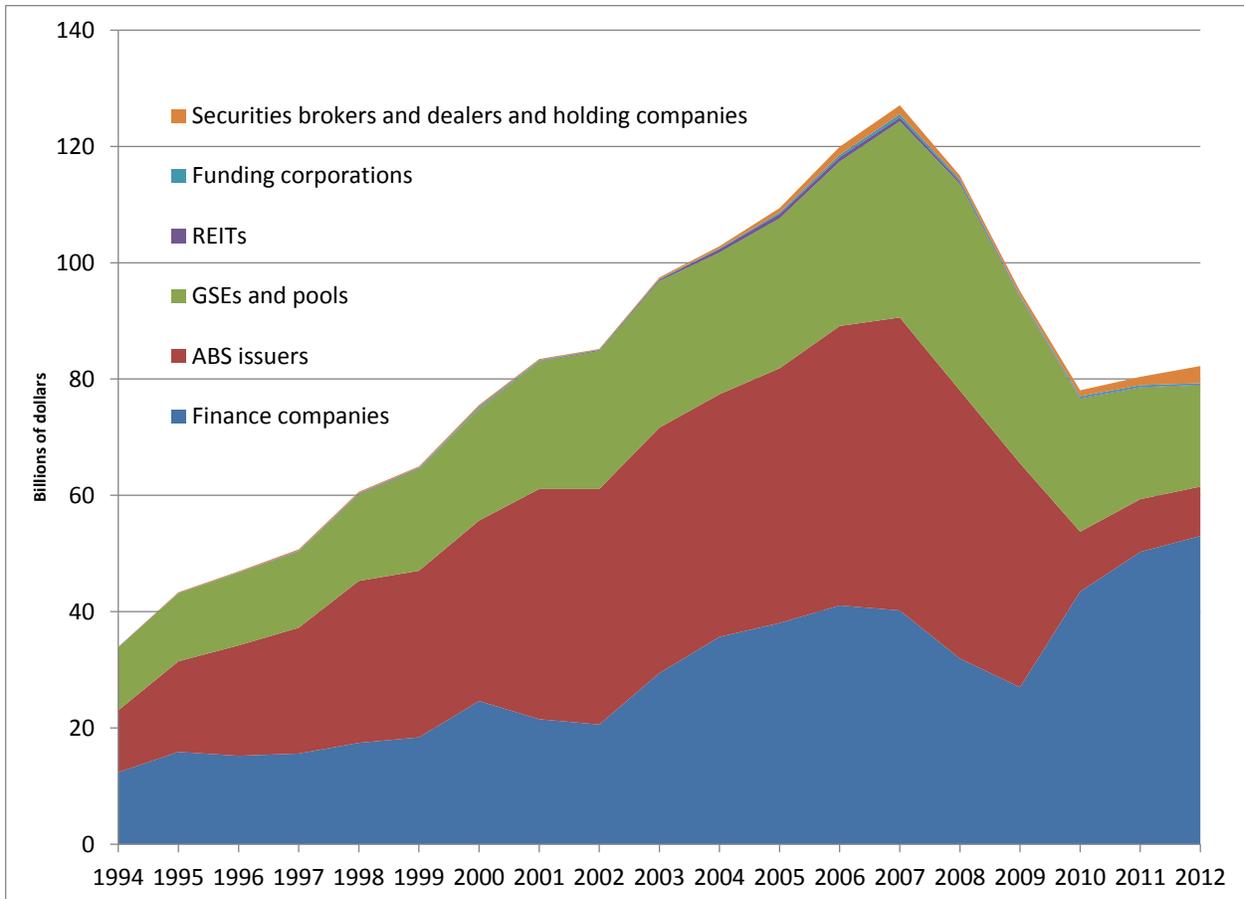


Figure 8: Borrower services by institutional sector

