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Changes in the Effects of Bank Lending Shocks and the Development of Public Debt Markets

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Abstract

This paper investigates whether the real effect of bank lending shocks has changed over time by applying a sign-restriction approach. I identify a negative bank lending shock by considering markets for bank loans and public debt (corporate bonds and commercial papers) jointly. Since the real effect of bank lending shocks hinges critically on firms' ability to access alternative sources of financing, the rapid development in public debt markets from the 1980s could change this effect as well. Indeed, I find that firms' enhanced ability to access public debt markets is associated with a decline in the effect of bank lending shocks on output during the Great Moderation. Consistent with the underlying identifying strategy based on the firm's ability to access public debt markets, the substantial decline in the effects of bank lending shocks is only observed on investment, not consumption.

Keywords: Bank lending shocks; Sign-restriction VARs; Great Moderation; Public debt market; Substitutability between bank loans and bonds

JEL Codes: E32; E44; G21

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1. Introduction

The real effect of bank lending shocks hinges critically on firms' ability to access alternative sources of financing, which, in turn, could be enhanced by development in public debt markets. Bernanke and Blinder (1988) show that if some borrowers have limited access to public debt markets and depend mostly on bank-intermediated credit for external funding, bonds and loans become imperfect substitutes. Thus, an exogenous decline in bank loan supply can directly influence real activity. In their review of the recent financial crisis through the lens of financial frictions, Adrian et al. (2013) also highlight the shift in the composition of credit between loans and bonds during the crisis, thereby arguing that a shock to the supply of intermediated credit by banks rather than its demand is largely responsible for a sharp contraction in bank lending.

Against this background, we re-evaluate the real effect of bank lending shocks in the U.S. economy considering that public debt markets have expanded rapidly since the 1980s. While a contraction in bank lending is known to have adverse effects on real activity, empirical challenges in isolating a supply shock from a demand shock make it difficult to reach consensus on its quantitative importance over business cycles. I address the challenges in identification by controlling for credit demand over business cycles. To be more specific, I embed Becker and Ivashina (2014)'s identification strategy into Uhlig's (2005) sign-restriction approach. I find that the effects of bank lending shocks on output and investment have substantially decreased since the Great Moderation with the rapid expansion in public debt markets. Consistent with the underlying identifying strategy based on the firm's ability to access corporate bond and commercial paper markets, the substantial decline in the effects of bank lending shocks is only observed on investment, not consumption.

2. Data

Following Becker and Ivashina (2014), I construct the time series of aggregate U.S. nonfinancial corporate debt using the Federal Reserve Board's Flow of Fund data. The indirect financing series combines data on "Other loans and advances" and "Bank loans not elsewhere classified." The direct financing series combines "Corporate bonds" and "Commercial paper."

Figure 1 illustrates the evolution of each type of financing as a share of GDP over the last 60 years. It is clear that the expansion of the U.S. public debt market has accelerated since the mid-1980s, whereas the share of indirect financing has been stable since then. Figure 2 shows the year-on-year growth rate of each type of credit to firms. As noted in prior studies, bank-intermediated credit is much more procyclical than direct financing via public debt markets, implying the distinct role of financial intermediaries over business cycles due to their efficient monitoring.

3. Empirical findings

3.1. Sign-restriction VARs and identification strategy

The volume of bank lending depends on many potential factors shifting the demand and supply curve of bank loans simultaneously. Thus, regressing changes in real variables, such as GDP, on changes in the volume of bank loans or the loan rate cannot help identify bank lending shocks. Recently, Uhlig's (2005) sign-restriction approach has been applied to overcome this issue (e.g., Meeks, 2012; Gambetti and Musso, 2017; Choi, 2018).³ Sign restrictions based on simple price theory identify a loan supply shock from a demand component as an increase in the price of loans (the loan rate) and a decrease in the volume of loans from the observed data. However, such identification assumption does not take into account the substitutability of bank loans with other sources of financing, which may have changed over time.

Based on the identification strategy used in Becker and Ivashina (2014)'s micro-level analysis, I identify an exogenous contraction in the supply of bank loans to the business sector when I observe an increase in firms' overall demand for external financing, which is identified, in turn, by a simultaneous increase in the price and quantity of financing via public debt markets, together with conventional sign restrictions on the market for bank loans. Thus, this identifying assumption also considers the substitutability between bank loans and corporate bonds (and commercial papers).

