

# How do you Complete the Picture of Credit Intermediation?

## Production and Consumption of Shadow Banking Services in the United States

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(Preliminary, with corrections)

**ABSTRACT:** *This paper measures credit intermediation services supplied by the “shadow banking system” of the United States. We adapt the reference-rate approach used to measure services supplied by commercial banks in national accounts (Fizler, Reinsdorf, and Smith, 2003; Hood, 2013b) by (a) introducing aggregation methods that avoid double-counting due to securitization, and (b) measuring margins from market information (rather than regulatory information). The resulting measures reveal (1) shadow bank services (% of GDP) peaked in 2002, when the sector’s gross production of services was almost as large as implicit services supplied by traditional banks; (2) shadow bank services fell after 2004 and were a drag on economic activity leading into and during the Great Recession; and (3) shadow banks supply depositor services largely to one another; thus the sector’s main contribution to the wider economy is provision of borrower services.*

**KEYWORDS:** *financial intermediation; financial accounts; national accounts; user cost of money; reference-rate approach.*

**JEL CODES:** *E01, E44, G01, G23*

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## How do you Complete the Picture of Credit Intermediation?

The migration of credit intermediation activity away from traditional banks created conditions that made a financial crisis possible, and a run on what has come to be called “the shadow banking system” played a central role in the financial crisis of 2007–2008.<sup>1</sup> Although traditional depository institutions remain important in the overall credit intermediation process, the shift towards intermediaries lacking government and monetary authority deposit backstops is striking: Traditional banks and institutions held less than half (about 40 percent) of U.S. nonfinancial loan liabilities in 2007, down from nearly 100 percent forty years earlier (Corrado, Reinsdorf, and Hood, 2012, figure 3, p. 8).

Measuring the size and growth of the nonbank intermediaries that comprise the shadow banking sector is an active research topic. Much of the work approaches the issue via balance sheet positions (Pozsar, Adrian, Ashcraft, and Boesky, 2010, 2013; Gorton, Lewellen, and Metrick, 2012; Gallin, 2013). In this paper we take a different approach and measure the size and growth of the shadow banking sector by its *production of credit intermediation services*, i.e., we take an output approach.

Other things being equal, measures based on balance sheet sizes are likely to overstate the relative importance of shadow banking in credit intermediation for two reasons. First, the loan-to-deposit margins that determine total credit intermediation services tend to imply smaller ratios of services to assets or liabilities for shadow banks than for traditional banks. Shadow banks do not provide the same range of retail services as traditional banks, e.g, they are unlikely to have extensive ATM networks, automatic bill payment programs or friendly teller windows, so this is unsurprising. Thus, while shadow banks retain the essential liquidity transformation services central to credit intermediation (Diamond and Dybvig, 1983), they eliminate many of the services provided by “brick and mortar” banks.

Second, the shadow bank assets generated by a loan to a final borrower can be a multiple of the amount of the loan if the intermediation chain involves more than one step (as documented, e.g., by Adrian and Shin, 2010). By using methods developed and applied in this paper, an output approach avoids this double counting. An output approach also makes possible comparisons of

<sup>1</sup>That runs on instruments associated with shadow banking played an important role in the crisis is the basis of an extensive literature, including Kacperczyk and Schnabl (2010) and Covitz, Liang, and Suarez (2013), who argue that a run on asset-backed commercial paper (CP) was important in the early part of the crisis. Lehman’s failure then led to additional runs on CP, as well as money market mutual funds (MMMFs) and repos (for further discussion see Duffie, 2010; and Gorton and Metrick, 2012).

shadow banking activity with traditional banking activity and with overall economic activity, or GDP.<sup>2</sup>

We define shadow banking using the Federal Reserve’s Financial Accounts of the United States (or FAs) following an approach with some notable parallels to Gallin (2013). We include all of the direct or securitized lending of nondepository financial institutions (excluding long-term funders such as pension funds and life insurers) and all of the funding that nondepository financial institutions obtain through short-term, deposit-like liabilities. All told, this amounts to exploiting information from nearly half of the 19 institutional sectors of the FAs.

The U.S. national accounts do not now record implicit services for shadow banks, and as we shall shortly see, this is a notable shortcoming of the way in which financial services output is portrayed in U.S. macroeconomic data. The institutional character of shadow banking is of course rather country-specific, but the basic message of this paper, that the production of credit intermediation services takes place in sizable quantities both inside and outside traditional entities, is a broadly applicable one. Most major countries also fail to account for services produced by shadow banks despite the fact that (1) recent IMF paper claims that two-thirds of shadow banking now occurs outside the United States (Claessens et al. 2012, p.6).<sup>3</sup> and (2) the System of National Accounts (European Commission et al. 2009, section 6.165) recommends measuring borrower services for loans made by nondepository financial institutions as well as for loans made by depository institutions.<sup>4</sup>

This paper has two main sections: One reviews our framework and general methods; another presents our application to the United States and analyzes results. A final section concludes.

## I. Framework and Approach

The output of nondepository credit intermediaries that make up the shadow banking sector is measured by applying the reference rate approach, the same approach used in the U.S. NIPAs, as explained in Fixler, Reinsdorf, and Smith (2003, p. 35) and amended by Hood (2013b). The

<sup>2</sup>Some previous research has used an output approach but has done so in a more limited way than in this paper: Ashcraft and Steindel (2008) measured output from off-balance sheet mortgage- and asset-backed securities (MBSs and ABSs) sponsored by commercial banks; our own prior work presented estimates of borrower services supplied by finance companies (Corrado et al., 2012); and Greenwood and Scharfstein (2013), who constructed a broad measure of output of borrower services associated with securitized loans but applied commercial bank margins without adjustment for default risk.

<sup>3</sup>Apparently, activity is notable not just in the Euro Area and the United Kingdom, but also in many emerging markets where rapid growth is offsetting a decline in the United States.

<sup>4</sup>The SNA stops short of recommending the inclusion of funder services provided by nontraditional credit intermediaries, a matter this paper also shed light on.

reference rate approach is based on the theory of the user cost of money,<sup>5</sup> and its use to measure implicitly priced credit intermediation services, known in national accounts as financial services indirectly measured (FISIM) consumed by borrowers and depositors, is the recommended international standard.

There are open research questions concerning national accounts guidelines and FISIM measurement practice, however. With regard to completing the picture of credit intermediation, three central issues emerge:

- 1) How can we be sure we are capturing all credit intermediation services produced by domestic financial institutions? (And does this differ from total financial services produced and consumed in the economy?)
- 2) How do we account for a financial services production technology that breaks the credit intermediation process into steps that are performed by different institutions?
- 3) What reference rate should be used? (And how can the lack of the regulatory information on shadow bank operations be surmounted?)

#### *A. The circular flow*

To address the first issue, we begin by asking how financial institutions fit into Knight’s circular flow model (CFM) of the economy. At least one answer to that question, offered in Corrado and Hulten (2014), is that the financial sector should be placed in the center of the circular flow to reflect its essential nature as an intermediary.<sup>6</sup> Although the issues we address are different than in Corrado and Hulten (they focussed on market valuations), we adapt this notion and place financial institutions in the center of the CFM (see figure 1). This permits us to focus on the services flows that originate from financial intermediaries (all of which are in the box with the dashed outline) and the producers and consumers in the circular flow. Consumers are of course the investors; producers are the usual businesses: corporations, small business and also households as owner-occupiers of homes.

An advantage of organizing financial activities as in figure 1 is that credit intermediation services flows primarily occur (1) between financial institutions themselves or (2) between a

<sup>5</sup>The user cost theory for financial assets was developed by Diewert (1974) and Barnett (1978) and applied to banking by Hancock (1985), Fixler (1993), and Fixler and Zieschang (1999).

<sup>6</sup>Hulten (2006) set out the general reasoning for a “special” treatment of capital in the circular flow.

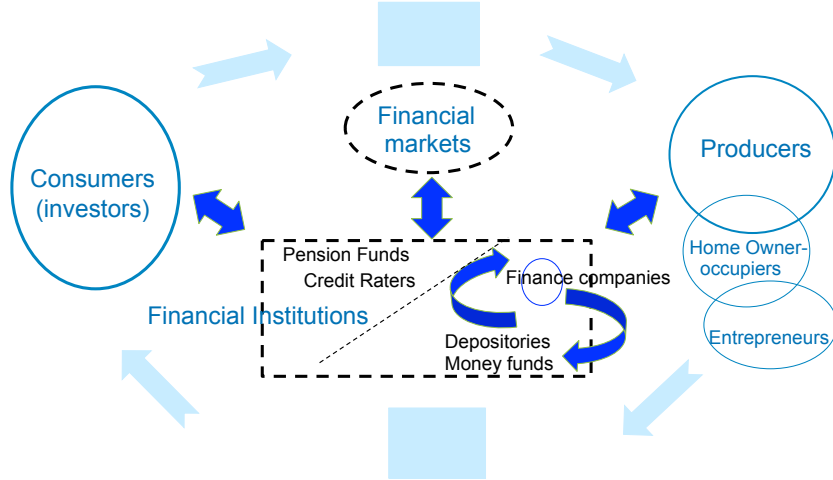


FIGURE 1. MODIFIED CIRCULAR FLOW

financial institution on the one hand and, either consumers as investors *or* business as producers, on the other. Issuance of financial instruments by nonfinancial businesses to each other, or to consumers, is not central in this set up (although the activity is obviously not precluded). If the provision of financial services is a line of business for a nonfinancial company, it usually takes place through a finance company subsidiary or a holding company, both of which are shadow entities included in the financial sector of accounts such as the Federal Reserve’s FAs. Indeed, the shadow bank percentage of total U.S. short-term credit market liabilities held outside the traditional banking sector has stood at or above 97 percent for more than 10 years.<sup>7</sup>

The names shown in the financial institutions block of figure 1 are illustrative, not comprehensive. They are designed to distinguish between two essential types of institutions: “pass-through” financial institutions, such as pension funds and insurers, on the left and “runnable” deposit-taking intermediaries on the right. Institutions on the left are assumed to provide direct, fee-based services to investors (i.e., mainly asset management services, not maturity transformation), whereas activities on the right are a mix of direct and indirectly provided credit intermediation services. Shadow banks are a sub-set of these “runnable” intermediaries.