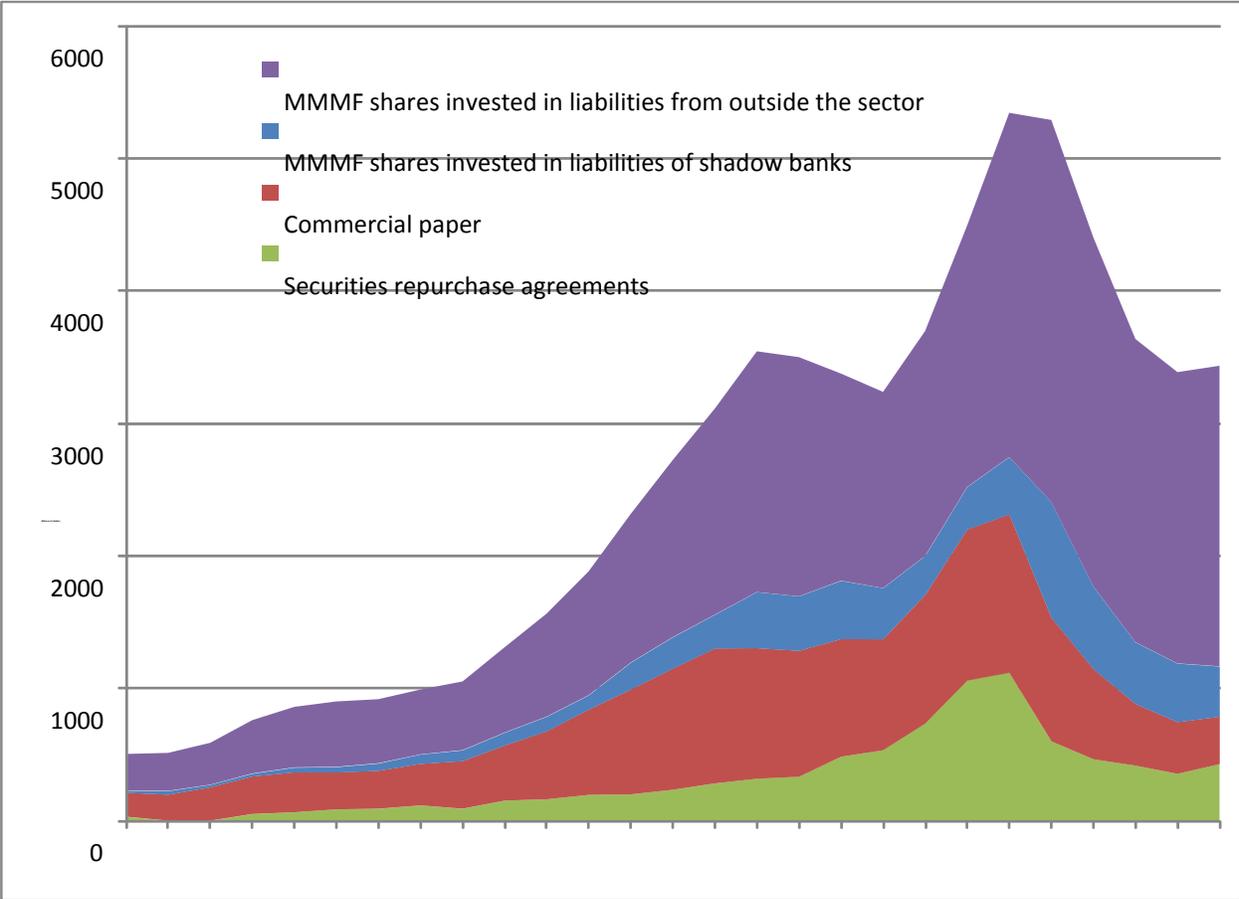


Figure 9: Short-term funding of nondepository financial intermediaries, by instrument

