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The Macroeconomic Relevance of Credit Flows: An Exploration of U.S. Data

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The Macroeconomic Relevance of Credit Flows: An Exploration of U.S. Data

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Abstract

This paper exploits the Financial Accounts of the United States to derive long time series of bank and nonbank credit to different sectors, and to examine the cyclical behavior of these series in relation to (i) the long-term business cycle, (ii) recessions and recoveries, and (iii) systemic financial crises. We find that bank and nonbank credit exhibit different dynamics throughout the business cycle. This diverging cyclical behavior of output and bank and nonbank credit argues for placing greater emphasis on sector-specific macroprudential measures to contain risks to the financial system, rather than using interest rates to address any vulnerabilities. Finally, we examine the role of bank and nonbank credit in the creation of financial interconnections and illustrate a method to conduct macro-financial stability assessments.

JEL Classification Numbers: E44, E52, G21

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I. INTRODUCTION

The 2007–08 financial crisis made poignantly evident that neither policy makers nor the academic community understood the extent of the risks involved in nonbank financial activity, which became of macroeconomic relevance as the crisis unfolded. This painful lesson unleashed a massive research and policy agenda seeking to understand, measure, and (re-) regulate the nonbank sector. Progress has been made in various fronts, ranging from the quantification and monitoring of the nonbank sector (e.g., Pozsar et al., 2010) to an ongoing important regulatory reform (cf., FSB, 2011). However, we still know little about the cyclical behavior of credit flows between banks and nonbanks and their relationship with the rest of the economy.

In this paper, we use the Financial Accounts (FAs) of the United States (formerly known as the Flow of Funds) to construct measures of credit among all sectors of the economy. Differing from previous papers, we carefully distinguish between financial flows intermediated by banks and by nonbanks, and then examine the behavior of these credit measures in relation to (i) the long-term business cycle, (ii) recessions and recoveries, and (iii) the last two systemic financial crises in the United States (namely, the Savings & Loans crisis of the 1980s and the Global Financial Crisis of 2007–08).

Our analytical approach will allow us to know which type of credit follows the business cycle closer, and whether bank and nonbank credit to different sectors move in synchrony. We also investigate which forms of credit are associated with deeper recessions and with stronger recoveries. Finally, we examine the role of bank and nonbank credit in creating systemic vulnerabilities, notably the creation of financial interconnections.

This study joins a series of recent papers that have helped improve our understanding of nonbanks and shadow banking. Gallin (2013) shows how to derive an estimate of funding provided by shadow banks to nonfinancial businesses, households, and governments, defining shadow banking as the set of entities and activities that provide short-term funding outside of the traditional commercial banking system.[2] Pozsar (2014) builds on the database constructed in Pozsar et al. (2010), to present an accounting framework for measuring the sources and uses of short-term funding in the global financial system, identify the gaps in the current data landscape, and make recommendations to fill the gaps so that his proposed framework can be applied. Duca (2014) analyzes how capital regulation and other factors shaped the use of shadow-bank-funded, short-term business debt since the early 1960s. Errico et al. (2014) use external stock and flow matrices to map claims between sector-location pairs to document that external debt liabilities of the U.S. financial sector are procyclical and are closely aligned with domestic credit growth. Our approach complements these papers and aims to provide a more complete (albeit perhaps a more macro, and thus

[2] There are various definitions of shadow banking in the literature. Shin and Shin (2010) lay it out as a conceptual distinction between core (traditional deposits) and noncore liabilities of the banking sector. Harutyunyan et al. (2015) propose an alternative approach to shadow banking as all noncore liabilities of both bank and nonbank financial institutions. In our analysis, we focus on the bank-nonbank distinction and the maturity of various funding sources.

high-level) view of the credit links between banks, nonbanks, and the nonfinancial sector and their co-movement with the business cycle.

Our findings yield important lessons at two levels. First, from a surveillance standpoint, our analysis illustrates the relatively untapped potential of the FAs to conduct macro-financial stability assessments. Second, from a policy perspective, understanding how credit and output co-move through the business cycle is necessary to design effective macroeconomic and macroprudential policies that appropriately balance growth and financial stability objectives. In this regard, and in broad terms, our analysis is more supportive of placing greater emphasis on macroprudential measures to contain risks to the financial system, than of using interest rates to address these vulnerabilities.

To be more specific, our main results and their policy implications are listed below:

- The different dynamics of credit and business cycles uncovered in this paper complicate the use of a single tool – e.g., monetary policy – to contain financial stability risks.

- Moreover, the divergent behavior of intra-financial system credit throughout the business cycle suggests that policies targeting specific subsectors or activities (rather than broad-brush policies) would be more effective to address the potential build-up of risks.

- The high procyclicality of credit cycles stresses the need to build resilience in the cycle upswing (e.g., via countercyclical measures), particularly in the more procyclical nonbank sector.

- During output downturns, supervisory scrutiny should be intensified to counter the continued accumulation of financial risks, and prevent their materialization later on – the so-called ‘balance sheet recession’ phenomenon.

The paper is organized as follows. Section II describes how we exploit the Financial Accounts of the United States to construct a database to estimate credit across a range of sectors and financial instruments. In Sections III and IV, we take an increasingly narrower approach to study the behavior of these credit measures. First, we analyze the cyclical behavior of the estimated series throughout the entire sample—from 1952 to 2014—focusing on recessions and recoveries and study the potential effect of interest rate shocks on different types of credit (Section III). Then, we examine the two last systemic financial crises in the United States—the Savings & Loans (S&L) crisis in the 1980s and the 2007–08 Global Financial Crisis (GFC)—(Section IV). Section V discusses the policy implications of our analysis.

II. A Mapping Exercise Using the Financial Accounts

A. The Database

The FAs provide the most comprehensive overview of financial transactions in the United States. The database contains information on 25 sectors of the economy (e.g., households, depository institutions, money market mutual funds) and on the flows and levels of their assets and liabilities, broken down into 22 different financial instruments (e.g., home mortgages, corporate equities). The data are available on a quarterly frequency, in most cases going as far back as 1952.

As a whole, the FAs paint a picture of who owes what. Unfortunately, however, the FAs do not contain information on the financial interconnections between counterparties. In other words, the FAs do not provide information on the "whom-to-whom lending."[3] An example helps clarify what is contained or not in the FAs: regarding commercial paper, Table L.208 shows that, as of 2014Q4, of the $930 billion outstanding commercial paper, $182 billion had been issued by nonfinancial corporations and $65 billion by asset-backed security (ABS) issuers. The table also contains information on the holders: for instance, $36 billion worth of commercial paper was held by pension funds and $334 billion by money market mutual funds. However, the table does not specify how much of the commercial paper held by pension funds was issued by the nonfinancial corporations, by the ABS issuers, or by some other issuer. That is, the FAs do not specify the connection between pension funds and ABS issuers via commercial paper. In the next subsection, we outline a method to construct such interconnections with the data at hand.

B. Estimating Financial Interconnections

We are interested in measuring financial linkages across different sectors of the economy. These linkages are established via specific financial instruments, with more than one instrument being used most of the time. For example, banks and households are linked via mortgages and consumer loans. At the same time, banks are linked to money market mutual funds via commercial paper. It is through such linkages that credit and funding risks among different sectors arise, facilitating the transmission and potential amplification of shocks to a specific asset class or sector. Often these linkages are an under-used source of information and measuring them is paramount to monitoring risks to the financial system and the economy as a whole.

To get a measure of financial interconnections, we first obtain assets and liabilities of each sector for each *debt* instrument in the FAs. We focus on debt instruments because these contracts carry the features that are more likely to enable the transmission and amplification of shocks throughout the system.[4] We then assume that the whom-to-whom lending (for each

[3] Industry-specific sources sometimes provide more details (e.g., the NAIC on the flows in the insurance sector) but combining those with the FAs is not straightforward and may require critical assumptions.

[4] Debt instruments are contracts that require a fixed payment to the holder, usually with interest. The promise of a fixed payment to debt instrument holders creates the possibility of default and, thus, facilitates the

(continued…)

specific instrument) is proportional to each sector's asset holdings of that instrument.[5] A step-by-step description and example of this procedure is helpful:

Figure 1. U.S. Flow of Funds: Agency- and GSE-Backed Securities

L.210 Agency- and GSE-Backed Securities (1)

Billions of dollars; amounts outstanding end of period, not seasonally adjusted

		2010	2011	2012
1	**Total liabilities**	**7598.2**	**7577.4**	**7554.6**
2	Budget agencies	24.2	25.3	24.9
3	Government-sponsored enterprises	6434.5	6247.3	6092.7
4	Agency- and GSE-backed mortgage pools	1139.5	1304.8	1437.0
5	**Total assets**	**7598.2**	**7577.4**	**7554.6**
6	Household sector	332.7	303.9	163.7
7	Nonfinancial corporate business	16.0	14.3	13.1
8	Federal government	149.2	31.1	0.0
9	State and local governments	516.7	503.8	494.7
10	Monetary authority	1139.6	941.7	1003.4
11	U.S.-chartered depository institutions	1527.2	1634.1	1669.6
12	Foreign banking offices in U.S.	26.5	30.6	32.1
13	Banks in U.S.-affiliated areas	12.8	4.8	2.6
14	Credit unions	151.5	182.1	197.0
15	Property-casualty insurance companies	115.8	122.7	114.3
16	Life insurance companies	376.0	374.4	360.9
17	Private pension funds	184.0	188.2	210.4
18	Federal government retirement funds	5.8	6.5	8.1
19	State and local govt. retirement funds	169.6	182.0	202.9
20	Money market mutual funds	402.8	403.7	343.5
21	Mutual funds	681.3	787.1	875.9
22	Government-sponsored enterprises	377.0	358.9	310.6
23	ABS issuers	3.6	0.3	0.3
24	REITs	143.4	248.1	357.6
25	Brokers and dealers	149.8	147.7	169.6
26	Holding companies	21.1	33.1	22.9
27	Rest of the world	1095.8	1078.2	1001.2

Source: Financial Accounts of the United States.

transmission of shocks across agents when debt instruments appear on both sides of balance sheets. Equity instruments, on the other hand, are claims on the earnings and assets of an entity or project. Equity instrument holders, thus, are expected by contract to absorb the losses stemming from the underlying investment.

[5] To the best of our knowledge, Bhatia and Bayoumi (2012) were the first to apply this method for attempting to derive cross-sectoral holdings of financial assets. Gallin (2013) follows a similar approach. However, contrary to Gallin (2013), we are interested in measuring direct gross exposures among sectors, and hence we do not attempt to unravel the linkages as he does.

1. For each instrument, we obtain the assets and liabilities held by each sector from Tables L.204 to L.226. For example, Table L.210 (partially reproduced in Figure 1) indicates that, in 2010, there was a total of $7,598 billion in agency- and GSE-backed securities issued by budget agencies ($24.2 billion), government-sponsored enterprises ($6,435 billion), and agency- and GSE-backed mortgage pools ($1,140 billion). The same table shows that private pension funds held $184 billion out of the total amount. But note that the table does not specify who issued the securites the pension funds held—budget agencies, government-sponsored enterprises, or agency- and GSE-backed mortgage pools.

2. With the information on asset holdings by each sector, we calculate the share of assets held by each sector. For instance, private pension funds held 2.4 percent of the total amount of agency- and GSE-backed securities outstanding in 2009 (that is, $184 billion out of $7,598 billion).

Finally, we allocate each sector's liabilities obtained in step 1 uniformly according to the asset shares computed in step 2. For example, private pension funds held 2.4 percent of the agency- and GSE-backed securities issued by budget agencies (i.e., 2.4 percent of $24.2 billion = $0.6 billion), by government-sponsored enterprises (i.e., 2.4 percent of $6,435 billion = $156 billion), and by agency- and GSE-backed mortgage pools (i.e., 2.4 percent of $1,140 billion = $28 billion).Applying this procedure to each instrument we are interested in yields 22 three-dimensional matrices of size 25-by-25-by-252 (22 being the number of instruments; 25 being the number of sectors, and 252 being the number of quarters from 1952Q1 to 2014Q4). We then consolidate these matrices to arrive at a more general breakdown of sectors and instruments. In particular, we consolidate the Financial Accounts sectors and create the following groupings for the analysis:

- Households (HSH): Households and nonprofit organizations;
- Nonfinancial business (NFB): Nonfinancial corporate and nonfinancial non-corporate businesses;
- Banks (BNK): U.S.-chartered depository institutions, foreign banking offices in the United States, banks in U.S.-affiliated areas, credit unions;
- Nonbanks (NoBNK): Property-casualty insurance, life insurance companies, private pension funds, state and local government retirement funds, federal governemnt retirement funds, money market mutual funds, mutual funds, closed-end funds, ETFs, government-sponsored enterprises, agency- and GSE-backed mortgage pools, ABS issuers, finance companies, REITs, broker-dealers, funding corporations, holding companies;[6]
- Rest of the World (RoW).

[6] This grouping includes most asset managers. Note that in the FAs, hedge funds, private equity funds, and personal trusts are reported under the household grouping.

Regarding instruments, recall that we are interested in studying the pattern of different types of credit flows over the business cycle. Hence, we make a distinction between those instruments that are equity or equity-like (such as corporate equities and mutual fund shares), and those that are debt and debt-like (i.e., those instrument that embed a *de jure* or *de facto* promise to repay at par). Thus we group the FAs' instruments into the following categories:

- Equity-like: corporate equities and mutual fund shares;
- Debt and debt-like:
    - Short-term (and non-insured): Shares of money market funds, fed funds and repo agreements, open market paper (mostly commercial paper);
    - Long-term: Checkable deposits, time and savings deposits, Treasuries, GSE-backed securities, municipal decurities and loans, corporate and foreign bonds, bank loans not classified, other loans, total mortgages (home, multifamily, commercial, and farm), consumer credit, trade credit, and security credit.

