

What do a Million Observations on Banks Say About Federal Credit Policy?

Preliminary and incomplete

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May 15, 2021

Abstract

We study what we call “the bank lending channel of credit policy”, i.e. federal credit programs (subsidies, guarantees or direct loans) and their effect on the supply of credit by private lenders. In the theory part of the paper we extend the model in [Lucas \(2016\)](#) by endogenizing the behavior of lenders in the private sector. In the empirical part we test the predictions of the model by proceeding in two steps. First, we build a new dataset on federal credit from 1977 to 2018 at the quarterly frequency. Second, we put together a large panel of bank-level balance sheet and income statement data for all commercial banks in the United States for the same period. Using these data and applying the identification strategy of [Kashyap and Stein \(2000\)](#) we obtain results consistent with the presence of a bank-lending channel of federal credit policy. Our estimates show that a 1% increase in the outstanding amount of bond holdings issued by the federal government to finance credit programs loosens lenders’ liquidity constraints by 28% which is equivalent to an additional \$21.7 billion in lending for the average bank in the United States.

Keywords: federal credit policies, bank lending channel.

JEL Codes: E44, E62, H39, H53.

*Corresponding author: María Pía Olivero moliver1@swarthmore.edu www.mariapia-olivero.com. A good part of the work on this paper was done while María was visiting the Haverford College. She thanks their Department of Economics for their hospitality. Christopher obtained the outstanding Economics thesis award at the Haverford College with work that provided the earlier results for this paper. Chongkyung (Jason) Kim provided excellent research assistance. We want to thank Marco Airaud, Patricia Gómez-Gonzalez, Saleha Jilani, Shannon Mudd and seminar participants at Fordham, Drexel and Swarthmore for very helpful comments.

1 Introduction

Federal credit programs consist of subsidies, guarantees or direct loans extended by the government to non-federal sectors. Also, tax-exempt status allows state and local governments to borrow at reduced costs and to then operate their own credit programs by passing on the interest savings to preferred borrowers ([Gale \(1991\)](#)).

Significant resources are devoted to federal credit programs. United States Treasury holdings of bonds issued by federal government departments and agencies to finance these programs amounted to \$1.5 trillion dollars in 2018 (7.7% of GDP) and has been consistently increasing for the last two and a half decades from just \$153 billion in 1995. For reference, when starting in 1976 these programs were lending \$54 billion.¹ It consists of 57 unique loan programs and 186 reported line items in the President’s annual budget. Of these, currently 39 are actively extending new loans and 18 are managed programs (i.e., no longer financing new projects).

The most important sectors targeted by these programs are education (38%), agriculture (22%), the federal financing bank (13%) and housing (5%), with the rest going towards energy, small businesses and exporters.

Credit policies are also worth studying given their differences from other types of fiscal stimulus. Federal direct loans and guarantees can act as good automatic stabilizers since participation rates and loan amounts can increase during recessions without legislative action (see [Lucas \(2016\)](#)).

Despite the magnitude of these programs and the particularities surrounding the way they work as a fiscal stimulus tool, the existing literature on the impact of these programs at the macroeconomic level is still surprisingly thin.

The vast majority of the literature focuses on the effects at the intensive margin in the demand-side of credit markets working through a decline in the effective cost of credit which raises demand.

Another piece of the work on federal credit programs is related to the broad macroeconomic literature on the links between external finance and real activity. A common assumption in this literature is that higher credit availability directly translates into increased economic activity. However, research on individual programs at the more micro level has been devoted to understanding diversion of the additional loans to alternative uses and the crowding-out effects. The concern (which applies to all of the federal credit programs) is that the loans and guarantees could end up assigned to borrowers who would have still qualified for contracts in the private sector and that, therefore, this policy could end up potentially just crowding out the credit supply of commercial banks and other private lenders. If either diversion or crowding out take place, then this assumption does not necessarily hold true.

To the best of our knowledge there is no work on the effects at the extensive margin

¹As another example, in 2010 new loans granted by 150 different programs in the federal budget amounted to \$900 billion (almost 6.5% of GDP).

in the supply-side of the market for credit. By *extensive margin* we mean those effects working through a spillover effect on private lenders that ends up raising their supply of credit even net of potential crowding out effects.

In this paper we attempt to start filling this gap in the literature in two different but complementary ways. First, on the theory side, we study the *aggregate* implications of government credit policies by building a *general equilibrium* model and simulating the effects of these policies. We extend the partial equilibrium model in [Lucas \(2016\)](#) work in by endogenizing the behavior of lenders in the private sector and by assuming that, due to the asymmetric nature of information in credit markets, borrowers are subject to a collateral constraint. Federal credit policy interacts in a very meaningful way with the presence of this constraint since borrowers that benefit from direct loans or loan guarantees extended by the government can use these as a type of intangible collateral that is “posted” when trying to access credit from private lenders.

On the empirical side our contribution is twofold. First, we put together a novel and comprehensive on federal credit by various departments and agencies of the United States federal government from the first quarter of 1977 to the last quarter of 2017, and we combine it with a large dataset at the bank-level on private lenders/banks balance sheets and income statements. Second, we use the well established methodology of Kashyap and Stein (2000) to test the transmission channels between federal credit programs and lending in the private sector present in our theoretical model.

Our (still preliminary) results indicate the presence of what we label a “bank lending channel of credit policy”. A 1% increase in the outstanding amount of bond holdings issued by the federal government to finance credit programs loosens lenders’ liquidity constraints by 28%, which is equivalent to an extra \$21.7 billion in lending for the average bank in the United States. Also, we interpret the fact that these effects are significant and economically important for programs financing projects in agriculture, education, energy and housing as indirect evidence of direct loans and government guarantees acting as a type of “intangible collateral” that beneficiaries of these programs can use when trying to access additional funding in the private sector.

2 Literature Review

The theoretical literature discusses two main channels through which these policies can exert an impact on economic activity: an intensive and an extensive margin. The former refers to the amount of credit demanded increases as the cost of credit drops with the subsidies implied by these policies. The latter refers to an increase in the supply of loans available to credit-constrained individuals who are otherwise typically unable to borrow from private lenders.

[Gale \(1991\)](#) develops a theoretical model in which as a lender, the government interacts with banks in a competitive loan market and both have imperfect information on the

borrowers’ projects. Through model simulations, he finds that while credit programs succeed in allocating credit to target groups, they still result in a net welfare loss when the costs of financing these programs are taken into account. An exception to the latter result takes place when credit finances activities with significant externalities, in which case there can be welfare gains associated to government lending.²

In chapter 8 of his book, [Elliott \(2011\)](#) points to ten very specific areas for improvement in the design and administration of federal credit programs. Among them, it is worth highlighting the idea that in order to really spur investment and productivity, these programs should be targeting borrowers more carefully and not necessarily direct their loans to sectors which would have undertaken the projects anyway even with no federal assistance. This “crowding out” of private lending is also discussed elsewhere in the literature and there seems to be some consensus on this being the major drawback of federal credit policy.

[Lucas \(2016\)](#) estimates a multiplier of federal credit programs of \$4.86 of output stimulus per \$1 of taxpayer cost, significantly larger than the average multiplier of 1.5 estimated by the Congressional Budget Office for the American Recovery and Reinvestment Act (ARRA) of 2009.³

There is more abundant work with a microeconomic approach focusing on the effects of individual programs. As an example, [Quigley \(2006\)](#) studies the effects of credit programs related to the 1934 Act that established the Federal Housing Administration (FHA). These are mostly mortgage insurance and guarantee programs administered by the Department of Housing and Urban Development to stimulate housing markets and help people achieve home ownership.⁴

[Lucas and Hadley \(2012\)](#) provides details on data use for these programs.

²Like in much of the lending literature, an implicit assumption in [Gale \(1991\)](#) is that more lending leads to more economic activity. The author does acknowledge the limitations of this assumption. The overall real effects on output would be overestimated in situations in which borrowers substitute debt with equity and capital for labor, or use the funds for an unrelated cause. Conversely, effects would be underestimated if federal lending would allow for an increase in private investment by more than what the credit program provides (like when the programs finance marginal parts of large projects).

³? discusses how the methodology used to calculate fiscal multipliers for government spending cannot be readily applied to credit policies since cash flows are more uncertain and typically extend over a longer period of time. To calculate the cost of the loan, most commonly the literature projects lifetime cash flows for each federal credit loan and uses Treasury Bill rates to discount them all the way to the date of origination.

⁴According to his findings, these credit programs help to increase minority access to housing and are projected to increase homeownership for the eligible population in general. He also shows that government programs are less inclined to discriminate among heterogeneous borrowers than lenders in the private sector. Furthermore, he shows that even those eligible participants that are typically considered “inframarginal” (those whose likelihood of becoming homeowners is unaffected by FHA programs) are able to afford better housing.

3 The Model

Our model builds on that of [Lucas \(2016\)](#)⁵ and it is extended to endogenize the private lenders' behavior in terms of their supply decisions in the market for credit. In particular, we introduce lenders requiring borrowers to post collateral as a way to deal with the asymmetric information regarding projects' outcomes. This framework is in the spirit of [Rothschild and Stiglitz \(1976\)](#).⁶ We want to introduce this transmission channel in the model to make it consistent with the link that we want to identify in the empirical part, namely the effect of federal credit on the supply of bank credit. In particular, our hypothesis is that lending guarantees provided by the government lead lenders in the private sector to expand their supply of credit since they view the federal guarantees as a form of what we call "intangible collateral" that the beneficiaries can "post" when trying to access supplementary credit from the private sector. By comparing empirically how this effect differs across types of loans and for different types of federal credit programs, we intend to find whether there is enough support for this channel of transmission in the data.

