Measurement of balance sheet effects on mortgage loans

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ABSTRACT

Monetary policy influences loan demand through balance sheet channel. This paper measures balance sheet channel on mortgage loans in the US for 2000-2010 period when the housing market bubble formed and busted. In addition to measuring this impact in such an important time period, the paper employs a very special dataset which includes the first MSA-level data to measure the balance sheet effect. Furthermore, it measures the collateral values of housing market using data specific to housing market instead of approximations used by similar studies. By using these data, this paper employs the most detailed information that is so far used to analyze the balance sheet effect of monetary policy in the US. The findings indicate that balance sheet channel is significant for mortgage loans, though it is smaller than the previous literature's estimations. The results also show that recent financial innovations have improved the effectiveness of the balance sheet channel.

Keywords: Monetary policy transmission, bank lending channel, balance sheet channel, mortgage loans, housing market.

INTRODUCTION

Many observers argue that overly expansionary monetary policy of 2000s led to the recent global financial crisis (Gerlach and Moretti (2011)). They claim that excessively low interest rates reduced borrowing costs during this time period and this caused overleveraging especially in housing market. This paper analyzes the impact of monetary policy on housing market and it specifically focuses on how monetary policy of 2000s influenced the behavior of the demand side of the mortgage loan market in 2000s. This impact of the monetary policy on the demand side of the loan market is known as the balance sheet channel of monetary policy.

While there are empirical studies analyzing the balance sheet channel, the literature analyzes the balance sheet channel mostly for total loans without analyzing specific loan types such as mortgage loans. This is surprising considering the fact that mortgage loans has a very high share in total loans in the US and the US economy recently experienced a housing market crash and a financial crisis following that crash[1]. The paper addresses this gap in the literature by analyzing the balance sheet channel specifically for mortgage loans. This will give us insight into the role of monetary policy in the housing market bubble in 2000s.

Secondly, this paper addresses a gap in the literature regarding the measurement of the balance sheet effect. To be able to measure the balance sheet channel of monetary policy, researchers need to be able to measure how policy made an impact on collateral values of the assets examined. The literature has limited success in achieving this because of data constraints. Ideally, research would be based on data that reflect trends in a specific region. Unfortunately, this type of data is not available publicly. As a result, studies in this literature use state-level approximations of collaterals such as state-level output gap in order to measure the collateral values. This is suboptimal for measuring the balance sheet effect because the detail lost is of critical importance in calculating the balance sheet effect. For this paper, we were able to partner with FNC[2], a company that provides real estate collateral valuation services. This allowed access to the house price data collected at the MSA (metropolitan statistical area) level.

The data provided by FNC has a second benefit in addition to providing detail at the MSA level: instead of using approximations such as output gap to measure the collateral values, the paper can use house price data directly to measure the collateral value of houses.

Finally, the literature has shown interest in analyzing the role of financial innovations in measuring the credit channel for total loans (Altunbas et al (2009)), once again without separating the types of loans they made. However, financial innovations such as securitization has had a significant influence in especially the mortgage loan market. This influence is due to widespread creation of mortgage-related assets such as mortgage-backed securities (Johnson and Kwak (2011)). The paper analyzes the role of these innovations for mortgage loans and addresses this gap in the literature.

MONETARY POLICY TRANSMISSION MECHANISM AND LITERATURE REVIEW:

Monetary policy transmission mechanism is the process through which monetary policy decisions affect the economy. This mechanism describes how policy-induced changes in the

[1] Residential mortgages have the largest share of the loan portfolio of the five largest U.S. banks taken together – making up over 30% of total loans (Forbes (2017)).

[2] FNC is located in Oxford Mississippi and specializes in building systems that give mortgage lenders and servicers access to the most current residential real estate information available.

nominal money stock or the short-term nominal interest rate impact real variables such as aggregate output and employment (Ireland (2016)).

