

Transmission of Monetary Policy in Canada: Does the Money Multiplier Exist?

Demetri Gianopoulos

1043506

ECO 6199 Major Paper

Submitted to

Professor L. Karnizova

Department of Economics

University of Ottawa

April 2013

Abstract

This paper examines whether a money multiplier mechanism or narrow bank lending channel is operative in the monetary transmission of the Canadian banking system for the period 1968-2007. By employing Structural Vector Auto-Regression (SVAR) models, proposed by Bernanke & Blinder (1992) and Carpenter & Demiralp (2011), this paper concludes that the evidence for Canada indicates that the money multiplier is not the main transmission mechanism in Canada. This paper compares the Canadian results with an identical examination of the US banking system for the same time period.

The evidence for the overall sample period indicates that the money multiplier mechanism has less of an impact in Canada than for the US. For both Canada and the US there is a break in the response of total loans and reservable deposits starting in the late 1980's and early 1990's. This break in the data is likely caused by institutional, legislative and regulatory changes occurring in the respective banking and financial systems. In addition, the results also indicate significant differences between Canada and the US when the overall sample period is broken down into the subsamples 1968-1989 and 1990-2007. The results for the US, consistent with Carpenter and Demiralp (2011), suggest that the money multiplier was an operative monetary transmission mechanism in the 1968-1989 period but not in the 1990-2007 subsample. The results for the Canadian data, for the same subsample periods, are exactly the opposite. These puzzling results call for a more detailed analysis of the reasons explaining these differences between Canada and the US. A more formal analysis evaluating the role of different factors in the structure of the banking sectors and regulatory requirements in the two countries would further our understanding of the money multiplier mechanism.

Table of Contents

1. Introduction.....	4
2. The Money Multiplier.....	8
3. The Data and Estimation Methodology.....	11
4. Results, Analysis and Discussion.....	15
4.1. US 1968 -2007.....	16
4.2. CANADA 1968 -2007.....	21
5. Robustness	28
6. Conclusion.....	30
Appendix A: Data Details.....	33
Appendix B: SVAR Impulse Response Figures.....	34
Appendix C: SVAR Impulse Response Figures (Robustness Tests).....	46
References.....	56

List of SVAR Impulse Response Figures

Figure 1A: US 1968-2007.....	34
Figure 1B: US 1968-2007 - Response of Liabilities to Loans/Response of Loans to Liabilities.....	35
Figure 2A: US 1968-1989.....	36
Figure 2B: US 1968-1989 - Response of Liabilities to Loans/Response of Loans to Liabilities.....	37
Figure 3A: US 1990-2007.....	38
Figure 3B: US 1968-2007 - Response of Liabilities to Loans/Response of Loans to Liabilities.....	39
Figure 4A: CANADA 1968-2007.....	40
Figure 4B: CANADA 1968-2007 - Response of Liabilities to Loans/Response of Loans to Liabilities.....	41
Figure 5A: CANADA 1968-1989.....	42
Figure 5B: CANADA 1968-1989 - Response of Liabilities to Loans/Response of Loans to Liabilities.....	43
Figure 6A: CANADA 1990-2007.....	44
Figure 6B: CANADA 1990-2007 - Response of Liabilities to Loans/Response of Loans to Liabilities.....	45
Figure 7A: CANADA 1968-2012.....	46
Figure 7B: CANADA 1968-2012 - Response of Liabilities to Loans/Response of Loans to Liabilities.....	47
Figure 8A: CANADA 1990-2012.....	48
Figure 8B: CANADA 1968-2012 - Response of Liabilities to Loans/Response of Loans to Liabilities.....	49
Figure 9A: CANADA 1968-2007 (6-lags).....	50
Figure 9B: CANADA 1968-2007 (6-lags) - Response of Liabilities to Loans/Response of Loans to Liabilities.....	51
Figure 10A: CANADA 1968-1989 (6-lags).....	52
Figure 10B: CANADA 1968-1989 (6-lags) - Response of Liabilities to Loans/Response of Loans to Liabilities....	53
Figure 11A: CANADA 1990-2007 (6-lags).....	54
Figure 11B: CANADA 1990-2007 (6-lags) - Response of Liabilities to Loans/Response of Loans to Liabilities....	55

1. Introduction

The last couple of decades have seen institutional, legislative, and regulatory changes in the Canadian and US banking systems that have impacted the money multiplier mechanism. The goal of this paper is to focus on the Canadian experience while comparing it with the US. The impacts for the US have been demonstrated by Carpenter and Demiralp (2011). They conclude that the money multiplier mechanism is no longer operative in the US monetary transmission mechanism after 1990, most likely due to fundamental changes in the institutional and regulatory structure of the US banking system. In particular, they find that US banks expand their lending after contractionary monetary shocks despite the fall in the quantity of their reservable deposits. Banks in the US are effectively able to extend credit by compensating the fall in deposits through raising alternative sources of funds. Consequently, Carpenter and Demiralp (2011) argue that banks' lending decisions are determined by the demand for loans and are not necessarily responsive to open market operations conducted by the Federal Reserve. The main reason given by Carpenter and Demiralp (2011) for these results¹ is that the banking system in the US, since 1990, is more capable of accessing alternative or external sources of funding through various types of managed liabilities. Whether or not similar conclusions can be reached for Canada is the driving force behind this paper.

It is very important in the current global and domestic economic environment to understand if the money multiplier mechanism is an operative channel for monetary policy. Whether it is the recent global financial crisis, the European debt crisis, or Japan's experience with quantitative easing it has become clear that to clean up financial messes, and start stimulating the economy, central banks of various nationalistic backgrounds have attempted to use various types' of unconventional monetary policies. One of the policies used to flush out the system has been the tool of increasing reserves in the banking system whether for

¹ The same reasons are echoed by Romer and Romer (1990), Bernanke and Gertler (1995), Disyatat (2008), and other researchers.

economic stabilization, bank solvency purposes, or simply to remove toxic assets from the system. The question then becomes what will happen to all these excess reserves floating around in the banking system. The traditional textbook answer would be that the banking system can use those excess reserves to increase lending to bank dependent borrowers which would ultimately stimulate the economy and increase inflation. Those who fear excess inflation find the current economic environment very dangerous for future inflation. If the traditional money multiplier mechanism is operative in the current situation, with a large amount of reserves, this will lead to excess inflation and more problems in the future. However, even with these large amounts of reserves in the banking system, it is frequently reported in various forms of media that lending has not increased and economic growth is slow, stagnant or barely recognizable. If lending is still dry, economic growth is still slow, and high levels of inflation are currently not on the horizon then this would be an appropriate time to investigate whether the money multiplier mechanism of monetary policy even exists.

According to Bernanke and Gertler (1995), a credit channel, in general, is an important mechanism to study because it allows us to better understand the effects of monetary policy. More specifically, a money multiplier mechanism or very narrow bank lending channel attempts to capture the impact of central bank policy on the supply of loans provided by banks. Moreover, institutional, legislative, and regulatory developments may increase or decrease the relative strength of such a mechanism on bank lending (Bernanke and Gertler, 1995). Furthermore, in developed financial systems, such as Canada and the US, banks may have access to various forms of managed liabilities which allow them to offset any impact caused by a monetary shock (Romer and Romer, 1990, Disyatat, 2008).

Banks are the main financial intermediaries in Canada and any disruption to the supply of loans, in this case caused by monetary policy shocks, would have a detrimental impact on bank dependent borrowers since they would have to incur additional costs to find alternative sources of funding (Bernanke and Gertler 1995). It is widely believed that banks play a crucial role in the functioning of the financial system because they have the ability to deal with problems of asymmetric information and help finance borrowers who are incapable or limited

in their ability to access other credit markets (Mishkin and Serletis, 2008). Since bank dependent borrowers rely on banks to provide them with loans, the money multiplier, or narrow bank lending channel, is crucially important to understand correctly. For example, a money multiplier model predicts that contractionary monetary policy will decrease bank reserves, and reservable deposits, thus reducing the availability of loans. Consequently, since many borrowers rely on banks for their financing, this decrease in loans will cause a decrease in economic activity.

The narrow bank lending channel suggests that a monetary contraction policy by the Bank of Canada (BoC) would reduce reserves in the banking system. Consequently, reservable deposits would decrease, which would hinder banks from creating loans. As a result, one of the main assumptions for this narrow bank lending channel to exist is that a decrease in reservable deposits leads to a decrease in loans. Moreover, banks are limited or unable to replace that decrease in reservable deposits with other sources of funding (Bernanke and Gertler 1995). Based on empirical evidence, Carpenter and Demiralp (2011) argue that this assumption was a good one for the US up to the late 1980's, but in the period 1990-2007 this mechanism seems to not be operative. Over the past couple of decades, due to financial deregulation and innovation, US banks are more capable of raising funds by issuing other types of managed liabilities (Romer and Romer, 1990, Bernanke and Gertler, 1995).

The effectiveness of the money multiplier mechanism, however, may depend on the historical period or the institutional framework in which financial intermediaries are operating in. The money multiplier or narrow bank lending channel may be more or less effective depending on the country, time period, and institutional framework. This paper investigates whether or not a decrease in reservable deposits leads to a decrease in loans for the Canadian banking system. Since the late 1980's, Canadian banks have increased access to managed liabilities as a consequence of financial deregulation and innovation. This paper starts by providing a brief overview of the Canadian and US banking systems.

According to Bordo, Redish, and Rockoff (2011), the Canadian banking system is essentially an oligopoly that is heavily regulated with limited entry in the banking industry. As government regulations have increased the minimum capital stock levels for the Canadian banking system over the last couple of decades, the barriers to entry have also increased. As a result, Canada has a small number of very large well-capitalized financial institutions. By contrast, the US system is characterized by a very large number of small banks with a strong reliance on financial markets and various levels of regulation (Bordo, Redish, and Rockoff 2011).

Canada and the US have both experienced some form of deregulation after the 1980s, but in Canada deregulation led to bigger banks while in the US it led to an expansion of financial markets and to investment banks also referred to as 'shadow banks'. Investment banks have historically played a more important role in the US and deregulation has only led to their expansion and increased influence. As a result, commercial banks in the US have faced more competition from 'shadow banks' which may have led to the employment of riskier banking strategies (Bordo, Redish, and Rockoff 2011). In Canada, legislative action in the late 1980's began a process where many of the investment and financial institutions were absorbed by the oligopoly (Bordo, Redish, and Rockoff 2011). Furthermore, over the last couple of decades, there has also been an increase in the use of securities markets and the number of services that banks offer their customers. These types of tactics allow banks to alter their balance sheets by making portfolio adjustments in order to avoid any effects caused by monetary shocks (Saidenberg and Strahan, 1999).

There are also important differences in capital requirements between the two countries. In Canada, the government regulator has imposed higher capital requirements, especially after the implementation of the Basel rules in 1988, which may have led to less risky behavior by the Canadian banking system (Bordo, Redish, and Rockoff 2011). Moreover, starting in the early 1990's, the BoC began to implement new procedures which, ultimately, allowed them to strictly focus on the short term interest rate (Lavoie 2005). By 1994 there were no longer any reserve requirements for banks, and the BoC started focusing on targeting the overnight rate with the bank rate being set 25-basis-points above that. By the end of the 1990's the BoC also

established an electronic large-value payment system which assisted in making the operations of the BoC very transparent and credible. According to Lavoie (2005), procedures implemented by the BoC to make the central bank more transparent may highlight that the quantity of reserves are not as crucial in the monetary transmission mechanism as traditionally expected.

The next section describes the traditional money multiplier mechanism that is found in economic textbooks. This paper will then proceed by describing the data and estimation methodology. This is followed by the results, analysis, and discussion for the US and Canada respectively. After a brief discussion of the robustness of the data results this paper will conclude.

2. The Money Multiplier

Economic textbooks on money and banking such as *“The Economics of Money, Banking, and Financial Markets”* by Mishkin and Serletis (2008) describe the simple money multiplier through the formula $\Delta D = (1/r)\Delta R$ where ΔD is the change in total chequable deposits (reservable deposits), r is the required reserve ratio, and ΔR is the change in reserves. This formula provides the link that an increase in reserves, or a decline in the required reserve ratio, will lead to an increase in reservable deposits in the banking system. As a result, the banking system will be able to use the extra reservable deposits to generate more loans. This formula is also presented in Carpenter and Demiralp (2011) and provides an intuitive framework on how the money multiplier mechanism operates.

Traditionally, the variable r has been interpreted to represent the required reserve ratio set by the central bank. In recent years, however, many central banks have been reducing or eliminating their reserve requirements. In the US, for example, the reserve requirements are minimal. In Canada, there are no legal requirements for banks to hold reserves at all since 1994. In an environment of zero required reserves, the simple money multiplier model takes on a new meaning. The underlying argument is that banks do not want to hold excess reserves. Yet,

banks may want to hold some fraction of deposits as reserves for prudential reasons, to be able to accommodate expected and unexpected deposit outflows. Thus, the term ‘desired reserves’ has been developed. The simple money multiplier model may still be deemed useful, in understanding the process of multiple deposit creation and contraction, if the variable r is taken to represent the ‘desired reserve ratio’, rather than the required reserve ratio (Mishkin and Serletis, 2008) Finally, the simple money multiplier model also assumes that there is no currency and that all monetary transactions are conducted with chequable deposits.

As a result, the textbooks also provide a more sophisticated version of the money multiplier mechanism that attempts to take into consideration other factors that determine the size of the money multiplier such as the behaviour of depositors and banks decisions about reserves (Mishkin and Serletis, 2008). This can be captured with the formula $m = (1+c)/(c+dr+r) = \Delta D/\Delta MB$ where c is the currency ratio (currency in circulation/chequable deposits) set by depositors, dr is the banks desired reserve ratio, ΔD is the change in total chequable deposits (reservable deposits), and ΔMB is the change in the monetary base. This version of the money multiplier (m) attempts to show how an increase (decrease) in the monetary base, given the behavior of depositors and banks, leads to an increase (decrease) in the money supply (Mishkin and Serletis, 2008). This adaptation of the money multiplier takes into consideration depositors desire to hold a certain level of currency. In addition, it attempts to deal with the fact that some banking systems, such as Canada, have zero reserve requirements or very minimal reserve requirements, such as the US, but banks may still want to hold some level of desired reserves.

Nevertheless, the issue of the money multiplier remains the same: “Does a change in reserves lead to multiplicative deposit expansion or contraction and, as a consequence, does it lead to an increase or decrease in bank lending?” Ultimately, the money multiplier mechanism is summarized in monetary textbooks as the process by which a central bank, through conducting open market operation, removes (or adds) reserves from the banking system, causing a reduction (or increase) in banks access to loanable funds, which leads them to reduce (or increase) the number of loans. The main underlying assumption for this to work is that

banks are unable to replace lost reserves with other types of managed liabilities when there is a monetary contraction.