The economy is populated by a continuum of measure one of borrowers. They can be of either of two types: type A (with a measure μ) or type B (with a measure $(1-\mu)$). Borrowers of type A always repay their loans in full. Borrowers of type B repay a fraction ρ of the promised amount. There is also a continuum of perfectly competitive lenders who cannot identify/observe the borrowers' types and only know the distribution of those types.

The utility of borrowers of type $i \in \{A, B\}$ is given by:

$$U(L_i) = \frac{\nu L_i^{(1-\gamma)}}{(1-\gamma)} - R_i L_i \quad (1)$$

where L denotes the loan amount and R , the gross interest rate on loans which is type-specific in equilibrium. Borrowers maximize their utility subject to a collateral constraint

$$L_i \leq \xi f(g_i) \quad f'(\cdot) > 0 \quad [\phi] \quad (2)$$

Equation (2) assumes that borrowers can use the assistance that they are entitled to from the government as an intangible type of collateral when borrowing from lenders in the private sector. We denote the shadow value associated to this constraint with ϕ . Thus, the maximum amount that they can borrow from the private sector is increasing in the amount of assistance that they get from the government. This is the way in which we intend to capture in the model the channel that we intend to test for in the empirical section of the paper.

The solution to the borrower of type i 's optimization problem yields their demand for

⁵The supply of credit is exogenous and assumed to be perfectly elastic in [Lucas \(2016\)](#).

⁶Other related models are in [Jaffe and Russell \(1976\)](#), [Stiglitz and Weiss \(1981\)](#), [Smith \(1983\)](#), [Smith and Stutzer \(1989\)](#), [Gale \(1990\)](#), [Lacker \(1993\)](#) and [Williamson \(1994\)](#).

loans:

$$L_A = \left(\frac{R_A + \phi_A}{\nu} \right)^{-\frac{1}{\gamma}} \quad (3)$$

$$L_B = \left(\frac{R_B + \phi_B}{\nu} \right)^{-\frac{1}{\gamma}} \quad (4)$$

Since the collateral constraint will always bind with equality for (the bad project) borrowers of type B:

$$L_B = \xi f(g_B) \quad (5)$$

For the borrowers who have the good projects, the collateral constraint will turn out to be non-binding so that $\phi_A = 0$.

Now we switch to the lender's optimization problem. She maximizes her expected profits Π subject to a resource (balance sheet) constraint:

$$\Pi = [\mu + (1 - \mu)\rho](1 + r)L - (1 + r_f)D \quad (6)$$

s.t.

$$D = L \quad (7)$$

where $(1 + r)$ is the (gross) contractual rate on loans L granted by the lender, D is the (exogenous) supply of funds available to lenders at the risk-free net interest rate r_f . The FOC for this problem yields the optimal pricing equation for the lender as in:

$$[\mu + (1 - \mu)\rho](1 + r(\theta)) - (1 + r_f) = 0 \quad (8)$$

Solving for the equilibrium contractual rate, we get:

$$(1 + r(\theta)) = \frac{(1 + r_f)}{[\mu + (1 - \mu)\rho]} \quad (9)$$

3.1 Closing the Model

$$R_A = (1 + r(\theta)) \quad (10)$$

$$R_B = (1 + r(\theta))\rho \quad (11)$$

$$L = L_A + L_B \quad (12)$$

3.2 Federal Credit Policy in the Model

The government guarantees a repayment capacity for borrowers of type B that is denoted by g and for the policy to be effective, it meets the condition that $g > \rho$. Thus, with the lending guarantee, the contractual rate offered by private lenders falls below $(1 + r(\theta))$ to

$$(1 + r^P(\theta))$$

$$(1 + r^P(\theta)) = \frac{(1 + r_f)}{[\mu + (1 - \mu)g]} \quad (13)$$

where the superscript P stands for policy. When policy is put in place, the repayment by the borrowers of type B is given by:

$$R_B^P = (1 + r(\theta))g \quad (14)$$

The subsidy rate is defined as the cost to the government of providing the guarantee per dollar of loan principal:

$$s = (g - \rho)(1 - \mu) \quad (15)$$

3.3 Parameterization

In the following exercise, we parameterize the model to be able to get quantitative measures of the effects of raising g as our shock to the stance of federal credit policy.

We set the parameter ρ to the average delinquency rate on commercial and industrial loans in the United States which we take from the Board of Governors of the Federal Reserve System.

We normalize L_A to one and we calibrate ξ for the ratio $\frac{L_B}{(L_A + L_B)}$ to match the ratio of non-performing loans to gross loans in the data from the Global Financial Development Database of the World Bank from 1998 to 2017. We also used data on the banks' balance sheets for the ratio of loan loss reserves to total assets as part of a sensitivity analysis.

As of the function $f(g_i)$ we assume it to be concave in g and parameterized so that when $g = 1$, $L_B = L_A$.

r_f is assumed to indicate a risk free interest rate and calibrated to match the average yield on 3-month constant maturity Treasury bills from 1982 to 2017 (we have access to the bank-level data from 1977 to 2017 but the data on yields starts in 1982).

In Figure ?? we show the total supply and the cost of credit for increasing strengths of the fiscal policy, i.e. for $g \in [0, 1]$.

4 Empirical Work: Taking the Model to the Data

We implement the two-step methodology first introduced by [Kashyap and Stein \(2000\)](#) to identify the bank lending channel of monetary policy. We apply it here to identify the supply-side effects of federal credit policy in the market for bank lending. The methodology consists of two steps.

In the first step (equation (16)) we run one cross-sectional regression for each time period (quarter) and each bank size class. Thus, for each period we use all banks (indexed by i) to run a regression of their loan growth on an indicator of the health of their balance sheets (H). We label these estimates β_t for each period t . In the second step (equation (18)) we run a time-series regressions of the $\hat{\beta}_t$ obtained from the first step on the measure of federal credit policy (FC_t). The coefficient estimates from the second step can be interpreted as a measure of the intensity of lenders' liquidity constraints to shocks to the stance of federal credit policy.

Having access to balance sheet and income statement data at the bank level allows to study the transmission channels of federal credit policies that operate via the credit supply. Bank-level data help to identify the credit channel by investigating a specific empirical implication of the credit view, namely, that the response of loan supply to policy shocks is expected to be different across banks with different characteristics and financial strength ([Olivero and Jeon \(2011\)](#)). To incorporate this idea into the model and to control for the effect of the financial strength in banks' balance sheets, in the first step regression equation (16) we run a regression of the growth rate of total loans and leases ($\Delta \ln L_i$) on the H measure of balance sheet strength, four lags of the dependent variable and a Federal Reserve district dummy as a geographic control.

$$\Delta \ln L_i = \alpha + \sum_{j=1}^4 \gamma_j \Delta \ln L_{i,-j} + \beta H_i + \sum_{n=1}^{12} \theta FEDDISTRICT_{i,n} + \epsilon_i \quad (16)$$

In our benchmark specification, the measure of balance sheet strength is bank liquidity. It is calculated as the ratio of liquid assets in excess of required reserves (the sum of federal funds sold and security holdings) to total assets at the bank level. The idea is that banks with more liquid balance sheets may be better prepared to insulate their loan supply from unexpected shocks to their balance sheets and/or cash flows ([Olivero and Li \(2011\)](#)).⁷ The raw measure of liquidity taken straight from the bank-level data is subject to endogeneity concerns that are well known in the literature (see [Kashyap and Stein \(2000\)](#)) since the amount of loans a bank can supply and the growth in this supply could well be a function of the liquidity of that bank's asset portfolio. To build a measure of strength of banks' balance sheets considered by the literature as free of endogeneity concerns, we use a "quasi" instrumental variable procedure similar to that in [Kashyap and Stein \(2000\)](#). In a step 0 regression, we regress the liquidity ratio against contemporaneous GDP growth and one

⁷We did not want to include required reserves since banks are not free to draw from these assets to insulate their credit supply in the event of a negative shock to their balance sheets.

lag of itself as observable measures of loan cyclicalilty. We then use the residuals from those regressions as instruments.⁸

As a robustness check we also use two alternative measures of the state of banks' balance sheets taken from the extensive literature on the credit/bank lending channel of monetary policy transmission (for the most influential pieces on this channel see [Bernanke and Blinder \(1992\)](#), [Bernanke and Gertler \(1995\)](#), [Kashyap and Stein \(1995\)](#), and [Kashyap and Stein \(2000\)](#)). The first is bank capitalization, calculated as the ratio of banks equity capital to total assets. Empirical evidence shows that highly capitalized banks tend to pay lower risk premia on their uninsured debt, which makes them better prepared to insulate their credit from macroeconomic as well as policy shocks (see [Kishan and Opiela \(2000\)](#)). The second is bank size. There is abundant empirical evidence supporting that bigger banks face lower external finance premia and find it easier to isolate a shock to deposits by switching to alternative sources of funding (see [Kishan and Opiela \(2000\)](#) and [Luc Laeven \(2016\)](#), among others). We use a *relative* measure of size, calculated as the difference between the log of bank i 's assets for period t and the average of the log of assets for all banks during the same period. Therefore:

$$size_{i,t} = \ln(assets)_{i,t} - \frac{\sum_i^{N_t} \ln(assets_{i,t})}{N_t} \quad (17)$$

where N_t denotes the number of banks at time t .