³ Due to the space constraint, I do not report the details of the Bayesian estimation procedure here. See Uhlig (2005) and Choi (2018) for further details.

When it comes to the data, I impose sign restrictions on the prime banking rate, and the constructed series of indirect financing to capture a decline in the supply of bank loans.⁴ I further impose sign restrictions on corporate bond yields and the constructed series of direct financing to capture a shift in the demand for external credit. Following Uhlig (2005), I identify only one structural shock, rather than identify every structural shock in the system of the economy. Unlike Uhlig's (2005) original approach, however, I impose a restriction on output based on the extensive theoretical and empirical literature on the real effect of bank lending shocks.⁵ Table 1 summarizes sign restrictions imposed to identify a negative bank lending shock.⁶ GDP, the volume of bank loans, and the volume of corporate bonds and commercial paper enter the system in log levels, while the other variables are included in levels. I use four lags ($p = 4$) in the baseline model. Following Uhlig (2005), all restrictions are imposed for two quarters ($k = 2$) following the initial shock.⁷

3.2. Results

Given the existence of a structural break in many U.S. macroeconomic variables in the 1980s (McConnel and Perez-Quiros, 2000), I divide the sample into two sub-samples (1956Q1 through 1983Q4 and 1984Q1 through 2007Q4). Setting an exact breakpoint is difficult, so I exclude the volatile transition period of Paul Volcker, from 1979 through 1983, for robustness checks. I also estimate the VARs including the period after the Great Recession and the binding Zero-Lower-Bound to test whether the inclusion of the extreme events alters the conclusion.

Figure 3 shows the response of output to bank lending shocks from the two periods. Following an empirical practice in the Bayesian literature, the solid lines plot the median impulse response functions (IRFs), and shaded areas note their 16th and 84th percentile bands from the

⁴ To rule out the possibility that changes in the pattern of monetary easing in response to a decline in bank lending drive my finding, I also impose nonnegative restrictions on the response of the Federal Funds rate following a negative bank lending shock. This additional restriction does not affect the conclusion of the paper. The results are available upon request.

⁵ However, remaining agnostic about the response of output to the bank lending shock does not affect the conclusion of the paper, as shown in the following section.

⁶ I do not report the details of the Bayesian estimation procedure to save space. See Choi (2018) for further details.

⁷ The results are robust to minor variations in p and q . The results are available upon request.

500 accepted draws.⁸ A striking difference emerges between the two periods: a decline in output following a negative bank lending shock has substantially decreased over time. When I drop the transition period in the first period or add the recent observations to the second period, I still obtain similar results. It is important to note that this finding is not driven by the potentially stringent restrictions on output. Following Uhlig (2005), I also remain agnostic about the response of output to the identified bank lending shock. Figure 4 shows that relaxing this restriction hardly affects the paper's conclusion.

One may argue that the reduced effects of bank lending shocks on output are the mechanical outcome of the Great Moderation—during which many macroeconomic variables exhibited lower volatility—rather than an actual decline in the effect of the bank lending shocks. To test this possibility, I compare the response of private investment and consumption to the same shock. If the results are simply driven by low volatility of macroeconomic variables during the Great Moderation, the responses of consumption and investment—the two main components of GDP—to any shocks should exhibit a similar pattern of changes over time. If the reduced effect of bank lending shocks is truly driven by firms' improved ability to access alternative sources of financing, those should manifest through investment, not consumption.⁹

I replace real GDP with real private investment and real private consumption in turn and apply the same set of sign restrictions.¹⁰ Figure 5 shows that the effects of bank lending shocks on private investment decreased substantially and the decline is even larger when I include the recent period spanning the Great Recession and its aftermath. However, changes in the magnitude of the consumption responses are much less pronounced. Moreover, the consumption responses remain statistically significant over the all horizons during the Great Moderation, unlike the responses of private investment, which quickly become statistically insignificant.