The transmission mechanism works through various channels. One of these, the "interest-rate channel" is known as the key transmission channel. In this, policy changes make an impact on the real interest rate and therefore the cost of borrowing, which in turn causes a change in total spending. Mishkin (1996) explains that monetary policy transmission works through other asset prices channels known as exchange rate channel and equity price channel as well. In the exchange rate channel, contractionary monetary policy makes investment to a country more attractive since it pushes the interest rates up. Capital inflow to this country induced by higher interest rates prompts appreciation and stronger trade balance. In the equity price channel, expansionary monetary policy could result in higher equity prices. Consumers who are feeling wealthier due to increase in the value of their portfolio in turn increase their spending which ultimately causes output to go up.

While the impact of monetary policy through interest rates and other asset prices have been commonly discussed and used by mainstream macroeconomic models, there is another channel that has attracted attention following the recent crisis due to its emphasis on the role banks play in the transmission of monetary policy: the credit channel of monetary policy. This channel arises for two reasons: As a result of information asymmetries in the credit market and due to the fact that banks play a special role in solving the asymmetric information problems. Banks address the adverse selection problem by screening loan applicants (Mishkin 1996). They play an important role in monitoring as well by reducing the amount of monitoring required (Gorton and Winton (2003)).

Credit channel of monetary policy works through two conduits: balance sheet channel and bank lending channel. These two channels works well because some borrowers, such as low income consumers and small firms, have access to credit markets only through banks. Since these customers are not able to substitute bank credits with other credit market instruments, bank credits have a vital importance for these customers.

In case of the bank lending channel, monetary policy is assumed to influence the supply side of the loan market by influencing the amount of reserves and deposits that are available to banks. Under the assumption that other sources of funds such as mutual funds and CDs are costlier to collect for banks, the drainage of reserves from the system during the contractionary monetary policy periods will decrease the loans banks make. As loan flow declines, customers who are not able to borrow from banks will spend less.

On the other hand, in case of the balance sheet channel, monetary policy influences the demand side of the loan market by influencing the net worth of borrowers and that in turn influences loan quantity. Bernanke and Gertler (1995) highlight that in the presence of financial market imperfections, a firm's cost of credit rises when the strength of its balance sheet deteriorates. When monetary policy is contractionary, an increase in interest rates works to increase the payments that the firm must make to service its floating rate debt. Moreover, the increase in interest rates works to reduce the capitalized value of the firm's long□lived assets. Hence, contractionary policy raises each firm's cost of capital through the balance sheet channel, deepening and extending the initial decline in output and employment. Similarly, monetary policy makes an impact on consumers as well. When monetary policy is expansionary, consumers whose balance sheets have large portions of financial assets may estimate their probability of becoming financially distressed as low. As a result, they may be more willing to spend on durable goods and housing.

Early studies analyzing the credit channel generally focus on differences of the characteristics of banks in determining the effectiveness of the credit channel. Kashyap and Stein (1995) and Kashyap and Stein (2000) find that credit channel is more effective for small banks since funding options of small banks are more limited. Ashcraft (2001) and Campello (2002) both analyze the bank lending channel for the US banks and they show that lending of small subsidiaries of a large bank holding company (BHC hereafter) is less sensitive to monetary contractions than the lending of comparable small, independent banks. In contrast to stand-alone banks, members of a large BHCs seem to resort to funds available from conglomerates' internal capital markets to sustain their supply of loans during a contraction. Van den Heuvel (2002) and Van den Heuvel (2006) show that poorly capitalized banks have less access to markets for uninsured funds and therefore the credit channel is found to be more effective for these banks. Altunbas et al. (2009) show that securitization provides banks with additional flexibility to face changes in market conditions associated with monetary policy movements. They found that asset securitization reduces the effectiveness of bank lending channel.

Lamont and Rosen (2007) empirically differentiate the balance sheet channel and the bank lending channel. They find that during periods of tight monetary policy, banks adjust their stock of loans by reducing the maturity of loan originations and they reallocate their short-term loan supply from small firms to large firms. These results are stronger for large banks than for small banks. Ashcraft and Campello (2007) analyzes the balance sheet channel and uses the findings of Ashcraft (2001) and Campello (2002) in order to solve the identification problem of the balance sheet channel. Since small subsidiaries of large BHCs are found to be insensitive to monetary policy shocks, Ashcraft and Campello (2007) focus on loans made by the small banks affiliated with large bank holding companies. In order to allow variation in the balance sheet channel, they only include BHCs that have subsidiaries in more than one physical location. Aysun and Hepp (2011) measures the influence of financial innovation on the balance sheet channel of monetary policy. They compare the balance sheet channel for banks that securitize their loans to banks that do not securitize. They find that the balance sheet channel of monetary transmission is stronger for the US banks that securitize their assets.