<sup>7</sup>In this regard, our framework appears rather different than the financial accounting framework of Diewert, Fixler, and Zieschang (2012) and Diewert (2013) even though both can be said to follow the functional approach to defining financial output set out by Wang (2004) and Wang, Basu, and Fernald (2009). Diewert (2013), for example, argues that depositor services are produced by nonfinancial firms issuing commercial paper. Although not apparent via figure 1, much of these services are then consumed by shadow banks, and accounting for such services also takes place in our scheme. This will become apparent in our discussion of production and value added in intermediation chains below.

Figure 1’s ring fence of financial intermediaries helps frame activities requiring measurement. In the United States, there are 19 major sub-sectors of the financial sector in the U.S. financial accounts (figure 2 provides this U.S.-specific list). These sub-sectors collectively correspond to the financial activities sector of the industry classification system used in the United States (NAICS 52), with the noteworthy exception that holding companies, leasing finance, and credit rating agencies are outside this central sector. Eight of the FA sub-sectors are primarily long-term funders performing asset management and insurance functions, i.e., they are what we have termed pass-through institutions. The remainder are credit intermediaries, nine of which are the shadow banks highlighted in figure 2.<sup>8</sup>

### Sub-sectors of financial business in U.S. financial accounts

- |  |  |
|--|--|
| <b>1. Monetary Authority</b>                 | <b>9. Money Market Mutual Funds</b>      |
| <b>2. Private Depository Institutions</b>    | <b>10. Mutual Funds</b>                  |
| U.S.-chartered Depository                    | <b>11. Closed-End and Exchange-</b>      |
| Institutions, ex. Credit Unions              | <b>Traded Funds</b>                      |
| Foreign Banking Offices in U.S.              | <b>12. Government-Sponsored</b>          |
| Banks in U.S.-Affiliated Areas               | <b>Enterprises</b>                       |
| Credit Unions                                | <b>13. Agency- and GSE-Backed</b>        |
| <b>3. Property-Casualty Insur. Comp.</b>     | <b>Mortgage Pools</b>                    |
| <b>4. Life Insurance Companies</b>           | <b>14. Issuers of Asset-Backed</b>       |
| <b>5. Private and Public Pension Funds</b>   | <b>Securities</b>                        |
| <b>6. Private Pension Funds</b>              | <b>15. Finance Companies</b>             |
| <b>7. S&amp;L Gov. Emp. Retirement Funds</b> | <b>16. Real Estate Investment Trusts</b> |
| <b>8. Fed. Gov. Emp. Retirement Funds</b>    | <b>17. Security Brokers and Dealers</b>  |
|  | <b>18. Holding Companies</b>             |
|  | <b>19. Funding Corporations</b>          |
- Gray=Traditional Banks    Black=“Shadow Banks”    Blue=pass-through institutions**

FIGURE 2. FA FINANCIAL SUBSECTORS

Though the term shadow banking suggests an absence of information, by using the FAs we are able to cover almost all of the relevant credit intermediation activity. A few noteworthy gaps in the data on nondepository financial sectors in the FAs that affect our estimates are: Insufficient information is available on security lending liabilities for us to include them; no information is

<sup>8</sup>The count of financial sub-sectors includes the monetary authority as well as funding corporations. The latter sector tracks the lending associated with the Federal Reserve’s special lending facilities created during the crisis and is included with shadow banks.

available on the use of leverage by hedge funds and closed-end mutual funds; and commercial paper and repo positions are not broken down by term, so we cannot take account of changes in average maturity like the shortening that occurred during the crisis.<sup>9</sup> All that said, we believe we are able to derive measures of credit intermediation activity by financial institutions that are close to comprehensive and afford new insights into the importance of nonbank intermediaries in the recent evolution of the U.S. economy.

### B. Intermediation chains

The production technology of the shadow banking sector breaks up the credit intermediation process into steps that are performed by different institutions. This makes the treatment of intermediation chains a critical issue in measuring the output of nonbank intermediaries.

#### SERVICES FLOWS

Accounting for the transactions that occur along an intermediation chain that links a final borrower to a final funder is equivalent to accounting for flows of intermediate inputs inside a consolidated sector of an economy. The standard solution to this problem is to calculate via Domar aggregation a sectoral output measure that includes only the output produced within the sector for use *outside* the sector. Sectoral output is a term used in productivity analysis for aggregates and sub-aggregates of industries when production technology entails the use of own-produced intermediate inputs as well as standard inputs (labor, capital, and intermediates purchased from other sectors). The financial services production process we are modeling need not account for standard inputs (because they are already accounted for in the usual way), so we use the term *consolidated* output to refer to FISIM produced by shadow banks for use outside the sector.

When considering the consolidated output of the shadow bank system, however, it is important to keep in mind that intermediation may occur within the sector, i.e., between the institutional sub-sectors of the shadow bank system.<sup>10</sup> We thus compute FISIM for each institutional sector of the shadow banking sector separately, which can be summed to yield the *gross* output of

<sup>9</sup>Note that trade credit is excluded from our analysis, mainly because we know very little about its terms and risks, but also because financial institutions are not materially involved (i.e., it is largely a B2B activity with a very small footprint in the macroeconomic circular flow).

<sup>10</sup>GSEs and funding corporations, for example, hold repo assets, and so consume some of the depositor services produced by net repo borrowers.

the shadow banking sector. The consolidated output is in fact obtained by subtracting within-sector uses of each sub-sector's output. After further excluding FISIM inputs supplied by both traditional banks *and* other sectors, we obtain a value-added type measure for the implicit services contributed by the shadow banking sector to the rest of the economy.<sup>11</sup> This of course is not precisely value added because we ignore non-FISIM inputs and outputs, and we thus call it *net* output.

Finally, we produce estimates of the uses of intermediation services to complete the picture of credit intermediation from a national accounts perspective. We call this measure *final purchases*, and it represents the impact that estimating shadow banking FISIM has on estimates of the level and trajectory of GDP. A notable portion of the value added components we estimate (shadow bank FISIM and inputs to the production of shadow bank FISIM) reflect a reallocation of existing sector value added, and only the value of final purchases adds to total value added.

#### BALANCE SHEETS

Final uses of borrower services are estimated using consolidated sector borrowings; final uses of depositor, or funder, services are estimated using consolidated sector holdings. We adapt the aggregation approach developed by Gallin (2013) for determining the consolidated balance sheet of the shadow banking sector, which has notable parallels to Domar aggregation as does the process for computing services flows described above. The requisite consolidated balance sheets are not found in the FAs.

For completeness, figure 3 sets out stylized versions of the requisite balance sheets as per the revised CFM. Compared with our calculations, these have been simplified in two main ways: one, they ignore the fact that nonfinancial business holds deposits; second they ignore that consumers have personal loans. These are not essential to the main points we wish to make with the figure, the first of which is that the consumer (column 1) owns all of the equity in the economy, and these holdings consists of equity in nonfinancial business *and* equity in financial business. As seen in column 2, producers use nonfinancial assets  $N^P$  (capital) to produce goods and nonfinancial services, and a fraction  $(L + B^P)/N^P$  of that capital is leveraged and held as financial assets in financial business. This is seen in column 6, which shows the financial sector

<sup>11</sup>Inputs supplied by other sectors is computed based on shadow bank holdings of short-term assets, mostly commercial paper, issued by non-shadow, non-depository businesses. This mainly reflects CP issuance by nonfinancial business although a small portion reflects services supplied by pass-through financial business. Our measure of inputs supplied by other sources is not necessarily *all* FISIM attributable to nonfinancial and passthrough financial business, but as a practical matter, for the United States, it is very close.



| Balance sheet for Investors, Producers and Financial Institutions.                           |                         |           |   |  |                     |                    |                     |                     |     |
|--|-------------------------|-----------|---|--|---------------------|--------------------|---------------------|---------------------|-----|
| Balance sheet items  | Investors/<br>consumers | Producers |   | Financial Institutions   |                     |                    |                     |                     |     |
|  |                         | A         | B | C  | Total               | C.I.               | Pass.               | Total               |     |
|  |                         |           |   |  |                     |                    |                     | Gross               | Net |
|  | (1)                     |           |   | (2)  | (3)                 | (4)                | (5)                 | (6)                 |     |
| Productive Assets  |                         |           |   | N <sup>P</sup>   | N <sup>F1</sup>     | N <sup>F2</sup>    | N <sup>F</sup>      | N <sup>F</sup>      |     |
| Financial Assets   | E+D                     |           |   |  | L                   | B                  | L<br>B              | L<br>B <sup>P</sup> |     |
| Financial liabilities  |                         |           |   | L<br>B <sup>P</sup>  | D<br>B <sup>F</sup> |                    | D<br>B <sup>F</sup> | D                   |     |
| Equity <sup>1</sup>  |                         |           |   | E <sup>P</sup>   | E <sup>F1</sup>     | E <sup>F2</sup>    | E <sup>F</sup>      | E <sup>F</sup>      |     |
| Net worth  | E+D                     |           |   |  |                     |                    |                     |                     |     |
| 1. Includes reserves.<br>C.I. = credit intermediaries<br>Pass. = asset managers and insurers |                         |           |   | E=Equity=E <sup>P</sup> +E <sup>F</sup><br>N=Nonfinancial assets<br>D=Deposits |                     | L=Loans<br>B=Bonds |                     |                     |     |

FIGURE 3. STYLIZED BALANCE SHEETS.

on consolidated basis. Column 6 underscores that financial services production uses standard inputs (labor and capital) *and* the levered portion of producer assets ( $L$  and  $B^P$ ) to produce a flow of output.