In the second step we estimate the bivariate empirical model of equation (18). We regress the sensitivity estimate from the first step $\hat{\beta}$ on an indicator of federal credit policy (FC).

$$\hat{\beta}_t = \delta_1 + \delta_2 \ln FC_t + \epsilon_t \quad (18)$$

The estimated coefficient $\hat{\delta}_2$ is expected to be negative. This is interpreted to say that expansionary federal credit policy loosens the liquidity constraints experienced by lenders in the private sector.

We also estimate a multivariate version as in equation (19) where we control for other macroeconomic indicators. $\Delta \ln Y_t$ is the growth rate of real GDP, $\Delta FF_t^{-1} \equiv (FF_t^{-1} - FF_{t-1}^{-1})$ is a measure of the stance of monetary policy, and π_t is inflation. These three variabes are included to control for changes in the demand for credit as a way to isolate the effects of credit policy on the supply side of the market for loans. Q_j are quarterly dummies included to control for seasonality in the data. The idea is to make sure that a negative estimate for the δ_2 coefficient is not picking up the effect of aggregate expansions on the degree of bank's liquidity constraints. This could well be the case if resources devoted to federal credit policies and economic activity were positively correlated with each other.⁹

⁸[Kashyap and Stein \(2000\)](#) also use the ratio of commercial and industrial, real estate and individual loans to total loans as measures of cyclicalilty. We do not because of limited data availability on all these loan categories for our entire time series.

⁹A priori we don't think this is the case since these policies are typically countercyclical. We still account

$$\hat{\beta}_t = \delta_1 + \delta_2 \ln FC_t + \delta_3 \Delta \ln Y_t + \delta_4 \pi_t + \delta_5 \Delta F F_t^{-1} + \sum_{j=1}^3 \delta_{6,j} Q_{j,t} + \epsilon_t \quad (19)$$

After controlling for these indicators of cyclical activity in economic activity, a negative $\hat{\delta}_2$ is interpreted as confirming the expansionary effect of federal credit policies even when filtering the estimates from the spurious effect of GDP growth.

5 The Data

5.1 Bank-Level Data

Our banking data is a panel composed of all national banks, state member banks, insured state non-member banks and savings associations in the United States, and available quarterly from 1976 to 2017. This data is reported in accordance with Federal Reserve System regulation for all Bank Holding Companies under their mandated *Consolidated Reports on Condition and Income* administered by the Federal Financial Institutions Examination Council (FFIEC).¹⁰ It includes information on all balance sheet and income statement accounts.

We have information from different reports depending on the regulatory form of banks of varying sizes and locations. Banks of any size with foreign offices must file the FFIEC 031. Banks with total consolidated assets exceeding \$100 billion that have domestic offices only must file the FFIEC 031. Banks with total consolidated assets of less than \$100 billion file FFIEC 041, and banks with total assets of less than \$1 billion file FFIEC 051. While there exist differences across FFIEC reporting forms, these do not affect the construction of the dataset. Differences typically include additional form reporting for larger banks or differences in accounting standards for banks with foreign operations.

All variable definitions and codes are available from the Micro Data Reference Manual (2018). We retrieve the following variables: total assets (RCFD2170), liabilities (RCFD2950), deposits (RCFD2200)¹¹, total transaction accounts (RCFD2215), non-transaction savings deposits (RCFD2389), time deposits (RCFD2514), equity capital (RCFD3210)¹², loans secured by real estate (RCFD1410), commercial and industrial loans (RCFD1600), loans to individuals (RCFD1975), and agricultural loans (RCFD1590).

We cleaned the data by following the next four steps. First, we dropped observations for which total assets or total loans are missing. Second, we kept only banks for which at

for this possibility in the analysis.

¹⁰The Federal Deposit Insurance Corporation (FDIC) administers the FFIEC collection of data, which is reported under compliance with the Financial Accounting Standards Board (FASB). “Any national bank, state member bank, insured state nonmember bank, and savings association” is required to file a call report, or balance sheet and regulatory filing, within 30 days of the quarter end reporting date.”

¹¹In the data deposits are defined as an unpaid balance or draft where the bank is obligated to give credit to an account (i.e. checking, savings, time, or thrift account).

¹²Equity capital is defined as the sum of preferred stock, common stock, undivided profits and capital reserves.

least four consecutive quarters of data were available. Third, we deleted a few observations for which the loans or security holdings share of total assets was larger than one. Fourth, we dropped banks for which lending is only a marginal activity as measured by loans being less than 5% of their assets. Fifth, we got rid of banks that could have been potentially involved in a merger or acquisition as measured from their quarter-to-quarter growth rate of loans being larger than 80%. Last, we deleted banks for which the growth rate of lending was too far away from the cross-sectional average for that year-quarter as measured by the difference between their growth rate and the mean exceeding five standard deviations.

After applying all these filters a total of 1,602,290 bank-quarter observations remain. The data are indexed by a unique bank identifier (RRSD9001) and a quarterly reporting date (RSSD9999).

Table 2 presents summary statistics for the data at the bank level both in constant dollars of 2012 and as a percentage of total assets. A few statistics worth noting are the average loan-to-asset ratio being 58% with roughly one third of those being commercial and industrial loans and 15% being agricultural loans. The average capitalization and liquidity for all commercial banks in the sample being 10.7% and 42.6%, respectively. Of the liquid assets three fourths are securities and the rest are cash and federal funds sold. On the liabilities side of banks' balance sheets, deposits are by far the largest component and amount to 86% of total assets.

5.2 Credit Policies Data

Our data on federal credit policies is the United States Treasury holdings of securities issued by government corporations and other agencies available from the monthly Treasury statements of receipts and outlays of the United States government. Certain federal agencies are authorized to borrow money from the Treasury to finance direct loan programs. The Treasury then finances these loans by selling Treasury securities to the public.¹³

Putting together this dataset is not trivial since the data are available only as a part of the Treasury bulletins published by the Bureau of the Fiscal Service of the Department of the Treasury. These are published only as scans of the printed versions as a separate pdf file for each quarter. The difficulties are compounded when having to build a long enough time series since the format of the bulletins changes across the decades.

The statements provide data on these bond holdings by agency, namely, the departments of Agriculture¹⁴, Education, Energy, Housing and Urban Development¹⁵ and the Treasury, the Export-Import Bank of the United States, the Railroad Retirement Board, and the Small Business Administration.

¹³Agencies such as the Bonneville Power Administration also borrow from the Treasury to finance capital projects (Quarterly Treasury Bulletins).

¹⁴The Department of Agriculture includes the Farm-Service Agency and the following services: Rural Utilities, Rural Housing and Community Development, Rural Business and Cooperative Development and Foreign Agricultural.

¹⁵The Department of Housing includes the Federal Housing Administration and other housing programs.

Table 3 contains the summary statistics of this data by program which shows that the average over time of outstanding bond holdings has been \$484 billion 2012 dollars with the minimum amount of \$160 billion corresponding to the third quarter of 1996 right after the GDP growth rate had reached almost 2% (quarterly) in the second quarter. The highest stock of bonds (\$1.42 trillion) was reached in the second half of 2018. Showing how these programs are used as automatic stabilizers during downward phases of the business cycle, the stock of bonds more than tripled during the global financial crisis from the beginning of 2008 to the end of 2009. In 2018 total bond holdings amounted to \$ 1370 billion (in 2012 dollars) rising significantly during just four decades all the way from \$ 210 billion in 1977. Since the inception of federal credit programs, even during years of marked expansion in macroeconomic activity when fiscal stimulus is less needed, like 1995 and 2005, bond holdings were \$184 and \$265 billion, respectively.

The average quarterly growth rate for the stock of bonds used to finance credit policy was 1.20% during our entire sample period, with those issued by the Department of Education growing as the fastest average rate of 3.77% but also being those with the highest volatility (they are three times more volatile than the total stock). The Department of Education together with the Federal Financing Bank make up for the largest shares of bonds: 32.6% and 32.4%, respectively. The Department of Agriculture follows with 17.8% of the total amount outstanding.

To get an idea of the economic significance of federal credit, we next look at data on bond holdings by the US Treasury issued by the Departments of Agriculture and Education, the Housing and Urban Development agency and the Federal Financing Bank to finance these programs. Figure ?? shows these data as a percentage of GDP. Total bond holdings start at 3% of GDP at the beginning of our sample in 1977 and end at 8% of GDP in 2018. Spending by these programs was at an all-time low during the period ranging from the mid 1990's to 2007 just before the global financial crisis (GFC) during which it was always below 2%. With fiscal stimulus becoming a priority after the crisis, spending started expanding soon after that. Bonds issued by the Department of Education from 1% of GDP to more than 6% in 2018. Securities issued by the Housing and Urban Development (HUD) Agency also saw a significant increase.

Figure ?? shows the time series for spending on all these programs measured as the quarterly change in the stock outstanding. It also shows these data as a percentage of other measures of fiscal stimulus at the federal level, namely, total government spending, subsidies and welfare spending. As evident from these plots, spending amounted to 2% of total government spending at the beginning of our sample and went to 1% in 2017, reaching a maximum of 13% in 2009. Spending by these programs was an average of 90% of the total amount of federal subsidies during the sample period and 70% by the end of 2017. Federal credit was approximately equal to 19% of spending on welfare and social services on average, and 30% in 2017 (see plot (d) of Figure ??).