Before proceeding, some comments about our procedure are in order. First, we compute these matrices using the 'level' of credit tables from the FAs and derive real credit series by deflating in the same manner as GDP (i.e., using the GDP deflator).

Second, by assuming that the whom-to-whom linkages are proportional to sectors' holdings of each instrument, we are abstracting from specific concentrations and/or risk profiles that may be present in the data. That could be the case, for instance, if there is relationship lending at the sector level or a sectoral preference by specific lenders for a specific type of assets issued by a specific type of borrower. For instance, in the previous example, this may be the case if pension funds preferred to hold agency- and GSE-backed securities issued only by budget agencies. Similarly, our approach treats all debt from a given sector as equally risky and may be ignoring preferences or institutional constraints that create demand for specific asset classes. For example, pension funds may be required to hold only investment-grade assets. This may generate inaccuracies especially when classifications of debt securities have subcomponents with very different characteristics, such as municipal securities and loans. Unfortunately, the lack of comprehensive information on such investor preferences and granular data on risk profiles prevents the construction of a more accurate database. That said, the distribution we propose is anchored in the data, minimizes the number of required assumptions, and is the one followed by other authors (cf., Bhatia and Bayoumi, 2012; Gallin, 2013).[7]

[7] Errico et al. (2014) combine several sources in addition to the FAs and also make assumptions when allocating assets of one sector as liabilities of the other. They, however, assume that some investors only invest in some types of assets (e.g., stakes in U.S. pension funds do not figure in the "securities other than shares" category).

Third, our measures capture *gross* and *direct* linkages. We do not attempt to net out the amount of lending between two sectors that is intermediated via a third sector. That is, in measuring credit from banks to households, we estimate direct loans that banks make to households, as opposed to trying to estimate the amount of credit that banks give to households via nonbanks (see Gallin, 2013, for an analysis along these lines). Therefore, our approach is appropriate for the purpose of documenting differences in bank and nonbank credit patterns throughout the macroeconomic cycle and around systemic events.

Fourth, since we are interested in the macroeconomic role of credit flows, some level of aggregation of nonbank entities is needed in Section III. However, grouping financial institutions with different business models and risk characteristics may also prevent the identification of different behavioral patterns among types of entities. To address this concern, we use a more disaggregated definition of nonbanks to examine the role of financial interconnections around systemic crises in Section IV.

III. The Role of Credit Flows in Macroeconomic Movements

In this section, we first study the cyclical co-evolution of several credit measures with GDP. We then use Vector Autoregressions (VARs) to explore the relationship between interest rates and credit. Finally, we turn to the behavior of credit during recessions and recoveries.

A. Business and Credit Cycles

As argued, understanding how credit and output co-move through the business cycle is necessary to design effective macroeconomic and macroprudential policies that appropriately balance growth and financial stability objectives. With this goal in mind, we follow Claessens et al. (2012) and apply Harding and Pagan (2002)'s algorithm to our various credit series.[8] In this manner, we identify the phases that each series has undergone in our 63-year sample. That is, we determine when a series reached a peak or trough, and when it was in a boom or bust phase. After that, we assess the length and depth of credit cycles compared to the business cycle. We also measure the ratio of synchronicity between various series. In other words, we measure how frequently both series are in the same phase of the cycle (e.g., both booming, both at a peak, etc.).[9]

The main patterns detected by this exercise are as follows (Table 1):

[8] Harding and Pagan (2002) followed Bry and Boschan (1971) to design their algorithm, which identifies the turning points in an economic series. The basic logic of this methodology consists in finding a sequence of local maxima and minima that allow segmenting the series into expansions and contractions.

[9] Note that our synchronicity measure is defined slightly differently that the concordance measure in Claessens et al. (2012). The latter measures how frequently two series are in a boom or bust, whereas our synchronicity also measures how frequently two series are at a peak or a trough. This is why our synchronicity ratios tend to be slightly lower than their respective concordance indices.

Table 1. Credit Cycle Length and Depth during 1952Q1 – 2014Q4

	Average cycle duration (in years)	Coefficient of variation	Share of GDP in 2014
GDP	6.3	0.5	…
Bank credit to households	10.5	0.6	25.6
Bank credit to nonfinancial businesses	10.5	0.6	21.6
Bank credit to banks	3.2	1.6	0.4
Bank credit to nonbanks	6.3	1.0	17.1
Nonbank credit to households	21.0	1.1	42.3
Nonbank credit to nonfinancial businesses	7.9	0.7	25.8
Nonbank credit to banks	6.3	1.1	8.2
Nonbank credit to nonbanks	10.5	1.2	44.5

Note: Coefficient of variation is defined as the standard deviation divided by the mean of a series.
Source: Authors' calculations

- The cycles of bank and nonbank credit to the private sector (households and businesses) are longer than the output cycle.[10] However, these cycles have similar amplitudes to the GDP cycle (except for nonbank credit to households), as evidenced by the coefficient of variation.

- Bank-to-bank credit and bank-to-nonbank credit tend to exhibit shorter cycles. And although shorter, these cycles tend to be relatively deep.

- Bank credit to households and bank credit to nonfinancial businesses have the shallowest cycles, but are the most similar in amplitude to GDP.

In terms of the cyclical dynamics, we find that (Table 2):

- Nonbank credit tends to be more procyclical than bank credit. This can be seen by comparing the synchronicity ratios in segment *a* of Table 2 to those in segment *b*. For instance, nonbank credit to businesses is in the same phase as output 79 percent of the time, whereas bank credit to businesses coincides with output 72 percent of the time.

- Credit within the financial system is less procyclical than credit to the nonfinancial sector. For example, bank-to-bank credit has a coefficient of 0.43 compared to 0.71 for bank credit to households and 0.72 for bank credit to businesses (cf., segment *a*). Similarly, nonbank credit to banks (0.68) and to nonbanks (0.75) is also less procyclical than nonbank credit to households (0.78) and to businesses (0.79), (cf., segment *b*).

[10] This is in line with the findings in Drehman et al. (2012).

Table 2. Synchronization Ratios of Output and Credit Cycles

	Synchronization ratio			Output-upward synchronization ratio	Output-downward synchronization ratio
	Full sample	1952-1979	1980-2014		
Output cycle and bank credit cycle					
Bank credit to households	0.71	0.84	0.61	0.77	0.60
Bank credit to nonfinancial businesses	0.72	0.79	0.66	0.82	0.35
Bank credit to banks	0.43	0.46	0.42	0.47	0.35
Bank credit to nonbanks	0.70	0.74	0.73	0.80	0.30
Bank credit to ROW	0.50	0.56	0.46	0.54	0.45
Output cycle and nonbank credit cycle					
Nonbank credit to households	0.78	0.85	0.86	0.89	0.40
Nonbank credit to nonfinancial businesses	0.79	0.81	0.76	0.90	0.30
Nonbank credit to banks	0.68	0.76	0.62	0.78	0.30
Nonbank credit to nonbanks	0.75	0.73	0.76	0.87	0.20
Nonbank credit to ROW	0.69	0.70	0.69	0.78	0.30
Bank credit cycle and nonbank credit cycle					
Credit to households	0.76	0.90	0.57	…	…
Credit to nonfinancial businesses	0.81	0.93	0.72	…	…
Credit to banks	0.51	0.63	0.42	…	…
Credit to nonbanks	0.75	0.72	0.75	…	…
Output cycle and ROW credit cycle					
ROW credit to households	…	…	…	…	…
ROW credit to nonfinancial businesses	0.73	0.65	0.80	0.84	0.30
ROW credit to banks	0.61	0.59	0.64	0.70	0.20
ROW credit to nonbanks	0.66	0.61	0.83	0.73	0.55
ROW credit to ROW	0.63	0.64	0.64	0.73	0.25

Note: Synchronization ratio is the ratio of number of observations where GDP and credit are in the same phase divided by total observations. Output-upward (output-downward) ratio is the ratio of observations where GDP and credit are both booming (slumping) divided by number of periods when GDP was booming (slumping).
Source: Authors' calculations

- Credit outflows to the rest of the world tends to be less procyclical that credit to the private sector, with nonbank credit being substantially more synchronized with the business cycle (0.69, at the bottom of segment *b*) than bank credit (0.50, at the bottom of segment *a*).

One interpretation for the longer cycles of credit to the private sector is that some lending linkages take longer to build and to unwind than some real variables (e.g., jobs can be created and destroyed very quickly in the U.S.). For banks, this may be a consequence of "relationship lending" whereas for nonbanks the longer cycle could reflect the slow-moving nature of real estate cycles that underlies a large fraction of nonbank lending. More generally, the same mechanisms that explain the close interaction between financial conditions and macroeconomic developments could also explain the longer duration of credit cycles.[11] For example, financial accelerator models demonstrate the importance of feedback effects across

[11] The theoretical literature on the interaction between financial and business cycles, starting with Bernanke and Blinder (1988), Bernanke and Gertler (1989), and Kiyotaki and Moore (1997), is expansive. See Allen and Gale (2007) and Adrian and Shin (2010) for reviews.

financial markets. In other models with credit frictions, financial cycles occur not only because financial variables reflect developments in the real economy but also because they act as propagation mechanisms themselves. Yet other models focus on the special role played by banks in financial intermediation and emphasize the bank lending channel, where a negative liquidity or interest rate shock limits banks' access to funding and forces them to adjust their lending with consequences for asset prices. A similar argument can be applied to financial intermediaries more broadly: leverage and balance sheet health affects intermediaries' ability to lend and has implications for asset prices, including through fire sales and contagion across institutions as well as asset classes.

Next, we explore whether the findings above apply across subperiods. We split our sample into two subsamples (from 1952 to 1979 and from 1980 to 2014) to account for the considerable transformation undergone by the financial system after the 1970s, when new financial instruments, such as money market mutual funds, commercial paper, repos, and mortgage securitization took off and redefined financial activity. Our findings are detailed below.

- Bank credit to the private sector has become markedly less procyclical (segments *c* and *d*). During 1980-2014, bank credit to households was in the same cyclical phase as output 61 percent of the time, compared to 84 percent in the previous three decades. Bank credit to businesses has also become less procyclical (with a coefficient going from 0.79 to 0.66). Nonbank credit to the private sector has changed less.

- Bank and nonbank credit cycles have generally become less synchronized, as revealed by comparing the higher synchronization ratios in segment *e* to those of segment *f* (of course, this result is another manifestation of the growing divergence in procyclicality mentioned above). An exception to this finding is bank credit to nonbanks and nonbank credit to nonbanks, which have become slightly more synchronized (bottom of segments *e* and *f*).

- External credit has become markedly more procyclical, especially lending to businesses and to nonbanks, which increased their coefficients from 0.65 to 0.80 and from 0.61 to 0.83, respectively (segments *g* and *h*). Interestingly too, the amount of financing that the rest of the world intermediates through the U.S. financial system has maintained a constant level of synchronicity with the U.S. business cycle (cf., coefficient of 0.64).

We also explore if it matters whether output is in an upswing or downturn for the cyclicality of credit. That is, conditioning on the phase of the business cycle, we compute how frequently each credit cycle is in the same phase as output. The difference in coefficients is remarkable, with the synchronicity ratios being much higher during output upswings than downturns (last two columns of Table 2). This is due to the fact that GDP and credit series are more often in expansion phases than in contraction phases. That is, expansions tend to be protracted, whereas contractions are sudden and sharper.

Additionally, we investigate the degree to which bank credit and nonbank credit are simultaneously synchronized with the business cycle (Table 3). Although synchronization ratios are broadly lower with respect to their bank and nonbank counterparts, they exhibit

Table 3. Synchronization Ratios of Output, Bank Credit, and Nonbank Credit Cycles

	Synchronization ratio			Output-upward synchronization ratio	Output-downward synchronization ratio
	Full sample	1952-1979	1980-2014		
Output cycle, bank credit cycle, and nonbank credit cycle					
Credit to households	0.65	0.81	0.55	0.73	0.40
Credit to nonfinancial businesses	0.69	0.78	0.61	0.79	0.30
Credit to banks	0.35	0.45	0.29	0.41	0.10
Credit to nonbanks	0.61	0.61	0.63	0.72	0.10
Credit to ROW	0.40	0.44	0.39	0.46	0.20

Note: Synchronization ratio is the ratio of number of observations where GDP and both types of credit are in the same phase divided by total observations. Output-upward (output-downward) ratio is the ratio of observations where GDP and both types of credit are both booming (slumping) divided by number of periods when GDP was booming (slumping).
Source: Authors' calculations

similar properties. As with both bank credit and nonbank credit, joint synchronization between both forms of credit to nonfinancial businesses and output in the full sample is the most procyclical (0.69) while external credit and credit to banks are the least procyclical (0.40 and 0.35, respectively). Similarities to bank and nonbank cyclical patterns extend across subsamples, as well as in upswings and downturns.