There is, however, a debate in the literature as to how monetary policy transmission operates (Disyatat 2008). One of the main contentions is whether monetary policy operates through central banks conducting open market operations, which adjust monetary aggregates such as reserves, or do central banks simply control short term interest rates, such as the bank rate in Canada, which adjusts borrowers' behavior and their demand for loans. The money multiplier view appears to give central banks more power over how banks supply loans and as a consequence over economic activity. Hence, the money multiplier mechanism suggests that central banks achieve their monetary policy goals by adjusting the supply of reserves which leads banks to alter their lending practices in the same direction. However, according to Lavoie (2010), banks do not necessarily increase or decrease their quantity of loans just because they have more or less reserves. In particular, banks may create loans based on the demand and creditworthiness of borrowers and not on the level of reserves as controlled by the central bank (Lavoie 2010). As a result, it would be the level of economic activity and the amount of lending that is actually carried out that will determine the amount of reserves.

Consequently, the money multiplier mechanism may exist implicitly through the adjustment of interest rates by the central bank. A change in the short-term interest rate will have an impact on bank funding conditions that leads to an adjustment of the amount of loans available to borrowers. The effect of these adjustments in loans, whether positive or negative, will be multiplied throughout the economy due to the banking systems crucial role in the financial system. For example, an expansionary monetary policy by the BoC will reduce the short term interest rate causing banks to soften their lending criteria/requirements which invites more borrowers to ask for more loans. As a result, the traditional money multiplier mechanism is diminished in this type of scenario since it is not the quantity of reserves that lead to more or less loans but a change in the short term interest rate that adjusts lending conditions (Lavoie 2010). Loans increase as a result of the decrease in interest rates which

motivates borrowers to begin investing, and spending, because their cost of funding has decreased and their projects appear more profitable (Lavoie 2010).

In summary, the textbook money multiplier story suggests that if the BoC reduces the amount of reserves in the Canadian banking system through contractionary monetary policy it would lead to a reduction in loans. This would imply that if the BoC wanted the banking system to increase the amount of loans they would have to generate more reserves for the system. Therefore, more reserves means more loans, less reserves equate to fewer loans. This paper examines if these patterns are present in the Canadian system for the period 1968-2007 and compares the results with the results for the US.

3. The Data and Estimation Methodology

Vector-autoregressions (VARs) treat all variables, including the monetary policy instrument, as endogenous. VARs model each variable as a function of all other variables and the resulting residuals, known as reduced form residuals, are generally correlated with each other. As a result, because VAR residuals are correlated, they cannot be directly used to simulate the effects of variations in monetary policy. Consequently, in order to empirically investigate whether the money multiplier mechanism is operating in Canada this paper employs Structural Vector Auto-Regressions (SVARs) for the econometric analysis.

SVAR models are used in the hope of representing a 'true' model of the behaviour of the economy. The main assumption of these models is that the economy is subject to unobserved structural disturbances, or innovations, which are orthogonal to each other. In order to identify the structural innovations, SVARs impose specific restrictions on how structural shocks affect the reduced form VAR residuals. For example, in my model, an unexpected monetary policy shock is identified with a restriction that it is the only shock that affects the monetary policy instrument contemporaneously. The responses of the model to the identified structural shocks are traced by impulse response functions. This paper will focus on the impulse response functions of a one standard deviation shock to the structural innovations.

Once estimated, SVARs can simulate the response over time of all variables in the system to a monetary policy shock. The results from the SVARs, in this paper, identify the dynamic response of economic variables to an unanticipated monetary contraction. The method used for the SVARs was developed in Bernanke and Blinder (1992) and expanded on in Carpenter and Demiralp (2011). Carpenter and Demiralp (2011) expanded the model by analyzing the SVAR impulse responses on the demand and supply of the loan creation process.

The focus of this paper is a very narrow bank lending channel. In particular, the main research question is: “Do total loans increase or decrease if there is an unanticipated monetary contraction policy implemented by the Bank of Canada (BoC)?” The traditional money multiplier mechanism story implies that, with a monetary contraction, the reserves in the banking system will decrease causing banks to decrease their lending. The results from the SVARs will help us determine the impact of reserves on the monetary transmission mechanism in Canada.

The SVARs will summarize the aggregated monthly data gathered for a very simple banking system balance sheet. The simplified Canadian banking system consists of the following:

ASSETS

Total Loans (Mortgage + Non-Mortgage)

Canadian Securities

LIABILITIES

Reservable Deposits (Chequable Deposits)

Managed Liabilities (Term Deposits)

All Canadian data was retrieved from Statistics Canada while the US data was retrieved from the St. Louis Federal Reserve (FRED) database. The specific data details can be found in Appendix A. The Canadian and US macroeconomic variables used for the SVARs include the following: the bank rate (Canada)/federal funds rate (US), consumer price index, total loans, reservable deposits, time deposits², securities and the unemployment rate.

This paper uses monthly data starting from the beginning of 1968 until June 2007. The beginning of 1968 was chosen because it was the earliest date that Canadian data was available

² Large Time Deposits were used for the US data. Personal + Non-personal Fixed Term Deposits were used for the Canadian data.

for all the variables. The end date of the data was chosen, as it was in Carpenter and Demiralp (2011), in order to avoid any of the possible effects of the recent financial crisis.³ The historical period of 1968-2007 will then be split into two subsample periods from 1968-1989 and 1990-2007. The 1990-2007 subsample will capture any differences that may have occurred in the conduct of monetary policy and the money multiplier mechanism following changes to the banking system such as the decline or elimination of reserve requirements, financial deregulation, innovation, and legislative changes that occurred in the late 1980's and early 1990's. In addition, the 1990-2007 period is consistent with the Carpenter and Demiralp (2011) paper for the purpose of comparing Canada and the US. Moreover, the Carpenter and Demiralp (2011) method for disentangling whether the effects originate from the demand or supply side of the loan creation process will then be used.

In this paper the BoC bank rate and the Federal Funds rate for the US are meant to indicate the monetary policy stance of the respective central bank. Any changes or innovations to these rates measure a new policy position. These policy changes will be viewed as a monetary policy shock. A monetary policy shock is identified through a Cholesky decomposition. By placing a policy instrument such as the BoC bank rate or the Federal Funds rate first, it is assumed, as in Bernanke and Blinder (1992) and Carpenter and Demiralp (2011), that the central bank does not respond to other shocks contemporaneously. That is, a monetary shock is the only structural shock that has an impact on the monetary policy position. Furthermore, it will capture the monetary transmission mechanism process by examining the responses of bank balance sheet variables, such as reservable deposits and total loans, for a particular historical period to a monetary policy shock (Bernanke and Blinder, 1992).

Following the model proposed by Bernanke & Blinder (1992) and Carpenter & Demiralp (2011) for the US, I estimated an identical seven variable Vector Auto-Regression (VAR) for Canada. In particular, the model included the bank rate (assumed to be the monetary policy stance of the BoC), the log of the CPI, the log levels of the balance sheet variables (total loans,

³ The author did run the SVARs until the end of 2012 and the results, as can be seen in Appendix C, are not fundamentally different from the ones presented in the text.

reservable deposits, term deposits, Canadian securities) and the unemployment rate. The variables are listed in the order according to which they enter the VAR. The Akaike Info Criterion optimal lag for each group is used to estimate the VARs⁴. All of the financial variables are normalized by the consumer price index and are in log form. The same estimation process is followed for the relevant US data.

The impulse responses to a monetary contraction were then calculated for each estimated SVAR for a time period of 24 months. The monetary contraction policy pursued by the BoC is an unanticipated orthogonalized increase to the bank rate. The impulse response figures of the other six variables will show us the dynamic movement of these variables in response to the new policy position. The impulse responses measure the movement of our variables to a one standard deviation shock to the BoC bank rate over a 24 month period.⁵

For the money multiplier mechanism to exist we expect loans and reservable deposits to be positively correlated, (i.e. both decreasing), following a monetary policy contraction. The impulse response figures, constructed from the SVAR, are found in Appendix B⁶. The solid lines represent the point estimates while the dotted lines represent the 95% confidence intervals.

Our main focus will be on the response of loans and reservable deposits to a monetary contraction. The time path of managed liabilities, which consists of large time deposits for the US and personal plus non-personal fixed term deposits for Canada, will help us understand how banks are able to compensate in the aftermath of a monetary policy shock that causes a reduction in reserves.

Studies of the monetary transmission mechanism, and specifically the narrow bank lending channel, have a difficult time disentangling whether the effects of monetary policy shocks are coming from the demand side or the supply side. This paper follows the method of Carpenter

⁴ The Akaike Info Criterion optimal lag and the number of observations for each sample can be found in Appendix B.

⁵ The impulse responses were extended for a 72 month period and there were no fundamental differences in the estimated results from the ones presented in the text. Furthermore, the extension of the time frame also reveals that the impulse response functions converge after 30 -50 months for the subsample variables that had not already converged in the 24-month period.

⁶ The systems were estimated using the JMulTi program.

and Demiralp (2011) by using the estimated SVAR of each period in order to try to distinguish whether the effects are from the demand or supply side. The demand side will correspond to a positive shock to total loans and the ensuing impulse response of reservable deposits and managed liabilities to that innovation. The supply side will demonstrate how a positive innovation to either reservable deposits or managed liabilities impacts the response of loans.

4. Results, Analysis and Discussion

This section begins the analysis by reproducing the results for the US data using the methodology from Bernanke and Blinder (1992) for the period 1968 -2007. The same procedure is then applied to the Canadian data. The figures in Appendix B show the SVAR impulse responses of the variables in the SVAR to an unanticipated monetary contraction policy pursued by the BoC in Canada and the Fed in the US. The results suggest two puzzles that this paper will attempt to address in the discussion section following the results for each period. On the one hand, the results for the Canadian full sample period of 1968-2007 are similar to the US results in Carpenter and Demiralp (2011) for the 1990-2007 period which suggest a weak money multiplier mechanism. On the other hand, the results for the Canadian subsample periods of 1968-1989 and 1990- 2007 are contradictory. The 1968-1989 period is consistent with the full sample period, but the 1990-2007 subsample indicates either an increased strength of the money multiplier mechanism or an alternative explanation is required for the observed results.

The results from the SVAR impulse responses will be presented first followed by the interpretation of the results for each historical period. The SVAR impulse response figures in Appendix B for each time period consist of, first, the seven variable updated Bernanke and Blinder (1992) model followed by the Carpenter and Demiralp (2011) expanded model that tries to disentangle the demand and supply side of the loan creation process. The main focus for the respective time periods, of both Canada and the US, will be on the second row of the updated Bernanke and Blinder (1992) SVAR impulse response figures which show the responses of real

total loans (LOANS/CPI) and real reservable deposits (RESDEPOS/CPI) to a monetary shock. Following that, the attention will shift to the third row of the same figures in order to investigate the role, if any, of managed liabilities (MNGLIAB/CPI) on the monetary transmission mechanism. As a final point, the results from the expanded Carpenter and Demiralp (2011) model which show the innovations to the demand and supply side of the loan creation process will be examined.

4.1 US 1968 - 2007

Results for the 1968-2007 sample

Figure 1A illustrates that a monetary tightening shock by the Fed, for the historical period 1968 -2007, reduces the amount of reservable deposits immediately while bank assets such as loans and securities also fall along with the drop in reservable deposits. These results are consistent with the money multiplier mechanism that a monetary contraction affects the composition of bank assets by reducing total loans. These results are similar to Bernanke and Blinder (1992) including the slight lag before total loans begin to decrease. It appears that, in the short run, banks sell off their own securities in order to maintain lending. Moreover, the lag before total loans begin to decline may be caused by legal/contractual commitments that banks have with their borrowers (Bernanke and Blinder, 1992). However, once these old loans are eliminated banks begin to decrease the amount of loans significantly as the monetary tightening effect is increasing. If borrowers are bank dependent for loans this will, ultimately, have a negative impact on the economy (Bernanke and Blinder, 1992).

Figure 1B follows the approach in Carpenter and Demiralp (2011) in an attempt to further determine the demand and supply of the loan creation process. On the demand side we see that managed liabilities rise immediately after a positive shock to bank loans and continue to do so for close to a year. There is almost no increase in reservable deposits following a positive shock to loans and they begin to decrease after 4 months. These results correspond with the idea that it is managed liabilities that support the lending of banks and makes the money multiplier mechanism less relevant as the operating channel for monetary transmission.

Figure 1B also shows that, on the supply side, if there is a positive shock to managed liabilities we see total loans increase immediately whereas a positive shock to reservable deposits begins to decrease loans immediately. This is consistent with the story in Carpenter and Demiralp (2011) where bank loans increase rather than decrease in response to a decrease in reservable deposits which contradicts the money multiplier mechanism story. These results may just be correlation or the result of something improperly captured in the VAR and the way it was ordered. Nevertheless, there does seem to be some link between managed liabilities and loans.

Results for the 1968-1989 subsample

Figure 2A illustrates that a monetary tightening shock by the Fed for the subsample period 1968-1989 is very similar to Figure 1A. In response to a monetary contraction, bank assets such as loans and securities fall along with the drop in reservable deposits. There is a slight increase in loans for the first month following the shock, but loans gradually begin to decrease and continue to decrease for the rest of the 24 month period. These results are consistent with the money multiplier mechanism idea that monetary shocks affect the composition of total loans. The results from these SVAR impulse responses do not correspond with the idea that it is only managed liabilities that support the lending of banks. Furthermore, the decrease in reservable deposits does play a role in the quantity of loans extended by US banks for the subsample period 1968-1989. Therefore, the textbook money multiplier may be the operating channel for this time period⁷.

Figure 2B follows the approach in Carpenter and Demiralp (2011) in an attempt to further determine the demand and supply of the loan creation process. On the demand side we see that managed liabilities rise immediately when there is a positive shock to bank loans. There is also a slight increase in reservable deposits following a positive shock to loans that is not as sharp as the increase in managed liabilities and only lasts for about one-quarter. These results are consistent with the idea that it is mostly managed liabilities that support the lending of banks and that reservable deposits only play a limited role. The results from figure 2B

⁷ In addition, the results for the 1968-1989 period in the US are consistent with the results from Bernanke and Blinder (1992) which analyzed the US period from 1959-1978.

contradict the results from Figure 2A. In the Figure 2B scenario, the traditional textbook money multiplier may not be the operating channel for monetary transmission. On the supply side, if there is a positive shock to managed liabilities we see that loans increase immediately whereas a positive shock to reservable deposits only slightly increases loans for about 4 months and then quickly declines back to pre-shock levels. These results appear to be consistent, although not conclusively, with the story in Carpenter and Demiralp (2011) that there is a strong link between managed liabilities and loans and that the impacts of reservable deposits on the loan creation process may be limited.