Figure ?? shows the shares by program in the overall Treasury holdings of securities

issued by government agencies. We include only the four main departments, Agriculture, Education, Housing and Urban Development (HUD) and the Federal Financing Bank for selected years: 1980, 1990, 2000 and 2010. While the Federal Financing Bank comprised almost 70% of the total during both the 1980's and the 1990's, that share fell to less than 20% in 2000 with Education and Agriculture gaining importance (35% and 25%, respectively).

6 Results

6.1 First Step Estimations: Sensitivity of Credit Supply

In this section we report the results of our estimation of equation (16). The main parameter of interest is $\hat{\beta}$ estimated at the cross-sectional level for each size class and each quarter in the sample from the first quarter in 1977 to the fourth in 2017. As in Kashyap and Stein (2000), the estimates $\hat{\beta}$ are a measure of $\frac{\partial \Delta \ln L_i}{\partial H_i}$, i.e. the intensity of liquidity constraints in a given size class at time t .

Table 4 presents summary statistics for these estimates. For banks that belong below the 95th percentile of size (in terms of total assets), the average (over 1977-2017) β is 0.1287, with the minimum value being 0.054 in the third quarter of 2017 and the maximum, 0.2381 in the fourth quarter of 1994. This means that a 1% increase in the liquidity ratio raises banks' loans supply by 12.87% on average.

For large banks, the average β is smaller (0.1119) but the range of the estimates is noticeably wider with a minimum of -0.2076 and a maximum of 0.4116. A consideration to keep in mind is that 57 out of 166 estimated values are not significantly different from zero. When we restrict attention to only the estimates that are significant, the average β rises to 0.1561.

Worthy of note is the difference in estimates across various types of loans. The average estimate does not change when we correct for credit and default risk by including only subtracting net income from loans. For commercial and industrial loans a 1% increase in banks' liquidity ratio rises the supply of loans by 14.7%. For agricultural loans it is even higher, and in this case an increase in liquidity of the same magnitude is associated to a 24.51% increase in the availability of this type of loans.

All estimation results are also presented in figures. In Figure ?? we show estimates for both small and larger banks, and in Figure ?? we do so for various types of loans.

We also experiment with alternative ways to determine the degree of lenders own financial frictions and constraints in extending credit. We do so by running the first step regression of equation (16) with two alternative measures of health of banks' balance sheets: capitalization, calculated as the ratio of equity capital to total assets, and bank size, measured as the logarithm of total assets. These results are presented in Figure ??.

6.2 Second Step Estimations: Response of Credit Supply to Federal Credit Policies

In this section we report the results of our estimation of equation (??). We are particularly interested in the $\hat{\delta}_2$ coefficient estimate on FC_t . We want to test our hypothesis that federal credit can lead to an increase in the supply of credit. In the more specific environment of [Kashyap and Stein \(2000\)](#) the hypothesis implies that, for the smallest class of banks, an expansionary shock to the stance of federal credit policy should lead to a reduction in β_t . Thus, the expected $\hat{\delta}_2$ estimates are negative.

Table 5 contains the results for our benchmark specification in which the $\hat{\beta}$ s were obtained using the exogenous measure of liquidity in which liquidity is defined as the ratio of securities to total assets. The first column contains the estimations for the banks that, following [Kashyap and Stein \(2000\)](#), we characterize as small since their assets are below the 95th percentile of the cross-sectional distribution in each period. The second column presents the same results but for large banks (those above the 95th percentile in size).

According to the outcome of our estimations, a 1% increase in those total bond holdings of the Treasury used to finance federal credit programs lowers β by 0.0367 points for small banks. With the standard deviation of the natural logarithm of the independent variable being in the order of 0.6283, a 1 standard deviation increase amounts would imply a fall in the average β from 0.1287 to 0.07. Since the standard deviation of β is 0.039, the drop is equivalent to one and a half standard deviation. In short, a 1 standard deviation increase in bond holdings lowers the measure of banks' own liquidity constraints in lending by one and a half standard deviation. To get a better sense of the economic significance of these effects, it is worth pointing out that the average yearly growth rate in Treasury bond holdings during our sample period from 1977 to 2017 was 1.22%.

The reduction in liquidity constraints for large banks is roughly of the same magnitude as for smaller ones. The drop in β is 0.0365 points for large banks. Bear in mind though that most of the estimates from the first step are not significant (see Figure ??).

These are the results from the multivariate specification in which we control for the effects of cycles in economic activity on the dynamics of the lending constraints estimate β . We choose to use three variables to control for cycles: GDP growth, inflation and the stance of monetary policy as measured by the change in the federal funds rate.¹⁶ Even though in many of the specifications the coefficients on these variables come up as non-significant, these results still indicate that the negative link between β and federal credit is not driven by increases (reductions) in federal credit picking up expansions (recessions) in economic activity and/or inflation (deflation). Also, when significant, the estimates are of the expected sign. For example, the coefficient on inflation is negative which we interpret as saying that when the cost of living and producing rises during expansions in economic activity banks start relaxing their lending standards.

¹⁶This is the measure of monetary policy used in [Kashyap and Stein \(2000\)](#) in which the federal funds rate is actually inverted so that an increase in the variable is associated with a positive shock.

6.3 Robustness

6.3.1 Other ways to measure the economic significance of federal credit policies

As a robustness check we explore results when the amount devoted to federal credit policies is scaled by size of the economy. We measure size in four alternative ways, namely: change in outstanding bond holdings as a share of GDP, GDP, total government spending, federal subsidies and federal spending on welfare and social programs. Results are presented in Table 6, with columns (1)-(5) showing the results for each of these measures, respectively.

Conclusions are consistent with what we those of the benchmark empirical model. As an example, according to these estimations, a 1 percentage point increase in outstanding bonds as a share of total federal government spending lowers the β estimate of liquidity constraints by 0.00254 points. This might seem like a very small effect but it is actually not. The average value of the independent variable $\frac{FC}{G}$ is 16.96 with a standard deviation of 8.1, so that a 1% increase in the ratio of these bonds to government spending is only one eighth of a standard deviation, and a one standard-deviation increase lowers β by 0.0206 points from an average of 0.1287 to 0.1081.

6.3.2 Other measures of banks' health

We also study whether conclusions are robust to measuring the state of banks' balance sheets through other indicators. Instead of our benchmark exogenous measure of the ratio of securities to total assets, we use capitalization and size. Results are presented in Table 7 in columns (1) and (2), respectively. According to these results federal credit programs are effective at lowering financial constraints of lenders when these are measured by the size of the lenders' portfolio, but not when measured by how strongly capitalized (or not so leveraged) they are.

6.3.3 Other types of loans as the dependent variable of interest

As a robustness check in the first step, we also estimate banks' liquidity constraints using alternative measures of loan growth as the dependent variable. We rerun the step 1 model with loans net of unearned income, individual, commercial and industrial and agricultural loans. Results are presented in Table 8.

The effects are approximately of the same magnitude when loans as the dependent variable are adjusted for default risk, i.e. when we use loans net of unearned income as the dependent variable instead of gross loans. A 1% increase in federal credit lowers β by 0.0373 points from an average of 0.1285 (i.e. a 29% drop).

For commercial and industrial loans, the magnitude of the effects is of roughly the same order (0.0356 from an average of 0.1470). For agricultural loans, though, the effects are almost double in size. A 1% increase in federal credit lowers banks' liquidity constraints by 0.0622 points.

We are unable to find any significant influence of federal credit programs on the availability of individual (consumer) loans in the private sector. We think this speaks to our intuition regarding the possible transmission channel through which governmentally-funded credit programs can induce banks to relax their lending standards and make more credit available. Our idea is that government financing of a borrower’s project can be used as a sort of “intangible collateral” that the project owner can “post” when trying to access additional funds in private credit markets. Since federal credit obviously does not target consumption, it makes sense that it has no effect on the supply of consumer loans.

6.4 Heterogeneous Impact across Programs

In Table 9 we present the results by each department or agency that issues bonds to finance their spending on federal credit programs. We view this analysis as having important policy implications since it can inform which programs are more “effective” at increasing the availability of credit from private lenders and which programs tend to only crowd out private lending. As discussed in the introduction, this has been a concern already identified by the literature on government-funded credit programs (see Lucas (2016) and Elliott (2011)).

According to our results, this is a valid concern in the case of programs that are mostly about direct lending to non-government sectors. For the effects of bonds issued by the Small Business Administration and the Federal Financing Bank we obtain positive and significant coefficients on bond holdings in the second step regressions. This allows us to conclude that the crowding-out concern is indeed valid for these programs since, in the language of the literature on the bank lending channel, they tighten financial constraints for banks and make them less prepared to insulate their supply of credit from adverse circumstances.

Conversely, programs that issue bonds to finance projects in the agriculture, education, energy or housing sectors seem to actually loosen these lending constraints of private banks. The coefficients on spending in the second step estimation of equation (19) are negative, with those corresponding to the Department of Agriculture showing the strongest effects ($\hat{\delta}_2 = -0.101$).

7 Conclusions

We study a novel transmission mechanism of federally-funded direct lending and loan guarantees that we label the “bank lending channel of credit policy”. Through this channel we intend to study the *extensive margin* of government guarantees that induces lenders in the private sector to increase their supply of credit. We want to test whether this effect is strong enough to overcome the crowding out effect of these programs that the literature has already recognized, and therefore, whether there is room for a positive net impact of credit policy as fiscal policy.

We start by building a general equilibrium model with asymmetric information in which borrowers subject to a collateral constraint can “post” the loans and guarantees obtained from the government as a type of “intangible collateral” in the private market for credit. We develop some testable implications from this model that we take to the data.