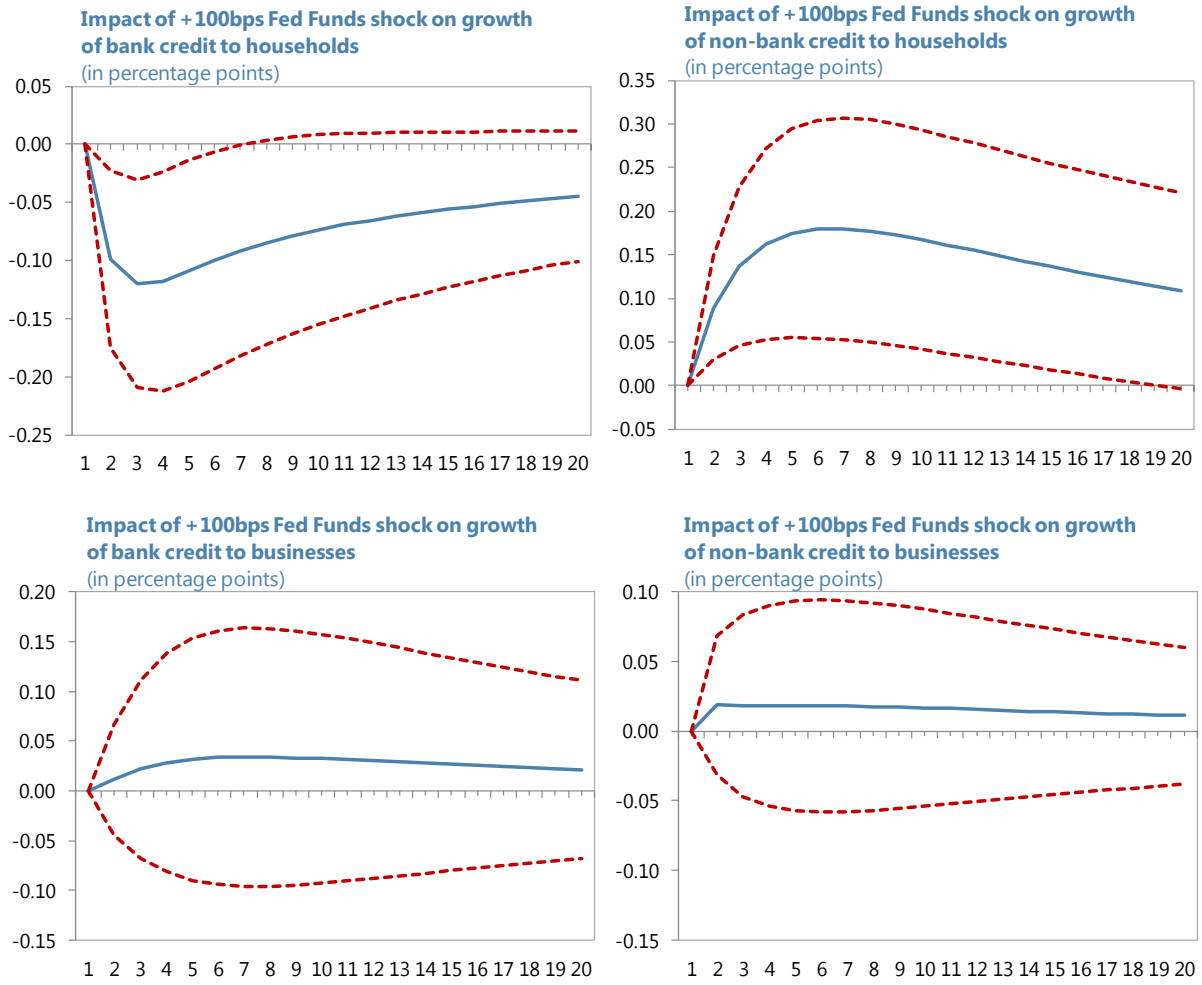
B. Interest Rates and Credit

The divergent cyclical behavior across types of credit identified above could translate into a different response of bank and nonbank lending to unexpected monetary policy changes. In this subsection, we perform some VAR analyses that seem to confirm this hypothesis. In particular, we estimate a series of small VAR specifications using real GDP, the fed funds rate, and the various real credit measures. We use the first difference of the logarithms of all variables except the fed funds rate. In our baseline model, we use one lag and focus on the period 1980Q1 to 2014Q4 given that it is after 1980 when the nonbank sector developed in earnest and also when the Federal Reserve began to explicitly target the fed funds as a policy variable. As robustness checks, we consider other subsample periods and two-lag specifications.

To study the impact of a monetary contraction on the credit measures, we assume an exogenous unanticipated shock of 100 basis points to the fed funds rate. In doing so, we follow the literature spawned by Bernanke and Blinder (1992) and use the fed funds rate as a relevant indicator of monetary policy (see, for instance, Den Haan and Sterk, 2011, who conduct a similar exercise to ours).

Figures 2 and 3 show the impulse response functions corresponding to the estimated VAR for the period 1980Q1 to 2014Q4. We find that while the growth rate of bank credit to households slows down in response to an interest rate shock, growth of nonbank credit to households actually accelerates (with significant coefficients for both bank and nonbank credit measures). Note, however, that the impact on credit to the business sector is not significant. Moreover, the flow of credit from nonbanks to other financial entities (bank and nonbank) also picks up and takes a long time to return to pre-shock growth rates (bottom panels of Figure 3).

Figure 2. Interest Rate Shocks and Bank and Nonbank Credit to Private Sector: 1980Q1–2014Q4

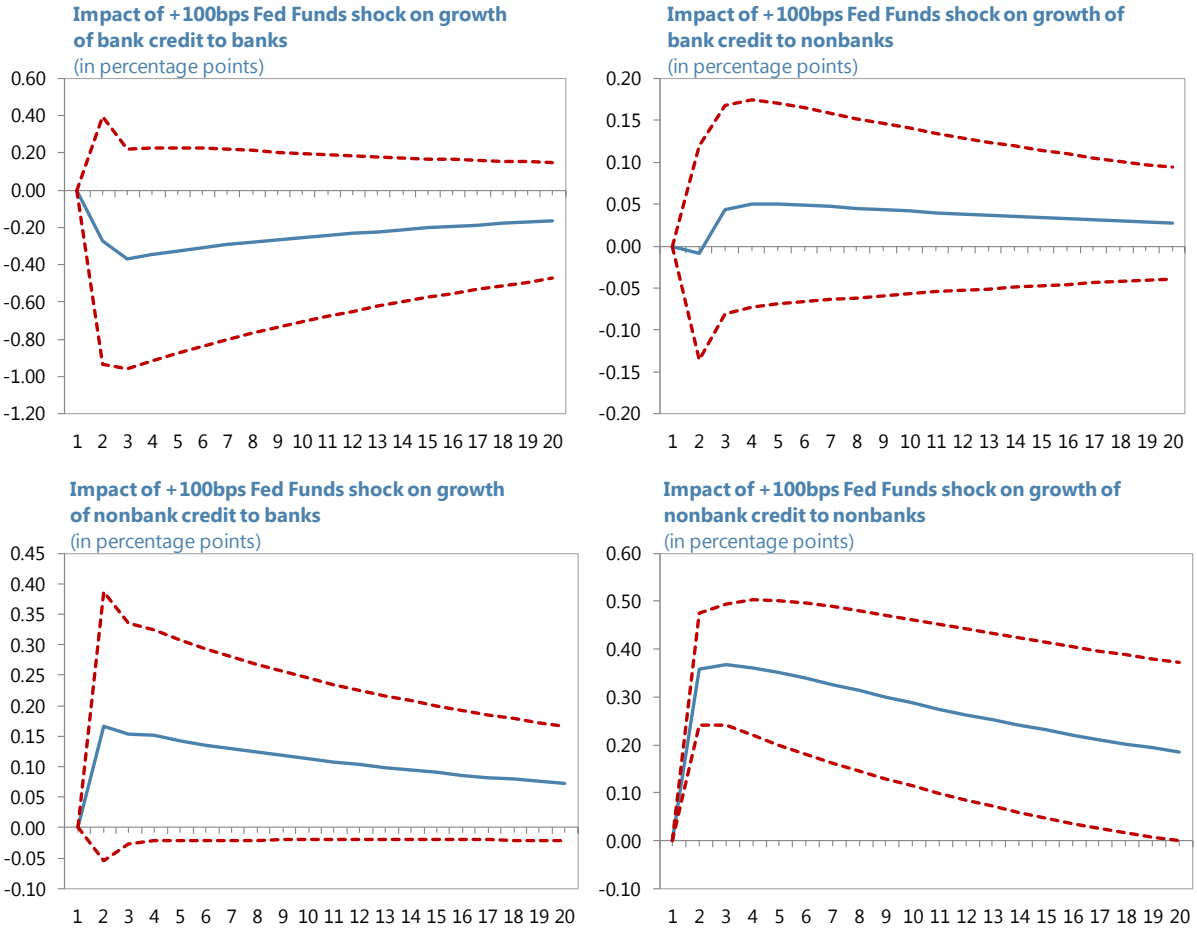


Source: Authors' calculations.

To assess the robustness of our results, we consider various estimations over different subsample periods and also by increasing the number of lags to two (the impulse-response functions of such tests are reported in Appendix I). We find that the direction of the (medium-term) response of each type of credit to an interest rate shock remains the same across these changes in the estimations but that the coefficients are most often not significant. Therefore, we treat these results with caution and view them as a prompt for further and more detailed research using more disaggregated data on each of the different types of credit (e.g., ABS issuers, GSEs, etc.). The most relevant lesson of this exercise, in our view, is that there seems to be growing evidence of different reactions of bank and nonbank credit to changes in monetary policy.

Our results, however, are also consistent with the findings of Den Haan and Sterk (2011) and Nelson et al. (2015). Specifically, the former find that following a monetary tightening bank mortgages decline but that nonbank mortgages increase. Nelson et al. (2015), in turn, find

Figure 3. Interest Rate Shocks and Intra-Financial System Credit: 1980Q1–2014Q4



Source: Authors' calculations.

that a contractionary monetary policy shock has a persistent negative impact on the asset growth of commercial banks but increases the asset growth of shadow banks.

The varying reaction of banks and nonbanks to policy rate shocks can be interpreted as symptomatic of the malleability of the complex U.S. financial system. Indeed, a highly interconnected system means that it is easier for financial entities to circumvent a tightening of policy measures. Faced with a tighter liquidity environment, banks may rely on financial innovation (e.g., securitization) to convert illiquid assets into liquid funds which could, in turn, lead to a migration of credit to nonbanks. Such is the dynamic found in Loutskina (2011), who finds evidence that securitization provides banks with an effective channel to transform illiquid assets into liquid ones and thus (by making the liquidity shock less binding) can potentially offset the impact of the Fed's policies to contract the loan supply.

C. Credit in Recessions and Recoveries: A Brief Historical Retrospective

In this subsection, we examine the typical credit dynamics around recessions as well as expansions. We use recession dates as determined by the NBER. Given the structural changes the U.S. economy has undergone over the sample period, one may argue that the

average or median dynamics are not representative. Hence, we provide the change experienced in each of the credit series prior to each business cycle peak and after each business cycle trough in Tables 4 and 5. In Appendix II, we provide a narrative of the evolution of credit measures around each of the ten post-war recessions. To guide the discussion of the typical dynamics, we plot median quarterly growth in annualized terms across time for each type of credit in Figures 4 and 5.

We note that the growth of credit to the private sector (households and businesses) begins to slow down prior to the onset of the recession, and does not pick up again before four quarters into the recession. Bank credit to households tends to have a wider range of negative growth in recessions, whereas nonbank credit to households may recover as early as two quarters post-peak. Intra-financial system credit (i.e., bank and nonbank credit to banks and nonbanks), on the other hand, exhibits more volatility before and after recessions, and it is hard to discern a clear pattern. Note also, that the scale of these variations is quite significant.

We also construct parallel event studies for credit behavior around business cycle troughs. Here, we find that credit to households tends to recover quickly, typically within two to three quarters. Credit recoveries tend to vary widely for credit to households, while credit to businesses is more stable and recovers after three quarters. As before, interbank and inter-nonbank credit is volatile after troughs, recovering after about four quarters.

Table 4. Credit Growth before Business Cycle Peaks

(Annualized growth; 6 quarters pre-peak)

	1953Q3	1957Q3	1960Q2	1969Q4	1973Q4	1980Q1	1981Q3	1990Q3	2001Q1	2007Q4
Bank credit to:										
Households	16.4	7.5	11.4	3.0	8.2	1.2	-4.3	-0.4	5.3	3.0
Nonfinancial Businesses	3.1	5.3	8.0	6.3	11.3	3.4	0.0	-2.6	7.8	9.5
Banks	-4.5	14.2	-15.2	-5.7	-7.2	2.9	-9.2	-23.2	22.1	23.6
Nonbanks	15.5	-3.8	14.8	13.0	19.0	4.6	4.6	0.0	2.7	0.6
Nonbank credit to:										
Households	16.8	7.4	9.1	1.4	2.1	15.2	2.9	12.1	6.2	6.7
Nonfinancial Businesses	9.8	4.3	3.3	3.3	5.8	4.0	1.9	7.0	4.8	5.2
Banks	1.2	3.1	3.4	5.1	12.5	19.5	21.2	-5.8	6.9	8.0
Nonbanks	35.7	11.6	24.9	5.0	15.0	13.1	19.6	8.0	12.7	8.1

Source: Authors' calculations.