⁸ We follow the bulk of the empirical literature and discuss results referring to the median IRFs. However, note that the median and percentile bands are computed from the IRFs satisfying the sign restrictions, thereby subject to not only sampling but model uncertainty, due to the non-uniqueness of the identified shocks (Fry and Pagan, 2011). To check the sensitivity of the results, I use the median target method by Fry and Pagan (2011) and obtain similar results.

⁹ Obviously, this is because the analysis uses data on credit to the business sector only.

¹⁰ In other words, I maintain the number of variables to be six. The results are robust to the joint inclusion of consumption and investment in the 7-variable VARs.

To further gauge the role of bank lending shocks in explaining fluctuations in output, consumption, and investment, I decompose the share of the variation in each variable explained by the identified bank lending shock.¹¹ At the 20-quarter horizon, bank lending shocks explain 18–22% of U.S. real GDP prior to the Great Moderation. However, this share decreases to 10–11% during the Great Moderation. Supporting the results from the IRFs, the share of variation in private investment explained by bank lending shocks substantially decreases from the first period to the second (14~16% to 6~7%), whereas the share of variation in consumption does not fall.

4. Conclusion

The empirical findings from a novel identification approach suggest that the real effect of bank lending shocks has decreased over time together with firms' increased ability to access alternative sources of financing via public debt markets. Future research should provide more direct and systemic evidence on the causality from financial innovation to a decline in the real effect of bank lending shocks.

¹¹ Unlike variance decomposition using the Cholesky decomposition, the interpretation should be taken with caution because I only identified a subset of structural shocks.

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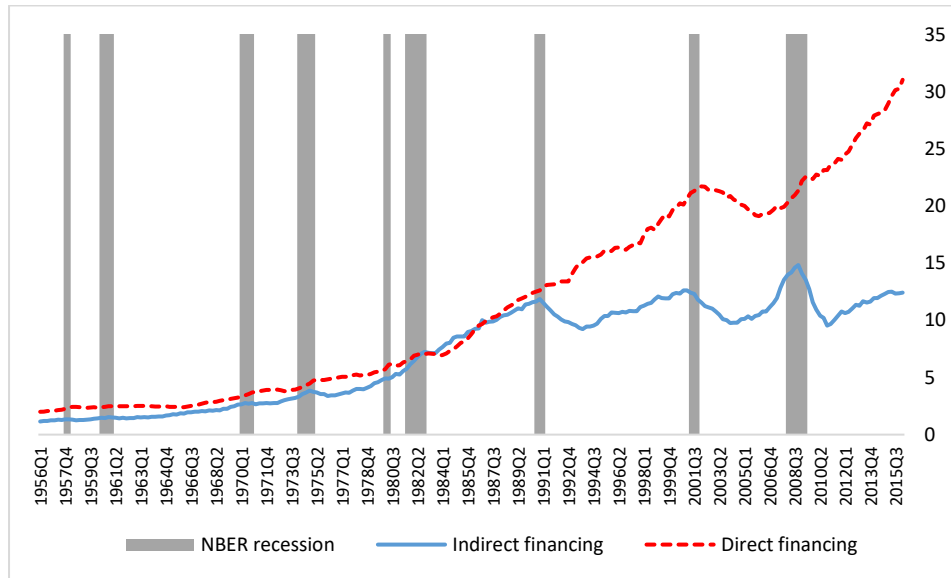
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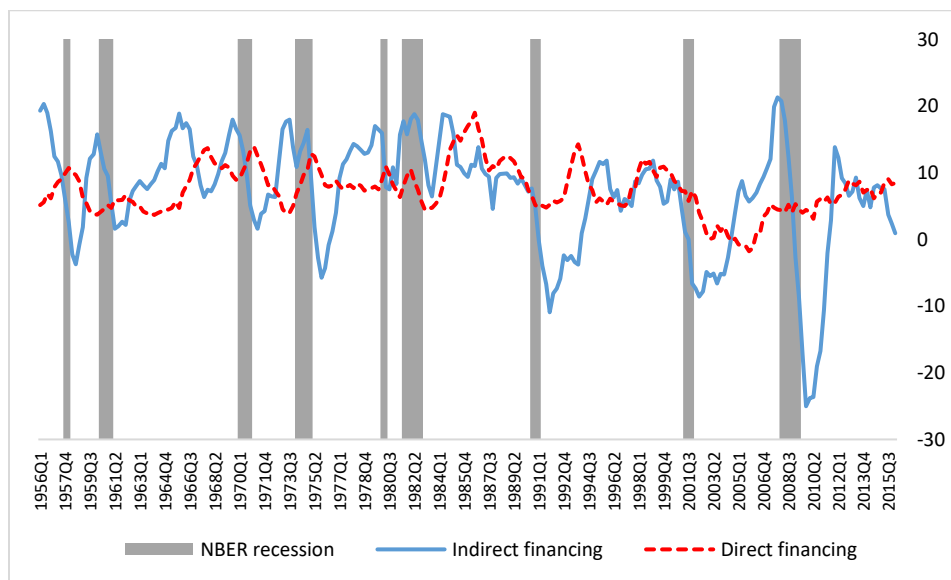
Figures and tables