Before turning to how we estimate prices for these financial assets, it is useful to explain what is meant by shadow bank deposits. The shadow banking analog of deposits are the short-term and current liabilities that permit shadow bank funders to obtain cash in much the same way that depositors can withdraw money from a retail bank. Funders of shadow banks thus obtain via such instruments the same kind of liquidity and cash management services that depositors at traditional banks do.

Two credit instruments we include in connection with shadow banking deposits are securities repurchase agreements (repos) and commercial paper (CP). The SNA (11.59 and 17.254) recommends including short-term repo liabilities in measures of depositor services for traditional banks. We argue that CP plays a similar role to repos in credit intermediation by shadow banks. Asset-backed commercial paper, for example, is a key link in the intermediation chain by which investments in money market mutual funds (MMMFs) undergo maturity transformation and fund mortgages Kacperczyk and Schnabl (2010, p. 36). To generate a complete picture of intermediation services produced by shadow banks, we thus include CP in our measure of depositor

services.

In addition to CP and repos, figure 4 reports the relative sizes of MMMF liabilities that are used to calculate depositor services for shadow banks. Our gross output of the MMMF sector reflects the entire value of depositor services consumed by investors in MMMF shares, and we thus include all credit market instruments held by MMMFs, i.e., we include corporate bonds and asset-backed securities, not just commercial paper and repos. As may be seen, there are dramatic upward movements in these components prior to the crisis.

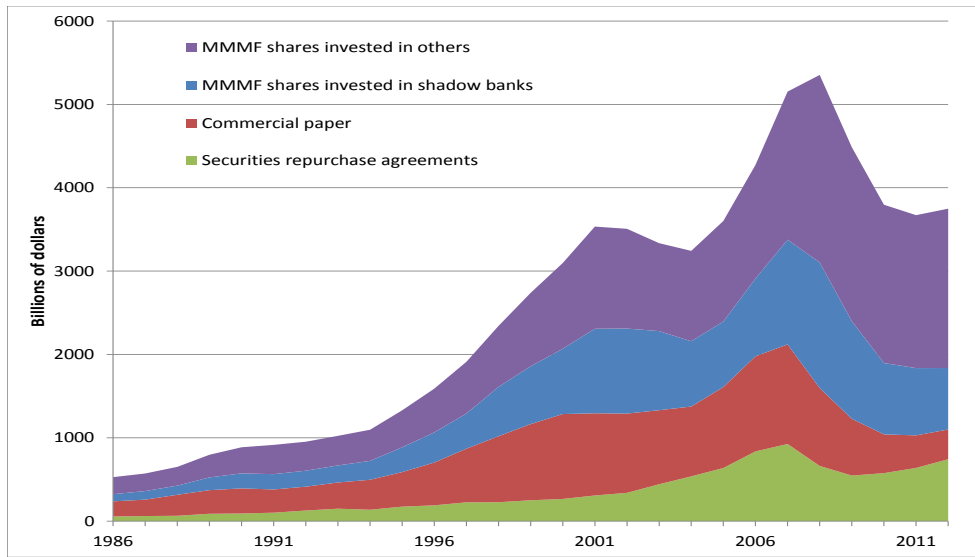


FIGURE 4. LIABILITIES USED TO CALCULATE SHADOW BANKING DEPOSITOR SERVICES, 1986–2012.

### C. The Reference Rate

The reference rate approach can be described rather simply at some level, but application and implementation are complex matters and a subject of debate in the literature. A recent change made to the U.S. national accounts—one that removes interest banks set aside to cover expected default costs from borrower FISIM (Hood, 2013b)—requires a brief review. In that light we then consider the applicability of positions taken by Wang and her co-authors (Wang, 2004; Wang, Basu, and Fernald, 2009; Basu, Inklaar, and Wang, 2011) for the estimation of FISIM for shadow banks.

## BASICS

Let  $r^R$  be a reference rate available on an instrument that does not entail services to or from the creditor or debtor, i.e., a rate that represents the opportunity cost of funds for the financial intermediary and for investors. Let  $r^D$  be the interest rate paid on deposits or analogs to deposits. Then the user cost of that liability  $\rho^D$  is

$$(1) \quad \rho^D = r^R - r^D .$$

Depositors purchase implicitly priced services via foregone interest. The value of these services equals this user cost times the balance in the deposit account. For loans, the user cost  $\rho^L$  is the difference between the loan rate net of expected default costs ( $r^L - \delta$ ) and the reference rate,

$$(2) \quad \rho^L = (r^L - \delta) - r^R .$$

Borrowers purchase implicitly priced services via the excess interest paid. Note that  $(r^L - \delta)$  is the yield to the lender.

In the NIPAs, the reference rate for commercial banks is based on rates that banks receive on their Treasury and Federal agency bonds and on market rates for Treasury bonds. The adjustment for expected default costs  $\delta$  is estimated by loan type based on historical charge-off patterns (see Hood 2013b) and is rather consequential; see figure 4, which reports charge-off rates for commercial banks. Charge-off rates are very large for credit card loans (where the corresponding interest rate is very high too) and sizeable for other loan types as well.

Consider now the position of Wang and her co-authors. They advocate (1) taking a functional approach to defining bank output for measurement purposes (i.e., defining banks by the services functions they carry out, e.g., loan screening and processing, asset management, etc.), (2) excluding expected default costs from borrower FISIM, and (3) adopting a definition for FISIM that excludes returns to risk-bearing by replacing the single reference rate with a family of maturity-matched reference rates. The first principle is of course sensible and corresponds, in our language, to the “financial services production” we attempt to model in this paper. The second has been implemented in the U.S. national accounts and is followed in this paper.

With regard to (3)—using a risk-adjusted reference rate—note first that the Wang et al. (2009) position follows from (a) the view that the investor/consumer is the equity holder of the bank,

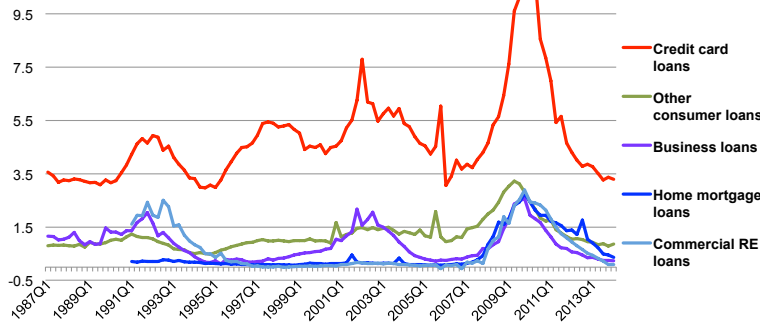


FIGURE 5. COMMERCIAL BANK CHARGE-OFF RATES, 1987Q1-2014Q1

as in our framework, and (b) that risk aversion causes investors to demand a premium  $\phi$  in the form of a higher rate of return when the risk posed by a borrower adds significant variance to the return on a diversified portfolio. Thus we have a risk premium that compensates the investor for the disutility of bearing risk (i.e., earnings the lender is expected to retain or pay out in dividends), and a default premium that compensates a lender for the possibility that the interest charge on a loan fails to be paid,<sup>12</sup>

$$\begin{aligned}
 (3) \quad \rho^L &= (r^L - \delta) - (r^R + \phi) \\
 &= \text{lender's yield} \\
 &\quad - \text{investor's required rate of return.}
 \end{aligned}$$

Where does this leave us?

First, for loans that are close substitutes for funding that could have been obtained through other means (marketed bonds or equity), the Wang group proposal seems conceptually appropriate, yet as argued in Reinsdorf (2011), most commercial bank loans are *not* close substitutes for other forms of financing, and the inclusion of  $\phi$  in (3) fails to give financial institutions adequate credit for the liquidity provision and liquidity transformation services they produce.

Second, consider the trusts that hold pools of mortgages or loans and issue securities in the shadow bank sector, e.g., the GSE-sponsored pools in the United States. We can estimate

<sup>12</sup>As explained in (Wang et al., 2009, p. 282), a default premium differs from the risk premium to the extent the probability of default is correlated the marginal utility of consumption, i.e., a risk premium includes compensation for bearing additional systematic, nondiversifiable risk.

borrower FISIM produced by these and related entities using the *spread* between the interest rate paid by those borrowing from the pool (adjusted for default costs, so that it is a yield to the pool) and the interest rate received by the investors in the securities issued by the pool. The latter clearly reflects the inclusion of a risk premium (it is the rate of return to pool investors) so that this procedure *is* equivalent to using a risk-adjusted reference rate to measure borrower services on securitized mortgages and loans.

All told, and as described in more detail below, we use the GSE spread for many of the margins that we need for the estimation of FISIM for shadow banks—and we also make use of the commercial bank business loan FISIM margin from the U.S. national accounts for estimates of business borrower services produced by the shadow system. We do the latter mainly because relevant information on interest payments, default risk, and cost of funds is not available for business borrowing from shadow entities, but also because many loans are in fact very much like loans from commercial banks, e.g., business equipment loans issued by finance companies. All told, then, the procedure for estimating borrower services for shadow banks is similar to that used for traditional banks, except certain instruments for certain entities use risk-adjusted reference rates.