Table 5. Credit Growth after Business Cycle Troughs

(Annualized growth; 6 quarters post-trough)

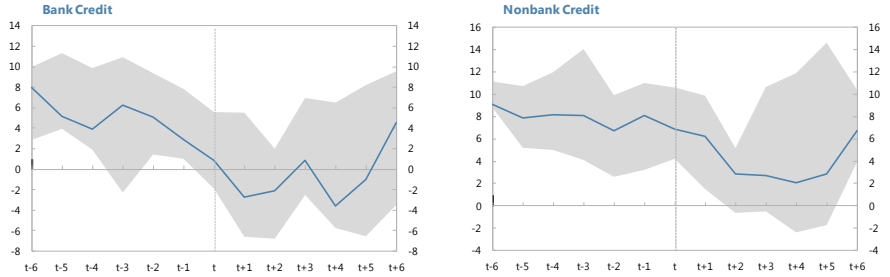
	1954Q2	1958Q2	1961Q1	1970Q4	1975Q1	1980Q3	1982Q4	1991Q1	2001Q4	2009Q2
Bank credit to:										
Households	15.1	11.4	9.4	9.8	6.6	-4.9	8.7	-3.5	10.9	-0.4
Nonfinancial Businesses	8.7	8.2	10.2	10.7	-1.4	3.3	11.8	-7.8	-1.4	-7.3
Banks	-16.0	-25.8	6.5	2.7	22.5	-9.2	10.1	-3.4	65.4	37.5
Nonbanks	8.6	17.8	21.8	15.5	0.0	5.5	9.0	5.3	14.4	0.0
Nonbank credit to:										
Households	17.9	8.0	4.9	5.7	4.1	5.3	11.7	10.7	10.3	-7.3
Nonfinancial Businesses	5.5	3.9	7.4	4.6	-0.2	2.6	7.0	1.2	1.6	2.6
Banks	2.2	5.4	10.9	9.2	7.4	23.3	5.7	-7.4	6.3	9.3
Nonbanks	18.8	20.3	4.9	20.0	14.0	21.1	22.5	10.1	5.2	-10.5

Source: Authors' calculations.

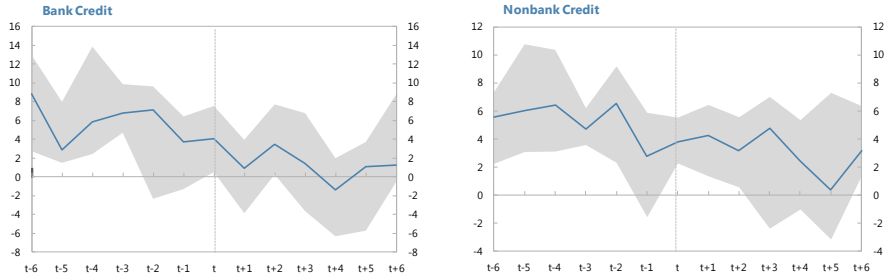
Figure 4. Credit Growth Around Business Cycle Peaks

(Median ± 25th percentile; Quarterly annualized growth)

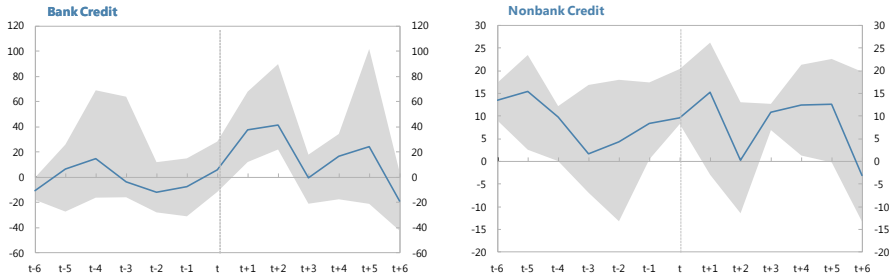
Credit to Households



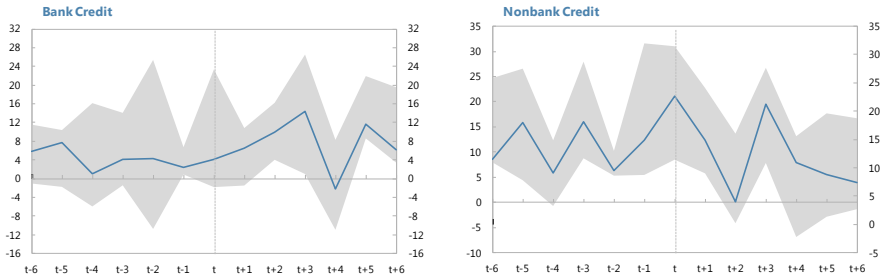
Credit to Nonfinancial Businesses



Credit to Banks



Credit to Nonbanks

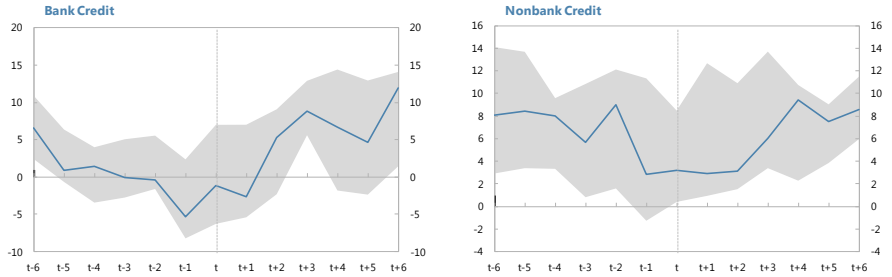


Note: t corresponds to beginning of recession.
Source: Authors' calculations.

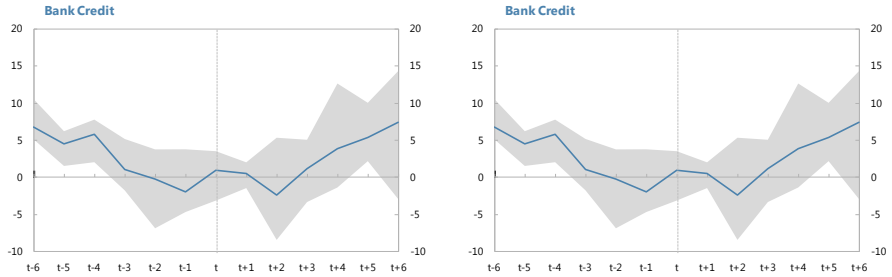
Figure 5. Credit Growth Around Business Cycle Troughs

(Median ± 25th percentile; Quarterly annualized growth)

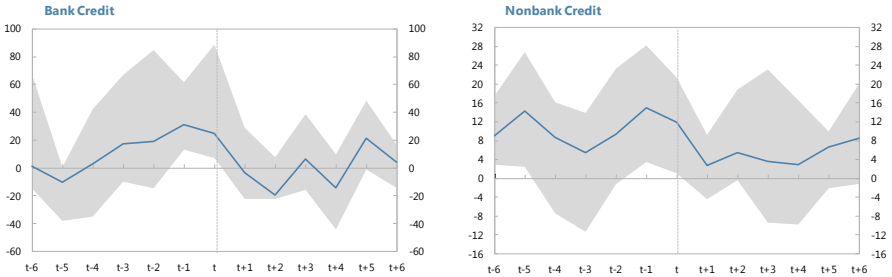
Credit to Households



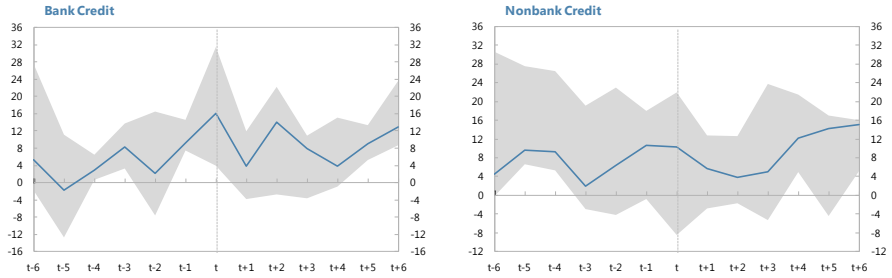
Credit to Nonfinancial Businesses



Credit to Banks



Credit to Nonbanks



Note: t corresponds to end of recession.
Source: Authors' calculations.

IV. The Role of Financial Interconnections in Systemic Crises

Next we look at the evolution of financial interconnections around the last two systemic crises in the United States: the S&L crisis of the 1980s and the GFC in 2007–08. We recount these episodes through the lens of our estimated credit measures to argue that key factors underlying the first crisis turned into mounting trends that aggravated the second, larger crisis. That is, we contend that, starting in the mid-1970s, increasing competition from nonbanks pushed banks to venture into riskier activities, eventually leading to the S&L crisis (cf. also Financial Crisis Inquiry Commission, 2011). The trend of steepening competition continued for decades fuelling what became an unsustainable level of lending to households.[12] Against this backdrop, we rely on our estimated series to contruct two measures of credit and funding exposures among financial entities, and argue that the secular rise of simple risk gauges like these—had they been available—would have helped suscitate concerns in the run-up to the crisis.

A. The 1980s: Financial Deregulation, a Banking Crisis, and New Interconnections

Financial regulation underwent fundamental changes in the 1970s and 1980s. Money market mutual funds were legalized in the mid-1970s and, contrary to banks and thrifts, were not subject to deposit rate ceilings. Such exemption soon became a major competitive threat for depository institutions, who then lobbied Congress succesfully to phase out the cap on interest rates and broaden the range of acceptable investments by banks.[13] Coetaneously, momentous legislative changes were enacted to spur the growth of GSEs and their sponsored vehicles.[14] Notably, GSEs were allowed to securitize assets, granted hefty credit lines with the Treasury, given exemptions from certain state and local taxes, and held to much lower capital requirements than banks and thrifts. And beyond the direct advantage these measures afforded, GSEs began to benefit from the 'quasi-sovereign' status granted by markets who funded them at rates close to that of Treasuries. Unsurprisingly, GSEs progressively became one of the dominant players in the housing market.

Faced with mounting competition from nonbanks, banks quickly took advantage of the laxer regulatory environment to switch from traditional home mortgages into more profitable but riskier projects, such as commercial real estate and high-yielding leveraged buyouts, oil extraction, and off-balance sheet products. Thus, we estimate that in less than a decade,

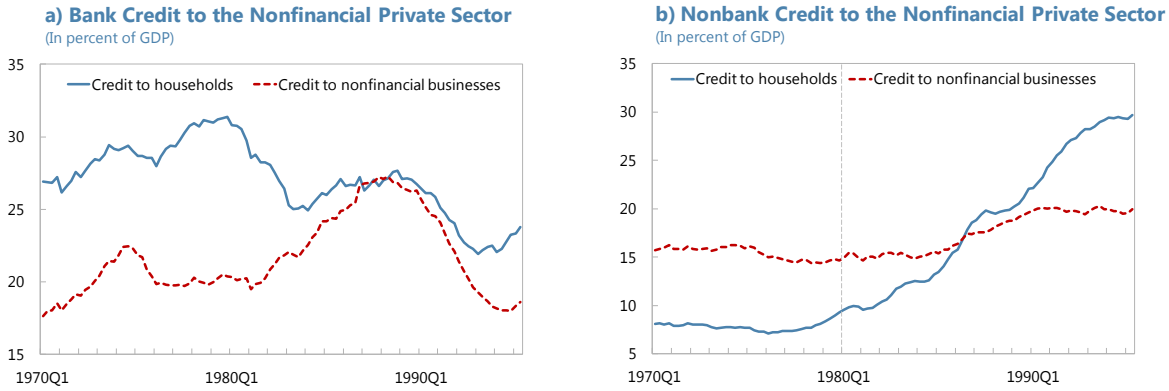
[12] Two excellent sources explaining these crises with a wealth of detail are FDIC (1997) and Financial Crisis Inquiry Commission (2011).

[13] Relevant new legislation included the Depository Institutions Deregulation and Monetary Control Act of 1980, the Garn-St. Germain Depository Institutions Act of 1982, various changes to OCC rules between 1983 and 1994, and modifications to the Glass-Steagall Act in 1987. Legislation passed in 1968 and 1970 authorized Fannie Mae and Freddie Mac to buy conventional fixed-rate mortgages, and to securitize assets. However, securitization by the agencies did not start in earnest until the 1980s (cf., FDIC, 1997, and Financial Crisis Inquiry Commission, 2011, for details).

[14] With a slight abuse of the term, we use the term "GSE" here to refer mostly to Fannie Mae and Freddie Mac. However, note that the FAs do not provide a breakdown of the GSEs into Fannie Mae, Freddie Mac, and others.

banks reshuffled their portfolios boosting credit to businesses in an amount equivalent to 7 percentage points of GDP and cutting down loans to households although by a smaller magnitude (4 percentage points of output; Figure 6a). Banks' portfolio recomposition turned out to be much riskier than anticipated, as the inherent riskiness of the new activities was exacerbated by regulations that curtailed banks' ability to invest out-of-state. Thus, a hefty measure of geographical concentration risk was added to banks' investments, also fostering overvaluations in several regional property markets and business activities.

Figure 6. Credit to the Nonfinancial Private Sector



Sources: Authors' calculations.

Risks materialized in two waves. First, as the regional real estate bubbles sequentially burst—moving from Texas to the Southeast and Mid-Atlantic to California and Arizona—bank and thrift failures skyrocketted. A second round of defaults erupted as risky corporate investments began to grossly underperform. The final tally was close to 3,000 failed depository institutions worth nearly a trillion dollars, with 70 percent of the losses coming from savings and loans thrifts, thus giving name to the episode.