Results for the 1990 -2007 subsample

Figure 3A illustrates that in response to a monetary contraction US banks, for the subsample 1990-2007, react to an increased demand for loans by increasing managed liabilities. Loans and managed liabilities appear to follow a similar upward trajectory after a monetary shock and are negatively correlated with reservable deposits. New loans seem to increase for approximately the first year before beginning their decline to pre-shock levels. Consequently, it appears new loans are funded by banks selling their own securities and increasing their managed liabilities. These results are not consistent with the idea of the money multiplier mechanism. In the short run, banks sell their own securities and increase managed liabilities in order to fund the increase in loans.

Figure 3B follows the approach in Carpenter and Demiralp (2011) in an attempt to further determine the demand and supply of the loan creation process. On the demand side we see that managed liabilities rise immediately after a positive shock to bank loans whereas there is a sharp decline in reservable deposits and they continue to decrease over the course of the 24 month period. This may correspond to the idea that it is managed liabilities that support the lending of banks and that the textbook money multiplier mechanism is not the operating channel for monetary transmission. On the supply side, if there is a positive shock to managed liabilities we see that loans begin to steadily increase for almost the entire period whereas a positive shock to reservable deposits decreases loans for the first couple of quarters before

returning back to pre-shock levels after one year. This scenario is consistent with the story in Carpenter and Demiralp (2011) where bank loans increase rather than decrease in response to a decrease in reservable deposits which contradicts the money multiplier story. Moreover, it is managed liabilities that support the lending of banks. These results may just be correlation but there does seem to be a strong link between managed liabilities and loans.

Discussion: potential reasons for the changing responses

It appears that the results for the US historical period of 1968-2007 and the subsample 1968-1989 suggest that the money multiplier mechanism is an operative channel for the transmission of monetary policy. On the contrary, the results for the subsample 1990-2007, as well as the results for all time periods in the demand and supply loan creation analysis, seem to suggest that the money multiplier mechanism is not the operative channel for the transmission of monetary policy in the US. The reasons for this interesting contradiction may be related, but not limited, to financial deregulation, a bank's size in term of their liquidity or capital position, or changes in the risk-taking behavior of the US banking system.

This puzzle was first raised by the results in Carpenter and Demiralp (2011). Their main conclusion suggested that the institutional structure of the US banking system had changed to such a degree, beginning in the late 1980's and early 1990's through deregulation and financial innovation, that the money multiplier mechanism was becoming irrelevant in the US for the 1990-2007 subsample period. This was a result of US banks having a considerable increase in their access to alternative or external sources of funding that was not available to them prior to the 1990-2007 time period. Moreover, Carpenter and Demiralp (2011) empirically demonstrate that US banks that were better capitalized and more liquid in the 1990-2007 period were unaffected by the money multiplier mechanism as it relates to the supply of loans. Ultimately, Carpenter and Demiralp (2011) claim that any changes in the quantity of reserves induced by the Federal Reserve will not lead to an increase in lending because the determinants of an increase or decrease in bank loans are driven by the demand side of the economy and not the actions of the central bank (Carpenter and Demiralp, 2011).

In order to better understand this puzzle it is worth considering that these results for the US may be related to a bank's financial structure, such as their level of bank capital. The majority of US banks have, historically, been small banks with low levels of capital. This would cause them to reduce lending opportunities following a monetary contraction in order to ensure that there is an adequate amount of capital in the future. According to Van den Heuvel (2007), historically, the lending response of smaller sized US banks, with low levels of bank capital, to a monetary contraction has been to not reduce the levels of loans initially due to binding capital requirements. However, they will end up reducing lending significantly after several quarters (Van den Heuvel, 2007). This analysis from Van den Heuvel (2007) corresponds quite well with the results from the SVAR impulse responses of this paper for the US sample period of 1968-2007 and the 1968-1989 subsample.

Moreover, according to Kashyap and Stein (2000), more liquid banks can maintain their lending behavior during monetary contractions by reducing their large share of securities. In contrast, less liquid banks have to decrease their lending in order to ensure that their levels of securities are not at a low level (Kashyap and Stein, 2000). As a result, smaller banks historically, such as those in the US, have a harder time raising uninsured forms of finance, such as managed liabilities, which makes their lending behavior more vulnerable to negative monetary shocks (Kashyap and Stein, 2000). According to this view, for the subsample period 1968-1989, monetary contractions in the US that raise interest rates would decrease economic activity and cause weaker banks to see a reduction in their capital position leading to a reduction in their lending behavior (Kashyap and Stein, 2000).

There may also be different levels of risk aversion caused by institutional changes or the decisions taken by banks themselves (Gambacorta and Mistrulli, 2003). Due to changes in regulation and the financial liberalization of the US financial system a risk-taking channel of the monetary policy transmission, in the period 1990-2007, may have been introduced (Borio and Zhu, 2008). The impact of how financial institutions perceive and price risk, especially in relation to a monetary shock, may be another way of explaining the monetary transmission mechanism. According to Borio and Zhu (2008), various forms of leverage instruments and

strategies have been created in the aftermath of financial liberalization and innovation that have given US banks, of all sizes, the ability and motive to raise alternative or external forms of funding (Borio and Zhu, 2008).

Consequently, a reason loans increase in the US for the 1990-2007 period following a monetary tightening may be related to the mortgage market (Den Haan, Sumner, and Yamashiro, 2008). The securitization of mortgages has played a very large role in the US. This strong market for mortgages allows US banks to unload their mortgages in order to maintain or increase their lending behavior following a monetary contraction (Den Haan, Sumner, and Yamashiro, 2008).

Furthermore, according to Cetorelli and Goldberg (2008), globalization has also played a role in how banks finance their operations. Banks that have a global presence are able to respond to a monetary contraction by moving funds between their domestic and international subsidiary banks in order to maintain their lending behavior (Cetorelli and Goldberg, 2008). Moreover, if there are smaller US banks that are associated or affiliated with larger US global banks they also benefit from the transferring of funds between domestic and international institutions and may be able, as a consequence, to maintain or possibly increase their lending behavior following a negative policy shock (Cetorelli and Goldberg, 2008). The development of external financial markets in the period 1990-2007 can help reduce or even eliminate any sensitivity that the domestic banking system may have to monetary contractions. Access to alternative sources of funding can make the money multiplier mechanism or narrow bank lending channel more ineffective for the US in the 1990-2007 time period. Cetorelli and Goldberg (2008) conclude that the expanding role of globalization in the US banking system may diminish, or possibly make irrelevant, the money multiplier mechanism (Cetorelli and Goldberg, 2008).

4.2 CANADA 1968 -2007

Overall, the results for Canada contrast the US results. In particular, for the full sample period of 1968-2007, and the subsample 1968-1989, the Canadian results indicate that the

money multiplier mechanism is not significant in the monetary transmission. However, the 1990-2007 subsample indicates that the money multiplier mechanism may not be as weak as the other time periods indicate. These results are the exact opposite of the US results and suggest a very interesting puzzle that requires a more formal investigation. The discussion section will provide some possible reasons for these differences.

Results for the 1968-2007 sample

Figure 4A illustrates that after a contractionary monetary shock, for the historical period 1968-2007, Canadian banks appear to be reacting to an increased demand for loans by increasing managed liabilities. This is in contrast to the US results for the same time period as indicated in Figure 1A. The Canadian results suggest that loans and managed liabilities follow a similar upward trajectory after a monetary shock. New loans are funded by banks selling off their own securities and increasing their managed liabilities while bank loans and reservable deposits move in opposing directions. These results are not consistent with the money multiplier mechanism. In the short run, banks sell their own securities and increase managed liabilities in order to fund the increase in loans. New loans seem to increase for about 8 -12 months before they begin their decline to pre-shock levels. Managed liabilities follow similar patterns. This seems to correspond with the idea that it is managed liabilities that support the lending of banks. As a result, the textbook money multiplier may not be the operating channel in Canada for this time period. The Canadian results for this time period, based on the Bernanke and Blinder (1992) model, are exactly the opposite of the US results for the same time period.

Figure 4B follows the approach in Carpenter and Demiralp (2011) in an attempt to further determine the demand and supply of the loan creation process. On the demand side we see that managed liabilities increase immediately when there is a positive shock to bank loans. There is virtually no increase in reservable deposits, following a positive shock to loans, and they start to decrease after 1-2 months. This seems to correspond with the idea that it is managed liabilities that support the lending of banks and diminishes the support for the textbook money multiplier mechanism as the operating channel for monetary transmission in

Canada. On the supply side, a positive shock to managed liabilities causes loans to increase considerably in the long run. Even though there is virtually no change in loans for the first 2-3 months, they do start to increase and continue to do so. On the contrary, a positive shock to reservable deposits leads to a sharp decrease in loans immediately for the first 2-3 months only to return back to pre-shock levels after 20 months. Figure 4B is consistent with the story in Carpenter and Demiralp (2011) where bank loans increase rather than decrease in response to a decrease in reservable deposits which contradicts the money multiplier mechanism. This may just be simple correlation caused by factors not properly captured in the VAR or the way that it was ordered, but there does seem to be a link between managed liabilities and loans. The Canadian results for the demand and supply side of the loan creation process, as proposed by Carpenter and Demiralp (2011), are similar to the US results for the same time period.

Results for the 1968 -1989 subsample

Figure 5A illustrates that after a contractionary monetary shock, for the subsample period 1968-1989, Canadian banks react to an increased demand for loans by increasing managed liabilities. Similar to Figure 4A, and the historical time period, loans and managed liabilities follow a similar upward trajectory after a monetary shock. Consequently, it appears new loans are funded by Canadian banks selling off their own securities and increasing their managed liabilities. Since the movement in bank loans is inversely related to reservable deposits these results are not necessarily consistent with the idea of the money multiplier mechanism. The results are also not consistent with the results for the same time period in the US as shown in Figure 2A. In the short run, Canadian banks sell their own securities and increase managed liabilities in order to fund the increase in loans. New loans seem to increase for approximately 8 months before beginning their decline to pre-shock levels. Managed liabilities follow a similar pattern. This corresponds with the idea that it is managed liabilities that support the lending of banks and the textbook money multiplier mechanism may not be the operating channel for monetary transmission. The Canadian results for this time period, based on the Bernanke and Blinder (1992) model, are exactly the opposite of the US results for the same time period.

Figure 5B follows the approach in Carpenter and Demiralp (2011) in an attempt to further determine the demand and supply of the loan creation process. On the demand side we see that managed liabilities rise immediately when there is a positive shock to bank loans whereas there is a small but short lived increase in reservable deposits following a positive shock to loans. After less than 2 months reservable deposits decrease and continue doing so. This appears to correspond with the idea that it is managed liabilities that support the lending of banks and diminishes the relevance of the textbook money multiplier mechanism for the transmission of monetary policy. On the supply side, if there is a positive shock to managed liabilities we see that loans increase considerably in the long run even though for the first 2 months there does not appear to be any change at all. A positive shock to reservable deposits causes loans to decrease right away for the first 2- 3 months and then slowly start to increase. Figure 5B, although not conclusive, appears to be consistent with the story in Carpenter and Demiralp (2011) where bank loans increase rather than decrease in response to a decrease in reservable deposits which contradicts the money multiplier story. Nevertheless, there does appear to be some link between managed liabilities and loans.

Results for the 1990-2007 subsample

Figure 6A illustrates that in response to a monetary contraction, for the Canadian subsample period 1990 -2007, bank assets such as loans and securities fall along with the drop in reservable deposits. These results, interestingly, contrast the US results for the same time period as indicated in Figure 3A. The Canadian results, for this time period, open the door for either an alternative explanation of the monetary transmission mechanism or an explanation of the money multiplier mechanism that makes it more relevant in Canada than the previous time periods have indicated. Figure 6B follows the approach in Carpenter and Demiralp (2011) in an attempt to further determine the demand and supply of the loan creation process. On the demand side we see that managed liabilities slowly decrease after a positive shock to loans whereas reservable deposits slowly increase when there is a positive shock to loans. This would indicate that loans are not financed by managed liabilities on the demand side. On the supply side, if there is a positive shock to managed liabilities we see that loans start to increase after

about 4 months. A positive shock to reservable deposits decreases loans for approximately 4 months, but then quickly rebounds and is back to pre-shock levels after 12 months. Overall, the scenario presented in Figure 6B is not conclusive and is not consistent with the story in Carpenter and Demiralp (2011) where bank loans increase rather than decrease in response to a decrease in reservable deposits. These results are in contrast to the US results for the same time period and indicate that other factors need to be considered.

Discussion: potential reasons for Canada – US differences

According to Den Haan, Sumner, and Yamashiro (2008), historically, loans should not necessarily decrease in Canada following a monetary contraction, as opposed to the US, because Canadian businesses are more dependent on bank loans. From a historical perspective, it may have been more difficult for Canadian firms to get funds from other sources (Den Haan, Sumner, and Yamashiro 2008). This, is what ultimately, may have changed in the period after the 1990s. Furthermore, other possible reasons for the differences between Canada and the US consist of the following: the size of banks (specifically their bank capital position), changes in the institutional structures of the two countries banking system, financial deregulation, capital requirements leading to more or less risk aversion, and access to international sources of funding.

Since it is difficult to precisely determine whether it is loan supply or loan demand that is affected by monetary policy shocks, studies have focused on the size of banks and whether or not they are constrained by bank capital (Kishan and Opiela, 2000). According to Kishan and Opiela (2000), small undercapitalized banks, such as those in the US, have a harder time dealing with the loss of reserves due to a contractionary shock than large well-capitalized banks (Kishan and Opiela, 2000). Even though most US banks have been small, historically, Carpenter and Demiralp (2011) show that institutional changes in the US banking system starting in the late 1980's have increased, in relative terms, the number of larger and better capitalized banks. As a result, these US banks are less sensitive to the money multiplier mechanism for the 1990-2007 time period.

Historically, Canadian banks would be qualified as larger and well-capitalized banks. Consequently, their loan supply will not respond negatively to a contractionary monetary policy shock. As the Canadian full sample data shows, loans may actually increase because larger-well-capitalized banks will not have a difficult time accessing other forms of managed liabilities. They are, thus, able to protect and sustain their lending behavior following a monetary contraction. Therefore, bank capital has an important influence over the effectiveness of the money multiplier mechanism. Large levels of bank capital allows banks to access other sources of funds whereas lower-capitalized banks may be considered too risky and are less likely to sustain their lending behavior due to their inability to access other sources of funding (Gambacorta and Mistrulli, 2003). As such, in a historical sense, the larger and better capitalized Canadian banks are less sensitive to contractionary monetary policy shocks than the smaller and less capitalized US banks. This is reflected in the results of both countries for the full sample period of 1968-2007 and the 1968-1989 subsample.