## II. Measurement

The NIPAs use data on interest flows and charge-offs at commercial banks to measure credit intermediation services, but direct data on these flows are not available for nondepository institutions. To measure the credit intermediation output of shadow banks we must model their spread interest income net of credit losses (i.e., for each of our institutional sectors, which we will denote by the subscript  $S$ , we must obtain measures of  $r_S^R$ ,  $r_S^D$ ,  $r_S^L$ , and  $\delta_S$ ) using data on market interest rates and on loan originations and payoff patterns.

Table 1 summarizes how the components of user cost for each shadow banking institutional sector is measured (GSEs and GSE-backed pools are combined, as are security broker-dealers, funding corporations, and holding companies; thus six sectors or groups of sectors are shown). The reference rate is the pass-through rate paid to investors in GSE pools  $r^{GSE}$ , an average of it and the reference rate for commercial banks  $r_{CB}^R$ , or just the latter. The depositor rate is either the repo rate (calculated from commercial bank Call Report data) or the 30-day commercial paper (CP) rate; the average maturity of CP held by shadow bank institutions is 30 days (Kacperczyk and Schnabl, 2010). Borrower rates, or service margins, are of course more complicated, and we now review some of these key components of user cost in more detail.

TABLE 1— COMPONENTS OF USER COST BY INSTITUTION OF THE SHADOW BANKING SECTOR

| FA Sector<br>(S)   | Reference Rate<br>$r_S^R$                       | Depositor Rate<br>$r_S^D$  | Borrower Rate (margin)<br>$r_S^L$  | Exp. Credit Loss<br>$\delta_S$   |
|--|---|--|--|--|
| 1. GSEs and<br>GSE-backed pools<br>(GSE)   | $r^{GSE}$                                       | Bonds held by MMMFs <sup>a</sup> :<br>$r^{CP30}$   | Mortgages: coupon<br>rates relative to $r^{GSE}$   | Fannie Mae<br>credit loss<br>rate <sup>b</sup>   |
| 2. Private ABS Issuers<br>(ABS)  | Weighted average of<br>$r^{GSE}$ and $r_{CB}^R$ | a. Bonds held by MMMFs <sup>a</sup> :<br>$r^{CP30}$<br>b. CP liab. <sup>a</sup> : $r^{CP30}$                                       | a. Mortgages: $r_{GSE}^L$<br>b. Auto: $r^{Auto}$<br>c. Non-auto con.: $r^{Con}$<br>d. Trade credit: $r^{C\&I}$ | a. $\delta_{GSE}$<br>b. Auto loan default index <sup>d</sup><br>c. Bank charge-off rates<br>c. Bank charge-off rates |
| 3. Finance companies<br>(FinC)   | Weighted average of<br>$r^{GSE}$ and $r_{CB}^R$ | a. Bonds held by MMMFs <sup>a</sup> :<br>$r^{CP30}$<br>b. CP liab. <sup>a</sup> : $r^{CP30}$                                       | a. Mortgages: $r_{GSE}^L$<br>b. Auto: $r^{Auto}$<br>c. Non-auto con.: $r^{Con}$<br>b. Business: $r^{C\&I}$     | a. $\delta_{GSE}$<br>b. Auto loan default index<br>c. Bank charge-off rates<br>d. Bank charge-off rates              |
| 4. Security broker-dealers,<br>funding corps and<br>holding companies<br>(BD/HC) | $r_{CB}^R$                                      | a. Repos <sup>a</sup> : $r^{Repo}$<br>b. CP liab. <sup>a</sup> : $r^{CP30}$<br>c. Bonds held by MMMFs <sup>a</sup> :<br>$r^{CP30}$ | $r^{C\&I}$   | Bank charge-off rates  |
| 5. Mortgage<br>REITs   | $r^{GSE}$                                       | Same method as $r_{BD/HC}^D$   | $r_{GSE}^L$  | $\delta_{GSE}$   |
| 6. MMMFs   | n.a.  | Average industry margin <sup>a</sup>   | n.a.   | n.a.   |

LEGEND:

$r^{Auto}$  = finance company auto loan rates;  $r^{Con}$  = commercial bank consumer non-auto loan rate

$r^{C\&I}$  = commercial bank commercial and industrial loan rate

$r^{CP30}$  = 30-day commercial paper rate

$r^{GSE}$  = weighted average of pass-through rates of GSE-backed pools

$r^{Repo}$  = commercial bank repo rate

NOTES:

a. Borrower services on commercial paper, repurchase agreement and bond liabilities of shadow banks that are held by MMMFs are allocated to output of MMMFs. Bonds held by MMMFs pay  $r^{CP30}$  by assumption.

b. Calculated from annual reports.

c. Auto service margins are calculated at origination, and in any given month they are an average of margins in the mix of outstanding loans.

d. S&P/Experian index.

### A. Borrower services: Mortgages

Borrower services are measured by multiplying the services margin by outstanding mortgage balances. Because the boundary between the accounts of the GSEs and the GSE-sponsored pools is porous, we combine the mortgage balances held by these two institutional sectors of the FAs and treat the relatively small amount of mortgages that are directly held by GSEs the same as the mortgages in the GSE-backed pools.

The vast majority of interest paid by GSE borrowers is passed through to investors. A small fraction of the remainder is used to cover losses due to defaults, leaving a modest spread that is retained by the mortgage pool manager as compensation for providing borrower services. Our estimate of this spread ranges from 0.61 percentage points in the late 1990s to about 0.5 percentage points at the time of the financial crisis.<sup>13</sup> This spread declines over the crisis in part because it is adjusted for a measure of expected credit losses, which ranges from less than 1 basis point (0.01%) in the late 1990s and early-mid 2000s to more than 25 basis points (0.25%) during the crisis.<sup>14</sup>

GSE-sponsored mortgage pools held more than half of the mortgages in the shadow banking system until 2010, when many of the pools were moved back onto the balance sheet of their sponsor; similarly, in the years before the crisis the private ABS issuers and mortgage REITs held about a third of the mortgages in the shadow banking system, dropping to around 20 percent after the crisis. Unfortunately, we do not have data on the extent to which the higher interest rates on non-conforming mortgages are converted into higher pass-through rates on private issue mortgage-backed securities. Thus, we also use the spreads retained by the GSE pools to measure the borrower services on the mortgages held by private ABS issuers and mortgage REITs. The assumption that the GSE spreads are applicable to private ABS issuers probably understates their implicit services, at least until the financial crisis sent their default costs soaring.

<sup>13</sup>The interest rate spread is calculated as the service margin  $r_{GSE}^L$ , which is the weighed average coupon (WAC) rate paid by the borrowers less the pass-through rate paid to investors in the pool, minus an adjustment for expected default losses  $\delta_{GSE}$ . Data from eMBS.com covering the mortgage pools outstanding in 2012-2013 provide WACs, pass-through rates, and remaining principal balances, broken out by origination year and sponsor. Using the remaining principal balances as weights, we combine all the pools of a given vintage to get the average WAC and pass-through rate for that vintage. The overall average spread retained by mortgage pool managers in 2012 is calculated as an average of the spreads on the various outstanding vintages in that year, with each vintage weighted by its share of the overall remaining principal balance. Next, by assuming that shares of year  $t - 1$ , year  $t - 2$ , and so on, do not change when year  $t$  is defined to be an earlier year, we are able to calculate average spreads retained by pool managers in the years before 2012.

<sup>14</sup> $\delta_{GSE}$  is measured as a geometrically-weighted moving average of the net rates at which losses of principal were charged off by mortgage lenders in previous years. The average life of a mortgage loan is set at 10 years and a geometric smoothing parameter of 0.1 is used; as described in Hood (2013a), this produces an expected credit loss rate that reacts gradually to changes in experience. The charge-off rates come from 10-K filings of Fannie Mae, and are adjusted for effects of changing accounting practices.

Taking into account that the majority of ABS-issued loans are home mortgage loans, historically more than 2/3 of the total value of borrower services of shadow banks were services provided by mortgage-issuing, or primarily mortgage-issuing institutions (figure 6). This situation changed dramatically after the financial crisis of 2007-2008: finance companies are now the dominant producer of shadow-banking borrower services.

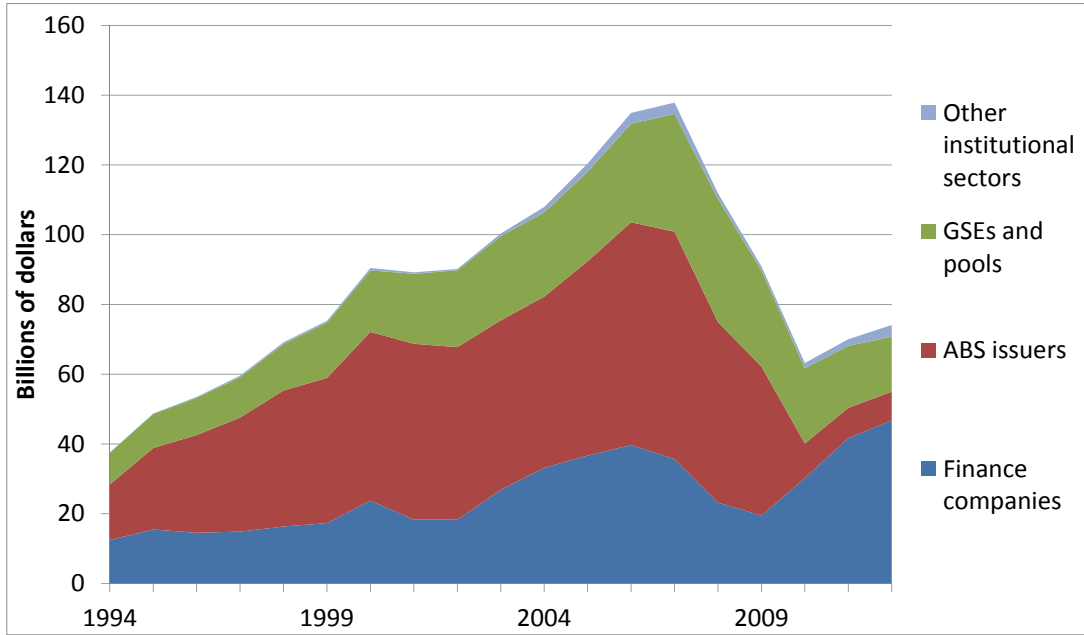


FIGURE 6. BORROWER SERVICES OF SHADOW BANKS, 1994–2012.