The section that follows this will discuss the data and present the results. The conclusions and policy suggestions will follow after.

DATA

One contribution of this article is to combine two very detailed datasets in order to analyze the balance sheet channel of monetary policy. The credit data and banking sector related variables come from the Call Report Data of US banks. The data are quarterly and are from the first quarter of 2000 through the last quarter of 2010. Although the banking sector data are available for earlier periods, the paper uses this period since housing market data (described below) are only available after the first quarter of 2000.

The housing market data are sourced from FNC, a company that collects very detailed information on housing loans in the US. The paper uses house prices and number of distressed sales and average prices of distressed and nondistressed sales at MSA level from this dataset. These variables will be used in measuring the collateral values of the loans in the estimations.

The paper uses the following process to combine these two datasets: First the physical locations of individual banks are determined from the Call Report data. Then, the housing market data for that specific physical location is identified. In other words, for all of the physical

locations of banks in the sample, the paper finds how well the housing market performed in that specific area.

EMPIRICAL ANALYSIS

Ashcraft and Campello (2007) and Aysun and Hepp (2011) both estimate the relationship between the strength of balance sheets and bank lending and investigate how this relationship is affected by monetary policy using the following model:

$$ld_{ijt} = \alpha + \sum_{k=1}^{4} \beta_k ld_{ijt-k} + \sum_{k=0}^{4} \chi_k mp_{t-k} + \sum_{k=1}^{4} \delta_k bs_{ijt-k} + \sum_{k=0}^{4} \sum_{m=1}^{4} \varphi_{km} bs_{ijt-k} mp_{t-m} + \sum_{k=1}^{4} v_k cd_{ijt-k} + \varepsilon_{ijt} \quad (1)$$

In this equation, ld_{ijt} measure the deviation of bank i's loan growth from its parent BHC average. That is to say, $ld_{ijt} = \lg_{ijt} - \lg_{jt}$ and here lg_{ijt} and lg_{jt} represent mortgage loan growth of bank i and the average loan growth of the other banks affiliated with the same BHC j. The reason for calculating this difference comes from Ashcraft and Campello (2007)'s identification method. To measure the balance sheet channel, Ashcraft and Campello (2007) discuss that the paper needs to control for the liquidity constraints that banks face which is the supply side of this market. The literature including Kashyap and Stein (2000) shows that subsidiaries of a large BHCs do not feel liquidity constraints because of the existence of their internal capital markets. When a liquidity need arises, these subsidiaries exchange funds with their brothers affiliated with the same BHC which relaxes their liquidity constraints. By focusing on subsidiaries of large BHCs' banks, the paper eliminates the liquidity constraints and therefore eliminates the role of supply side factors.

The implicit assumption here is that the subsidiaries are affected symmetrically by the liquidity position of their parent BHC, and by how monetary policy may affect this position. In other words, by measuring these variables as differences from the BHC averages, the paper shuts down the supply side, known as the lending channel. The remaining difference now reflects how much loan is made after controlling for the supply side factors. The paper uses the same approach in calculating variables that are on the right hand side of Equation (1) as well.

mp_t in Equation (1) measures the monetary policy. Three monetary policy indicators that have been commonly used by the literature are used as the monetary policy indicators. These indicators are: 1) the federal funds rate (FFR_t), 2) the difference between the federal funds rate and 10 year Treasury bill rate ($ffr10bill_t$) and 3) the growth of rate of non-borrowed reserves ($nonb_t$). These variables are adjusted in such a way that increases in these monetary policy indicators would reflect contractionary monetary policies.

bs_t measures the relative strength of balance sheets in the regions analyzed. One contribution of this paper is in employing multiple indicators to measure the strength of balance sheets in these regions. In addition to using state-level output gap data (similar to the rest of the literature), it also employs the housing market indicators to measure the strength of home owners' balance sheets. The housing market indicators are adjusted in such a way that increases in these indicators represent improvement in the balance sheets.