Figure 1. The evolution of credit to U.S. nonfinancial firms: 1956Q1–2016Q1 (as a share of GDP)



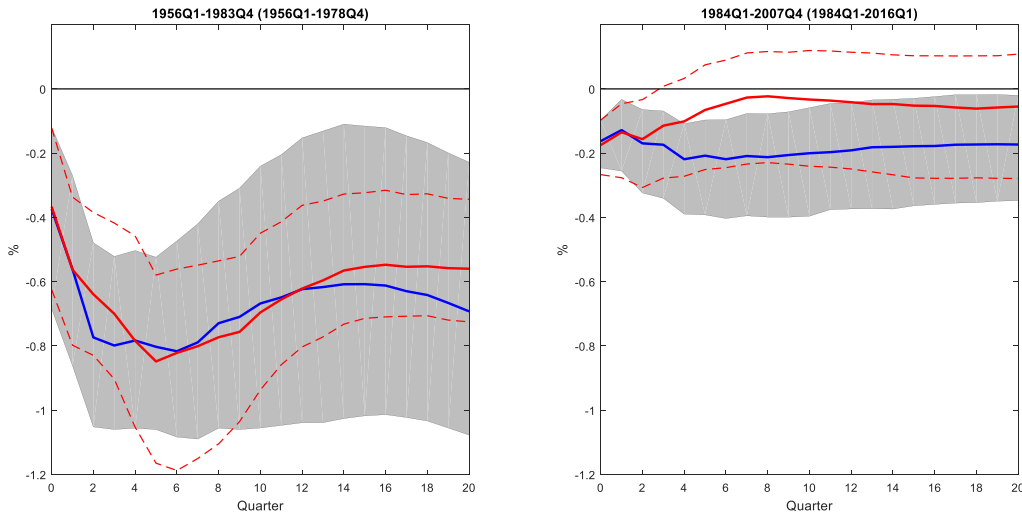
Note: The indirect financing series combines data on “Other loans and advances” and “Bank loans not elsewhere classified.” The direct financing series combines “Corporate bonds” and “Commercial paper.”

Figure 2. The growth rate of credit to U.S. nonfinancial firms: 1956Q1–2016Q1 (by percent)



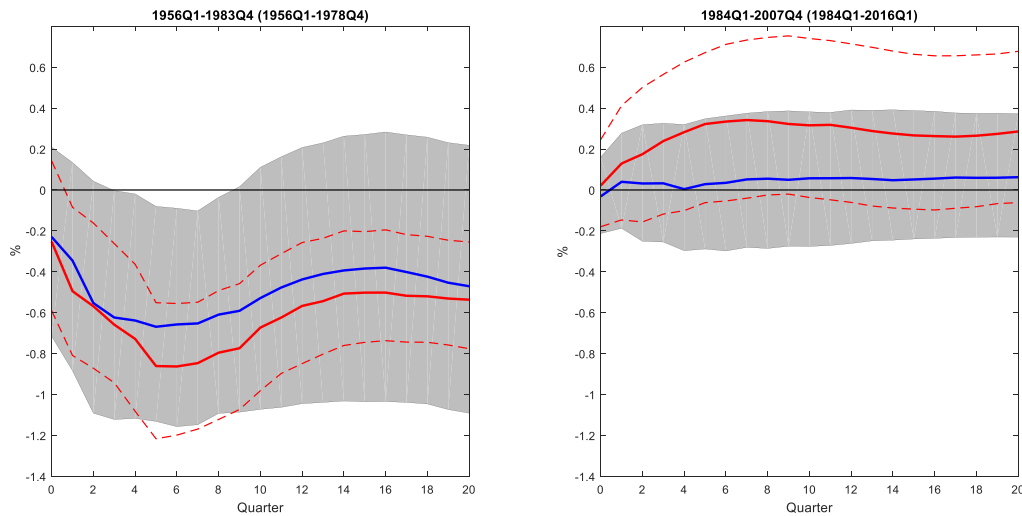
Note: The indirect financing series combines data on “Other loans and advances” and “Bank loans not elsewhere classified.” The direct financing series combines “Corporate bonds” and “Commercial paper.”