#### *B. Borrower services: Finance company loans*

Finance company loans consist of loans for autos, mortgages, revolving consumer credit (mainly credit cards), non-revolving consumer credit excluding autos, and business loans. The procedure for estimating the average rate being paid on auto loans combines rate data on cohorts of loans using appropriate weights in a similar way to the procedure used for mortgages. As set out in table 1, for mortgages, the interest rate that finance companies receive net of expected losses from defaults is assumed to equal the average net interest rate net received by the GSE-backed pools. For revolving consumer credit, we use the commercial bank interest rate for credit cards, and for non-revolving consumer credit other than auto loans, we use the commercial bank personal loan rate. Finally, for business loans we use the commercial bank commercial and industrial loan rate.



To estimate expected rates of loss due to defaults for revolving consumer debt we use bank charge-off rates for credit cards. For non-revolving consumer loans, we average banks' charge-off rate on non-revolving consumer loans with their charge-off rate on credit cards. By itself, the charge-off rate for non-revolving consumers loans from banks would be too low because non-revolving loans from banks include auto loans, which are collateralized, and the bank loans tend to go to safer borrowers.

For the reference rate for the finance company sector we use an average of the GSE pass-through rate and the commercial bank reference rate, with weights determined by mortgage and non-mortgage loan balances. The user cost margins implied by this reference rate for the loans made by finance companies are shown in figure 7. Finance companies have larger, more volatile margins on mortgages than GSEs. And their auto loan margins behave similarly to their mortgage margins, turning down after 2003, then rebounding after the financial crisis as the reference rate drops. By contrast, margins on revolving consumer loans and on business loans rise before the recessions of 2001 and 2008-2009, then fall during the recessions, only to rebound again after the recession has passed.

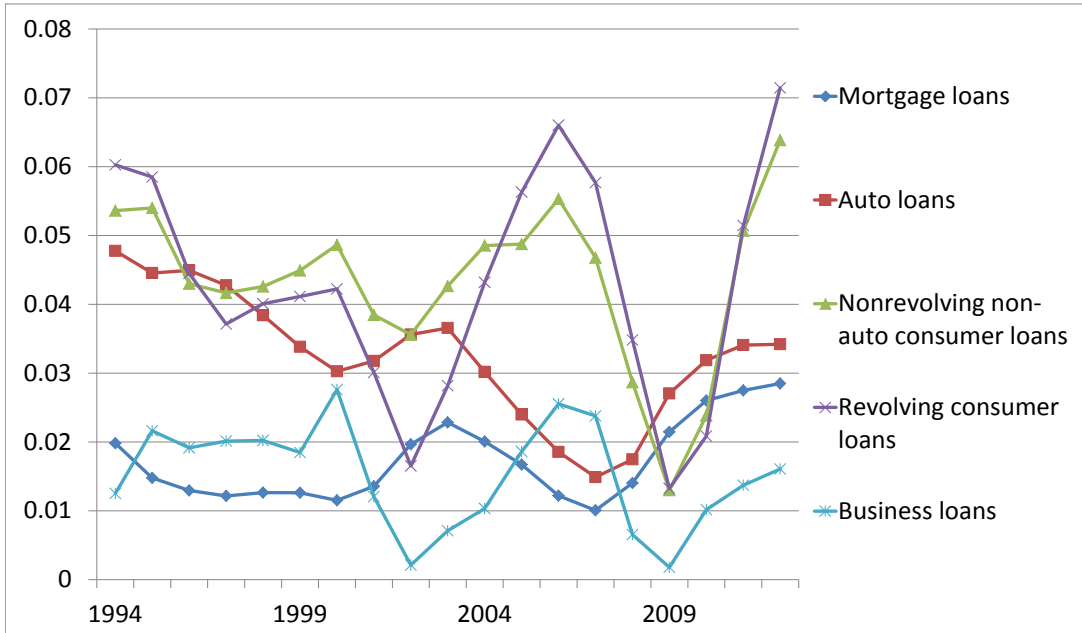


FIGURE 7. USER COST MARGINS FOR FINANCE COMPANY LOANS, 1994–2012.

Multiplying user cost margins by corresponding loan balances gives the borrower services

of finance companies. Total borrower services of finance companies grew rapidly prior to the financial crisis, declined sharply from 2007 to 2009, and then recovered starting in 2010 as margins on revolving consumer loans widened (figure 8). Balances owed on mortgages grew rapidly at finance companies from the late 1990s to 2006, and this growth leads to rising borrower services on mortgages up to 2004. From 2005 to 2009, changes in borrower services on mortgages are driven mainly by changes in their user cost margin; after 2009 falling mortgage balances pull down borrower services.

Borrower services on business loans are consistently smaller than on total consumer loans (revolving loans, non-revolving non-auto loans, and auto loans), even though in terms of balances consumer loans only become more important than business loans in the mid-2000s. The behavior of margins on business loans leads to a collapse of services to business during the downturn of 2000–2002, as well as a rebound a few years later, and then collapse again in the Great Recession.

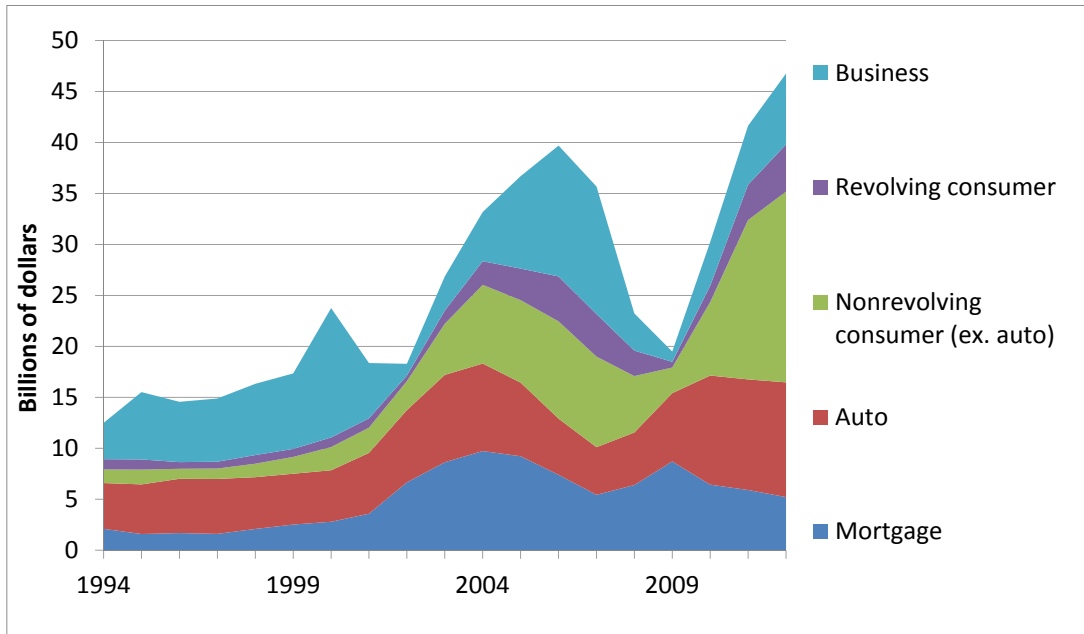


FIGURE 8. FINANCE COMPANY BORROWER SERVICES, 1994–2012.

### C. Depositor services

Figure 9 shows our estimates of depositor services. As previously indicated on table 1, user cost margins on the CP or repo liabilities of an institutional sector are based on the spread

between the sector's reference rate and the rate paid on CP or repos. In figure 9, the depositor services associated with CP or repo liabilities that are directly used to obtain funding from outside the shadow banking sector are classified as output of the sector of the liability issuer. The CP or repo liabilities that are used to obtain funding intermediated by an MMMF are included in MMMF depositor services. The GSE bonds held by MMMFs also are included in the depositor services intermediated by MMMFs (and by assuming that they pay the 30-day CP rate).<sup>15</sup>

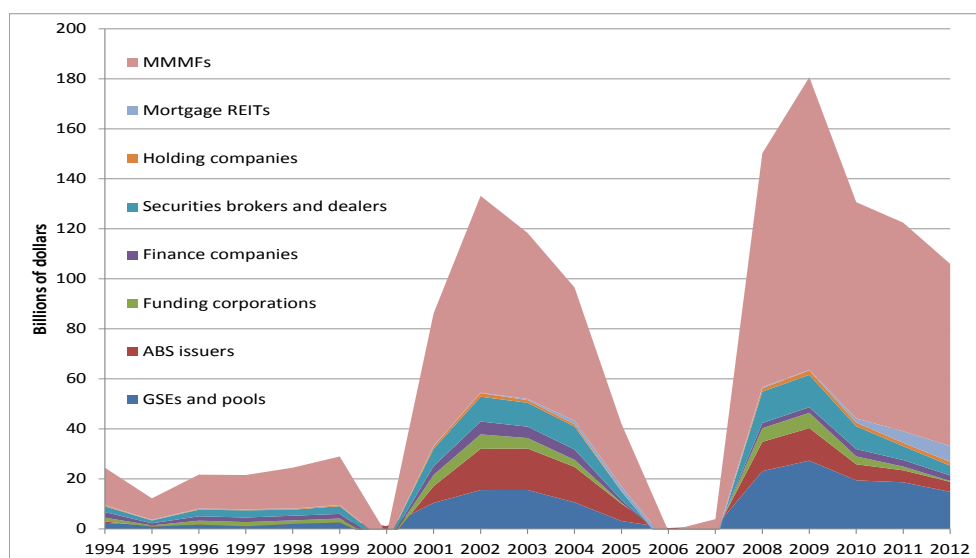


FIGURE 9. DEPOSITOR SERVICES OF SHADOW BANKS, 1994–2012.