The interaction term in Equation (1) measures the impact of monetary policy on banks' sensitivity to balance sheets. Finally, cd_{ijt} represents the control variables that include the log of total assets, the equity ratio and the liquid assets-to-total-assets ratio.

Table 1 in Appendix measures the balance sheet effect for mortgage loans. The first row in this table uses the state-level output-gap variable. In the second and third rows of the table, the

paper measures the balance sheet indicators using the prices and quantities of distressed sales[3]. In the second row, the share of the number of non-distressed sales to distressed sales measures how well housing market performed in a given MSA. Declines in the value of this indicator represent deterioration in the housing market. Similarly, the higher the ratio of nondistressed sale's price to distressed sale's price, the better the housing market is doing in a given region.

FFR_t is used as the monetary policy indicator in Table 1. The results in the first row show that when the paper uses the balance sheet indicator that is commonly used by the literature, the signs and magnitudes of the results are very close to literature's findings. In rows two and three of Table 1, the paper uses the new indicators. The signs of the policy and the balance sheet indicators are found to be in line with the first row. Tighter monetary policy has still been associated with lower loan growth. Moreover, in the second column the stronger the balance sheet indicators, the higher the loan growth. Once again, the balance sheet effect is significant for mortgage loans. However, there is one striking difference between the results for the balance sheet indicator used by the literature and the indicator this paper introduces. The findings show that the balance sheet effect is significantly smaller than the ones that the current literature finds. $ffr10bill_t$ and $nonb_t$ are used as the monetary policy indicator in Table 2 and 3 respectively. The results are in line with Table 1. The results show that balance sheet effect estimates which use the detailed data introduced by the paper are actually smaller than the literature's findings.

After presenting the results for balance sheet channel of mortgage loans, the paper next looks at the impact of recent financial innovations on the effectiveness of the balance sheet channel for mortgage loans. It specifically tests whether securitization makes an impact on the effectiveness of balance sheet channel as in Aysun and Hepp (2011). The commercial banks are divided into two groups: the ones that securitize their assets are called "Securitized Banks" and the ones that do not are called "Non-securitized Banks". In the first panels of Table 4, 5 and 6, the results for non-securitized banks are provided. In the second panels of these tables, the results for banks that did take advantage of financial innovations will be presented.

Table 4, 5 and 6 in Appendix present the results using FFR_t , $ffr10bill_t$ and $nonb_t$ respectively as the monetary policy indicator of the estimations. The findings in these tables show that the balance sheet effect in the mortgage loan market is still significant. Moreover, there is a very striking difference between the top and bottom panels of these tables. The findings indicate that the balance sheet channel is considerably higher for banks that securitize their loans, which is in line with Aysun and Hepp (2011). However, once again in contrast to the literature, the balance sheet effect is found substantially smaller for mortgage loans when using the detailed housing market data introduced by the paper. This suggests that monetary policy might be less influential on mortgage loans than the literature currently assumes.

CONCLUSIONS

This paper analyzes the balance sheet channel for the mortgage loans in the US during 2000s. The results of this analysis are very important in terms of understanding the recent developments in the housing market. First of all, the paper fixes the data problem encountered by other researches in this area by employing a special data set that is at MSA level and that directly measures the collateral values of housing market. Secondly, the time period covered in this paper is of significant importance considering the fact that the housing bubble had formed and then burst in the time period covered. By evaluating the balance sheet channel for mortgage loans, the

[3] Distressed sales often occur at a loss because funds tied up in the house are needed within a short period of time.

paper actually analyzes how influential monetary policy was on the demand side of mortgage loans during this bubble period. The paper therefore provides an explanation for the role of monetary policy in the formation of the housing bubble. Related to this, the paper also gives us a clue about what we can expect from monetary policy in the recovery period. This is especially important because in the aftermath of the recent financial crisis, attention once again turned to monetary policy. It was expected that monetary policy can help the recovery of the housing market. By analyzing the influence of balance sheet channel on mortgage loans, the paper measures how much we can expect from the monetary policy in the recovery periods.