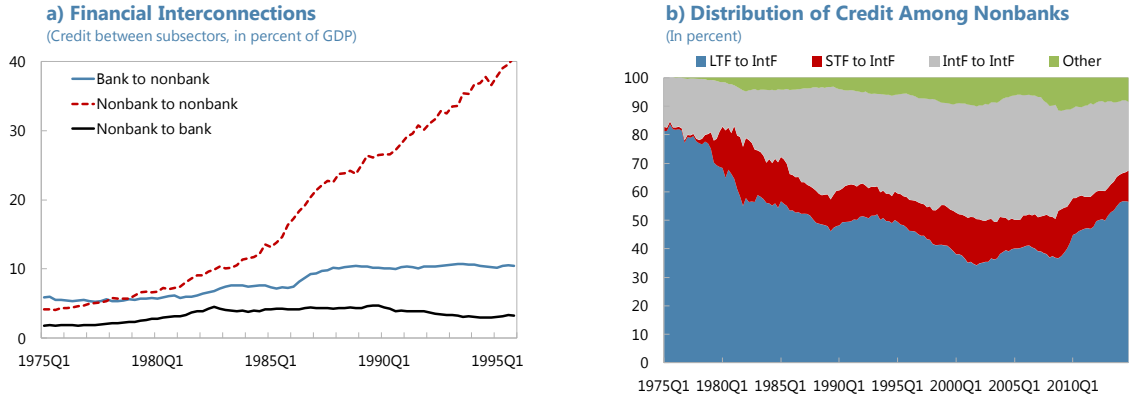
But as bank lending to households began to drop in 1980, nonbanks stepped in to provide increasing amounts of credit over a three-decade climb that culminated with the 2007 Great Financial Crisis (Figure 6b); nonbank credit to households reached 60 percent of GDP by end-2007. Large part of this growth was driven by the GSE complex which, as argued, had been empowered by legislation to expand credit to households vastly. Within a decade, GSEs doubled their mortgage portfolios while agency- and GSE-backed mortgage pools swelled almost ten-fold. That is, by 1990, the market volume of GSE securities surpassed $1.1 trillion, or sixteen percent of GDP, compared to less than $190 billion at end-1979.[15]

The vigorous expansion of nonbank credit to households was accompanied by a structural change that redefined the U.S. financial system in a way that became consequential thirty years later. This fundamental transformation was the creation of new and growing

[15] GSE mortgage portfolios went from $87 billion at end-1979 to $156 billion at end-1990, while agency- and GSE-backed mortgage pools grew from $95 billion to $1,020 billion in the same period.

interconnections among all types of financial entities, but most notably among nonbanks (Figure 7a). During the 1980s, estimated credit flows among nonbanks ballooned to reach a size equivalent to almost one-third of GDP by end-1990. Remarkably, however, interconnections between banks and nonbanks grew, but remained stable at around 14 percent of GDP until the 2000s (this can be seen by adding the blue and black lines in Figure 7a).

Figure 7. Financial Interconnections



Sources: Authors' calculations.

The unrelentless growth of the new financial interconnections begs a further inquiry into their implications for financial stability. Is a more interconnected system desirable since it helps diversify risks—as it was often argued before 2007—or do new linkages mask vulnerabilities that surpass potential benefits? In the next subsection we argue that the key financial interconnections that proved fatal in the 2007–08 crisis had a gestation period of almost thirty years and that they could have been 'macroeconomicaly' visible through analyses like ours.

B. From the 1990s to 2007: More Interconnections and a Full-Blown Financial Crisis

To investigate further how the interconnections that swelled over the three decades preceeding the GFC bear on financial stability, we take a more granular look at the different types of nonbank entities. We split the nonbank sector into three subgroups: long-term funders, short-term funders, and intermadiate funders.[16]

- *Long-term funders* are financial intermediaries with typically long-term investment horizons. This category includes private and public pension funds, casualty and life insurance companies, mutual funds, ETFs and closed-end funds.

[16] This classification broadly follows Gallin (2013). A notable exception is that this author defines short-term funders as activities rather than a type of entity.

- *Short-term funders*, on the other hand, are intermediaries with genuinely short investment horizons and whose liabilities are redeemable on demand. This category is comprised of money market mutual funds.[17]

- *Intermediate funders* include the rest of nonbank entities that provide credit to nonfinancial borrowers, and whose investment strategies vary at times between shorter- or longer-term. In this category we include the GSEs, agency- and GSE-backed mortgage pools, ABS issuers, finance companies, REITs, broker-dealers, holding companies, and funding corporations.

With this classification at hand, we examine the interconnections among nonbanks. That is, we measure credit flows between each pair of entity types (e.g., credit from long-term funders to short-term funders, from short-term funders to intermediate funders, and so on). We find that intermediate funders consistently received more than 90 percent of all the credit in the nonbank sector from 1980 onwards (Figure 7b). Interestingly, credit amongst intermediate funders doubled in the 1980s from 20 percent to 40 percent of all nonbank credit, and remained at that level until the 2007 crisis. Since then it has retrenched to account for just around one-fourth of nonbank credit.

The next natural question is whether it was possible to quantify somewhat the risks embedded in these interconnections. Admitting that the available data on financial linkages are deficient, we attempt a rough estimation of the credit and funding exposures faced by each subsector (Figure 8). We measure credit risk as the ratio of credit between two types of entities over the total financial assets of the lender.[18] Funding risk is approximated as the ratio of credit between two types of entities over the total liabilities of the borrower (cf., FSB 2012).

Given that *intermediate funders* were at the epicenter of the 2007 crisis (along with *short-term funders*, of course), we focus first on this group to assess vulnerabilities in the financial system. Our measure of credit risk reveals the secular accumulation of credit exposures to *intermediate funders* by all subsectors of the financial system, including banks, between 1980 and 2006 (Figure 9). Such growing exposure to a rather concentrated type of credit risk (i.e., the household sector as revealed by Figure 6b) should have raised concerns and thus elicited a closer monitoring, especially at a time when the financial system was becoming less regulated.[19]

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[17] For the ensuing analysis it is useful to maintain money market funds separate from other intermediaries, as these institutions played a key role as transmitters of contagion during 2007–08 (cf., Baba et al. 2009, among others).

[18] This is an approximation. We cannot accurately measure credit risk without knowing whether the exposure between the two entities is insured and how much of that credit risk is transformed into counterparty risk through use of credit default swaps. In addition, as noted earlier, not all debt is of similar credit risk. Unfortunately, data limitations force us to rely on this approximation.

[19] With respect to Fannie Mae and Freddie Mac, concerns arose around this time that resulted in the passage of the Federal Housing Enterprise Safety and Soundness Act in 1992. Unfortunately, the Act put in place a weak regulatory regime.

Figure 8. Credit and Funding Risk Measures

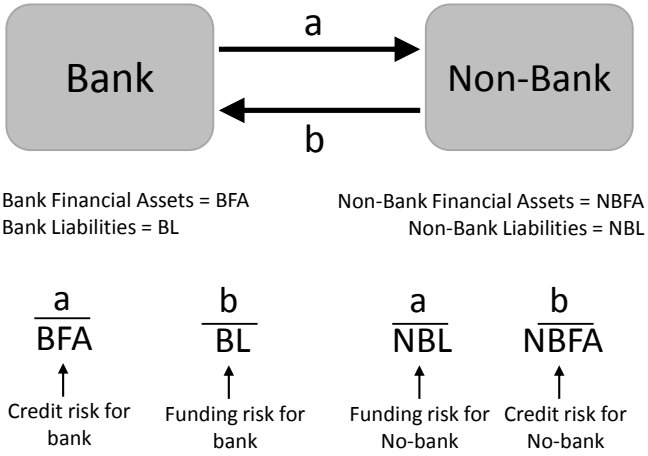
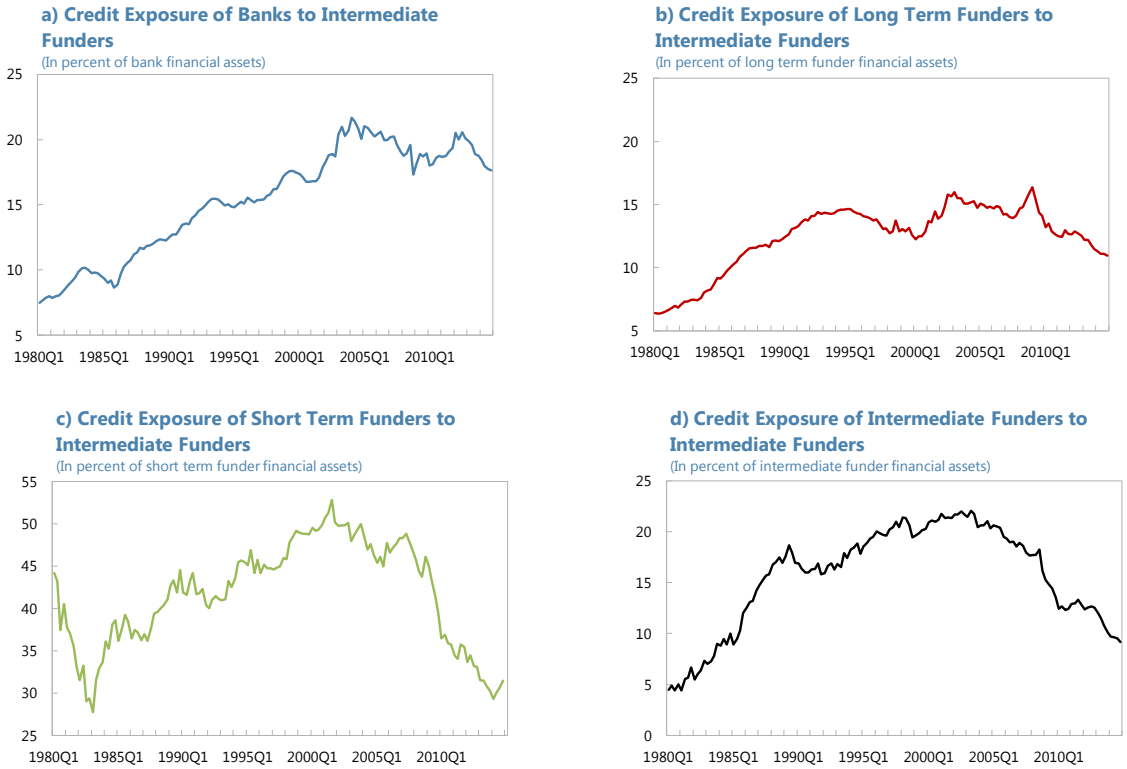


Figure 9. Evolution of Credit Exposures to Intermediate Funders

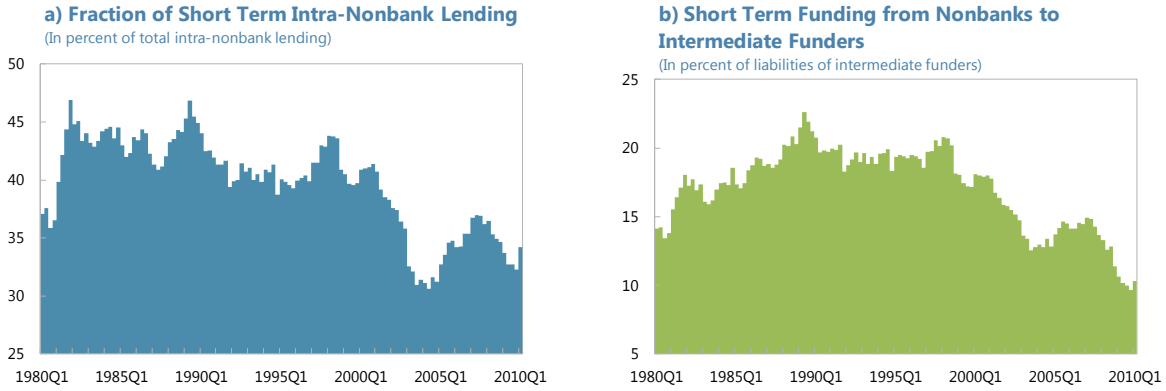


Sources: Authors' calculations.

Moreover, these credit vulnerabilities were compounded by the unstable nature of a non-negligible fraction of the funding received by nonbanks. By focusing on specific instruments that are either *runnable*—such as money market fund shares—or subject to high *roll-over risk*—such as commercial paper and repo contracts—we can derive a lower-bound estimate of the fraction of interconnections that are short-term and therefore more vulnerable to runs

(Figure 10).[20] We find that, on the eve of the GFC, around 36 percent of the funding among nonbanks was of short-term nature. And, as was soon to be shown, this vulnerability crystallized into widespread financial distress when nonbanks began to quickly withdraw funding from each other in response to escalating credit risk concerns. For *intermediate funders* in particular, the share of short-term funding from nonbanks amounted to 15 percent of all their liabilities. Note, however, that by 2007Q4, short-term funding among nonbanks was not at its historical high, although it still remained high enough to be a large vulnerability were it to dissipate suddenly and needed to be replaced quickly, as was soon to be the case. Moreover, it was the combination of still relatively high short-term funding and large credit risks that proved problematic.

Figure 10. Short-Term Funding Among Nonbanks



Sources: Authors' calculations.

As we now know, these elements—high and lightly supervised interconnections among financial entities (notably via securitizations), the build-up of credit risks, and large maturity transformation (on the back of the growing commercial paper and repo markets[21])—set the stage for the crisis dynamics that unraveled in 2007–08. After the fact, however, and from a macro-financial perspective one could argue that a framework to monitor these financial flows and measure their attendant risks, as proposed here, could be useful going forward.

V. Policy Implications and Concluding Remarks

We set out to improve our understanding of the macroeconomic relevance of credit flows and financial interconnections by tapping information in the Financial Accounts of the United

[20] This estimate is a lower-bound as other instruments in the FAs, such as bonds, "bank loans not classified elsewhere," and "other loans," can also be short-term. Unfortunately, there is not enough information in the FAs to estimate the fraction of these instruments that is short-term.

[21] Notably, the market volume of commercial paper and repos took off remarkably during the 1980s and 1990s, reaching a combined market size of sixteen percent of GDP by 1990, same as the GSE securities market.

States. While admitting the tentative nature of our exploration due to existing data limitations, our results have important implications for policy makers at two levels.