Besides the user cost margins on the assets of MMMFs, the depositor services of MMMFs also include a second margin representing the spread between the interest received by the MMMF on its assets and the interest paid to the MMMF shareholders. This margin—which is already measured in the NIPAs as part of mutual fund services—represents an implicit payment by the shareholders for the depositor services of the MMMF itself.

Returning to figure 9, shadow bank depositor services grew slowly in the early years, reflecting

<sup>15</sup>The depositor services on the financial instruments that MMMFs buy from outside the shadow banking sector are included in the gross output of depositor services that MMMFs deliver to their shareholders but not the net output because MMMFs use inputs from outside the shadow banking sector to produce these services. The user cost margin on the instruments bought from outside the shadow banking sector is assumed to equal the overall average user cost margin on instruments that the MMMFs buy from issuers inside the shadow banking sector.

the then slow growth in the value of liabilities (recall figure 4). Before the recessions of 2001 and 2007–2008 depositor services fell, while after the onset of these recessions they rose. This volatility is driven by prices, as user cost margins for depositor services contracted when short term rates rose before the recessions, and expanded when they fell with the arrival of the recessions. The run-up on rates paid on repos and CP was particularly sharp between 2004 and 2007, and in 2008 the rapid decline these rates (and consequent rebound in gross depositor services) can be largely attributed to funding facilities put in place by the Federal Reserve. After the crisis, ABS issuers fade in importance. Interestingly, the mortgage REITs have a different fate and show strong growth in 2011–2012. Funding corporations, which include the Federal Reserve’s credit facilities related to the crisis, also rebound before eventually fading as these facilities were wound down.

#### *D. Total Implicitly Priced Services*

Line 1 of table 2 shows the total implicitly priced credit intermediation services of the combined traditional and shadow banking sectors from 1995 to 2011.<sup>16</sup> Lines 15 and 16 of the table show that total intermediation services peak at 3.85% of GDP in 2002 and 2003. Although the services supplied by traditional banks remained at the 2002/3 relative rates through 2007, services supplied by shadow banks began to fall after 2002/3. Figure 10 charts these data as a percent of GDP; ratios to GDP for borrower services also are shown.

#### GROSS SERVICES OF SHADOW BANKS

The shadow banking sector’s output of implicit borrower services slows from 2006–7, peaking at \$137.9 billion in 2007. This is just as the subprime mortgage markets became severely troubled. Shadow banks’ implicit borrower services falls sharply after 2007 but appears to have stabilized by 2011, albeit at a rate lower (relative to GDP) 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

<sup>16</sup>Besides commercial banks, savings institutions and credit unions are depository institutions that also produce credit intermediation services in the United States. Hood (2013a) measures the output of these services with a user cost approach. Combining Hood’s estimates for savings institutions and credit unions with estimates for commercial banks from the NIPAs enables us to compare our new measures for credit intermediation services produced by shadow banks with conceptually similar measures of services produced by traditional intermediaries. We do not use the NIPA values for implicit services supplied by savings institutions and credit unions because they do not employ a user cost approach.

TABLE 2— TOTAL IMPLICITLY PRICED CREDIT INTERMEDIATION SERVICES, BILLIONS OF DOLLARS

|  | 1995  | 2000  | 2001  | 2002  | 2003  | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Total services</b>                        |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 1. Depository institutions <sup>a</sup>      | 210.7 | 279.7 | 367.6 | 428.7 | 436.9 | 429.9 | 406.9 | 400.9 | 420.1 | 532.1 | 519.2 | 446.8 | 439.3 |
| 2. Commercial banks <sup>b</sup>             | 149.7 | 191.4 | 192.2 | 205.3 | 218.2 | 225.4 | 244.5 | 266.9 | 278.4 | 270.0 | 247.6 | 252.9 | 246.8 |
| 3. Shadow banking system                     | 118.2 | 154.8 | 151.7 | 157.7 | 164.9 | 170.7 | 187.8 | 207.6 | 222.3 | 217.9 | 197.8 | 200.0 | 191.4 |
| 4. Shadow banking system                     | 61.0  | 88.3  | 175.5 | 223.4 | 218.7 | 204.5 | 162.4 | 134.0 | 141.8 | 262.1 | 271.6 | 193.9 | 192.5 |
| <b>Borrower services</b>                     |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 5. Depository institutions                   | 101.2 | 190.9 | 195.9 | 199.6 | 216.8 | 230.3 | 256.0 | 291.8 | 313.5 | 281.0 | 242.6 | 217.3 | 221.7 |
| 6. Shadow banking system                     | 52.4  | 100.4 | 106.7 | 109.4 | 116.4 | 122.3 | 135.6 | 156.9 | 175.6 | 169.2 | 151.7 | 154.0 | 151.7 |
| 7. Shadow banking system                     | 48.8  | 90.4  | 89.2  | 90.2  | 100.3 | 107.9 | 120.4 | 134.9 | 137.9 | 111.9 | 90.9  | 63.2  | 70.0  |
| <b>Depositor services</b>                    |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 8. Depository institutions                   | 109.5 | 88.8  | 171.7 | 229.1 | 220.1 | 199.6 | 150.9 | 109.1 | 106.6 | 251.1 | 276.6 | 229.5 | 217.6 |
| 9. Shadow banking system                     | 97.3  | 90.9  | 85.5  | 95.9  | 101.8 | 103.0 | 108.9 | 110.0 | 102.7 | 100.8 | 95.9  | 98.9  | 95.1  |
| 10. Shadow banking system                    | 12.2  | -2.1  | 86.3  | 133.2 | 118.4 | 96.6  | 42.0  | -0.9  | 3.9   | 150.2 | 180.7 | 130.7 | 122.5 |
| 11. FISIM inputs, shadow banks               | 5.3   | -2.3  | 51.4  | 77.8  | 68.1  | 50.8  | 22.9  | -2.0  | 0.0   | 92.8  | 105.6 | 75.7  | 71.5  |
| 12. Consolidated shadow banking services     | 56.4  | 91.4  | 128.6 | 151.0 | 156.8 | 159.5 | 145.0 | 137.2 | 141.4 | 177.6 | 173.6 | 125.7 | 133.2 |
| 13. FISIM inputs, other institutions         | 5.0   | -2.7  | 48.3  | 74.1  | 64.2  | 48.1  | 19.9  | -2.6  | 0.5   | 85.4  | 98.9  | 69.7  | 62.4  |
| 13. Net services, shadow banks               | 56.0  | 91.0  | 127.1 | 149.3 | 154.5 | 156.4 | 142.5 | 136.6 | 141.3 | 176.7 | 172.7 | 124.3 | 130.1 |
| 14. Final purchases, shadow banking services | 29.2  | 43.0  | 69.4  | 82.2  | 81.3  | 78.8  | 62.8  | 54.8  | 53.8  | 77.4  | 78.6  | 61.7  | 72.2  |
| <b>Memos (% GDP):</b>                        |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 15. Traditional depository institutions      | 1.95  | 1.86  | 1.81  | 1.87  | 1.90  | 1.84  | 1.87  | 1.93  | 1.92  | 1.83  | 1.72  | 1.69  | 1.59  |
| 16. Shadow banks, gross                      | 0.80  | 0.86  | 1.65  | 2.03  | 1.90  | 1.67  | 1.24  | 0.97  | 0.98  | 1.78  | 1.88  | 1.30  | 1.24  |
| 17. Shadow banks, consolidated               | 0.73  | 0.88  | 1.20  | 1.36  | 1.34  | 1.27  | 1.09  | 0.99  | 0.98  | 1.20  | 1.20  | 0.83  | 0.84  |
| 19. Shadow banks, net                        | 0.61  | 0.82  | 0.85  | 0.93  | 1.02  | 0.98  | 0.95  | 0.94  | 0.88  | 0.74  | 0.62  | 0.33  | 0.38  |
| 20. Shadow banks, final purchases            | 0.38  | 0.42  | 0.65  | 0.75  | 0.71  | 0.64  | 0.48  | 0.40  | 0.37  | 0.53  | 0.55  | 0.41  | 0.46  |

NOTES—

a. Includes estimates of FISIM for savings institutions and credit unions from Hood (2013a), which are available through 2011.

b. Values are from the NIPAs.