We then put together a novel dataset on resources devoted to federal credit policy from 1977 to 2017, and we merge with a large panel of information on banks’ balance sheets and income statements at the bank level. We then use the 2-step methodology in [Kashyap and Stein \(2000\)](#) for identification of supply-side effects in credit markets. The goal is to disentangle the effects that come from an increase in supply from those at the *intensive margin*, i.e. from the increase in the demand for loans as the interest rate falls in response to a change in the stance of credit policy.

Our preliminary results indicate that in the United States a 1% increase in the outstanding amount of bond holdings issued by federal department and agencies to finance credit policy loosens lenders liquidity constraints by 28%, which amounts to an additional \$21.7 billion dollars in loans for the average commercial bank in the country. We are also able to show that loans financing projects in agriculture, education, energy or housing tend to loosen banks’ own liquidity constraints in lending and to increase their loan supply. Last, we find some indirect evidence for the crowding out effect of some programs that are mostly about direct lending to non-government sectors. In particular, an increase in the amount of bonds issued by the Small Business Administration, the Federal Financing Bank or the Export-Import Bank tends to tighten financial constraints for banks and make them less prepared to insulate their supply of credit from negative shocks.

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Table 1: Model Calibration

Parameter	Definition	Value
r_f	risk-free rate	0.0391
$(1-\rho)$	default rate	0.0281
ξ	loan-to-value ratio	0.8
γ	inverse price elasticity of demand	4
$\frac{L_B}{(L_A+L_B)}$	share of non-performing loans	0.0192 / 0.0199

The risk-free rate is calibrated to the average yield on constant maturity Treasury bills. The default rate is calibrated with the charge-off rates for C&I loans from the Board of Governors.

Table 2: Bank-Level Data - Summary Statistics

	N	Mean	Std.Dev.	Min	Max
In thousands of 2012 dollars					
Total Assets	1,602,290	2.73e+08	8.03e+08	6516790.00	2.15e+10
Securities	1,568,343	5.81e+07	1.77e+08	906.90	1.06e+10
Cash	1,517,074	1.71e+07	6.91e+07	1052.79	8.86e+09
Loans and Leases	1,602,290	1.69e+08	5.18e+08	418665.30	1.67e+10
Loans Net of Unearned Income	1,602,290	1.68e+08	5.17e+08	407574.80	1.67e+10
C & I Loans	1,576,018	3.74e+07	1.64e+08	929.54	1.26e+10
Agricultural Loans	1,179,450	6777457	1.68e+07	903.51	2.05e+09
Liabilities	1,184,481	3.13e+08	9.48e+08	49925.11	3.43e+10
Deposits	1,578,983	2.07e+08	5.63e+08	1783.74	1.70e+10
Equity	1,572,240	2.79e+07	1.06e+08	1610.72	8.03e+09
Share of Total Assets					
Loans and Leases	1,602,290	0.5788	0.1531	0.0063	1.9887
Securities	1,568,343	0.2756	0.1463	0.0000	0.9306
C & I Loans	1,576,018	0.1904	0.1411	0.0000	1.0000
Agricultural Loans	1,179,450	0.0806	0.1023	0.0000	0.7714
Liabilities	1,184,481	1.0164	0.3006	0.0031	2.4682
Deposits	1,578,983	0.8628	0.0748	0.0000	1.5282
Balance Sheet Indicators					
Liquidity	1,568,343	0.2756	0.1463	0.0000	0.9306
Capitalization	1,572,240	0.1069	0.0535	0.0000	1.0000
Size	1,602,290	18.4300	1.2111	15.6899	23.7907

Liquidity is defined as the securities share of total assets. Size is defined as the natural logarithm of total assets.

Table 3: Federal Credit Programs - Summary Statistics

	N	Mean	Std. Dev.	Min	Max
Billions of 2012 dollars					
Total	166	483.98	382.32	160.07	1420.36
Dept. of Agriculture	166	60.65	10.16	30.71	86.06
HUD	166	19.68	11.39	4.61	52.93
Dept. of Education	143	254.25	376.40	1.09	1180.90
Dept. of Energy	143	3.21	0.66	1.93	5.00
Federal Financing Bank	154	103.24	83.21	14.14	271.16
Small Business Administration	101	10.39	2.20	4.59	14.22
Export-Import Bank	99	9.93	6.84	1.71	24.66
Growth Rates					
Total	165	1.20	6.86	-12.82	44.77
Dept. of Agriculture	165	0.25	11.33	-43.43	21.53
HUD	165	-0.39	15.57	-99.24	80.58
Dept. of Education	142	3.77	18.26	-62.72	132.73
Dept. of Energy	142	0.66	5.08	-12.65	19.82
Federal Financing Bank	152	-0.36	13.49	-77.87	60.40
Small Business Administration	100	0.78	13.11	-51.22	56.58
Export-Import Bank	98	2.41	12.95	-35.81	78.22
Shares of the Total					
Dept. of Agriculture	166	17.84	7.43	4.49	30.61
HUD	166	5.87	4.29	0.46	22.67
Dept. of Education	143	32.57	29.07	0.29	83.21
Dept. of Energy	143	0.93	0.50	0.24	2.09
Federal Financing Bank	154	32.37	27.72	3.98	76.50
Small Business Administration	101	3.28	2.21	0.53	7.70
Export-Import Bank	99	2.05	0.88	0.51	3.83
% of GDP					
Total	166	3.90	2.00	1.44	7.81
Dept. of Agriculture	166	0.57	0.22	0.28	1.04
HUD	166	0.21	0.18	0.03	0.70
Dept. of Education	143	1.54	2.14	0.01	6.46
Dept. of Energy	143	0.03	0.01	0.01	0.04
Federal Financing Bank	154	1.13	1.12	0.09	3.69
Small Business Administration	101	0.07	0.02	0.04	0.12
Export-Import Bank	99	0.06	0.04	0.02	0.14

Table 4: Step 1 Estimates of β - Summary Statistics

	N	Mean	Std. Dev.	Min	Max
All loans and leases - Small banks	161	0.1287	0.0389	0.0540	0.2381
All loans and leases - Large banks	161	0.1119	0.0806	-0.2076	0.4116
Capitalization as measure of balance sheet strength	121	0.0107	0.0197	-0.0673	0.0868
Size as measure of balance sheet strength	133	0.0006	0.0026	-0.0046	0.0086
Loans Net of Unearned Income	161	0.1285	0.0385	0.0541	0.2376
Individual Loans	136	0.0822	0.0403	0.0060	0.2080
Commercial and Industrial Loans	161	0.1470	0.0578	0.0281	0.3145
Agricultural Loans	161	0.2451	0.1036	0.0518	0.6084

Table 5: Step 2 Results
Benchmark

Dependent variable: $\beta = \frac{\partial \text{loangrowth}}{\partial \text{banks'liquidity}}$				
	Banks Below the 95 th Percentile		Large Banks	
	(1)	(2)	(3)	(4)
ln (total FC)	-0.0364*** (0.00408)	-0.0367*** (0.00433)	-0.0253** (0.0102)	-0.0365*** (0.0102)
GDP growth		0.511 (0.340)		0.201 (0.831)
$(FF_t^{-1} - FF_{t-1}^{-1})$		-0.00396 (0.00328)		0.0134 (0.00936)
inflation		-0.00124 (0.00485)		-0.0447*** (0.0116)
Constant	0.345*** (0.0243)	0.344*** (0.0273)	0.262*** (0.0605)	0.359*** (0.0645)
N	161	161	161	161
R-squared	0.334	0.350	0.038	0.135
AIC	-651.2	-649.2	-357.3	-368.6
BIC	-645.0	-633.8	-351.2	-353.2

Loan growth is $\Delta \ln(\text{loans})$ for total loans and leases.

Liquidity is measured by the residuals of a regression of the ratio of securities to total assets on indicators of economic cyclicalilty.

FC stands for federal credit measured by the total amount of outstanding bonds held by the Treasury and issued by various agencies and departments of the federal government to finance credit programs. FF stands for the federal funds rate.

Standard errors in parentheses. *p<0.10 **p<0.05 ***p<0.01

Table 6: Step 2 Results

Other Measures of the Extent of Spending on Federal Credit Programs

Dependent variable: $\beta = \frac{\partial \text{loangrowth}}{\partial \text{banks'liquidity}}$					
	FC/GDP (1)	ΔFC/GDP (2)	FC/G (3)	FC/S (4)	FC/W (5)
FC measure	-0.0102*** (0.00134)	-0.0145*** (0.00472)	-0.00254*** (0.000324)	-0.0000325*** (0.00000430)	-0.000132*** (0.0000367)
GDP growth	0.752** (0.348)	0.720* (0.402)	0.779** (0.345)	0.596* (0.351)	0.361 (0.642)
$(FF_t^{-1} - FF_{t-1}^{-1})$	-0.00351 (0.00338)	0.00104 (0.00379)	-0.00419 (0.00337)	-0.00449 (0.00341)	-0.00327 (0.00414)
Inflation	0.0104** (0.00483)	0.0111** (0.00551)	0.0114** (0.00480)	0.0107** (0.00484)	0.00443 (0.00830)
Constant	0.155*** (0.00722)	0.121*** (0.00595)	0.158*** (0.00735)	0.148*** (0.00666)	0.153*** (0.0121)
N	161	161	161	161	40
R-squared	0.307	0.105	0.319	0.306	0.289
AIC	-638.9	-597.5	-641.5	-638.5	-167.4
BIC	-623.5	-582.1	-626.1	-623.0	-158.9

Loan growth is $\Delta \ln(\text{loans})$ for total loans and leases.