First, from a surveillance perspective, our analysis illustrates the relatively untapped potential of the FAs to conduct macro-financial stability assessments. This is a nascent field of inquiry that still suffers from a dearth of data and an underdeveloped toolkit for risk assessment. We have proposed some solutions to both shortcomings, but, of course, our approach can be combined with other recent research pursuing similar goals. For instance, Gallin (2013) offers an alternative way to use FA data to track the reliance of the nonfinancial sector on short-term funding markets, while Errico et al. (2014) show one way to combine the FAs with other data sources.

Second, from a policy perspective, our analysis is more supportive of placing greater emphasis on macroprudential measures than on using interest rates to address risks in the financial sector. More specifically:

- The different credit and business cycles magnify the trade-offs of using interest rates to contain financial stability risks. We uncover that both cycles of bank and nonbank credit to the private sector are longer than the business cycle (particularly for nonbank credit to households). This suggests that a monetary policy of 'leaning against the wind' to curve down credit growth could have substantial costs in terms of employment growth and inflation: by raising rates to dampen the upswing in the long credit cycle, central banks may be accelerating an output downturn that is, in fact, closer than they think.

- Moreover, the divergent behavior of intra-financial system credit cycles also suggests that managing financial stability risks requires a carefully calibrated approach, and one that likely requires targeted policies for each subsegment of the financial system. A change in interest rates would affect each subsector differently, as they are in different cyclical phases, and could possibly lead to a re-routing of lending flows within the financial system. Hence, an apparent reduction in bank credit to other financial entities could simply mask a migration of credit to the less-monitored nonbank sector.

- The procyclicality of credit cycles in the nonbank sector stresses the need to strenghten resilience in the cycle upswing. As argued by others (e.g., Borio, 2012), the procyclicality of credit underscores the need to build prudential buffers in good times. Our findings imply that this lesson gains relevance for nonbanks, which have been shown to be more procyclical than banks. That said, note that for banks, stronger buffers can be built via capital and liquidity standards. For certain type of nonbank activities, however, there may be other tools more appropriate to reduce procyclicality and build resilience, such as margining and haircut requirements for securities lending (cf., BCBS, 2013, and FSB, 2014, for proposed new regulation in some of these areas). Our analysis also highlights the importance of designing policies to limit swings in short-term intra-financial sector funding, as this embeds a critical vulnerability.

- During output downturns, supervisory scrutiny should be intensified to counter the continued accumulation of financial risks. As shown in Section III, longer bank and nonbank credit cycles imply that, in most recessions, lending risks will continue to

accumulate for some time even as output falls—recall Table 2. History has shown that this dynamic can result in a sharper and prolongued adjustment later on (e.g., the phenomenon dubbed as a "balance sheet recession" by Koo, 2010, or "unfinished recession" by Drehman et al., 2012). Countering this threat requires cleaning up the balance sheets of financial entities as much and as quickly as possible. This necessitates elimination of nonperforming loans following a bust and during recessions, which can be accomplished via closer supervisory scrutiny, enhanced provisioning requirements, and an efficient bankruptcy and debt restructuring framework.

Finally, our study seems to corroborate that changes in financial regulation (and especially their removal) often lead to the slow and protracted build-up of risks. As demonstrated in the discussion of the period between the S&L crisis and the GFC, new regulations on financial institutions will no doubt cause migration of activities into new places and forms. By adopting a short-term view and focusing on recent incremental changes in risk metrics, financial stability practicioners may miss the secular accumulation of key vulnerabilities. The unpleasant analogy, here, is the one of the frog in the boiling pot. Hence, we close our study by re-iterating the need to adopt a long-term and economy-wide view of financial vulnerabilities when designing macro- *and* micro-prudential policies. This can only be accomplished by improving our understanding of the long-term dynamics of financial flows and the risks they entail. We hope that our exploration has helped in this endeavor.

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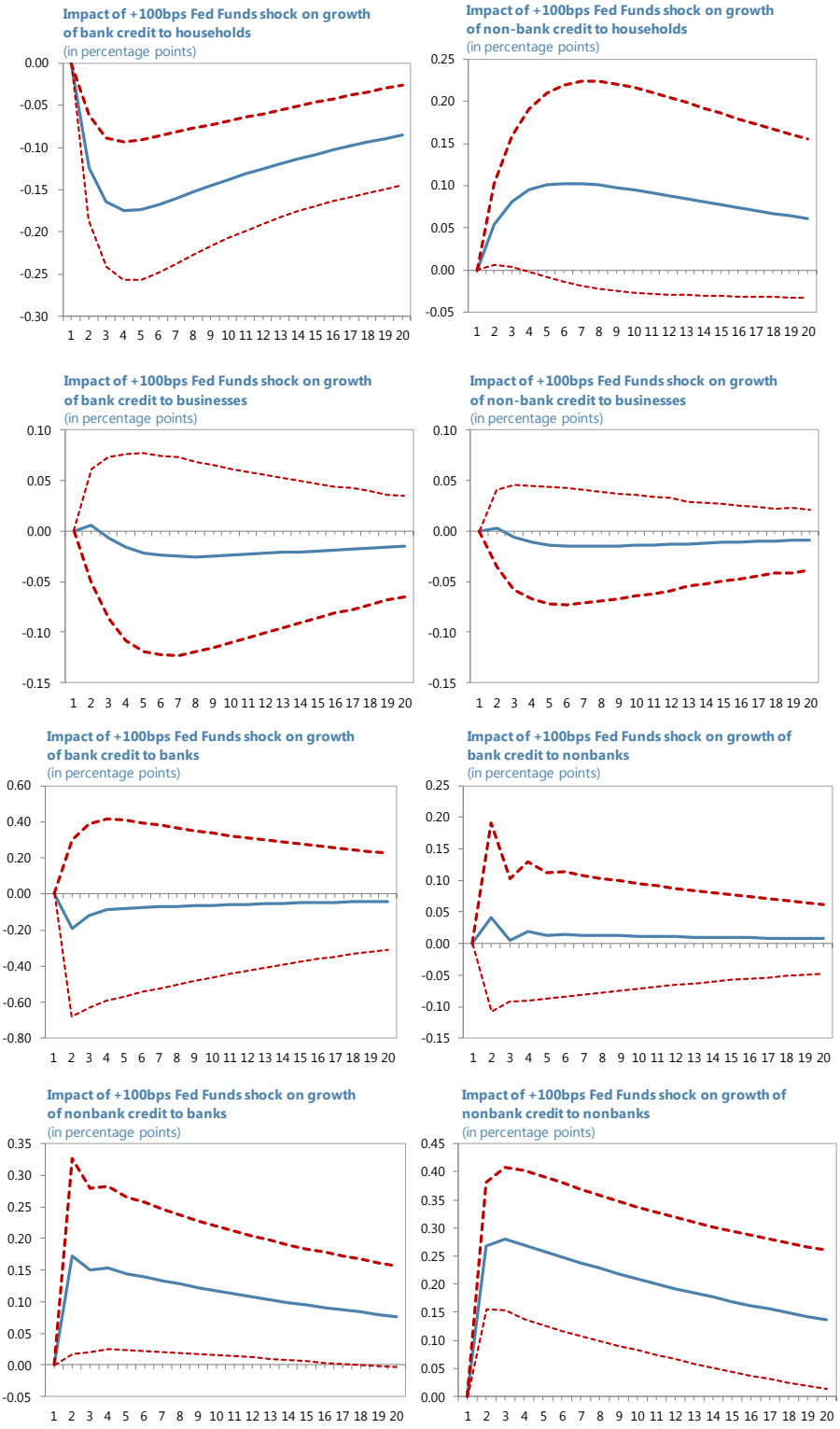
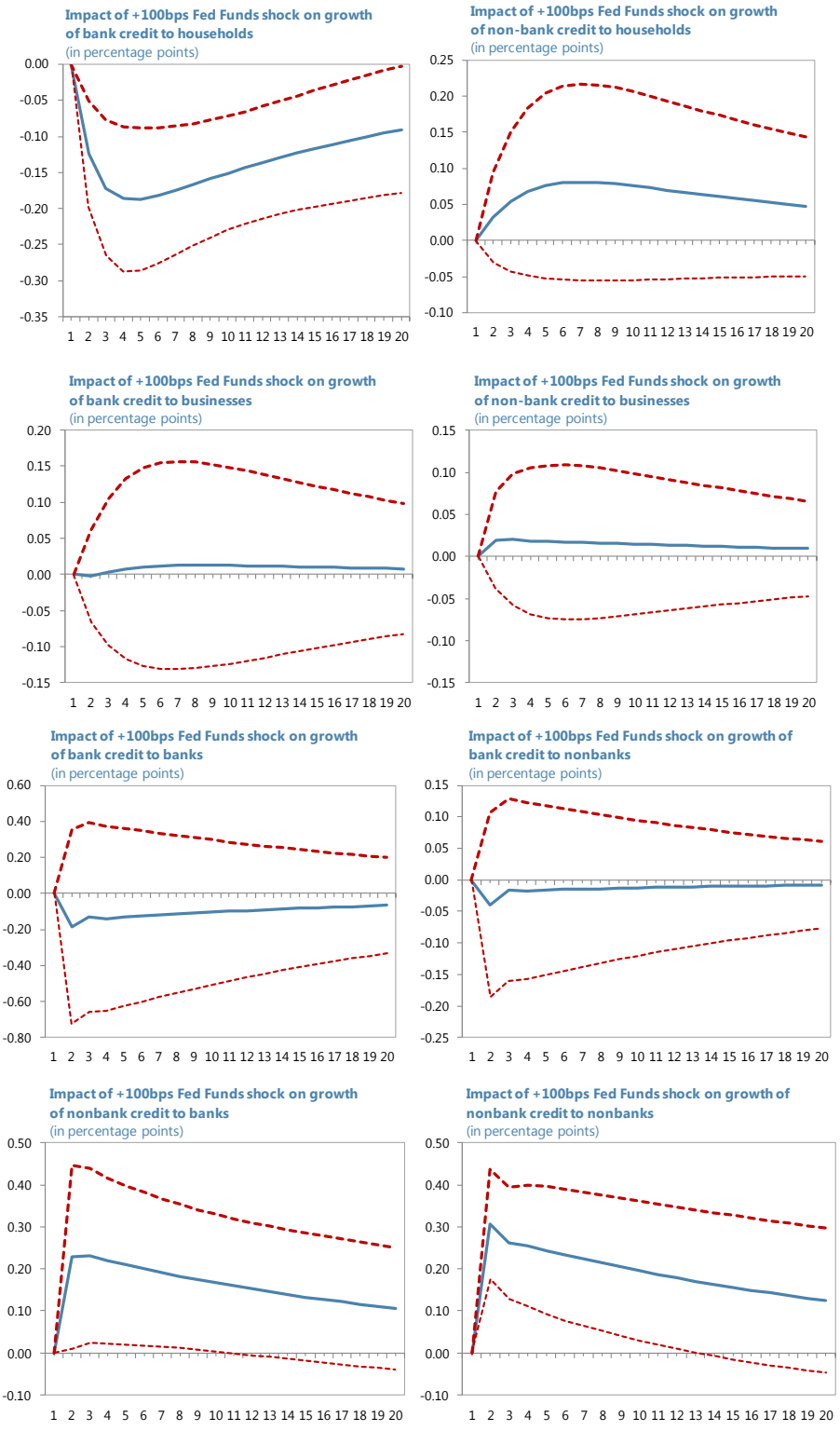
APPENDIX I. ROBUSTNESS CHECKS FOR THE VAR

Figure A-I.1. Interest Rate Shocks Impulse-Response Functions: 1952Q1 to 2014Q4



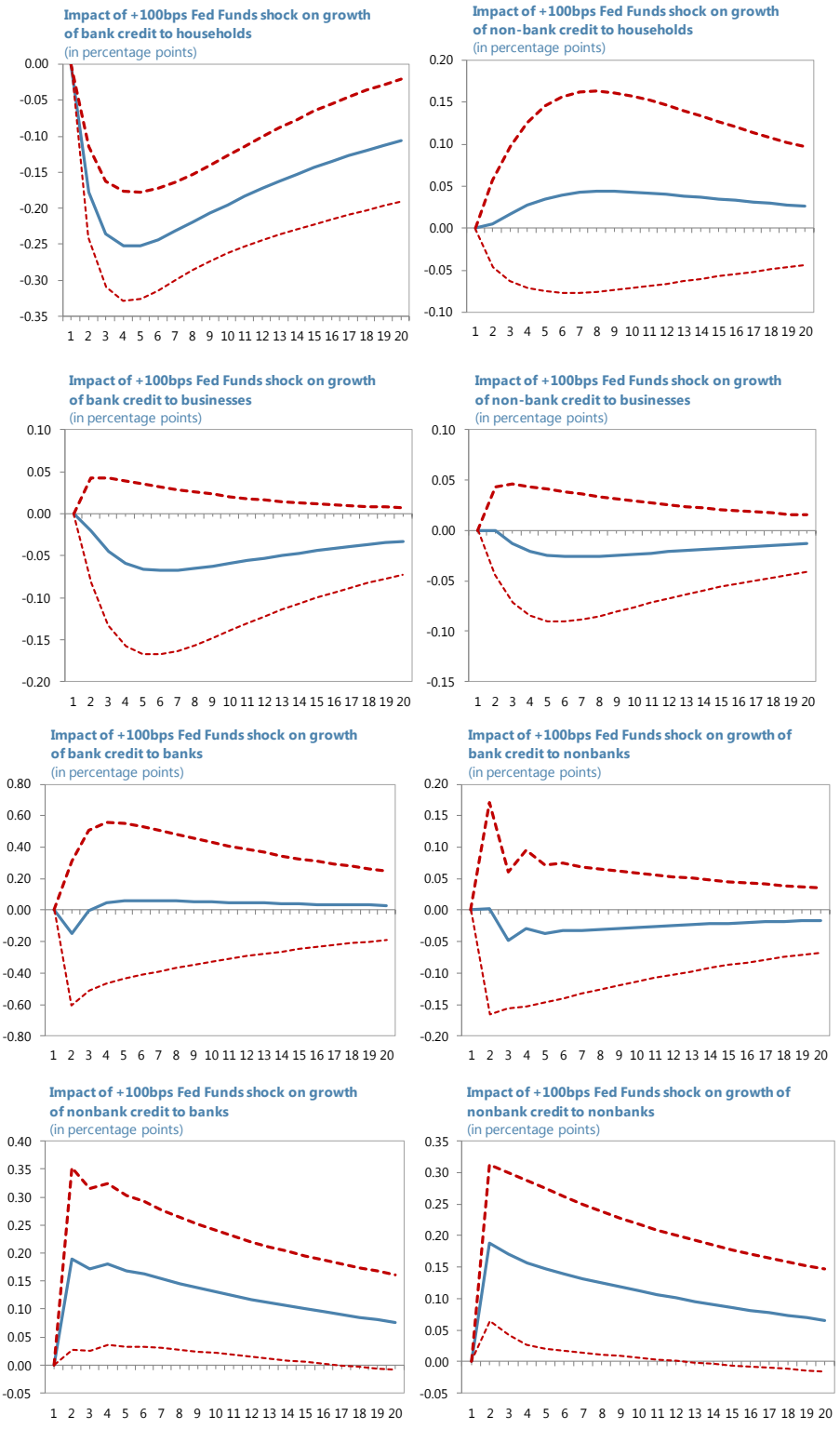
Source: Authors' calculations.