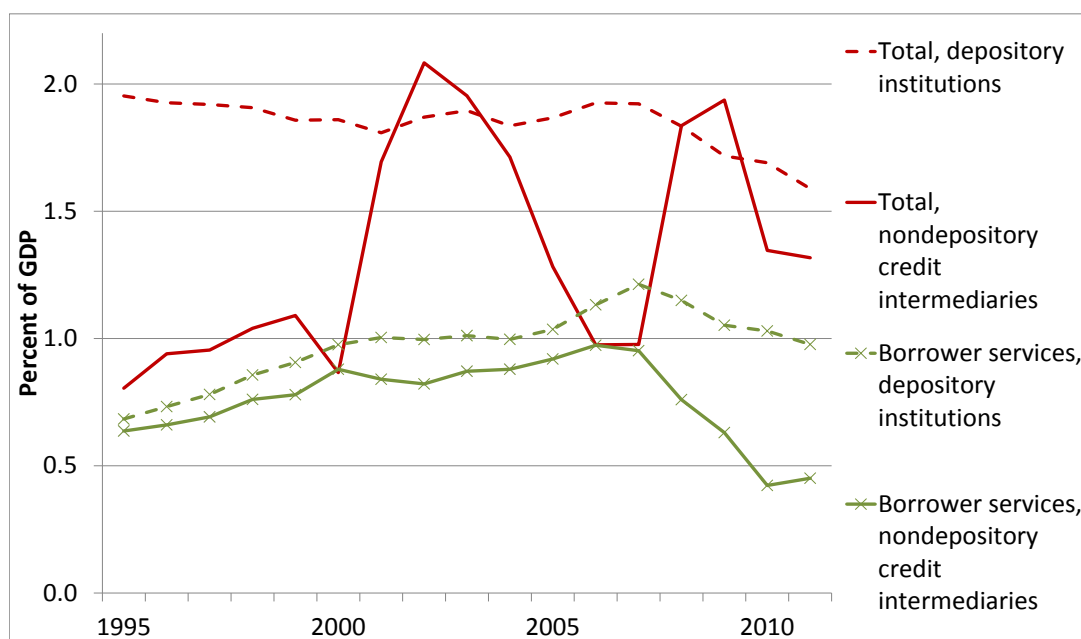


FIGURE 10. TOTAL AND BORROWER IMPLICIT SERVICES, TRADITIONAL AND SHADOW BANKS, 1995–2011.

implicit output of shadow banks rose rapidly from 1995 to 2002, to a peak of \$234.5 billion. Total implicit services of shadow banks declined four years earlier than borrower services because rising yields on shadow bank liabilities squeezed the user cost margins for depositor services starting in 2004.

Implicit depositor services then played a key role in what might seem to be a surprisingly rapid recovery from the crisis. The implicit output of shadow banks rebounded from \$0.2 billion in 2006 to \$188.3 billion in 2009. Many of the stabilization measures taken by the Federal Reserve during the crisis were directed at, or channeled through, the shadow banking sector.

Figure 10 also shows the output of credit intermediation services of the depository institutions, or traditional banks. At the shadow banking system’s peak in production in 2002, their implicit credit intermediation services was slightly above that produced by the traditional banking sector. Although total services produced by shadow banks have declined in relative terms since then, *total* services were larger in 2011 relative to production by traditional banks than they were in the 1990s.

Finally, it is important to note that interventions undertaken by the Federal Reserve after the financial crisis increased the depositor services output of shadow banks both *indirectly* by

lowering short-term interest rates and *directly* by providing credit through some shadow bank institutions. These actions staunched what might otherwise have been a sharp decline in shadow banking sector services. By contrast, credit intermediation services supplied by the traditional banking sector began a mild downtrend in 2007.

#### USES OF BORROWER AND DEPOSITOR SERVICES

To compute uses of the services of shadow banks, we use sector balances in the corresponding assets holdings (for depositor services) and liabilities (for borrower services) in the financial accounts. We assume, for example, that sectors use depositor services associated with commercial paper in proportion to their commercial paper assets. Borrower services from mortgages are sectorized according to asset holdings of shadow banks by type of mortgage first, then by mortgage liability holdings of users within these sectors. Uses are computed for each institutional sector and instrument separately, then summed to yield total uses.

Figure 11 shows uses of borrower services. While uses of borrower services both by the owner-occupied housing sector and for household consumption increase over the sample period before the crisis, owner-occupied housing sees a rapid expansion in the early to mid 2000s, followed by a rapid decline that continues through the end of the series. Household final uses, however, show a rebound after the crisis. No borrower services of shadow banks are used internally.

Figure 12 shows uses of depositor services. In contrast to borrower services, in most years more than half of depositor services are used within the shadow banking sector. This mostly reflects the large quantities of services used by MMMFs. MMMFs are the source of services furnished to households.

Overall, were these estimates incorporated into the U.S. National Accounts, we would see an increase in GDP ranging from about four tenths of a percent to about three quarters of a percent. The contribution of this sector to GDP peaks in 2002 at 0.77 percent.

#### NET SERVICES OF SHADOW BANKS

We define the “net output” of implicitly priced services of shadow banks as the sector’s consolidated gross output of such services (total gross output of FISIM less inputs of FISIM from other shadow banks) less its consumption of implicitly priced services from outside the sector.

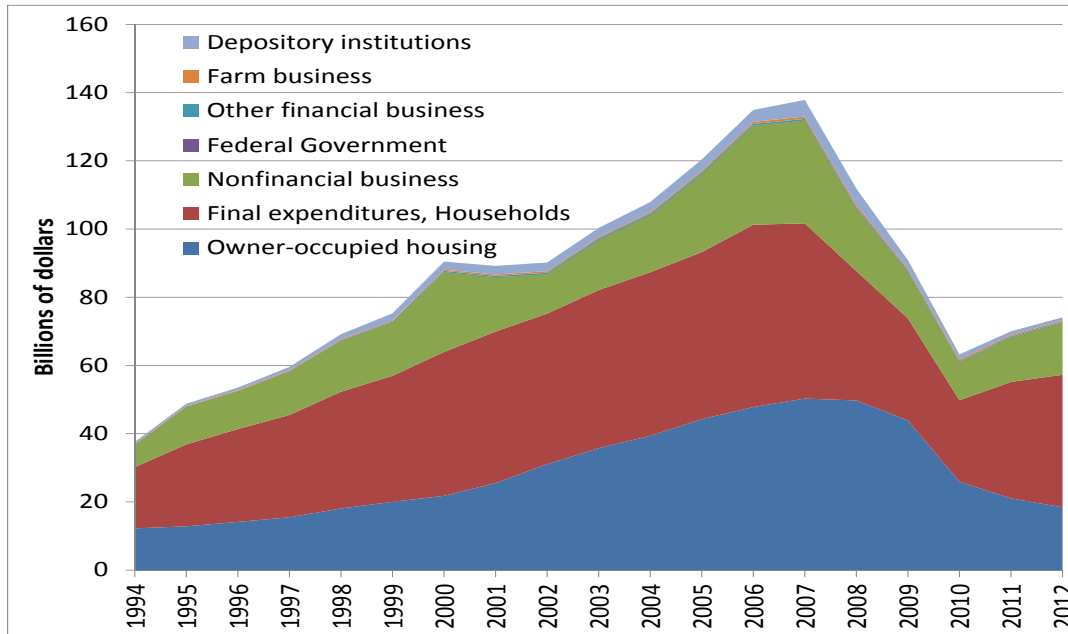


FIGURE 11. BORROWER SERVICES OF SHADOW BANKS BY USING SECTOR, 1994-2012.

Measuring the implicit output of shadow banks on a net (or approximate value-added) basis largely eliminates the volatility that is caused by fluctuating margins on depositor services: Net services of shadow banks climb steadily until 2006, then decline over the financial crisis and Great Recession (figure 13).<sup>17</sup> Canceling out intra-sector flows of FISIM in order to measure the shadow banking sector’s output on a consolidated basis reduces its volatility; then subtracting “new” FISIM produced by other sectors (mostly by nonfinancial firms<sup>18</sup>) eliminates volatility due to fluctuations in short-term interest rates. Figure 13 also shows that when measured on a net basis, the output of the shadow banking sector declines in 2008 in part because of the post-crisis inputs from the Federal Reserve.

The shadow banking sector is consistently both a producer and a user of depositor services, but but it is not a significant user of borrower services. Figure 14 shows both output produced

<sup>17</sup>To measure the consumption of implicitly-priced depositor services, we compute deposits and deposit-like assets of shadow banks that are claims on financial business excluding shadow banks, nonfinancial business, or the rest of the world. To estimate inputs of services from deposits, we use the commercial bank reference rate as the user cost margin (demand deposits are assumed to earn zero interest, while we use the commercial bank Call Reports for the interest rate on savings and time deposits). For other deposit-like assets, which include commercial paper issued by nonfinancial business, we use the average user cost margin that each shadow bank earns on its deposit-like liabilities. To measure consumption of borrower services on loan liabilities to financial institutions that are not shadow banks or on loan liabilities to the government, we use the shadow bank’s average user cost margin on its loan assets.

<sup>18</sup>This is mostly FISIM associated with commercial paper issued by nonfinancial firms that are in the asset holdings of MMMFs



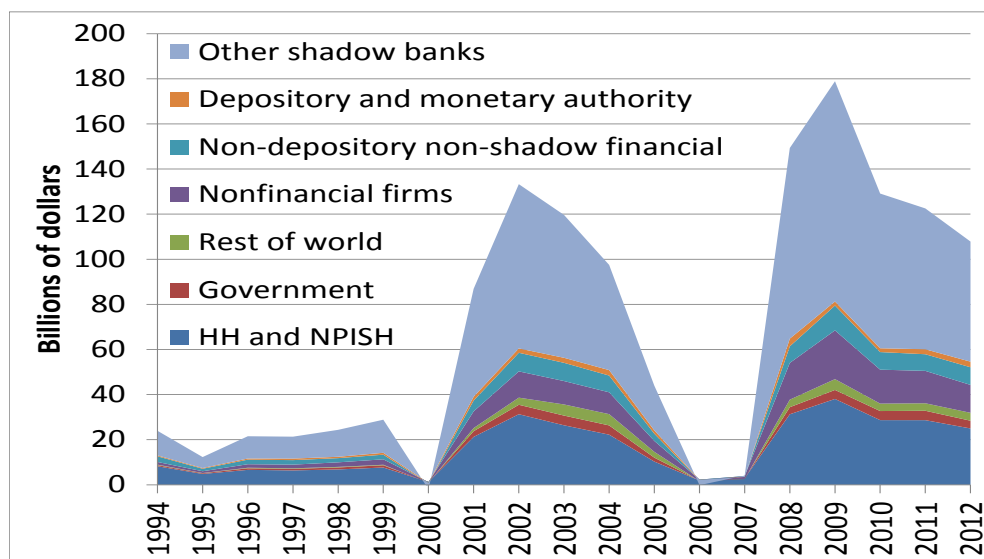


FIGURE 12. DEPOSITOR SERVICES OF SHADOW BANKS BY USING SECTOR, 1994-2012. HH: HOUSEHOLDS. NPISH: NONPROFIT INSTITUTIONS SERVING HOUSEHOLDS

by and inputs used by the shadow banking sector. We can see that uses of depositor services inputs closely track production of depositor services. On the other hand, the shadow banking sector produces substantially more borrower services than it uses.