Moreover, changes in the institutional structure of a country's financial system may also alter the effects of monetary policy. In the past couple of decades, Canada's financial system has been altered by financial deregulation, innovation, and disintermediation (Roldos, 2006). As a result, the transmission of monetary policy for the Canadian system has become more market based (Roldos, 2006). From the 1990's onward the Canadian corporate sector has become less reliant on lending from banks as a source of funding due to their increased use of corporate bonds and commercial paper (Roldos, 2006). Since this process of disintermediation has reduced bank dependency for loans, Canadian banks have transformed their businesses towards offering more underwriting and other securities (Roldos, 2006). As a result, the response to a monetary contraction for the subsample 1990-2007 is different from the 1968-1989 subsample, and the overall historical time period, due to institutional changes in the Canadian banking system. Moreover, Roldos claims that, improvements implemented by the BoC in the early 1990's such as increased transparency and the implementation of an inflation targeting regime, in conjunction with an expansion of available sources of funding, has made the systematic component of monetary policy more effective in Canada (Roldos, 2006).

Furthermore, Moazzami (1999) argues that financial deregulation in Canada, starting in the late 1980's, has led to increased concentration and effective barriers to entry in the Canadian banking industry. This may have had a negative impact on Canadian banks' lending behavior. According to Moazzami (1999), increased concentration and barriers to entry in the Canadian banking system reduced competition for the oligopolistic Canadian banks even further. Consequently, lending rate stickiness increased in Canada (Moazzami, 1999). In contrast, throughout the 1970's and 1980's the lending rate stickiness in Canada had decreased, even with higher concentration in the Canadian banking system, as the larger Canadian banks were still highly competitive and were more likely to adjust their loans rates due to market contestability⁸ (Moazzami,1999). According to Moazzami (1999), financial deregulation, starting from the 1980's, decreased the contestability of the Canadian financial market by effectively closing off the industry from any outside influence and reducing competition which led to increases in lending rate stickiness (Moazzami, 1999). This may be a possible explanation for the divergence in the Canadian results for the subsample periods of 1968-1989 and 1990-2007.

There may also be different levels of risk aversion between highly capitalized banks, such as those in Canada, versus the large majority of lower capitalized banks in the US. These differences in risk aversion may be the result of institutional differences as well as the decisions taken by the banks themselves relating to their profit margins (Gambacorta and Mistrulli, 2003). Since the implementation of the Basel Accord in 1988 a bank's capital adequacy has become an important feature of banking regulation, especially in Canada. This may have had an impact on the Canadian money multiplier or narrow bank lending channel for the 1990-2007 subsample. According to Van den Heuvel (2007), an increase in the interest rate following a monetary contraction reduces the profits in the banking system. Thus, any decrease in profit would cause a decrease in the capital position of the banks leading them to reduce lending (Van den Heuvel, 2007) Canadian banks may have become more focused on their profit margins,

⁸ A contestable market is a market structure where there is freedom of entry and exit, even if it is a small number of firms, and the threat of competition is sufficient to keep prices low and prevent abuse of monopoly power.

and as a consequence more risk averse, for the period 1990-2007 leading to a reduction in lending following a monetary contraction.

Thus, a monetary contraction policy implemented by the BoC in the 1990-2007 period can affect the supply of bank loans for Canadian banks, through its effect on bank capital, especially if Canadian banks hold excess amount of capital above the capital requirements set out by the regulator (Van den Heuvel, 2007). This may have made monetary policy in Canada more effective for the 1990-2007 subsample and it, ultimately, may have made Canadian banks more risk averse than US banks. In contrast, monetary policy may be less effective for the period 1990-2007 in the US banking system where most banks, due to their relatively smaller size, are only at or below the regulatory minimum for capital (Van den Heuvel, 2007). This suggests that the effects of a contractionary monetary policy shocks on bank lending will be smaller when more banks, such as the US, have lower capital levels relative to the regulatory minimum (Van den Heuvel, 2007). Ultimately, this may be one factor that explains the divergence in results between Canada and the US for the 1990-2007 subsample.

A final reason as to why loans may have decreased in Canada following a monetary shock in the 1990-2007 period is that Canadian businesses may have the opportunity to borrow funds from the US if their interest rates are lower (Den Haan, Sumner, and Yamashiro, 2008). A monetary shock created by the BoC does not need to coincide with a US monetary tightening. Also, with the expanded use of global markets, businesses may be able to borrow from elsewhere (Den Haan, Sumner, and Yamashiro, 2008).

5. Robustness

One of the crucial elements of this paper was in the identification of a break in the Canadian data around the late 1980's and early 1990's. Apart from the institutional changes that the Bank of Canada (BoC) put in place in the early to mid 1990's there was also the implementation of the Basel Accord in 1988 and legislative changes that altered the banking industry in Canada through the 1987 Bank Act. The data results suggest that those institutional and legislative

changes, including the BoC's switch to an inflation targeting policy starting in 1991, may have altered the monetary transmission mechanism in the period after 1990. Therefore, a number of robustness checks were performed in order to confirm the break points for the data sample. The following alternative subsamples were investigated: 1968 -1994, 1994-2007, and 1994-2012.

1) The 1994 breakpoint was chosen to coincide with the implementation of a zero reserve requirement regime for the Canadian banking system. The results from this alternative subsample were not significantly different from the results presented in the text.

2) The author chose to use 1990 as the mid-breakpoint and June 2007 as the end break point in order to correspond with the Carpenter and Demiralp (2011) paper in the hopes that it would make for a good comparison. The updated Bernanke and Blinder (1992) model was also divided into the same subsamples and the results were consistent with their study. Thus, there is a clear break point in that time period that is due to legislative and institutional changes.

3) Extending the data to 2012 and capturing the possible effects of the financial crisis, for both Canada and the US, also did not alter the results significantly. The SVAR impulse responses for the Canadian aggregate data for these subsamples can be found in Appendix C. This test was performed due to a concern raised in Carpenter and Demiralp (2011) that the inclusion of US data after June 2007, which would capture the effects of the financial crisis, might bias the results against the money multiplier mechanism.

4) As can also be seen in Appendix C, the SVARs were also carried out with 6-lags consistent with the original Bernanke and Blinder (1992) model and the subsequent update in Carpenter and Demiralp (2011). By using the optimal lags in the main text instead of the 6-lags, the main difference was that the SVAR impulse responses were generally slightly smoother lines than their 6-lag counterparts, but there was no significant difference in the results.

5) The main examination of this paper was to see how an unanticipated monetary shock impacts the movement of loans and deposits. As such, I also re-estimated the SVARs by

removing managed liabilities from the group in order to see whether the impulse responses of loans and reservable deposits would change. They did not.

6) In order to coincide with the Carpenter and Demiralp (2011) study, this paper only used total chequable deposits to generate the reservable deposits. According to the Carpenter and Demiralp (2011) study for the US, it is mostly chequable deposits that face reserve requirements. As such, in order to be consistent with their study, and for the purposes of comparison, this paper only used total chequable deposits to generate the reservable deposits. I also constructed and carried out the same SVARs for the Canadian data with reservable deposits consisting of chequable and non-chequable deposits. The results from that exercise were not significantly different from our main findings and are consistent with the ones presented in the text.

6. Conclusion

This paper performed SVARs to determine if the money multiplier mechanism exists in Canada. The results from the SVARs suggest that, historically, the money multiplier mechanism is not very prominent in Canada. The Canadian banking system is oligopolistic and highly regulated which facilitates and maintains a system of a few very large well-capitalized banks. These large banks through institutional and legislative changes have captured a dominant position in the Canadian banking system. Historically, this has made Canadian borrowers much more dependent on the banking system than borrowers in the US. Furthermore, since Canadian banks are well-capitalized they are able to find alternative or external sources of funding for the loans being demanded by their customers. As a result, if the Bank of Canada implements an unanticipated monetary contraction, the Canadian banking system, historically, is still able to maintain or even increase loans during that period.

The data results clearly show an increase in loans even with a decrease in reservable deposits for the overall sample period of 1968 -2007 and the subsample 1968 -1989. The results

suggest that Canadian banks can increase managed liabilities and sell off their own securities to mitigate the loss of reserves and reservable deposits in order to finance their clients' demands for new loans. Since Canadians have been, historically, more dependent on bank loans their demand for loans would not decrease significantly following a monetary contraction especially if they cannot find alternative sources of funding. Large well-capitalized banks in Canada have been able to insulate themselves and their customers from unanticipated monetary contractions. Furthermore, the SVAR results generated in this paper for the US data are consistent with the results in Bernanke and Blinder (1992) and Carpenter and Demiralp (2011). However, they are exactly the opposite of the Canadian experience.

As new regulations and legislative changes were introduced in the late 1980's, in conjunction with the Bank of Canada implementing new procedures in the early 1990's, the monetary transmission for Canada appears to have altered from the historical trend. Total loans decrease slightly when there is a monetary contraction along with the decrease in reservable deposits. Managed liabilities stay virtually the same. Moreover, due to new capital regulations, Canadian banks may have become more risk averse. Therefore, it seems plausible that loans would decrease in the 1990-2007 subsample if the banking sectors increased risk aversion is combined with the fact that businesses have more alternatives in accessing funds. As a result of these changes it appears that the Bank of Canada, if it were to tighten money by increasing the bank rate, has more influence over the monetary transmission mechanism in the 1990-2007 subsample⁹.

Although it is difficult to conclusively deny the existence of a money multiplier mechanism or a very narrow bank lending channel, it certainly does not appear to be the main operating channel in Canada. The results of this paper suggest that the time period, the institutional environment, along with the key importance of bank capital all combine to play a key role as to whether or not a money multiplier mechanism is operative. In addition, the literature is clear on the difficulties with carrying out these types of analyses on the monetary

⁹ This may also be due to BoC's increased credibility as a result of their inflation targeting policy.

transmission mechanism because of the complexity in disentangling whether the impacts are coming from the demand or supply side of the loan generating process.

Consequently, in order to understand the monetary transmission in Canada further, research would need to focus specifically on how Canadian banks create loans and on how risk averse they may be in the face of a monetary contraction. There may be a risk taking channel that needs to be explored in Canada. The results in this paper would seem to indicate that Canadian banks were less risky than US banks in the last few decades. They do not conclusively indicate the emergence of a money multiplier mechanism for the 1990-2007 subsample. Canadian banks are large well-capitalized banks that appear to have become more risk averse in an environment where capital requirements are tighter and the utilization of alternative sources of funding by firms has increased. The consequence of being more risk averse may have helped the Canadian banking system in the most recent financial crisis.

APPENDIX A: Data Details

1) USA Data from the Federal Reserve Bank of St. Louis Economic Research website.

<http://research.stlouisfed.org/fred2/>

Search Command

(FEDFUNDS)	- Effective Federal Funds Rate - Averages of Daily Figures.
(USACPIALLMINMEI)	- Consumer Price Index: All Items for the United States.
(LOANS)	- Loans and Leases in Bank Credit, All Commercial Banks, Billions of Dollars, Monthly, Seasonally Adjusted (TOTLL).
(TCDSL)	- Total Checkable Deposits - Demand deposits plus other checkable deposits. Calculated by the Federal Reserve Bank of St. Louis.
(LTDACBM027SBOG)	- Large Time Deposits, All Commercial Banks Billions of U.S. Dollars, Monthly, Seasonally Adjusted.
(INVEST)	- Securities in Bank Credit at All Commercial Banks, Billions of Dollars, Monthly, Seasonally Adjusted.
(UNRATE)	- Civilian Unemployment Rate - the number of unemployed as a percentage of the labor force.

2) Canadian Data from Statistics Canada (Canadian Socioeconomic Database).

<http://www5.statcan.gc.ca/cansim/home-accueil?lang=eng>

Bank Rate - **Table 176-0043** - Financial market statistics, monthly.

Consumer Price Index (CPI) - **Table 326-0020** - All-items CPI, monthly.

Total Loans - **Table 176-0011** - Chartered banks, assets and liabilities, monthly.

Total Less Liquid Assets - Canadian Securities = TOTAL LOANS (Non-Mortgage + Mortgage)

Canadian Securities - **Table 176-0011** - Chartered banks, assets and liabilities, monthly.

Total Canadian provincial and municipal securities + Total Canadian corporate securities = TOTAL CANADIAN SECURITIES

Managed Liabilities - **Table 176-0011** - Chartered banks, assets and liabilities, monthly.

Personal term deposits + Non-personal term deposits = MANAGED LIABILITIES

Total Chequable Deposits - **Table 176-0011** - Chartered banks, assets and liabilities, monthly.

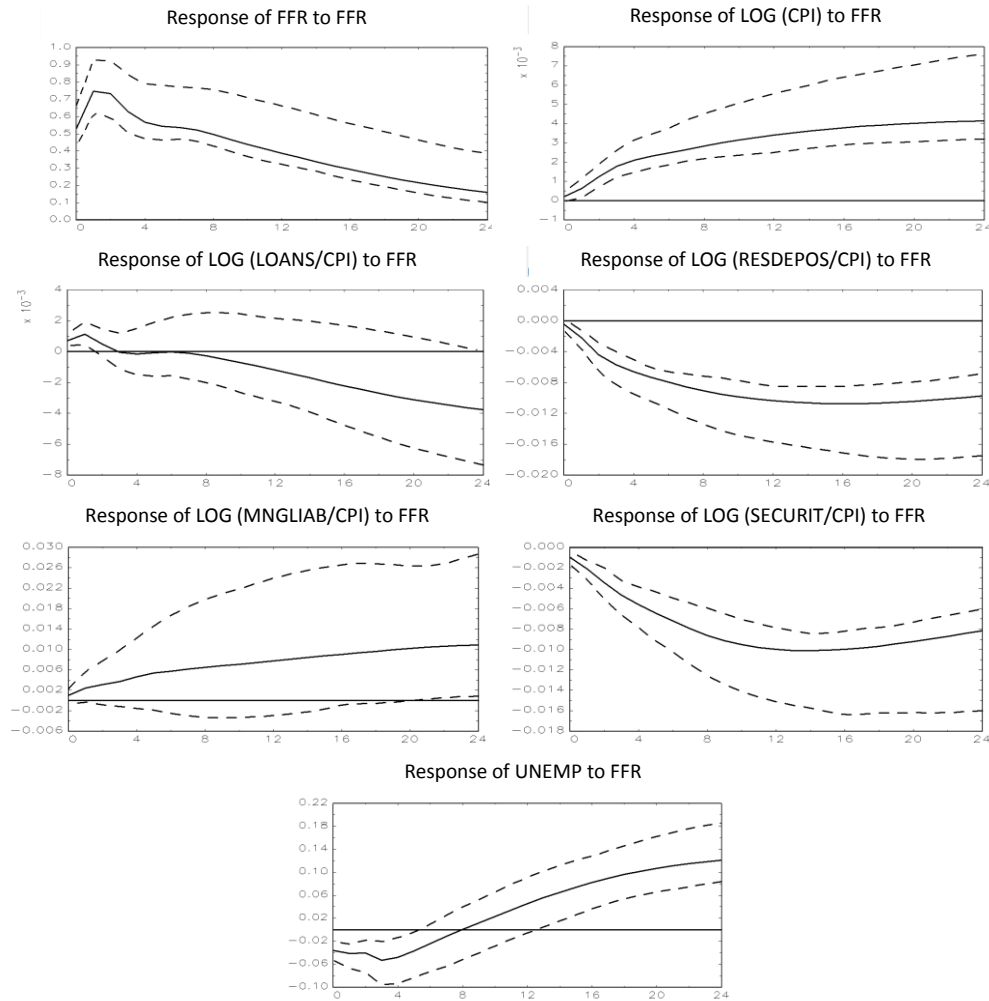
Total Chartered bank deposits – Government of Canada Chartered bank deposits – (non-personal + personal term Chartered bank deposits) – (non-personal + personal non-chequable Chartered bank deposits) = TOTAL CHEQUABLE DEPOSITS (personal & non-personal)

Unemployment rate - **Table 282-0087** - Labour force survey estimates (LFS), seasonally adjusted, monthly.