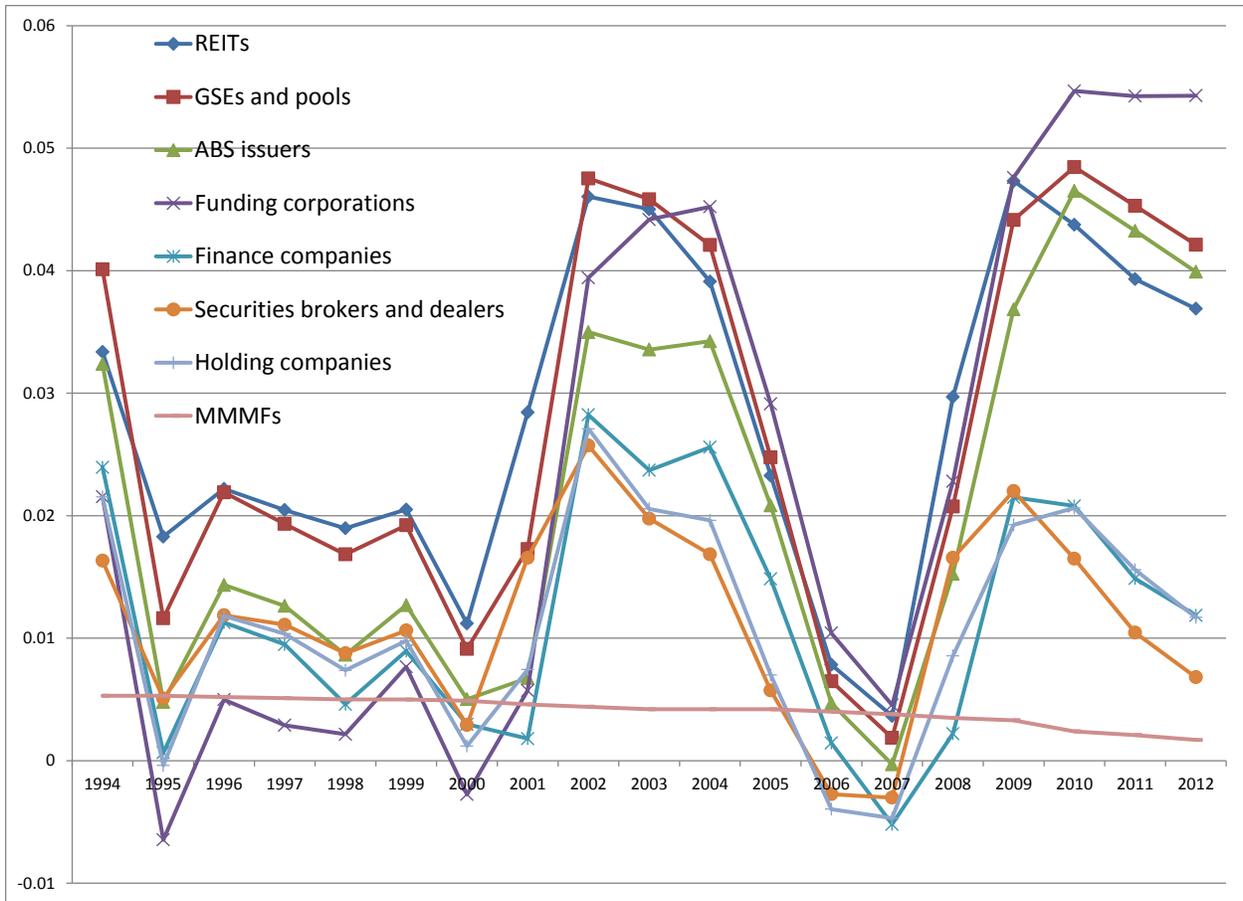


Figure 10: Depositor service user cost margins, by institutional sector

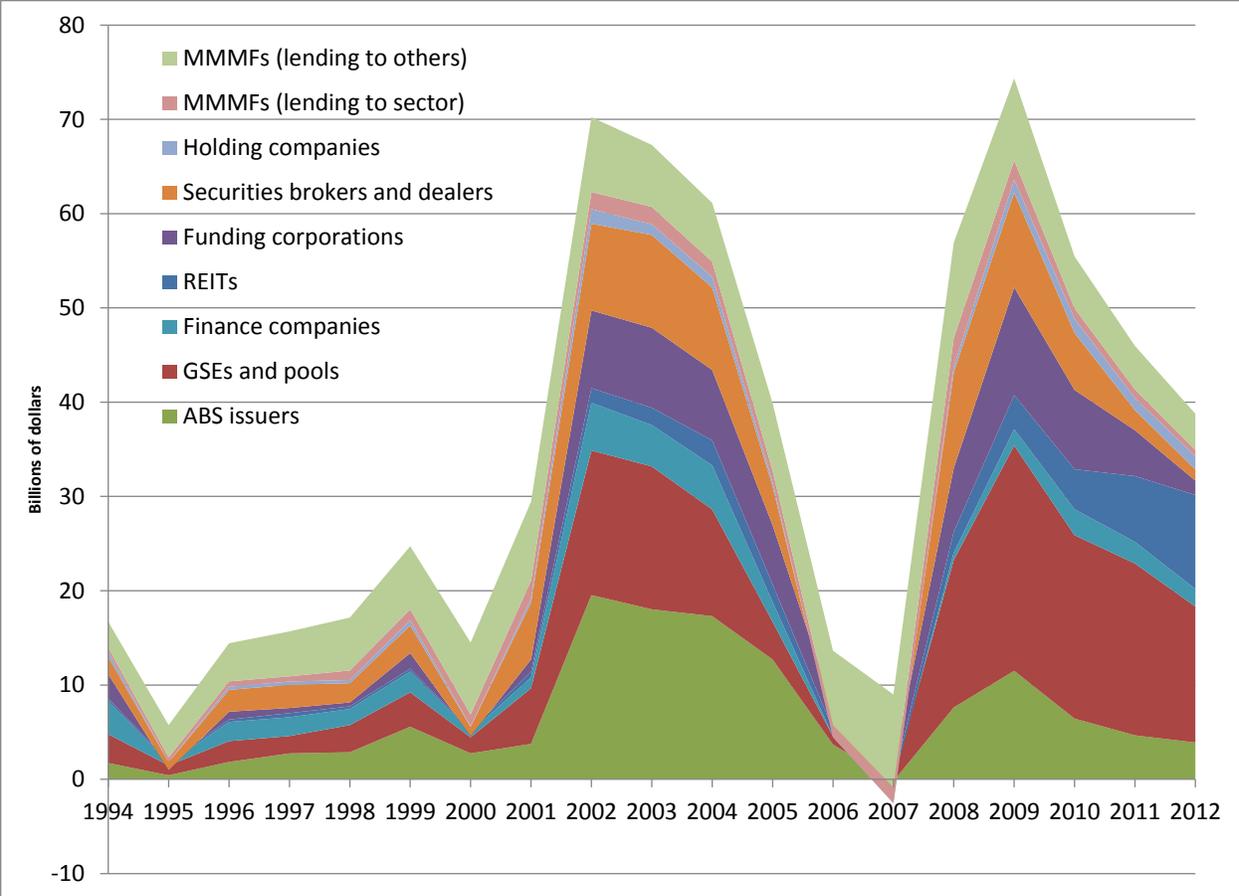


Figure 11: Depositor services