Depositor services are stable on a consolidated basis only. Figure 15 shows net borrower services (borrower services produced less borrower services inputs consumed) for institutional sectors within the shadow banking system. Funding corporations play a large, counterbalancing role as users of depositor services.

During the financial crisis, a large, persistent gap appeared between the gross and the net output measures because the shadow banking sector began to consume borrower services on loans from the Federal Reserve and increased its *use* of depositor services. Indeed, the remarkably quick rebound of the shadow banking sector's gross output in 2008–2009 is more than explained by a rise in inputs of credit intermediation services supplied by other sectors. The margin between loan and deposit rates remained wide through 2012.

Much of the drop-off in the shadow banking sector's net output thus appears to stem from a reallocation of value added to other sectors. Among these other sectors was nonfinancial

business, suggesting that a portion of the Fed’s support to the financial system during the crisis may have benefitted “Main Street” and not just “Wall Street.” But the main part of the net decline in shadow banking output during and after the crisis stemmed from the sharp decline in its production of borrower services, which would have had a contractionary effect on household and nonfinancial business investment and consumption. On a net basis, the decline in output of the shadow banking system was due almost exclusively to a reduction in its production of borrower services.

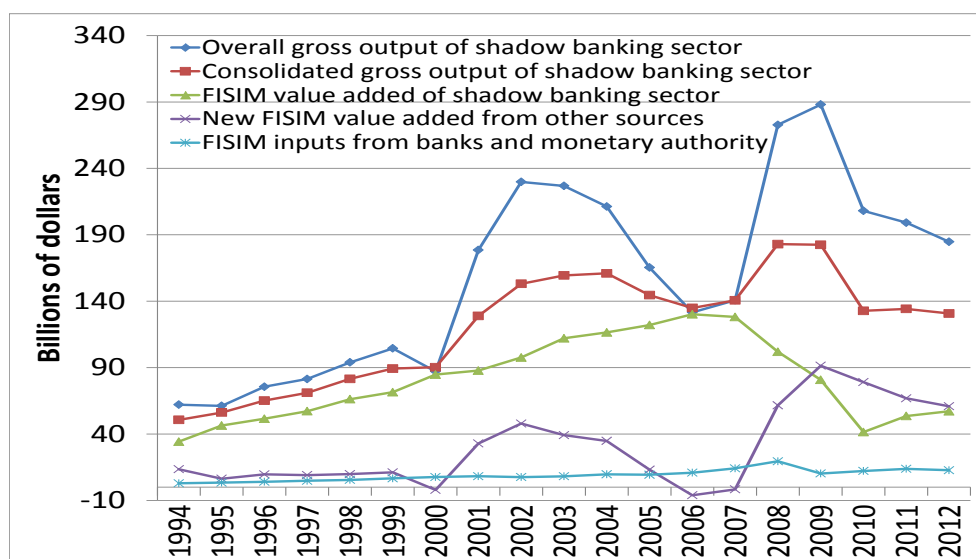


FIGURE 13. GROSS SERVICES AND VALUE ADDED OF SHADOW BANKS, 1994–2012.

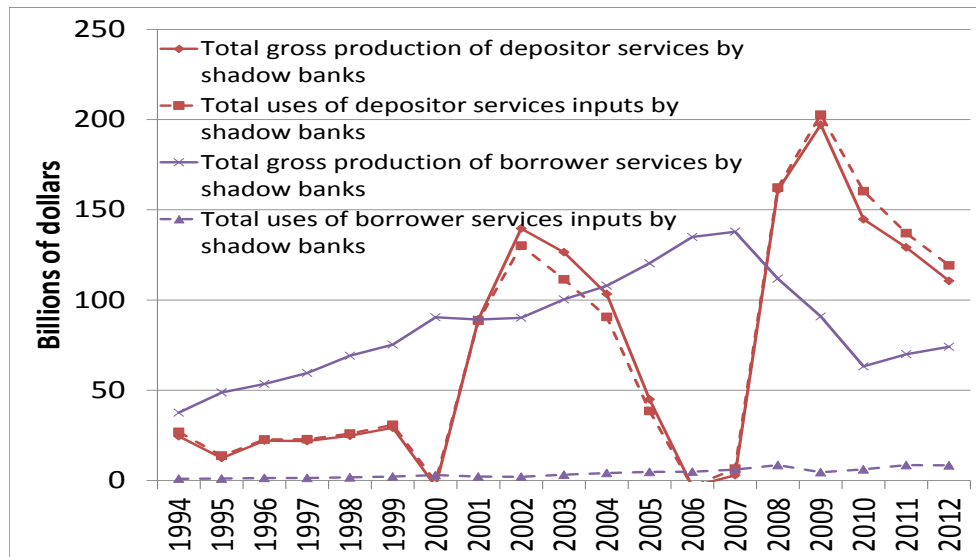


FIGURE 14. INPUTS AND OUTPUTS OF INTERMEDIATION SERVICES OF SHADOW BANKS, 1994–2012.

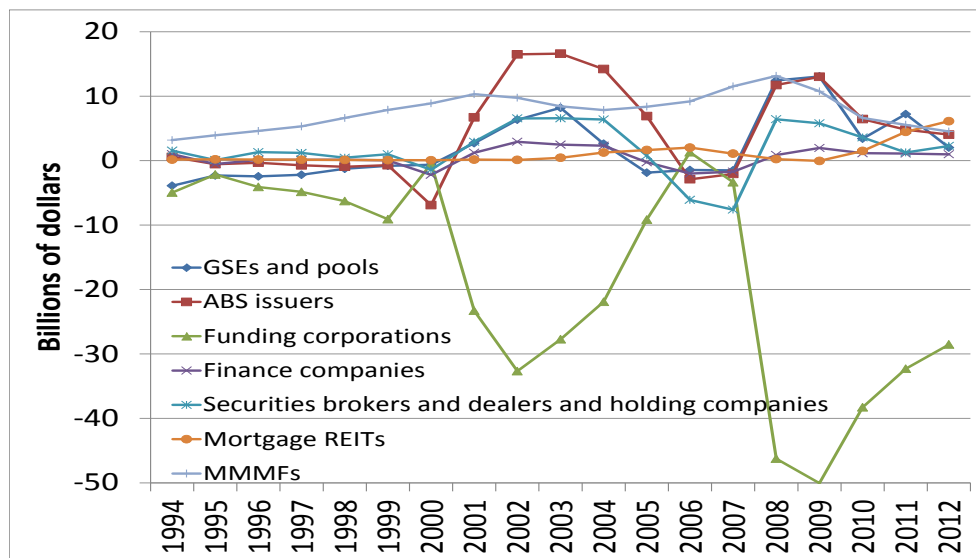


FIGURE 15. DEPOSITOR SERVICES PRODUCED LESS DEPOSITOR SERVICES CONSUMED BY INSTITUTIONAL SECTORS OF SHADOW BANKING SYSTEM, 1994–2012.

### III. Conclusion

The growth of the shadow banking sector was a key development in the U.S. economy, playing a central role in the financial crisis. By developing extensive estimates of the services produced by shadow banks and used by other sectors, we complete the picture of credit intermediation in the United States. The measurement challenges we surmounted, we believe, were considerable: We accounted for borrowing and lending along the intermediation chains that link final borrowers and final funders in a way that avoided double counting. We used data on interest rates, loan originations, default rates and loan pay-off patterns to model the effective rates needed to estimate user cost margins because we did not have information on interest flows available from reports filed by traditional banks that allow for direct estimation of user cost margins. We estimated the inputs from other sectors, including traditional banks, the monetary authority, and other producers of FISIM such as nonfinancial firms and non-depository, non-shadow financial firms. This was done for shadow bank lenders in nine institutional sectors of the Federal Reserve's Financial Accounts.

The user cost approach to sizing the shadow banking sector provides insights into the role played by implicitly priced intermediation services in the recent cyclical behavior of the U.S. economy. Shadow banking emerges as more than 70 percent the size of traditional banking from 2000 to 2011, and the precipitous fall in shadow bank borrower services during and after the recent financial crisis is one of our more striking results. Moreover, our estimates show a drop in gross shadow banking output from 2002 to 2007 of more than 3/4 percent of GDP—a notable drag on the economy unseen at the time due to gaps in measurement we fill in this paper.

Finally, even though it appears that gross depositor services of shadow banks are quite volatile, so is the consumption of depositor services by shadow banks. This indicates that the shadow banking system as a whole does not seem to be contributing much to depositor services consumed by final users, at least on a net basis. Nevertheless, within the shadow banking system, there is substantial heterogeneity in production and consumption of depositor services. Such a situation may suggest that the role that shadow banking played in the financial crisis had more to do with the asset and liability positions of institutions within the shadow banking sector, rather than of the sector as a whole.

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