APPENDIX B: SVAR Impulse Response Figures

FIGURE 1A: US 1968-2007 (Bernanke and Blinder Updated)

Response to Cholesky One S.D. Monetary Shock



where:

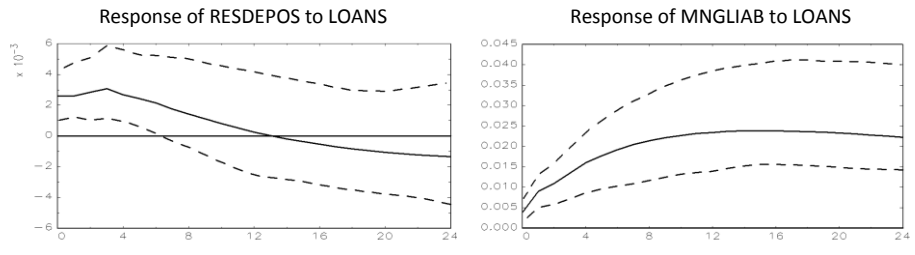
- FFR: Federal Funds Rate.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESDEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Large Time Deposits.
- SECURIT: Securities.
- UNEMP: Unemployment Rate.

# of observations	474
# of lags – Akaike optimal lags	4

FIGURE 1B:

US 1968 -2007 Response of Liabilities to Loans (Demand Side)

Response to Cholesky One S.D. Innovations



US 1968-2007 Response of Loans to Liabilities (Supply Side)

Response to Cholesky One S.D. Innovations

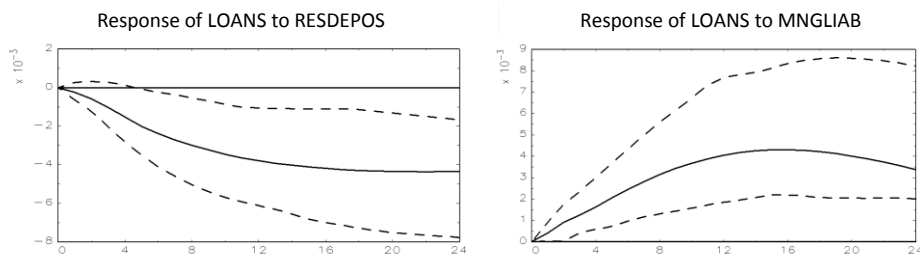
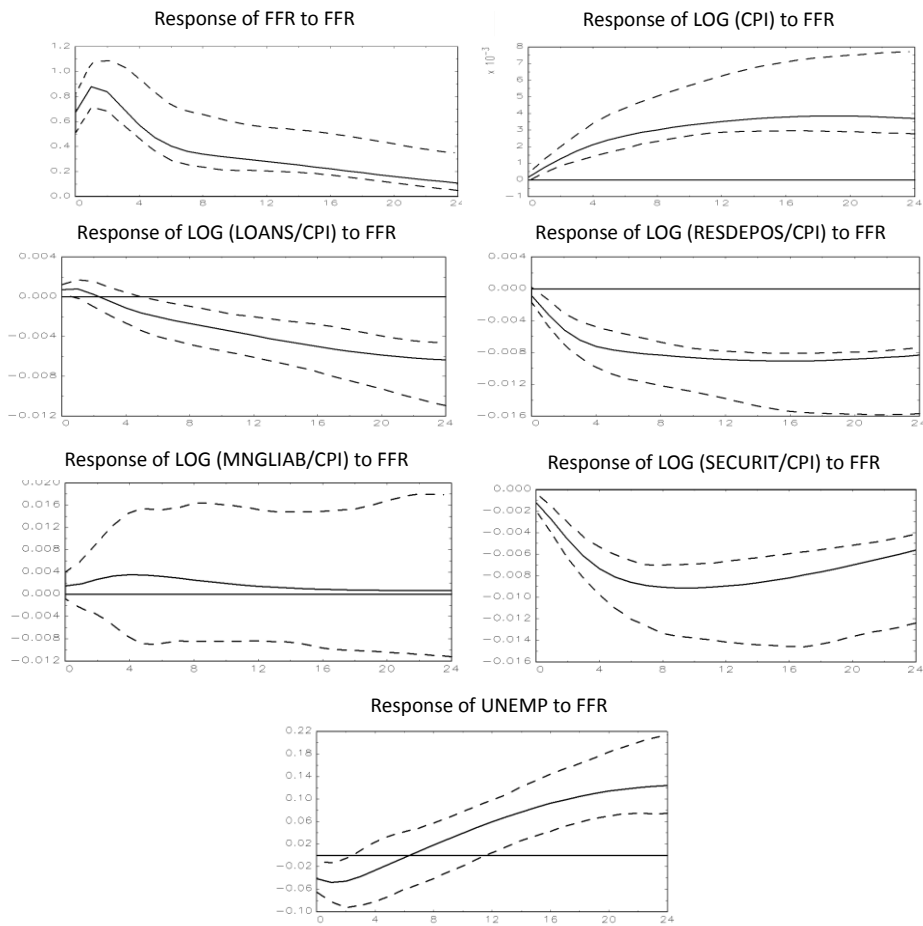


FIGURE 2A: US 1968-1989 (Bernanke and Blinder Updated)

Response to Cholesky One S.D. Monetary Shock



where:

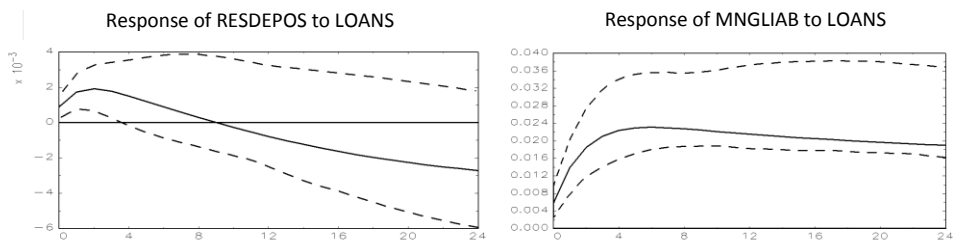
- FFR: Federal Funds Rate.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESDEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Large Time Deposits.
- SECURIT: Securities.
- UNEMP: Unemployment Rate.

# of observations	264
# of lags – Akaike optimal lags	2

FIGURE 2B:

US 1968 -1989 Response of Liabilities to Loans (Demand Side)

Response to Cholesky One S.D. Innovations



US 1968 – 1989 Response of Loans to Liabilities (Supply Side)

Response to Cholesky One S.D. Innovations

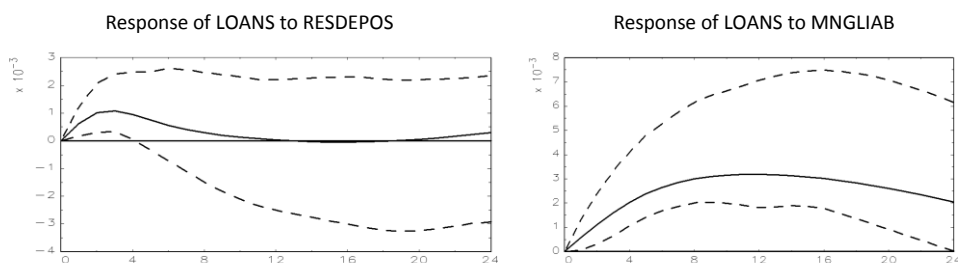
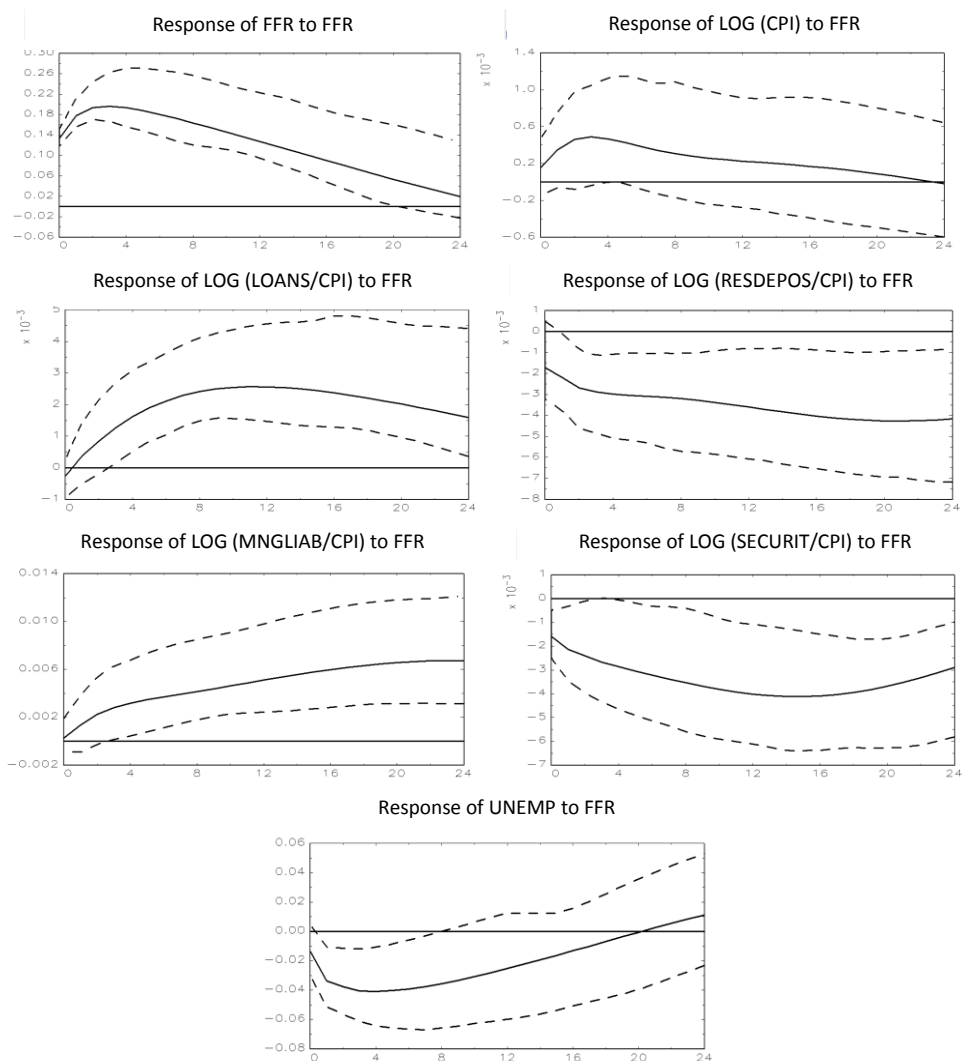


FIGURE 3A: US 1990-2007 (Bernanke and Blinder Updated)

Response to Cholesky One S.D. Monetary Shock



where:

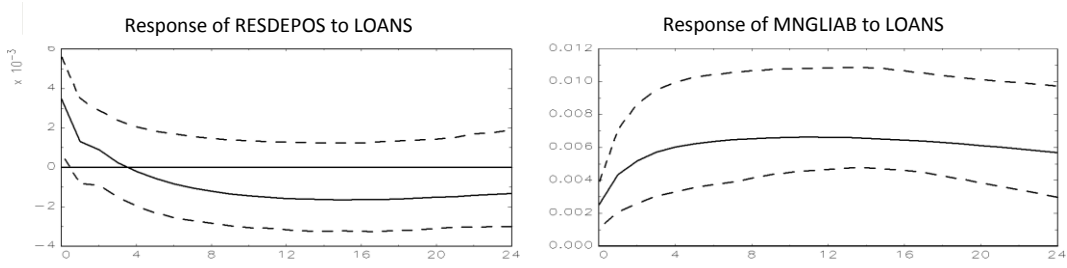
- FFR: Federal Funds Rate.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESDEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Large Time Deposits.
- SECURIT: Securities.
- UNEMP: Unemployment Rate.

# of observations	210
# of lags – Akaike optimal lags	2

FIGURE 3B:

US 1990 -2007 Response of Liabilities to Loans (Demand Side)

Response to Cholesky One S.D. Innovations



US 1990-2007 Response of Loans to Liabilities (Supply Side)

Response to Cholesky One S.D. Innovations

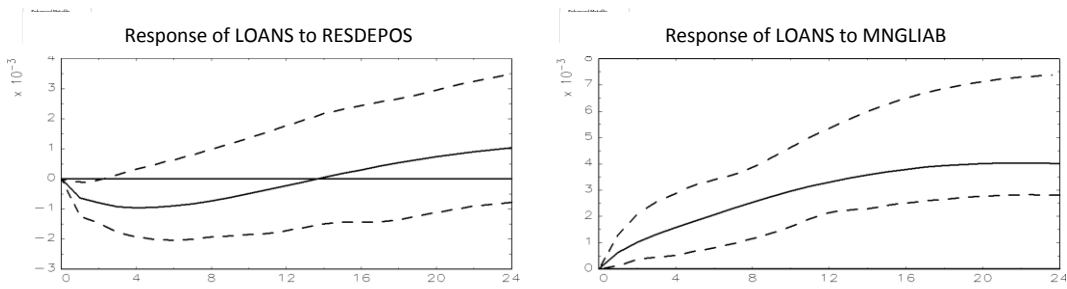
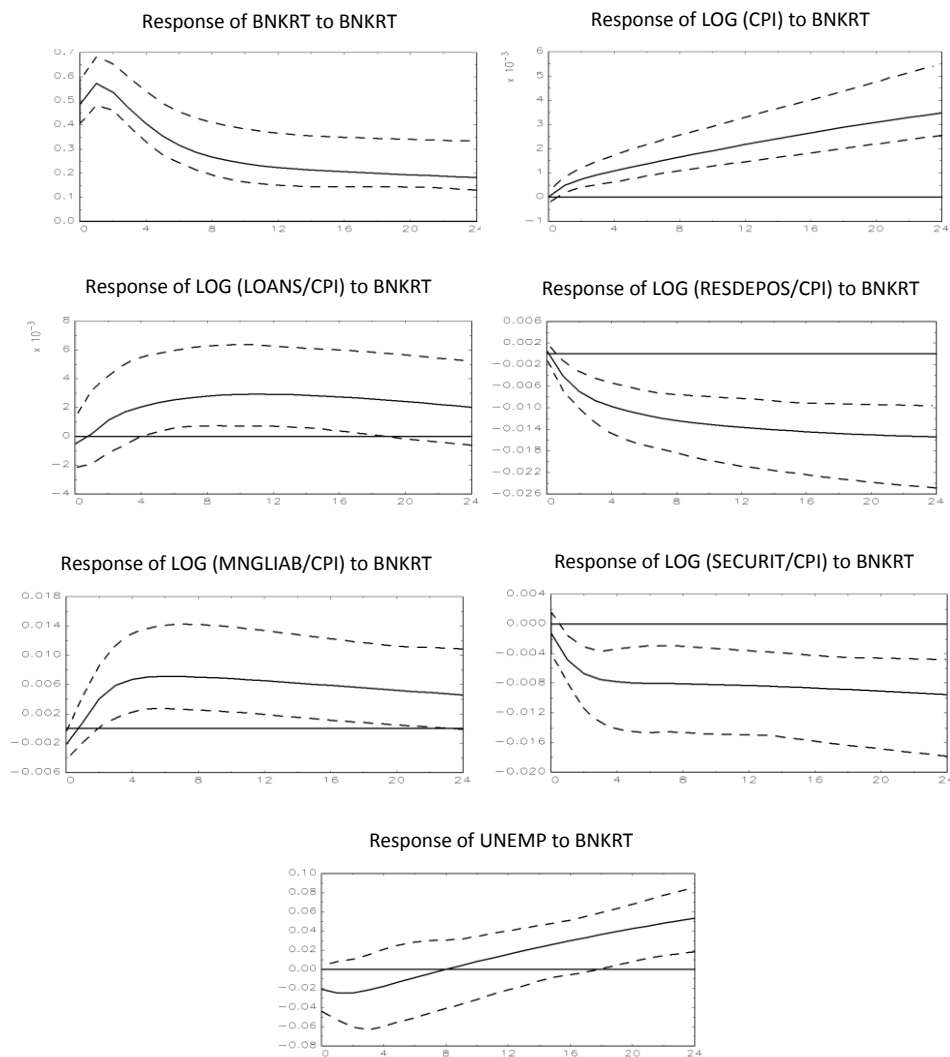