G stands for total federal government expenditures. S stands for total federal government current expenditure on subsidies. W stands for federal current expenditure on income security (i.e., welfare and social services). Data are in billions of dollars from the Bureau of Economic Analysis (BEA). G and S are quarterly and seasonally adjusted. W is annual and not seasonally adjusted.

Liquidity is measured by the residuals of a regression of the ratio of securities to total assets on indicators of economic cyclicalities.

FC stands for federal credit measured by the total amount of outstanding bonds held by the Treasury and issued by various agencies and departments of the federal government to finance credit programs. FF stands for the federal funds rate.

Standard errors in parentheses. *p<0.10 **p<0.05 ***p<0.01

Table 7: Step 2 Results
Other Measures of Health in Banks' Balance Sheets

Dependent variable:	$\beta = \frac{\partial \text{loangrowth}}{\partial \text{banks'balancesheetindicator}}$	
	capitalization (1)	size (2)
ln (total FC)	0.00168 (0.00305)	-0.000772* (0.000391)
GDP growth	0.0568 (0.242)	-0.00480 (0.0301)
$(FF_t^{-1} - FF_{t-1}^{-1})$	0.00105 (0.00299)	-0.000456* (0.000272)
Inflation	-0.00266 (0.00349)	-0.000390 (0.000429)
Constant	0.00229 (0.0196)	0.00544** (0.00245)
N	121	133
R-squared	0.012	0.045
AIC	-599.0	-1205.8
BIC	-585.0	-1191.4

Loan growth is $\Delta \ln(\text{loans})$ for total loans and leases.

Capitalization is defined as the ratio of equity capital to total assets. Size is defined as the natural logarithm of total bank's assets.

FC stands for federal credit measured by the total amount of outstanding bonds held by the Treasury and issued by various agencies and departments of the federal government to finance credit programs. FF stands for federal funds rate.

Standard errors in parentheses. *p<0.10 **p<0.05 ***p<0.01

Table 8: Step 2 Results
Other Loans

Dependent variable: $\beta = \frac{\partial \text{loangrowth}}{\partial \text{banks'liquidity}}$				
	Loans NUI	Individual Loans	C & I Loans	Agricultural Loans
	(1)	(2)	(3)	(4)
ln (total FC)	-0.0373*** (0.00425)	-0.00998 (0.00905)	-0.0356*** (0.00717)	-0.0622*** (0.0134)
GDP growth	0.392 (0.334)	0.594 (0.442)	0.339 (0.564)	-0.547 (1.050)
$(FF_t^{-1} - FF_{t-1}^{-1})$	-0.00411 (0.00322)	0.00194 (0.00937)	-0.00281 (0.00543)	-0.0148 (0.0101)
Inflation	-0.000874 (0.00476)	0.00268 (0.00627)	0.0148* (0.00804)	-0.00580 (0.0150)
Constant	0.347*** (0.0268)	0.133** (0.0531)	0.345*** (0.0453)	0.621*** (0.0844)
N	161	136	161	161
R-squared	0.361	0.028	0.193	0.128
AIC	-655.0	-482.5	-486.3	-286.3
BIC	-639.6	-468.0	-470.9	-270.9

Loan growth is $\Delta \ln(\text{loans})$ for each of the loan types indicated in the column titles.

Loans NUI stands for loans net of unearned income.

Liquidity is measured by the residuals of a regression of the ratio of securities to total assets on indicators of economic cyclicalilty.

FC stands for federal credit measured by the total amount of outstanding bonds held by the Treasury and issued by various agencies and departments of the federal government to finance credit programs. FF stands for the federal funds rate.

Standard errors in parentheses. *p<0.10 **p<0.05 ***p<0.01

Table 9: Step 2 Results by Department or Agency

Dependent variable: $\beta = \frac{\partial \text{loangrowth}}{\partial \text{banks'liquidity}}$						
	Agriculture (1)	Education (2)	Energy (3)	HUD (4)	SBA (5)	FF Bank (6)
ln (total FC)	-0.101*** (0.0143)	-0.00997*** (0.00152)	-0.0147 (0.0175)	-0.0148** (0.00572)	0.0273* (0.0156)	0.00815** (0.00384)
GDP growth	0.710** (0.356)	0.489 (0.472)	1.009* (0.535)	1.158*** (0.407)	1.891*** (0.630)	1.145*** (0.425)
$(FF_t^{-1} - FF_{t-1}^{-1})$	-0.000766 (0.00341)	-0.00195 (0.00344)	0.000486 (0.00396)	-0.000190 (0.00384)	0.000219 (0.00376)	0.00115 (0.00381)
Inflation	0.0129*** (0.00495)	-0.0454*** (0.0133)	-0.00526 (0.0139)	0.0193*** (0.00669)	0.0132 (0.0178)	0.00419 (0.00620)
Constant	0.527*** (0.0588)	0.186*** (0.0124)	0.139*** (0.0235)	0.148*** (0.0138)	0.0438 (0.0369)	0.0850*** (0.0155)
N	161	140	140	161	98	149
R-squared	0.278	0.260	0.030	0.089	0.132	0.095
AIC	-632.3	-548.9	-511.0	-594.8	-365.1	-550.9
BIC	-616.9	-534.2	-496.3	-579.4	-352.1	-535.9

Loan growth is $\Delta \ln(\text{loans})$ for total loans and leases.

Liquidity is measured by the residuals of a regression of the ratio of securities to total assets on indicators of economic cyclicality.

HUD stands for the Housing and Urban Development Agency. SBA stands for the Small Business Administration Agency. FFBank stands for Federal Financing Bank.

FC stands for federal credit measured by the total amount of outstanding bonds held by the Treasury and issued by various agencies and departments of the federal government to finance credit programs. FF stands for the federal funds rate.