Figure 3. The effects of bank lending shocks on output (left: 1956Q1–1983Q4, right: 1984Q1–2007Q4)



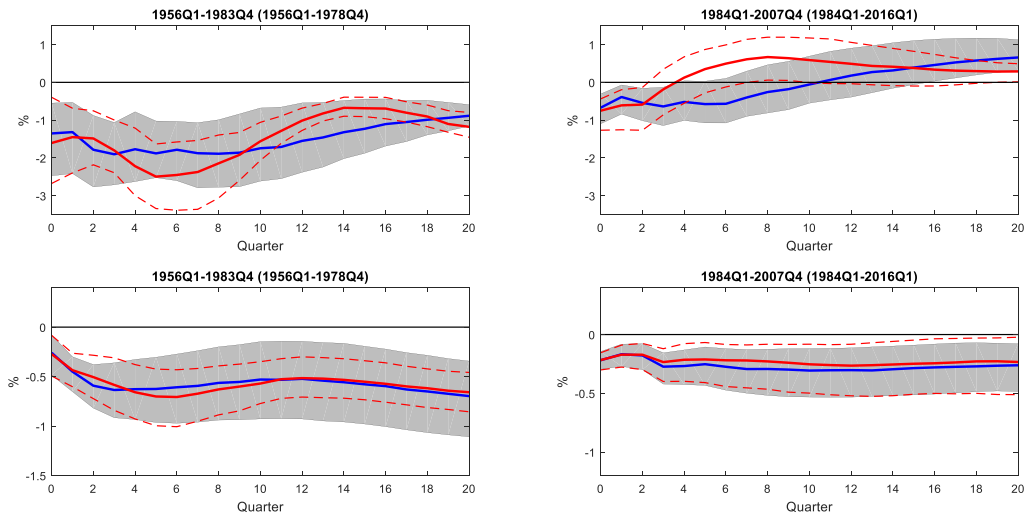
Note: Blue (red) lines indicate the periods of 1956Q1–1983Q4 (1956Q1–1978Q4) and 1984Q1–2007Q4 (1984Q1–2016Q1). The 16th and 84th percentile bands are plotted from the 500 accepted draws.

Figure 4. The effects of bank lending shocks on output without restrictions on output (left: 1956Q1–1983Q4, right: 1984Q1–2007Q4)



Note: Blue (red) lines indicate the periods of 1956Q1–1983Q4 (1956Q1–1978Q4) and 1984Q1–2007Q4 (1984Q1–2016Q1). The 16th and 84th percentile bands are plotted from the 500 accepted draws.

Figure 5. The effects of bank lending shocks on private investment (top) and private consumption (bottom)



Note: Blue (red) lines indicate the periods of 1956Q1–1983Q4 (1956Q1–1978Q4) and 1984Q1–2007Q4 (1984Q1–2016Q1). The 16th and 84th percentile bands are plotted from the 500 accepted draws.

Table 1. Sign restrictions

	GDP	Loan rate	Bank loans	Corporate bond yields	Outstanding corporate bonds
Bank lending shock	≤ 0	≥ 0	≤ 0	≥ 0	≥ 0

Table 2. Variance decomposition by bank lending shocks (at the 20-quarter horizon)

	1956Q1–1983Q4	1956Q1–1978Q4	1984Q1–2007Q4	1984Q1–2016Q1
GDP	21.83	18.12	11.24	9.82
Investment	16.36	14.58	6.55	6.04
Consumption	18.59	13.66	17.77	14.30

Note: Units in percent.