FIGURE 4A: CANADA 1968-2007 (Bernanke and Blinder Updated)

Response to Cholesky One S.D. Monetary Shock



where:

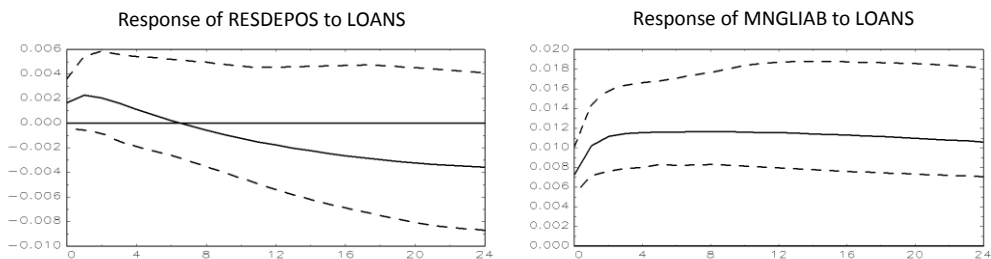
- BNKRT: Bank Rate set by the Bank of Canada.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESDEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Term Deposits.
- SECURIT: Canadian Securities.
- UNEMP: Unemployment Rate.

# of observations	474
# of lags – Akaike optimal lags	2

FIGURE 4B:

CANADA 1968 -2007 Response of Liabilities to Loans (Demand Side)

Response to Cholesky One S.D. Innovations



CANADA 1968-2007 Response of Loans to Liabilities (Supply Side)

Response to Cholesky One S.D. Innovations

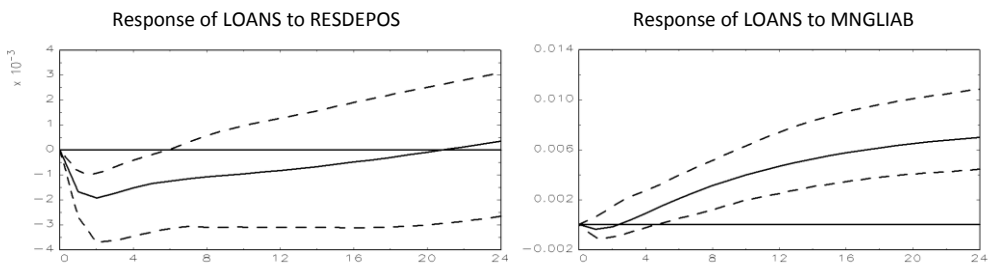
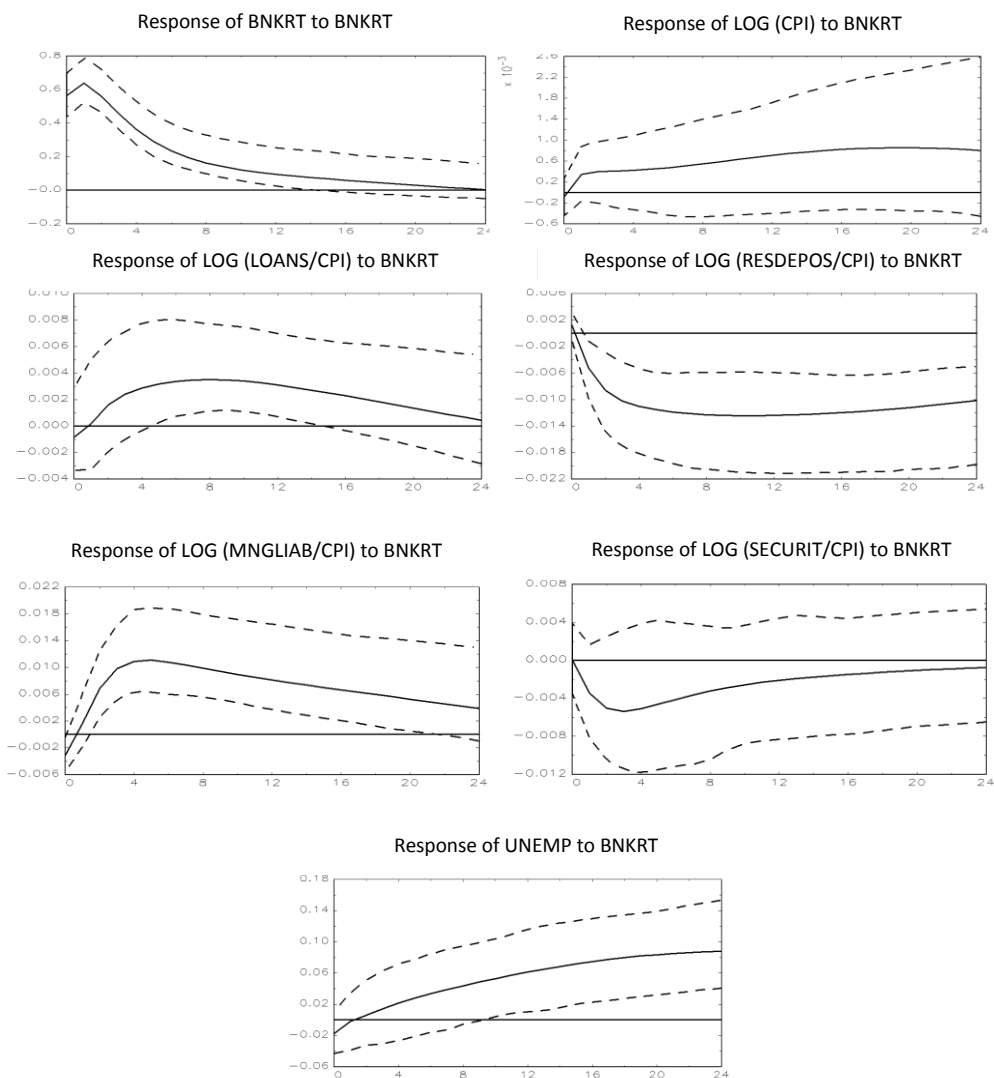


FIGURE 5A: CANADA 1968-1989 (Bernanke and Blinder Updated)

Response to Cholesky One S.D. Monetary Shock



where:

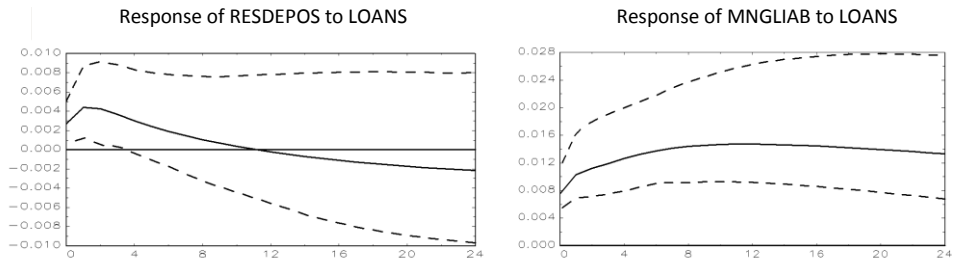
- BNKRT: Bank Rate set by the Bank of Canada.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESDEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Term Deposits.
- SECURIT: Canadian Securities.
- UNEMP: Unemployment Rate.

# of observations	264
# of lags – Akaike optimal lags	2

FIGURE 5B:

CANADA 1968 -1989 Response of Liabilities to Loans (Demand Side)

Response to Cholesky One S.D. Innovations



CANADA 1968-1989 Response of Loans to Liabilities (Supply Side)

Response to Cholesky One S.D. Innovations

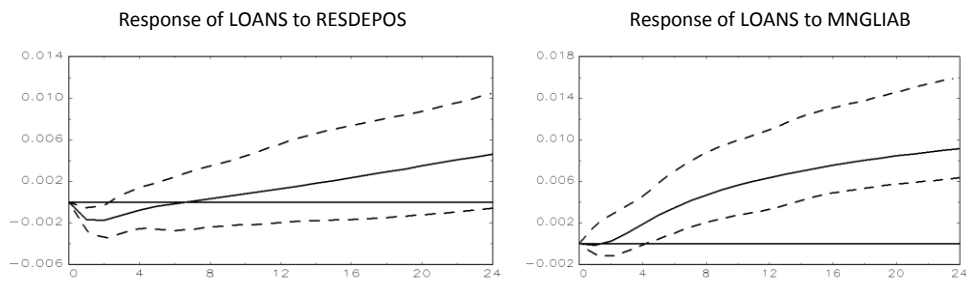
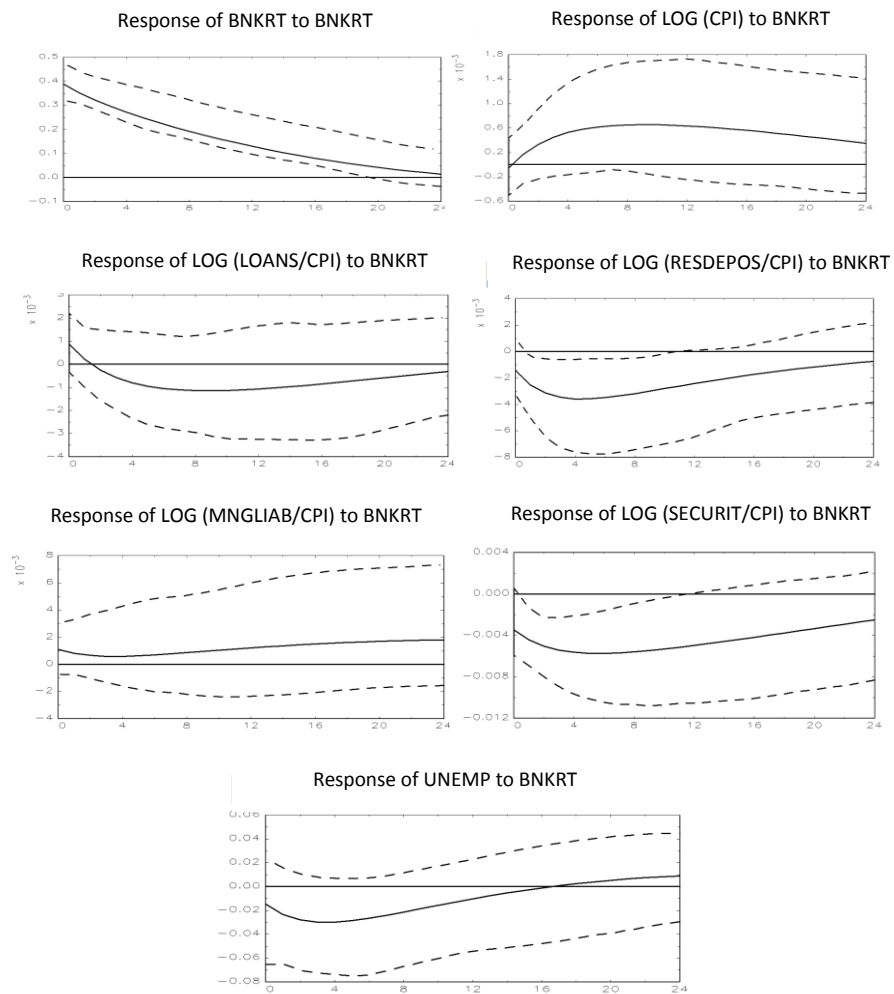


FIGURE 6A: CANADA 1990-2007 (Bernanke and Blinder Updated)

Response to Cholesky One S.D. Monetary Shock



where:

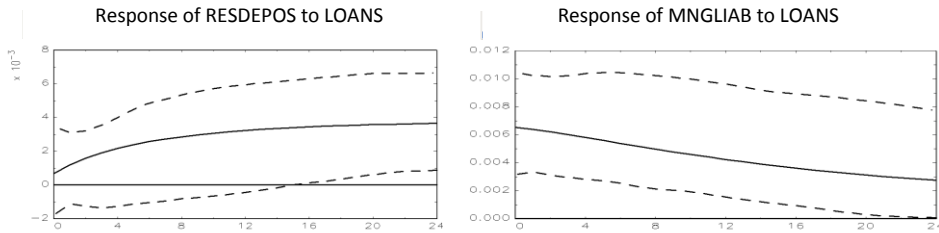
- BNKRT: Bank Rate set by the Bank of Canada.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESDEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Term Deposits.
- SECURIT: Canadian Securities.
- UNEMP: Unemployment Rate.