Figure A-I.2. Interest Rate Shocks Impulse-Response Functions: 1975Q1 to 2009Q1



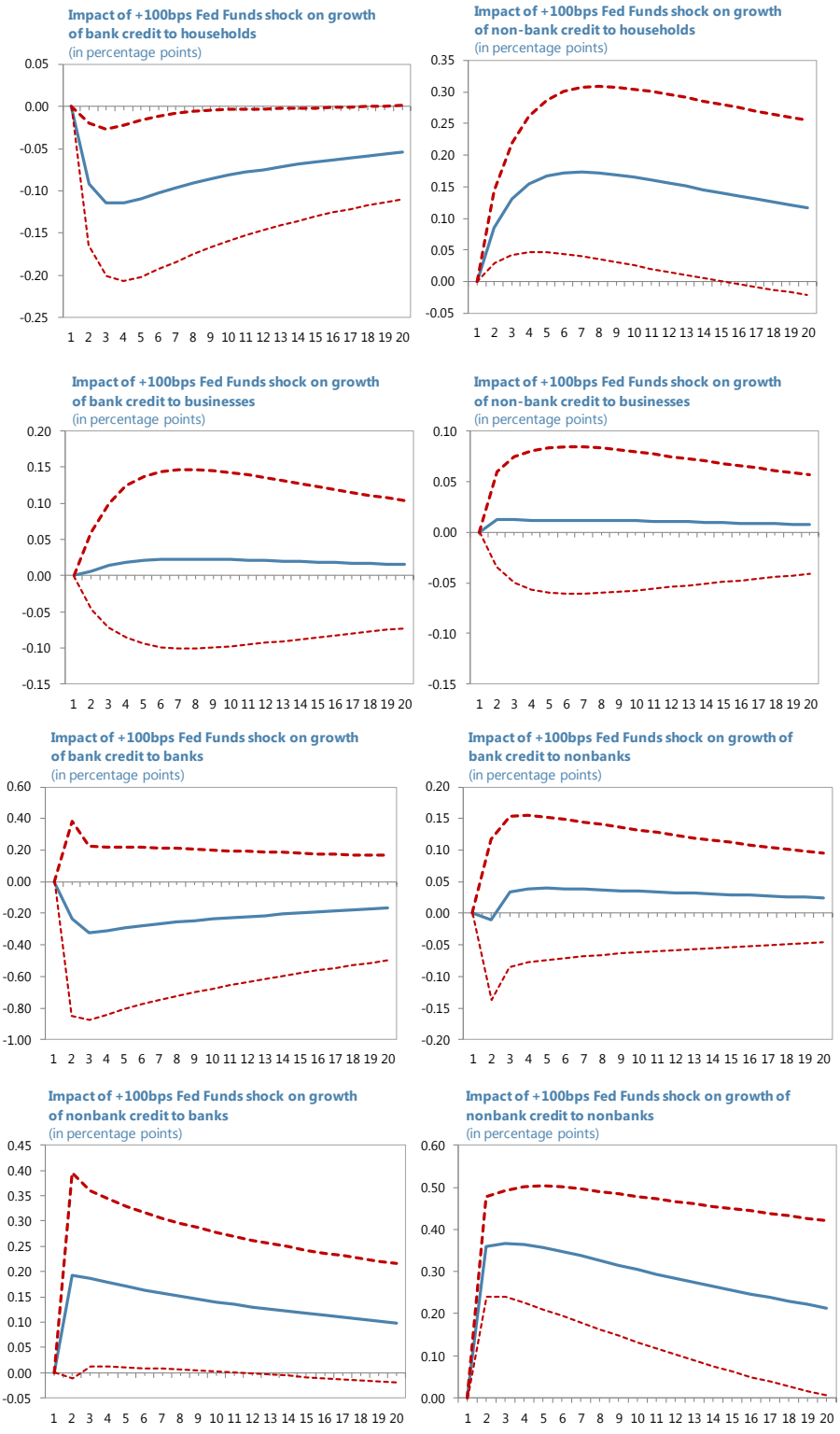
Source: Authors' calculations.

Figure A-I.3. Interest Rate Shocks Impulse-Response Functions: 1952Q1 to 2009Q1



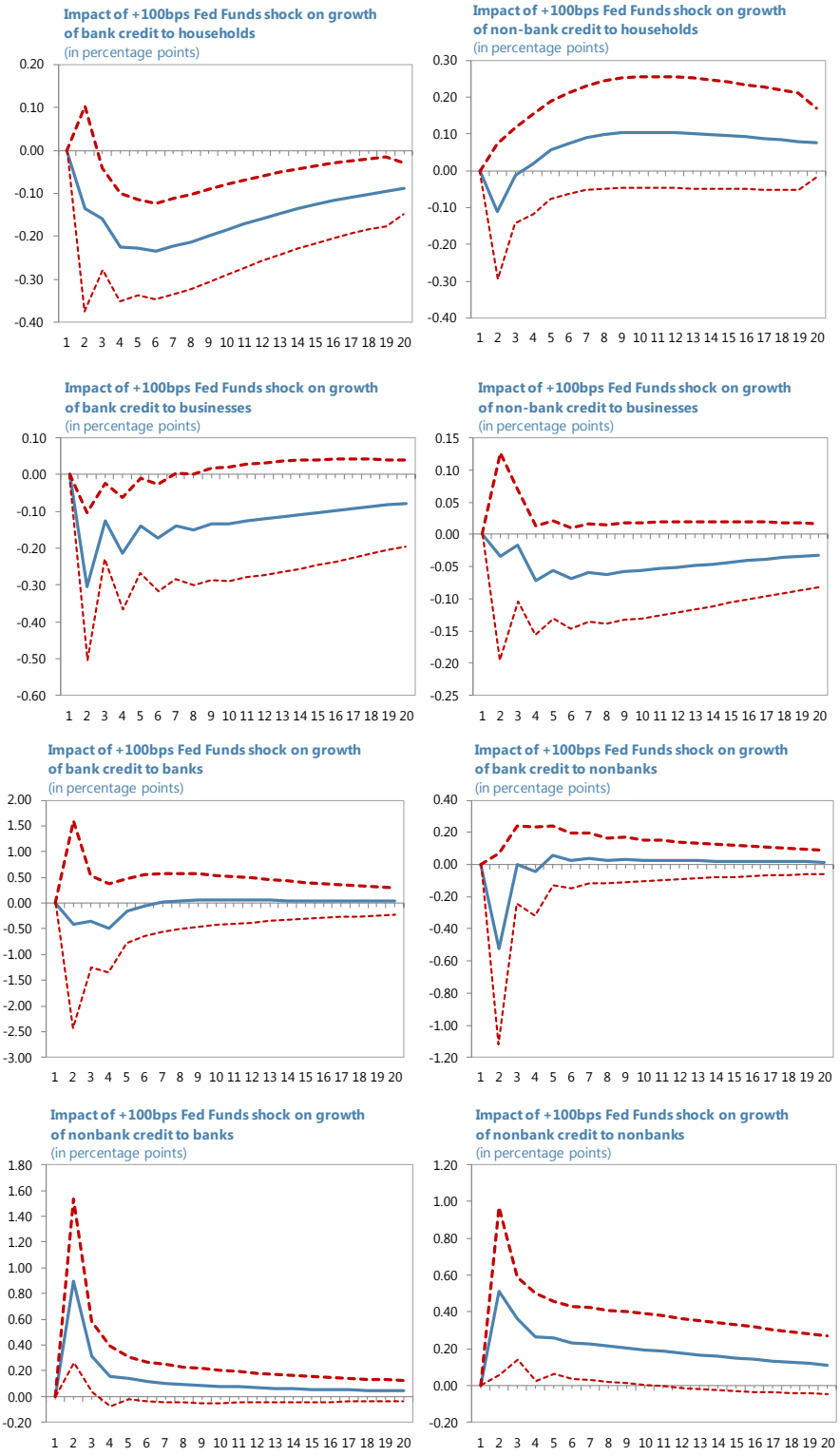
Source: Authors' calculations.

Figure A-I.4. Interest Rate Shocks Impulse-Response Functions: 1975Q1 to 2014Q4



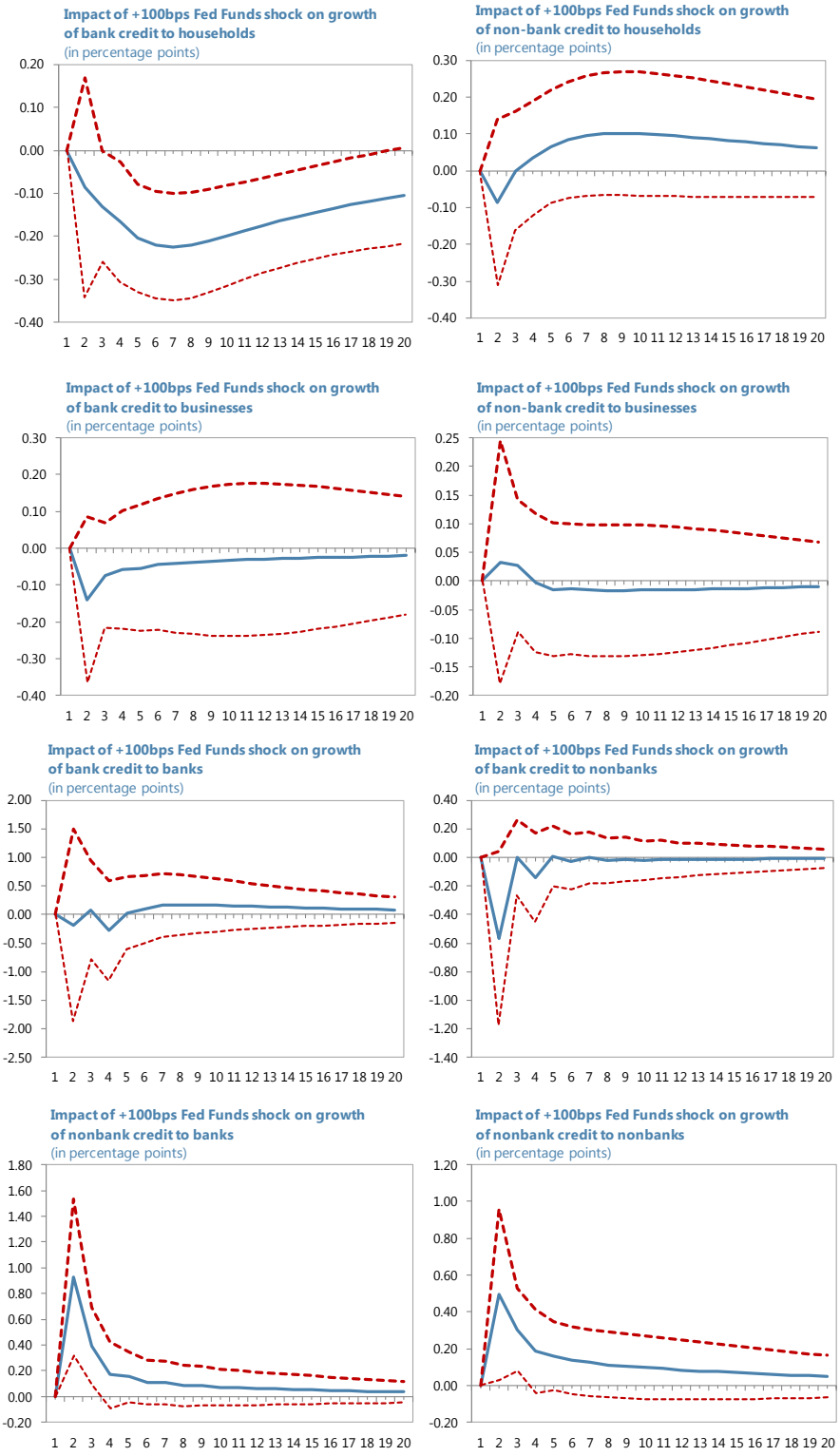
Source: Authors' calculations.