of nondepository financial intermediaries by subsector

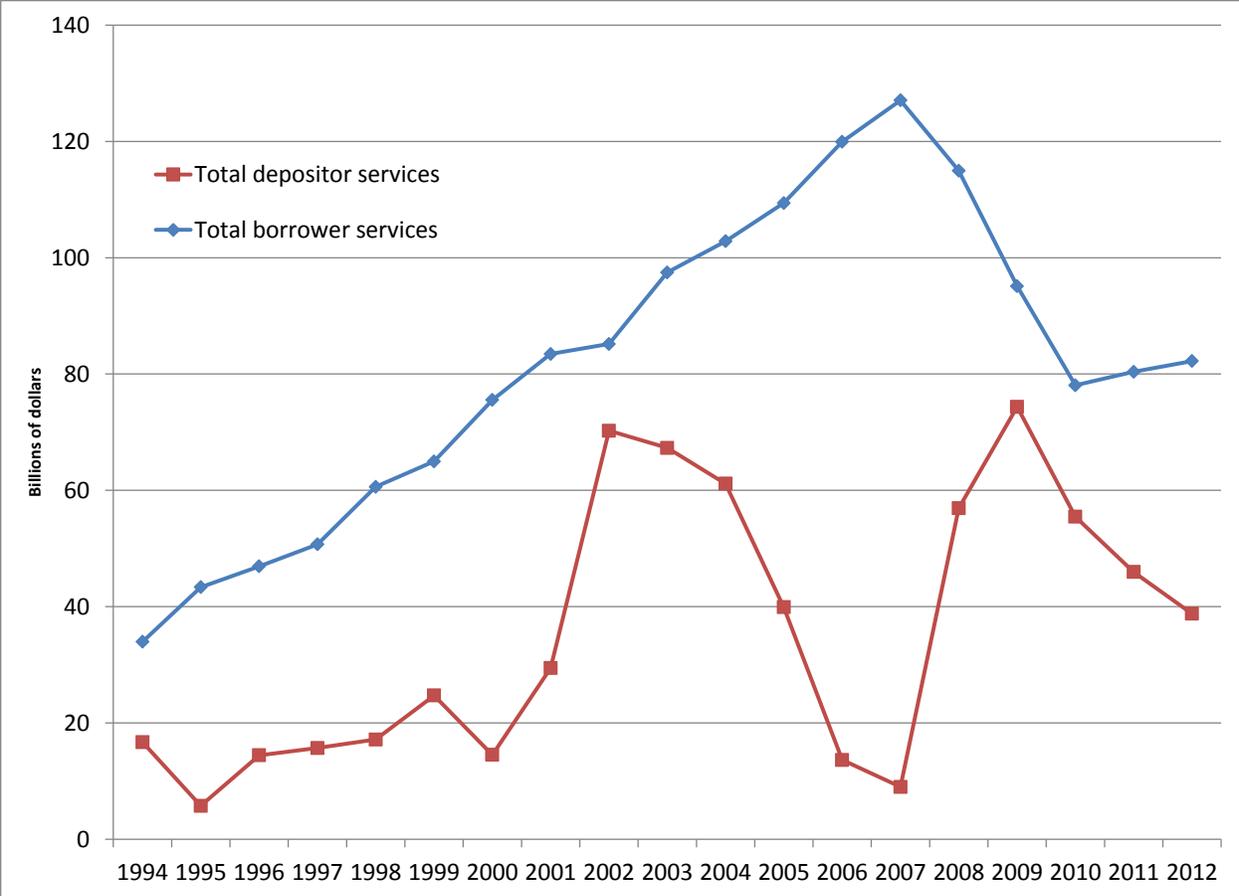


Figure 12: Total implicitly priced services of nondepository financial intermediaries