# of observations	210
# of lags – Akaike optimal lags	1

FIGURE 6B:

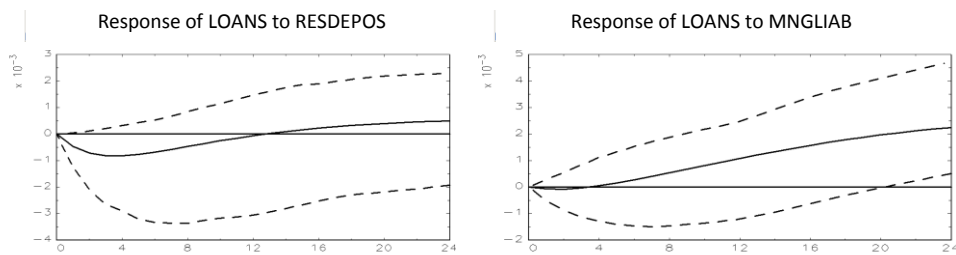
CANADA 1990 -2007 Response of Liabilities to Loans (Demand Side)

Response to Cholesky One S.D. Innovations



CANADA 1990 - 2007 Response of Loans to Liabilities (Supply Side)

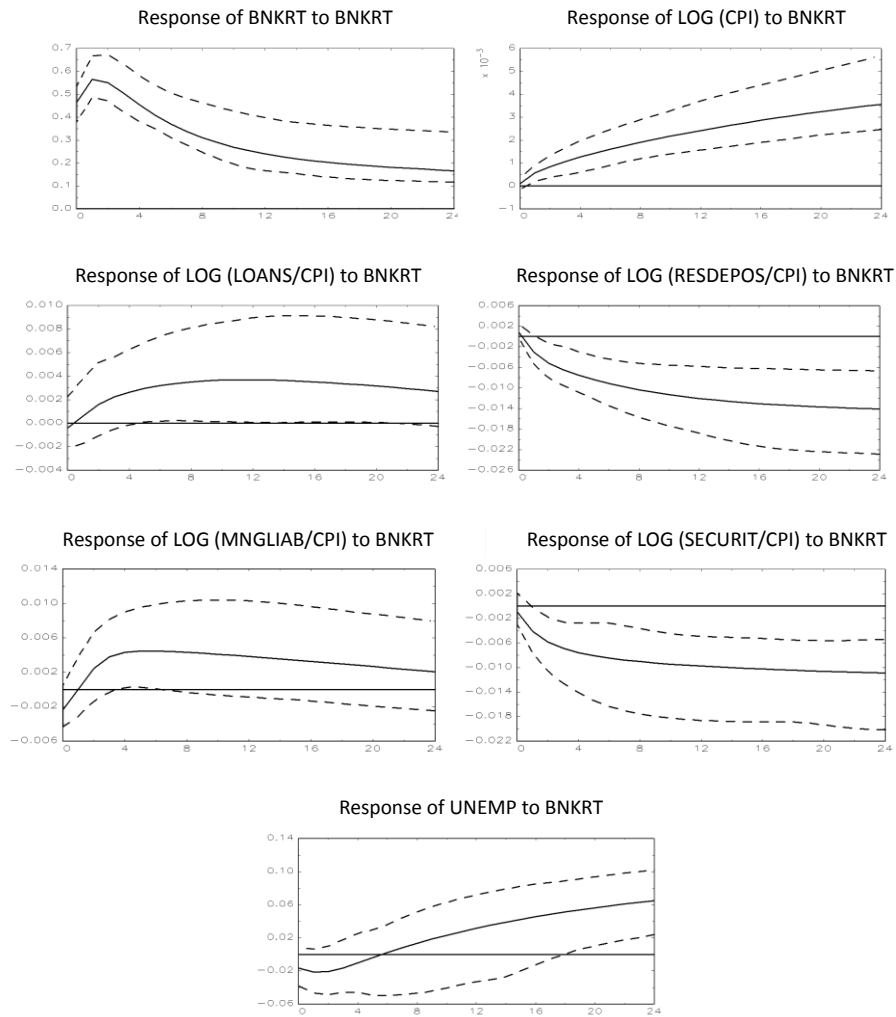
Response to Cholesky One S.D. Innovations



Appendix C: SVAR Impulse Response Figures (Robustness)

Figure 7A: CANADA 1968-2012 (Bernanke and Blinder Updated)

Response to Cholesky One S.D. Monetary Shock



where:

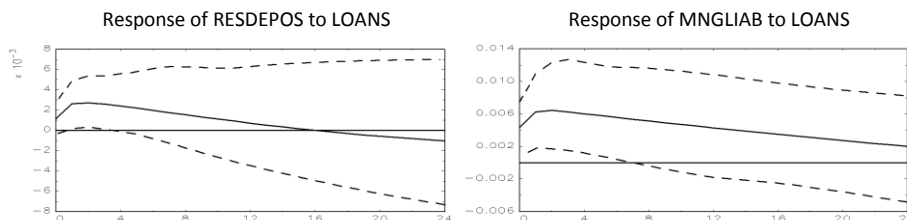
- BNKRT: Bank Rate set by the Bank of Canada.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESDEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Term Deposits.
- SECURIT: Canadian Securities.
- UNEMP: Unemployment Rate.

# of observations	540
# of lags – Akaike optimal lags	2

FIGURE 7B:

CANADA 1968 -2012 Response of Liabilities to Loans (Demand Side)

Response to Cholesky One S.D. Innovations



CANADA 1968 - 2012 Response of Loans to Liabilities (Supply Side)

Response to Cholesky One S.D. Innovations

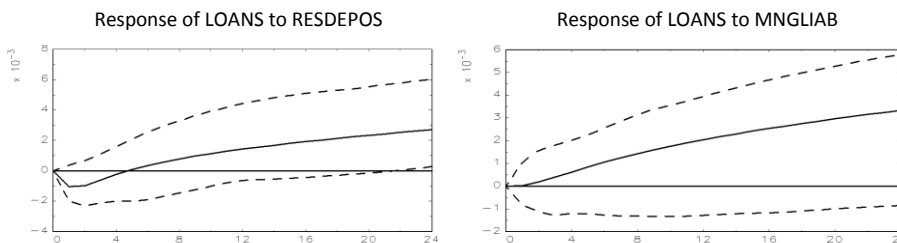
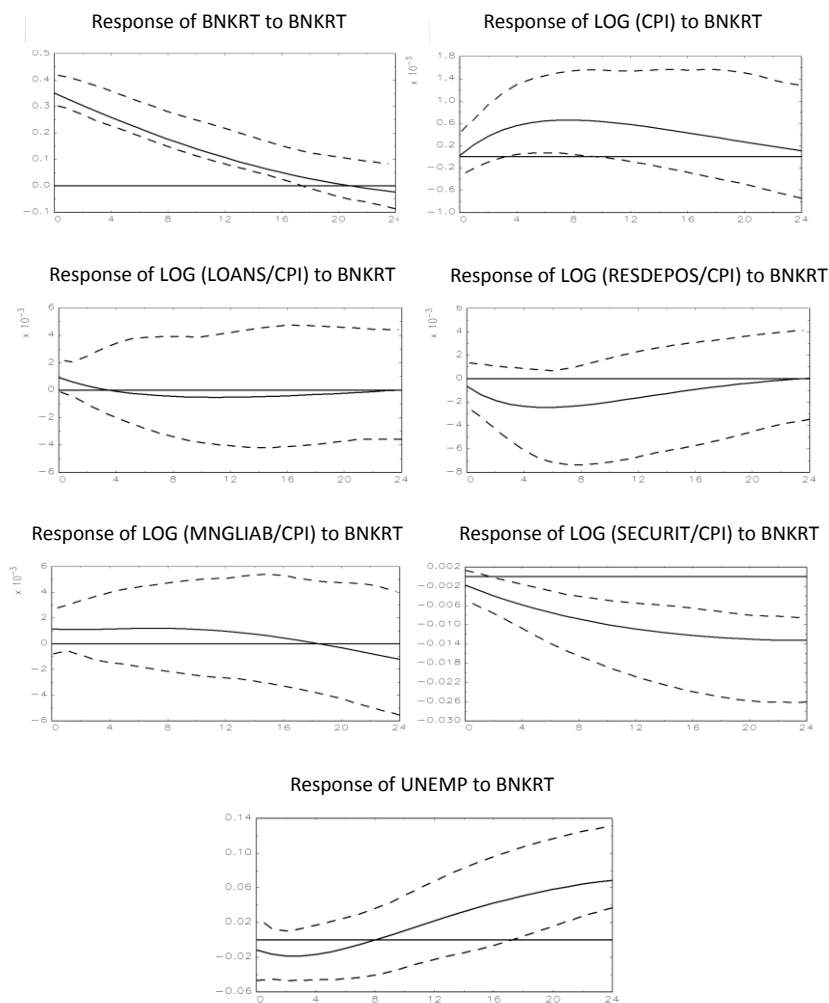


FIGURE 8A: CANADA 1990-2012 (Bernanke and Blinder Updated)

Response to Cholesky One S.D. Monetary Shock



where:

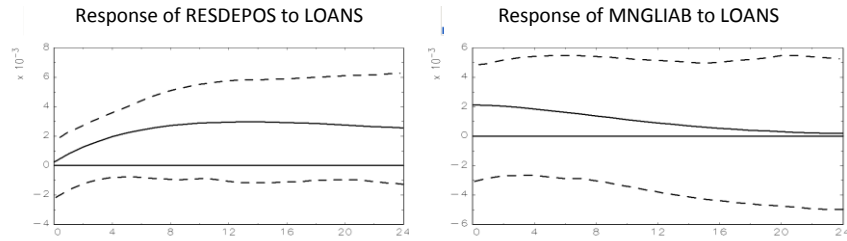
- BNKRT: Bank Rate set by the Bank of Canada.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Term Deposits.
- SECURIT: Canadian Securities.
- UNEMP: Unemployment Rate.

# of observations	276
# of lags – Akaike optimal lags	1

FIGURE 8B:

CANADA 1990 -2012 Response of Liabilities to Loans (Demand Side)

Response to Cholesky One S.D. Innovations



CANADA 1990 - 2012 Response of Loans to Liabilities (Supply Side)

Response to Cholesky One S.D. Innovations

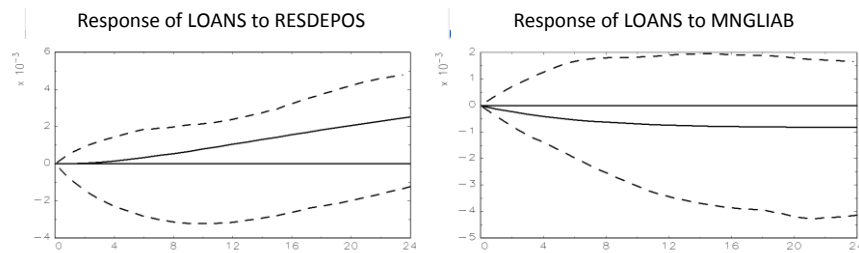
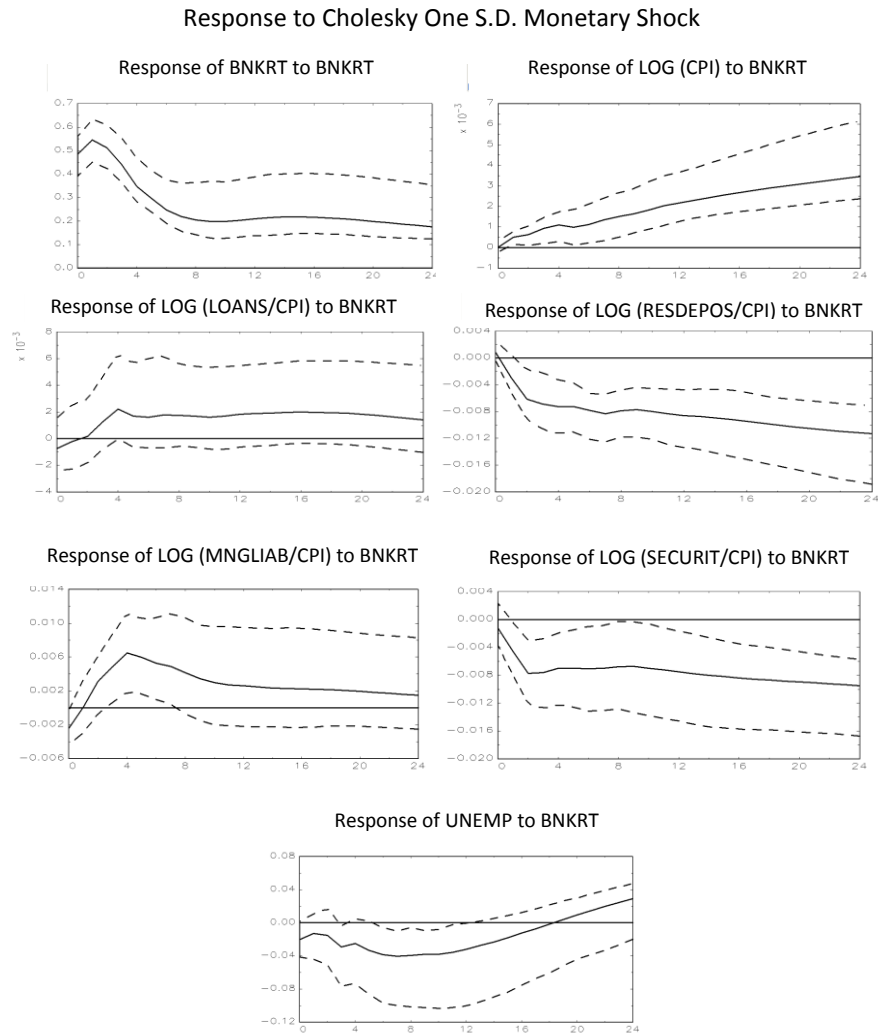


FIGURE 9A: CANADA 1968-2007 (Bernanke and Blinder Updated) – 6 Lags



where:

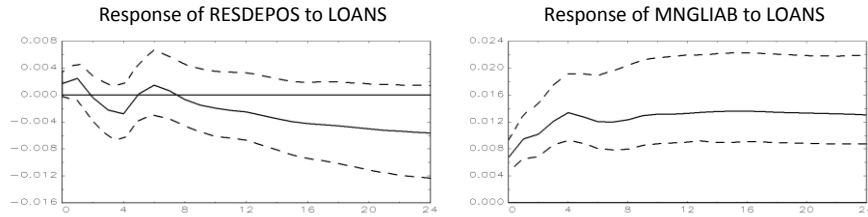
- BNKRT: Bank Rate set by the Bank of Canada.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESDEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Term Deposits.
- SECURIT: Canadian Securities.
- UNEMP: Unemployment Rate.