Standard errors in parentheses. *p<0.10 **p<0.05 ***p<0.01

Figure 1: General Equilibrium Model Simulations

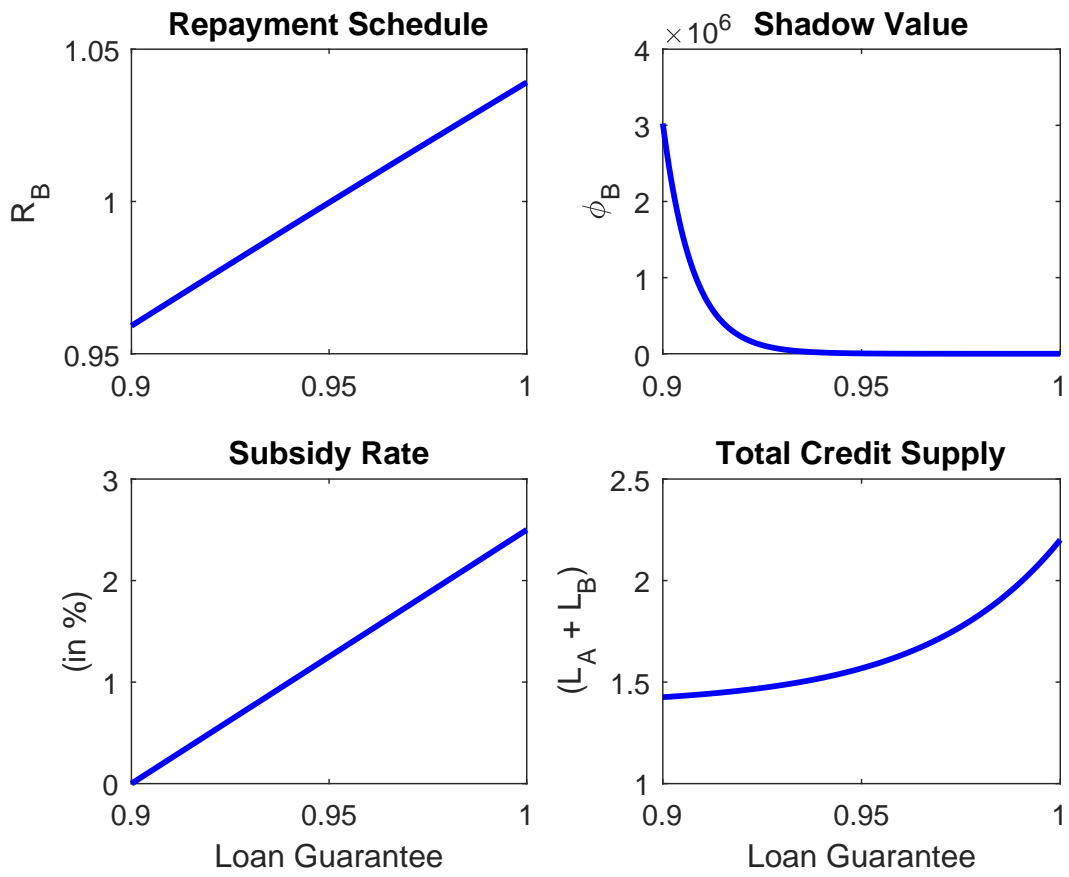
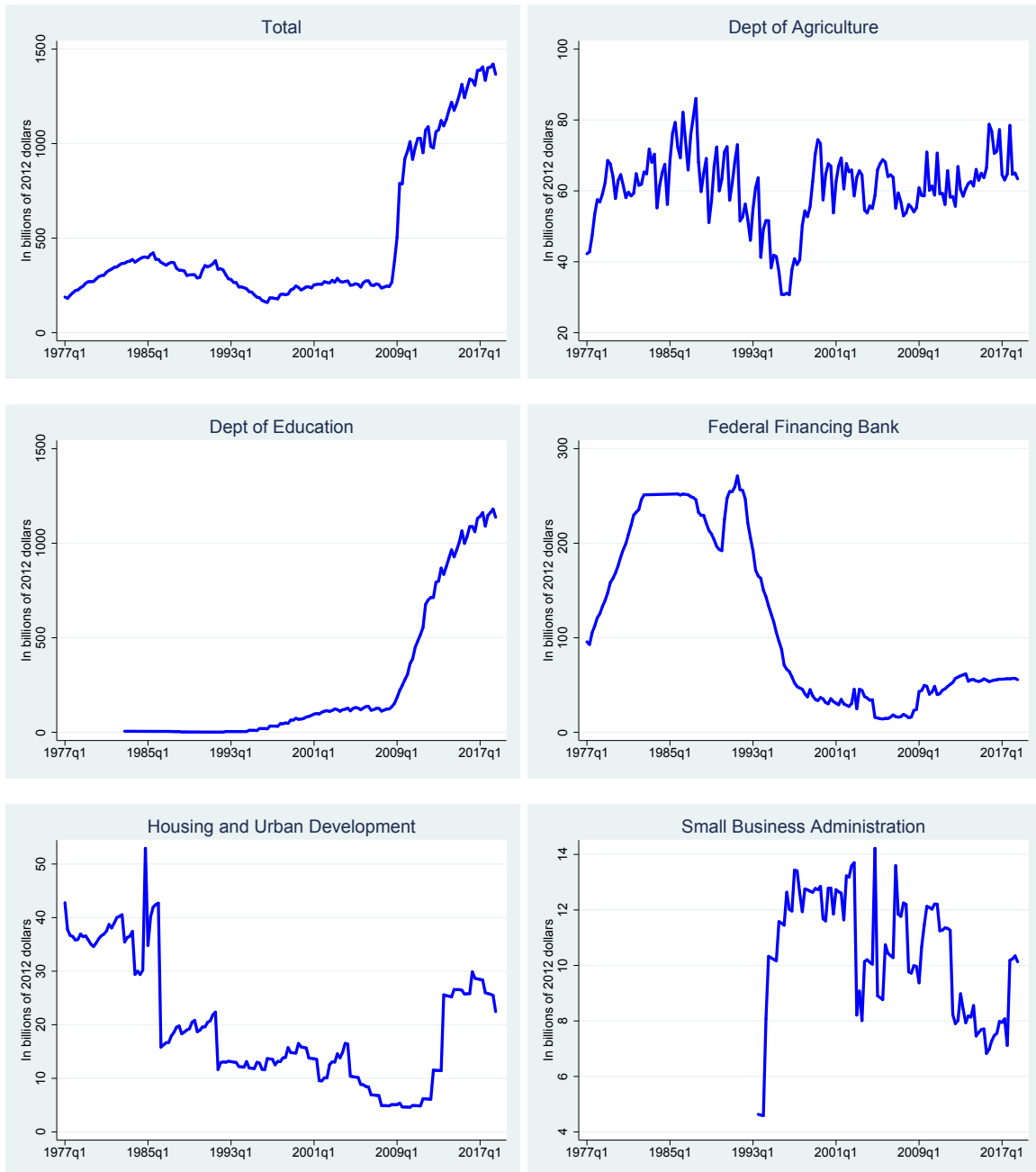
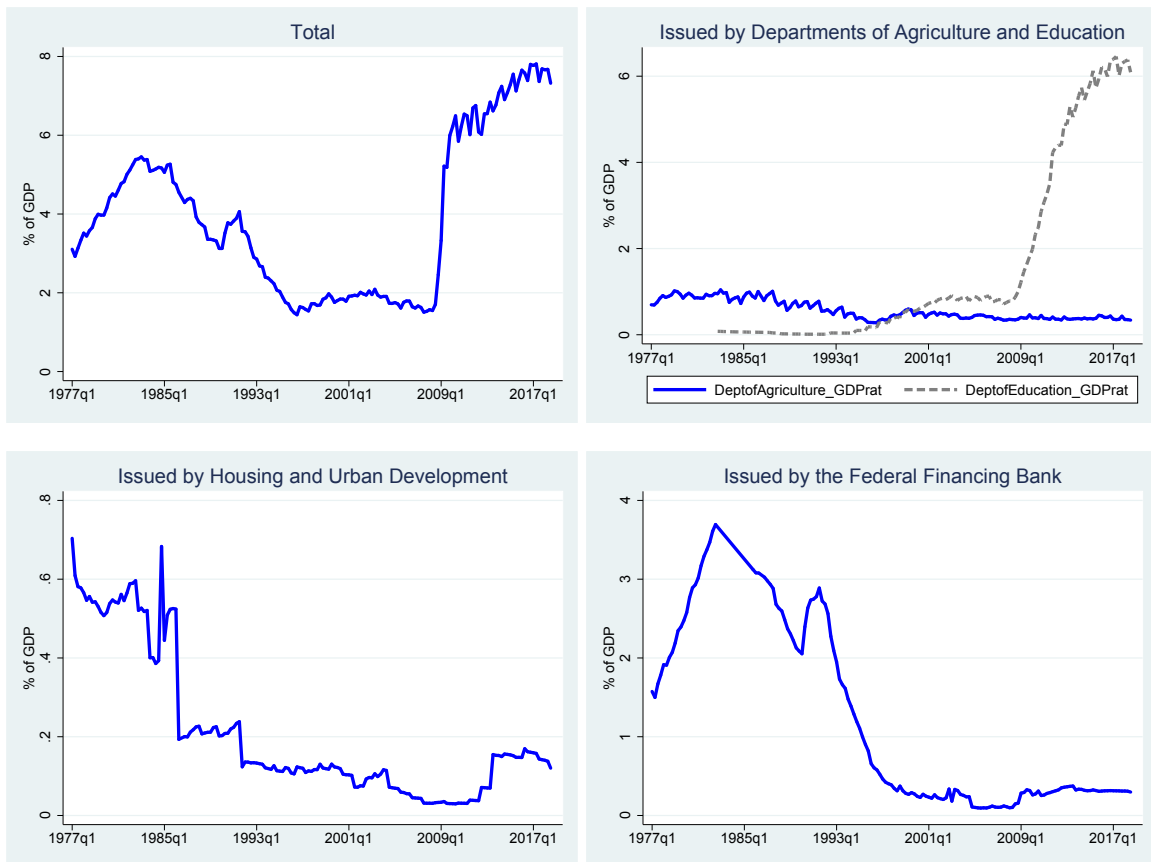


Figure 2: Treasury Bond Holdings for Financing of Federal Credit Programs



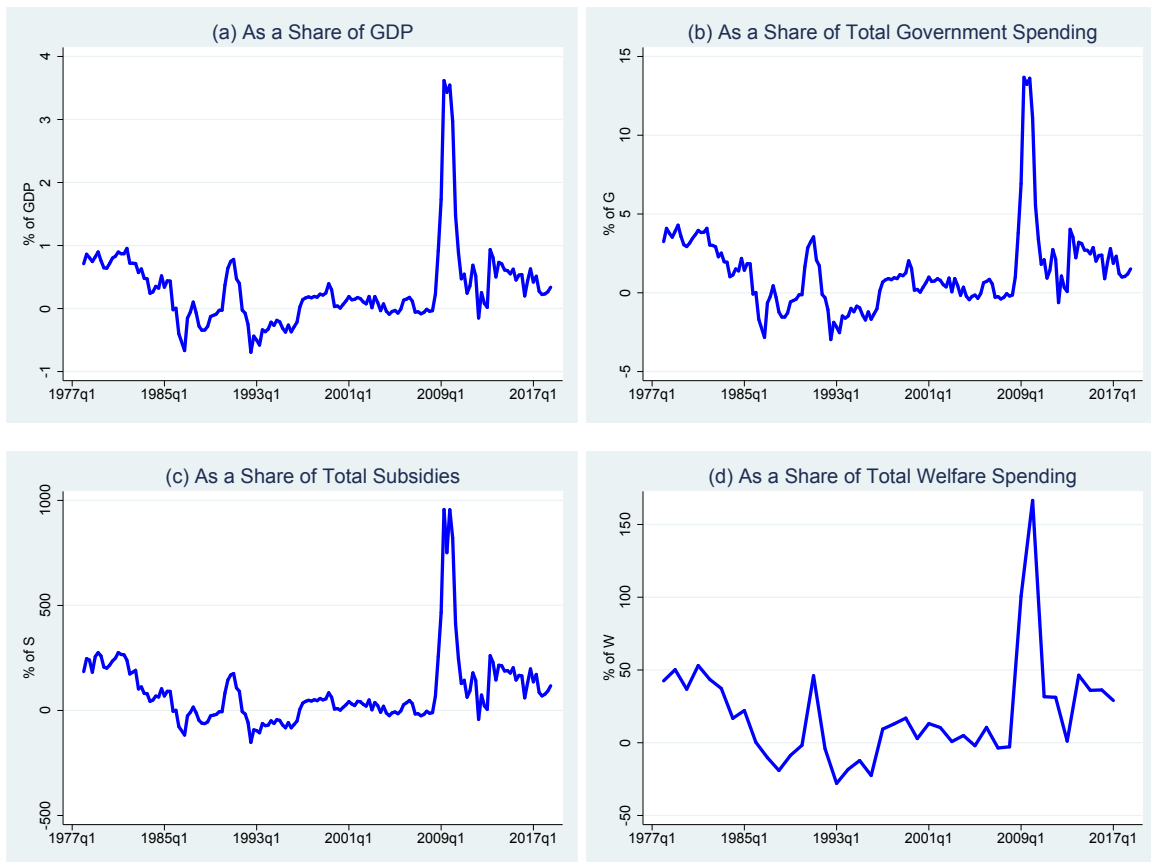
Source: Quarterly Treasury Bulletins.