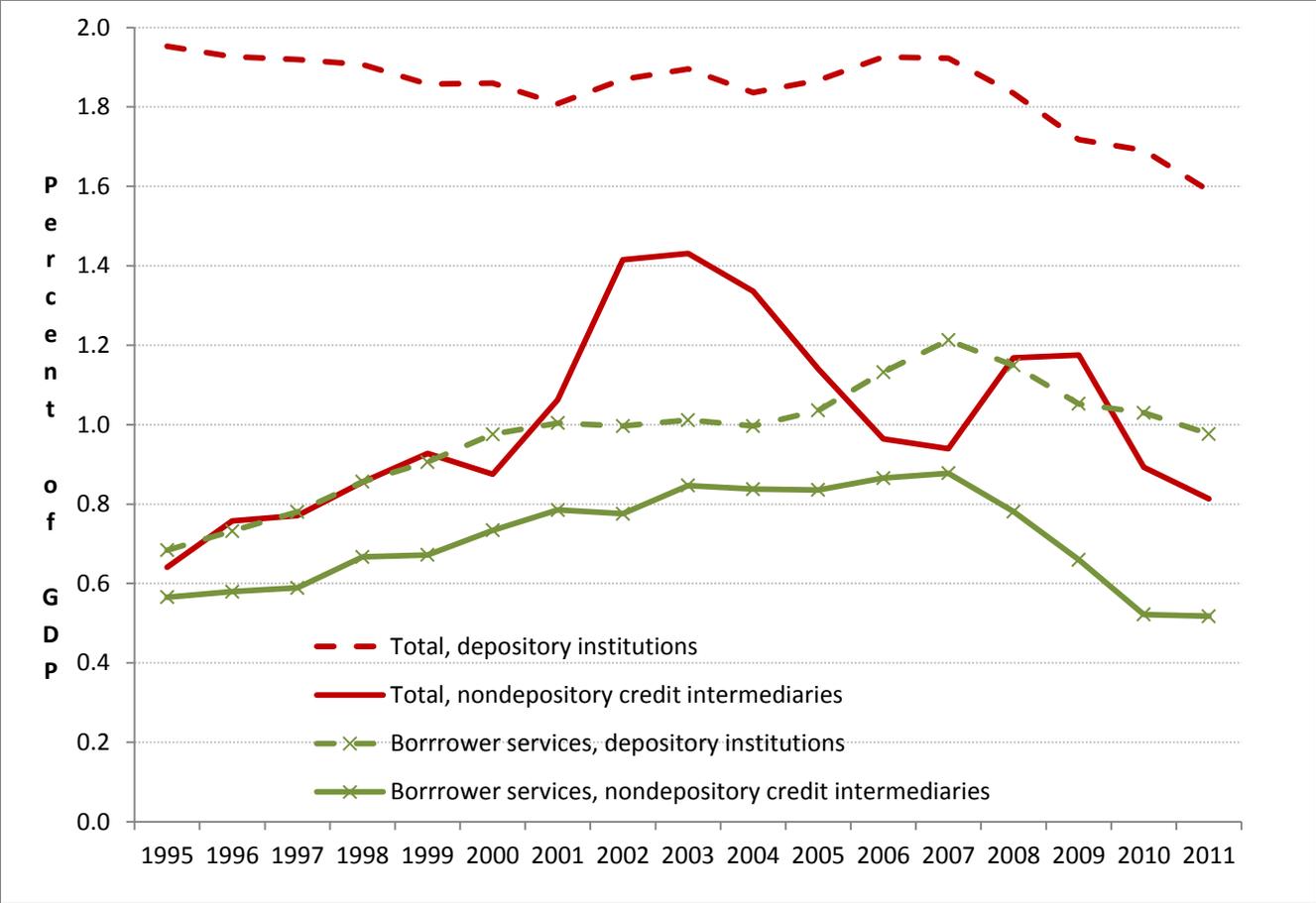


Figure 13 Total implicitly priced services of nondepository credit intermediaries and of depository institutions, as a percent of GDP