# of observations	474
# of lags	6

FIGURE 9B:

CANADA 1968 -2007 Response of Liabilities to Loans (Demand Side) – 6 Lags

Response to Cholesky One S.D. Innovations



CANADA 1968 - 2007 Response of Loans to Liabilities (Supply Side) – 6 Lags

Response to Cholesky One S.D. Innovations

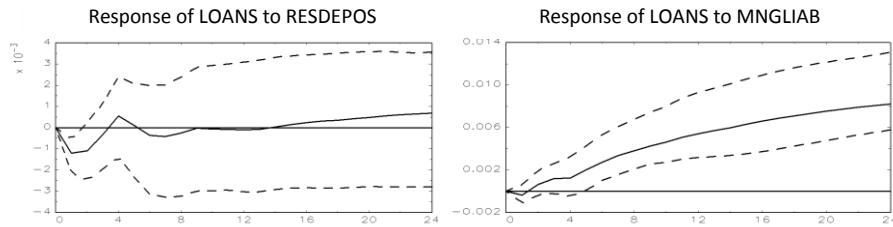
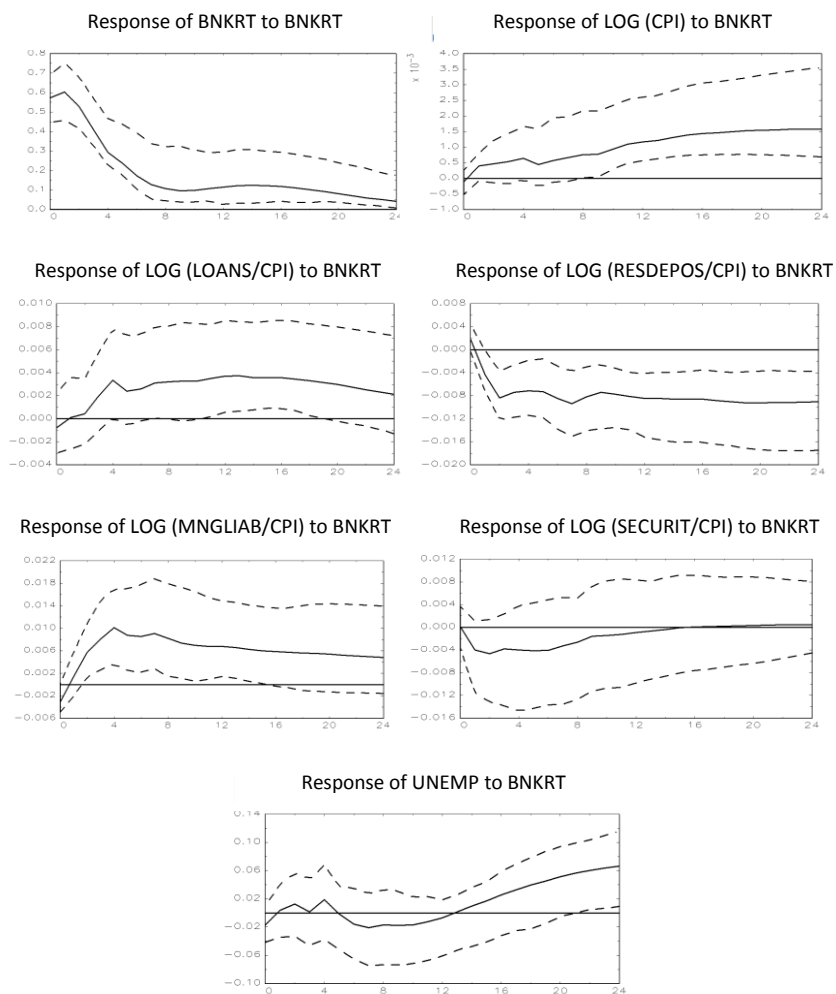


FIGURE 10A: CANADA 1968-1989 (Bernanke and Blinder Updated) – 6 Lags

Response to Cholesky One S.D. Monetary Shock



where:

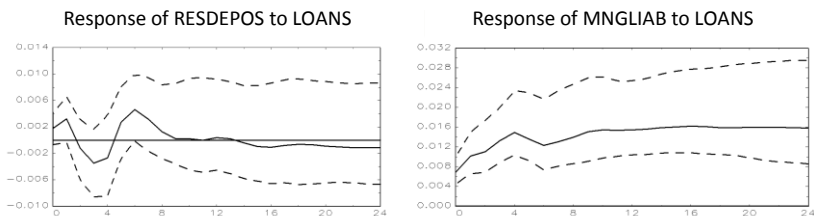
- BNKRT: Bank Rate set by the Bank of Canada.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESDEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Term Deposits.
- SECURIT: Canadian Securities.
- UNEMP: Unemployment Rate.

# of observations	264
# of lags	6

FIGURE 10B:

CANADA 1968 -1989 Response of Liabilities to Loans (Demand Side) – 6 Lags

Response to Cholesky One S.D. Innovations



CANADA 1968 – 1989 Response of Loans to Liabilities (Supply Side) – 6 Lags

Response to Cholesky One S.D. Innovations

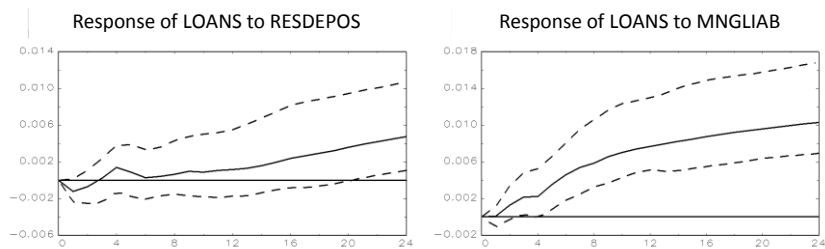
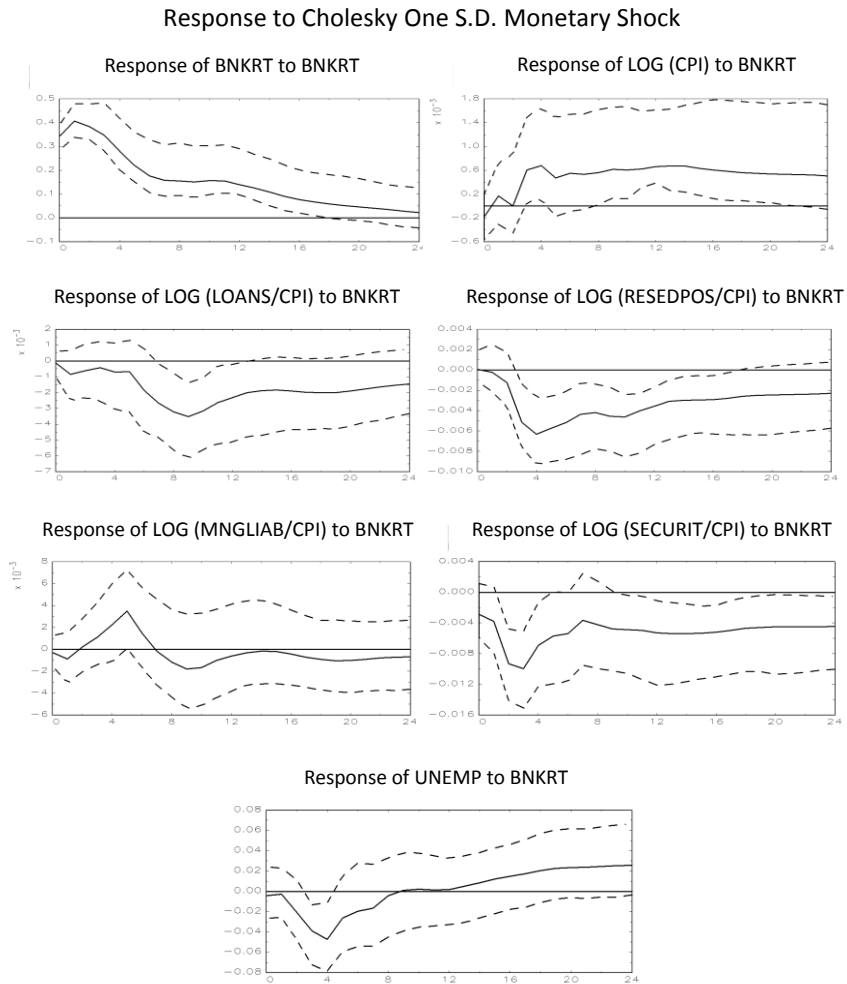


FIGURE 11A: CANADA 1990-2007 (Bernanke and Blinder Updated) – 6 Lags



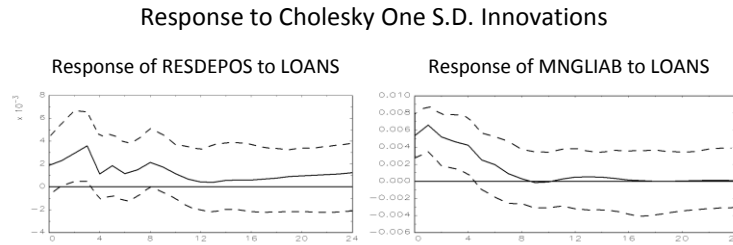
where:

- BNKRT: Bank Rate set by the Bank of Canada.
- CPI: Consumer Price Index.
- LOANS: Total Loans.
- RESEDEPOS: Reservable Deposits (Total Chequable Deposits).
- MNGLIAB: Term Deposits.
- SECURIT: Canadian Securities.
- UNEMP: Unemployment Rate.

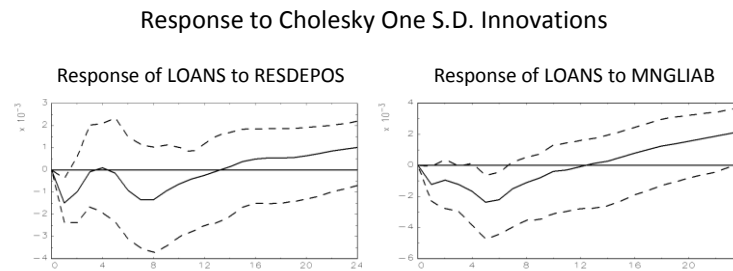
# of observations	210
# of lags	6

FIGURE 11B:

CANADA 1990 -2007 Response of Liabilities to Loans (Demand Side) – 6 Lags



CANADA 1990 – 2007 Response of Loans to Liabilities (Supply Side) – 6 Lags



References

- Bernanke, B.S. and Blinder, A.S., (1992), "The Federal Funds Rate and the Channels of Monetary Transmission", *The American Economic Review*, Vol. 82 No. 4, pp. 901-921.
<http://econ.ucdenver.edu/beckman/econ%206054/bernanke-blinder.pdf>
- Bernanke, B.S., and Gertler, M., (1995), "Inside the Black Box: The Credit Channel of Monetary Policy Transmission", *Journal of Economic Perspectives*, Volume 9, No. 4, pp. 27-48.
http://www.calstatela.edu/faculty/rcastil/ECON_435/Bernanke.pdf
- Bordo, M.D., Redish, A. and Rockoff, H., (2011), "Why Didn't Canada Have a Banking Crisis in 2008 (or in 1930, or in 1907, or...)?", *National Bureau of Economic Research*, Working Paper 17312.
<http://www.nber.org/papers/w17312>
- Borio, C. and Zhu, H., (2008), "Capital Regulation, Risk-Taking and Monetary Policy: A Missing Link in the Transmission Mechanism?", *Bank for International Settlements (BIS) Working Papers*, No. 268.
<http://www.bis.org/publ/work268.pdf>
- Carpenter, S. and Demiralp, S., (2011), "Money, Reserves, and the Transmission of Monetary Policy: Does the Money Multiplier Exist?", *Journal of Macroeconomics*, 34, pp.59-75.
- Cecchetti, S.G., (1995), "Distinguishing Theories of the Monetary Transmission Mechanism", *Federal Reserve Bank of St. Louis Review*, pp. 83-97.
http://research.stlouisfed.org/publications/review/95/05/Distinguishing_May_June1995.pdf
- Cetorelli, N. and Goldberg, L.S., (2008), "Banking Globalization and Monetary Policy", *Federal Reserve Bank of New York Staff Reports*, No.333.
http://www.newyorkfed.org/research/economists/cetorelli/Cetorelli_Goldberg_final.pdf
- Den Haan, W.J., Sumner, S.W. and Yamashiro, G.M., (2008), "Bank Loan Portfolios and the Canadian Monetary Transmission Mechanism".
<http://www.wouterdenhaan.com/papers/bankloanscanada.pdf>
- Disyatat, P., (2008), "Monetary Policy Implementation: Misconceptions and their Consequences", *Bank for International Settlements (BIS) Working Papers*, No 269.
<http://www.bis.org/publ/work269.pdf>
- Gambacorta, L. and Mistrulli, P.E., (2003), "Bank Capital and Lending Behavior: Empirical Evidence for Italy", Banca d'Italia Research Department.
<http://www.bis.org/bcbsevents/wkshop0303/p06gambmis.pdf>

- Kashyap, A.K. and Stein J.C., (2000), "What Do a Million Observations on Banks Say About the Transmission of Monetary Policy?", *The American Economic Review*, Vol. 90 No.3, pp. 407-428.
<https://www.msu.edu/~herrer20/documents/ec831/Kashyap&Stein.pdf>
- Kishan, R.P. and Opiela, T.P., (2000), "Bank Size, Bank Capital, and the Bank Lending Channel", *Journal of Money, Credit and Banking*, Vol. 32 No.1, pp. 121-141.
<http://ejournal.narotama.ac.id/files/Bank%20Size,%20Bank%20Capital,%20and%20the%20Bank%20Lending%20Channel.pdf>
- Lavoie, M. (2005). "Monetary Base Endogeneity and the New Procedures of the Asset-Based Canadian and American Monetary Systems", *Journal of Post Keynesian Economics*, Vol.27 No.4, pp. 689-709.
http://www.economia.unam.mx/amhe/pdfs/conferencia_marc_lavoie_01.pdf
- Lavoie, M., (2010), "Changes in Central Bank Procedures During the Subprime Crisis and their Repercussions on Monetary Theory", *International Journal of Political Economy*, Vol. 39 No.3, pp.3-23.
- Mishkin, F.S. and Serletis, A., (2008), "The Economics of Money, Banking, and Financial Markets", 3rd Canadian Ed., *Pearson Education Canada*.
- Moazzami, B., (1999), "Lending Rate Stickiness and Monetary Transmission Mechanism: The Case of Canada and the United States", *Applied Financial Economics*, 9, pp. 533-538.
- Roldos, J., (2006), "Disintermediation and Monetary Transmission in Canada", *IMF Working Paper*, WP/06/84.
<http://www.imf.org/external/pubs/ft/wp/2006/wp0684.pdf>
- Romer, C.D. and Romer, D.H., (1990), "New Evidence on the Monetary Transmission Mechanism", *Brookings Papers on Economic Activity*, 1:1990, pp. 149-213.
http://www.brookings.edu/~media/Projects/BPEA/1990%201/1990a_bpea_romer_romer_goldfeld_friedman.PDF
- Saidenberg, M.R., and Strahan, P.E., (1999), "Are Banks Still Important for Financing Large Businesses?", *Current Issues in Economics and Finance (FRBNY)*, Vol. 5 No. 12.
http://www.newyorkfed.org/research/current_issues/ci5-12.pdf
- Van den Heuvel, S.J., (2007), "Does Bank Capital Matter for the Transmission of Monetary Policy?", *Economic Policy Review, Federal Reserve Bank of New York*, Vol. 8 No. 1, pp.161-171.
<http://www.newyorkfed.org/research/epr/02v08n1/0205vand.pdf>