While some of the results agree with current literature, there are some new findings as well. The paper finds that the balance sheet effect is significant as previous articles have shown. However, the balance sheet channel is not as substantial as is currently assumed. The findings show that when regional factors are measured very carefully, the balance sheet channel is even less effective than what other papers find. The results support the view that monetary policy did not seem to play a major role in effecting the demand side of the mortgage loan market. They also suggest that the efforts of monetary policy would have a very limited effect in increasing the demand for mortgage loans in the recovery periods.

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APPENDIX: ESTIMATION RESULTS[4]

Table 1: Measurement of Balance Sheet Effect for the 2000q1-2010q4 Period with FFR*

	FFR_t	bs_t	interaction
Output gap	-0.0510**	7.5950***	-6.6562**
Number of Nondistressed sales /Number of	-0.0165***	0.1061***	-0.0191*
Price of nondistressed sales/Price of	-0.0148***	0.2814***	-1.0165*

Table 2: Measurement of Balance Sheet Effect for the 2000q1-2010q4 Period with the Difference between the FFR and 10 year Treasury Bill Rate Indicator

	$ffr10bill_t$	bs_t	interaction
Output gap	-0.0326**	6.6521*	-5.385*
Number of Nondistressed sales /Number of	-0.0154**	0.1125***	-0.0956*
Price of nondistressed sales/Price of	-0.0111***	0.2917**	-2.1654**

Table 3: Measurement of Balance Sheet Effect for the 2000q1-2010q4 Period with Nonborrowed Reserves Indicator

	$nonb_t$	bs_t	interaction
Output gap	-0.0785**	8.0580***	-7.7033**
Number of Nondistressed sales /Number of	-0.0325***	0.1665***	-0.0687**
Price of nondistressed sales/Price of	-0.0450***	0.1734***	-1.9853**

Table 4: Balance Sheet Effect for Banks that Securitize versus Do not Securitize (FFR_t)

		FFR_t	bs_t	interaction
Non-securitized Banks	Output gap	-0.0846**	4.6152*	-6.9429
	Number of Nondistressed sales	-0.0227**	0.0831**	-0.1051*
	Price of nondistressed sales/Price	-0.0104***	0.1002**	-0.0850*
Securitized	Output gap	-0.0762***	12.4681**	-21.8908*
	Number of Nondistressed sales	-0.0420***	2.2452***	-4.6370**
	Price of nondistressed sales/Price	-0.0286***	0.6852***	-9.3854*

Table 5: Balance Sheet Effect for Banks that Securitize versus Do not Securitize ($ffr10bill_t$)

		$ffr10bill_t$	bs_t	interaction
Non-securitized Banks	Output gap	-0.0638*	6.0740*	-8.0147*
	Number of Nondistressed sales	-0.0311***	0.1125**	-0.5830*
	Price of nondistressed sales/Price	-0.0330**	0.0256**	-0.7892**
Securitized	Output gap	-0.0465*	18.469**	-20.3589*
	Number of Nondistressed sales	-0.0271*	2.0015**	-4.7530**
	Price of nondistressed sales/Price	-0.0125***	0.7450***	-9.7850*

[4] In this Appendix, ***, ** and * represent significance levels at 1, 5 and 10 percent levels.

Table 6: Balance Sheet Effect for Banks that Securitize and Do not Securitize ($nonb_t$)

		$nonb_t$	bs_t	Interaction
Non-securitized Banks	Output gap	-0.1580**	9.2580*	-10.9632*
	Number of Nondistressed sales	-0.4589**	0.1004**	-0.1089*
	Price of nondistressed sales/Price	-0.1589***	0.1963**	-0.0878
Securitized	Output gap	-0.0001***	12.8975**	-13.0047
	Number of Nondistressed sales	-0.3689***	2.2587***	-7.3358**
	Price of nondistressed sales/Price	-0.2589***	0.1783***	-11.4578**