Figure 3: Treasury Bond Holdings (as a % of GDP)



Source: *Quarterly Treasury Bulletins*.

Figure 4: Federal Credit Spending



Source: *Quarterly Treasury Bulletins*.

Figure 5: Federal Credit: Shares by Program

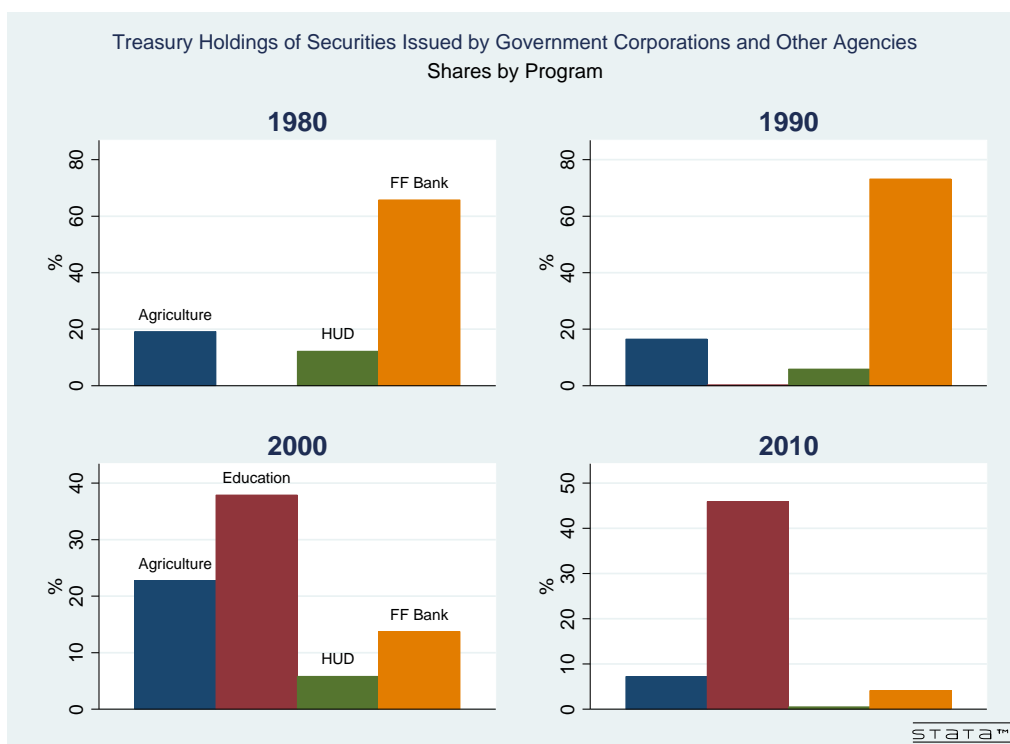


Figure 6: First Step Estimates of Sensitivity of Credit Supply

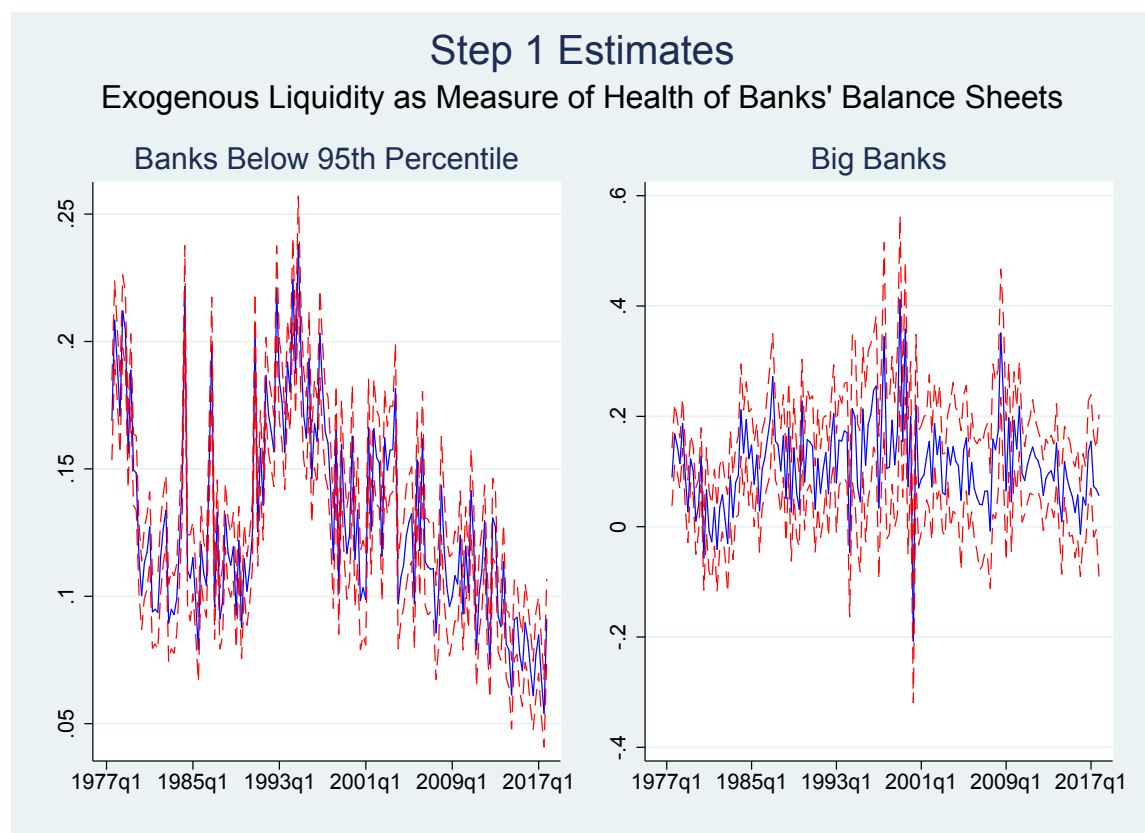


Figure 7: First Step Estimates of Sensitivity of Credit Supply

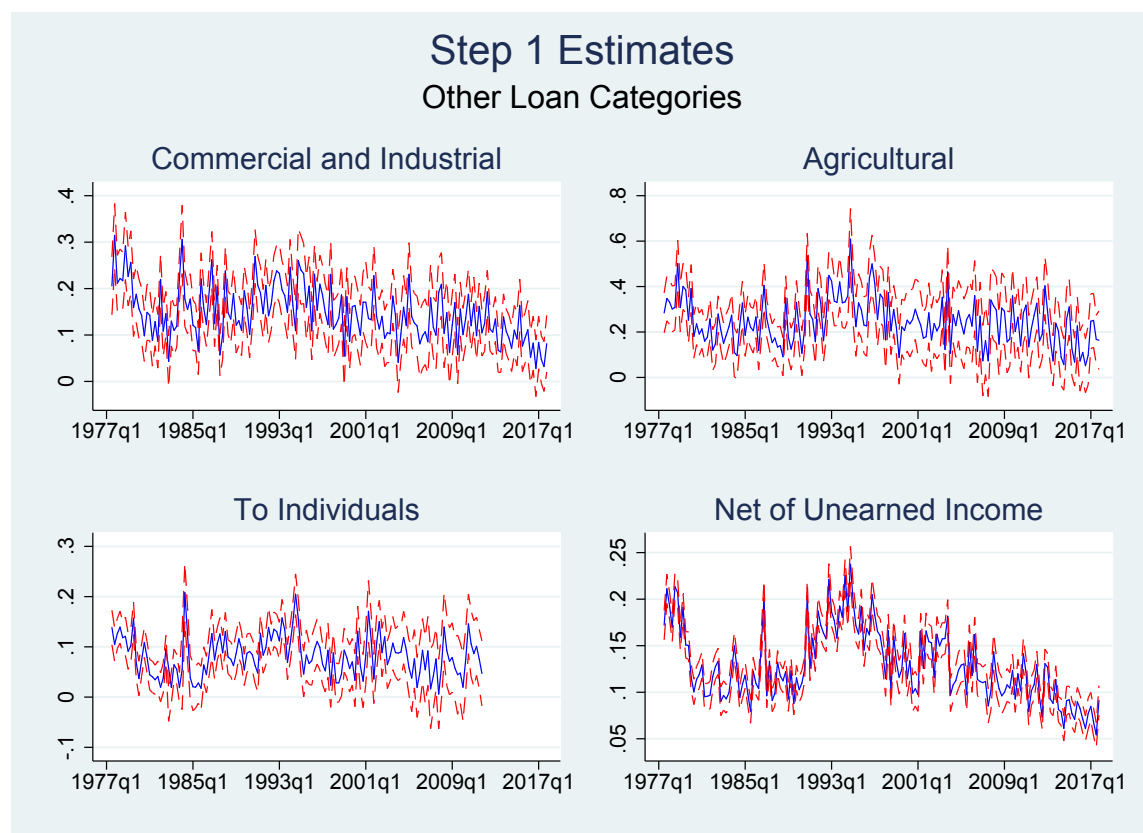


Figure 8: First Step Estimates of Sensitivity of Credit Supply