Figure A-I.5. Interest Rate Shocks Impulse-Response Functions: 1952Q1 to 2014Q4, Two Lags



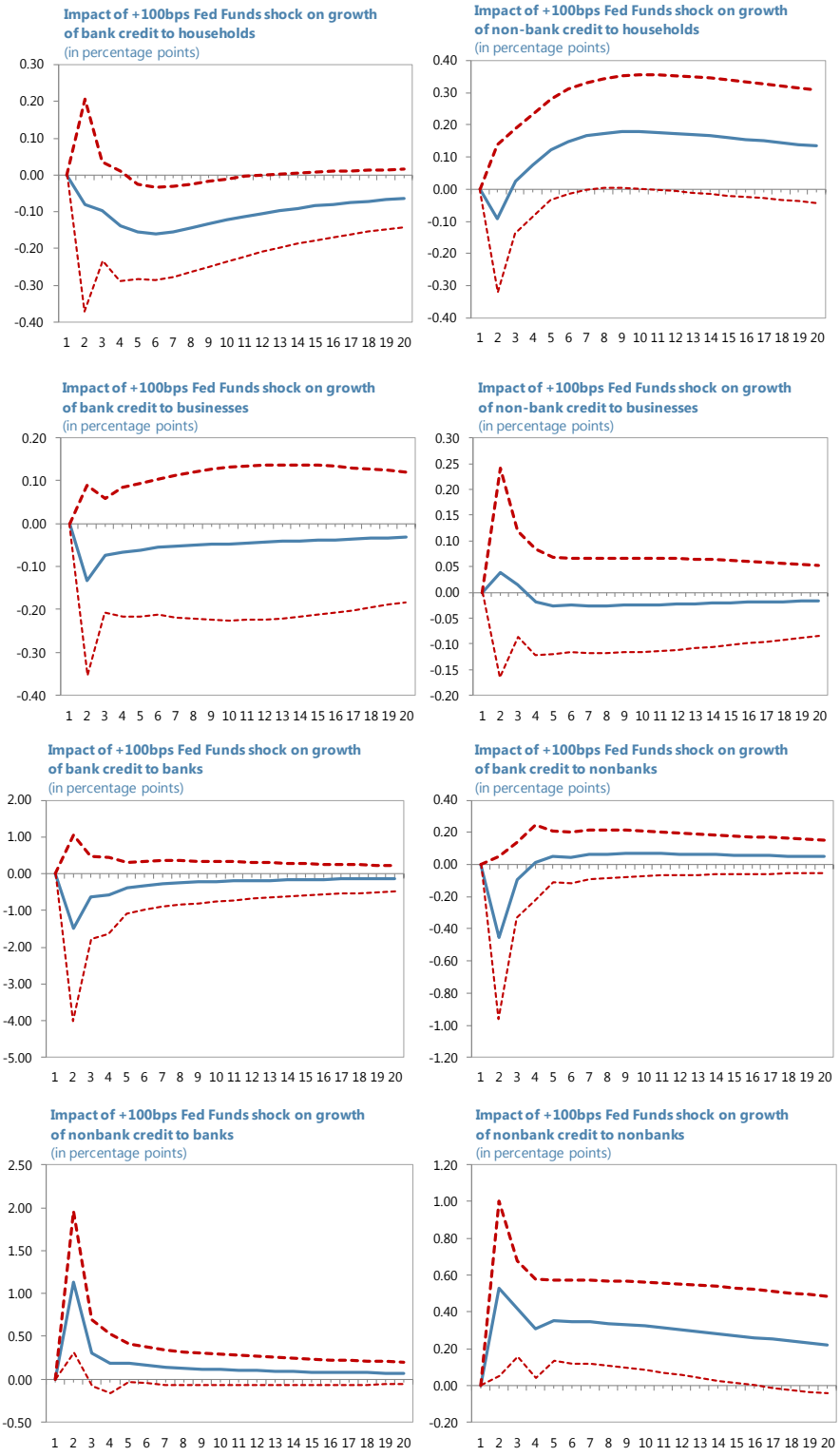
Source: Authors' calculations.

Figure A-I.6. Interest Rate Shocks Impulse-Response Functions: 1975Q1 to 2009Q1, Two Lags



Source: Authors' calculations.

Figure A-I.7. Interest Rate Shocks Impulse-Response Functions: 1975Q1 to 2014Q4, Two Lags



Source: Authors' calculations.

APPENDIX II. TEN RECESSIONS

Since 1952—when flow of funds data began to be collected—there have been 10 recessions and two systemic banking crises (the S&L crisis in the 1980s and the global financial crisis of 2007–08) in the United States.

Given that we have a very limited number of observations, it is difficult to utilize the usual econometric methods. Hence, we opt for a case-by-case approach where we look at the developments around each business cycle peak and trough separately.

Below we provide some narrative about the main characteristics of these recessions and subsequent recoveries. In particular, we discuss the "main" cause and the severity of the recession, as well as the behavior of bank and nonbank credit in the build up to the recession and the posterior recovery.[22]

1953 Recession

As the Korean War ended in July 1953, defense spending fell sharply. During the war, increased inflationary pressures had prompted the Fed to tighten monetary policy, which raised pessimism about the economic outlook and decreased aggregate demand. The recession started right after the end of the war and lasted for 10 months, but unemployment did not reach its peak of 6.1 percent until September 1954, three months after the recession ended. Real GDP level was down 2.5 percent from peak to trough.

Credit to the nonfinancial private sector was not a major factor in the run-up to the recession. Both bank and nonbank credit to households grew at a healthy pace in the six quarters before the peak but this reflected trend growth that had started earlier and continued during and after the recession.

The financial system had begun to become more interconnected prior to the recession as bank credit to nonbanks increased and, while strengthening of bank-to-nonbank linkages stalled during the recovery, nonbank credit to nonbanks continued to grow. Interestingly, bank-to-bank credit flows declined before the recession and this trend accelerated during the recovery.

1957 Recession

Drop in external demand, a strong dollar, and contractionary monetary policy contributed to a widening of the trade deficit and sharp drop in domestic activity led by auto sales and housing construction. The recession lasted 8 months from August 1957 to April 1958.

[22] Recessions, like other economic events, seldom have a single cause but are rather the result of a confluence of factors. There is typically, however, a trigger and/or a dominant force that drives the economy into recession and which we call the main cause of the recession.

Although shorter than the recession of 1953, the recession of 1957 was deeper: real GDP dropped by 3.6 percent and unemployment reached a peak of 7.4 percent in 1958q2.

Again, credit was not a major factor and patterns before and after the recession reflected the broader deepening of the financial system rather than cyclical movements. Notably, however, bank-to-bank credit flows increased in the run-up to the recession and plummeted during the recovery. Instead, bank-to-nonbank flows strengthened during the recovery and nonbank-to-nonbank flows also remained strong. This likely was a factor in ensuring uninterrupted provision of credit to households, in addition to the governmental actions taken—lowering the discount rate and ending restrictions on no-down-payment mortgage loans.

1960 Recession

As demand for autos shifted from large, domestic cars to compact and often foreign-made cars, the automotive industry drew down inventories. Starting in April 1960, the recession lasted 10 months and ended in February 1961. This was a relatively mild recession with real GDP falling by 1.3 percent and unemployment rising to 7.1 percent in May 1961. Stimulus spending helped get the economy back on track.

Credit developments continued to reflect broader secular trends. Bank-to-bank linkages weakened somewhat while bank-to-nonbank and nonbank-to-nonbank linkages continue to increase.

1970 Recession

On the back of contractionary monetary and fiscal policies, another relatively mild recession started in December 1969, lasting 11 months. Real GDP dropped by 0.6 percent. Unemployment peaked at 6.1 percent in December 1970.

Credit to the private sector barely increased in the run-up to the recession and grew at a measured pace during the recovery. Flows between financial institutions continued to evolve on a trend.

1973–75 Recession

This recession lasted 16 months from November 1973 to March 1975. Quadrupling of oil prices by OPEC for a few months in 1973 arguably was the trigger but obviously higher oil prices alone cannot explain the depth of the recession. Several other factors also played a role. First was the fall of the Bretton Woods system as a result of the unilateral decision by the United States to suspend the convertibility of the dollar to gold. Second, for the first time since World War II, wage and price controls were instituted to combat inflation. The result was stagflation and a 3.1 percent drop in real GDP. Unemployment reached a peak of 9 percent in May 1975, two months after the recession technically ended.

Bank and nonbank credit to the nonfinancial business sector grew at a somewhat faster pace than the previous recession episodes in the run-up. Growth of credit to this segment was negative during the recovery. Credit to households grew but at a rather sluggish pace.

In terms of linkages between financial segments, bank-to-bank credit shrank in the run-up while bank-to-nonbank credit grew rapidly. During the recovery, bank-to-bank credit bounced back while bank-to-nonbank credit stalled.

1980 and 1981 Recessions

Although commonly thought as a single, long recession, the years 1980–81 technically witnessed two recessions: the recession of 1980, which started in January and ended in July (lasting 6 months), and the recession of 1981, which started in July and ended in November next year (lasting 16 months). According to many, the Iranian oil embargo, which resulted in an increase in prices, was the original trigger. With inflation running in double digits (which has been in part carried over from the previous oil crisis), the Fed raised interest rates and slowed money supply growth, putting breaks on the economy and leading to a rise in unemployment. Real GDP fell by as much as 8.1 percent (annualized) in 1980q2 and by 6.7 percent (annualized) in 1982q1. Peak-to-trough drop was 2.2 percent in the 1980 recession and 2.6 percent in the 1981 recession. Unemployment rose to 10.8 percent in November 1982, the highest level of unemployment in any post-war recession to that date, and remained above 10 percent for 10 months. Ultimately, a combination of a boost to defense spending, tax cuts, and the lowering of interest rates slowly guided the economy to recovery.

Bank credit to households grew 1.2 percent (annualized) in the 6 quarters preceding the 1980 recession and contracted by -4.3 percent in the run-up to the 1981 recession. Bank credit to nonfinancial businesses grew at a rate of 3.4 percent and 0 percent in the 1980 and 1981 recessions, respectively. This pattern perhaps reflects the back-to-back nature of the two recessions, with credit to nonfinancial businesses remaining flat or declining during the short recovery period in between. Nonbank credit, especially to households, grew at a faster pace in the run-up to the first recession but also remained muted in the run-up to the second. The recovery from the second recession shows a bounce-back both in bank and nonbank credit to the nonfinancial private sector.

The recession hit the banks at a delicate time. Following a wave of deregulation, banks had been taking more risks. A growing number of loans turned sour as the economy turned and bank failures reached post-Depression highs. Linkages of nonbanks to banks and other nonbanks continued to grow rapidly. These events are discussed in further detail in Section IV.

1990–91 Recession

Triggered by another energy-related geopolitical event (invasion of Kuwait), this recession was eight months (July 1990 to March 1991). Yet, its origins can also be traced to the deregulation of the Savings and Loans industry and, hence, the dynamics of macroeconomic

variables and credit aggregates resemble familiar boom-bust cycles and feedback mechanisms. The deregulation resulted in massive growth of mortgage credit, including a surge in securitizations, and eventually the Savings and Loan Crisis of 1988–89. Recession followed soon after. Peak-to-trough drop in real GDP was a modest 1.3 percent.

Bank credit to households shrank by an average of -0.4 percent (annualized) in the 6 quarters preceding the recession (as bank credit started to retrench already in 1989), although it had grown at an average of 4 percent in the previous 5 quarters. Bank credit to nonfinancial businesses dropped at a rate of -3.4 percent in the 4 quarters ahead of the recession. Meanwhile, nonbank credit remained strong: credit to households to nonfinancial businesses grew 12.1 percent and 7 percent (annualized) in the 6 quarters preceding the recession, respectively. During the recovery, retrenchment in bank credit continued while nonbank credit somewhat made up for that, especially for households. In terms of interconnections, flows to banks contracted but nonbank-to-nonbank credit continued to increase at a robust pace of 8 percent before the recession and 10.1 percent during the recovery.

2001 Recession

This recession lasted eight months (March–November 2001). It was caused by the bust of the tech boom and exacerbated by the 9/11 terrorist attacks. Still, the economy contracted only mildly by a peak-to-trough decline of a mere -0.1 percent. Unemployment reached 5.7 percent during the recession.

Credit to the nonfinancial sector from both banks and nonbanks grew at a robust pace in the run-up to the crisis. During the recovery, however, credit to households grew at a fast pace while credit to nonfinancial businesses remained sluggish. Interbank linkages increased at an astounding pace both before the recession and during the recovery.

2008–09 Recession

The recession followed the problems in subprime mortgage markets, which then led to a global financial crisis. The Great Recession was the worst since the Great Depression in the 1930s. The economy shrank in five quarters, including four quarters in a row. In two of these, the drop in real GDP was more than 5 percent—the worst came in Q2 2008 when real GDP fell by an enormous 8.9 percent, more than any other recession since the Great Depression. The recession was also the longest seen since the Great Depression, lasting 18 months. The recession technically ended in Q3 2009, when real GDP growth turned positive. Aggressive monetary policy actions and stimulus spending were finally able to help the economy register positive growth rates, but the recovery was characterized by a sporadic pattern and lower-than-typical performance overall.

The astonishing speed of growth in interbank linkages continued in the run-up to the recession and during the recovery—in part reflecting the actions taken to clean up the damage from the crisis. Interestingly, nonbank-to-nonbank flows declined for the first time in this recovery.