**Examining a Contractionary Monetary Policy Shock over Two Regimes**

by

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Abstract

The goal of this thesis is to improve on the work done by Lawrence J. Christiano, Martin Eichenbaum, and Charles Evans in the 1996 article "The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds". In order to do so, proof is provided as to why a continuous sample from 1960:I to 1992:IV is inappropriate when using the Federal funds rate to show how monetary policy shocks affect the liabilities of the nonfinancial business sector. After correcting the data set, performing a vector autoregression and analyzing the output, support for the credit view as the monetary transmission mechanism is shown. Support showing how noncorporate businesses are affected disproportionately by contractionary shocks is also provided.

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# CHAPTER I

## INTRODUCTION

Monetary policy effects are always an important topic in economic research. Interestingly, unlike traffic laws, the way monetary policy affects our lives changes over time. Twenty years from now our economy will look much different than it does today. There will, most likely, be new government officials, new businesses, new global crises, new financial instruments, basically an all around new economy! Everything and everyone all interacting with each other in a different way than they do now. Albeit a very exciting concept, this presents a constant difficulty for the Federal Reserve to obtain a complete knowledge of how to keep our economy stable. Economic stability comes from preventing extraordinary booms or busts from occurring. When the economy slows down too much the Fed will loosen their policy creating a period of expansion,and when the economy accelerates too quickly the Fed will tighten policy in an attempt to slow it down. Tightening policy is of interest here and more formally what defines a contractionary movement in monetary policy stance and how does it affect the nonfinancial business sector of the US economy. It would be interesting to see how the effects of these policy shocks have changed across different regimes as well.

Tight monetary policy is never something businesses look forward to. For the most part, businesses want to do better than what they did last year. Obviously, a business that does worse year on year will eventually dissolve. By definition, a period of contractionary policy makes it more difficult for a business to outperform itself than when the policy was looser. This difficulty can arise from two areas; either the contractionary stance makes loans more expensive or harder to get and therefore more difficult for the firm to operate or the contraction negatively affects consumers who in turn buy less leading to smaller profits for businesses. Either way, firms must adjust their funding habits in order to accommodate the new financial environment and some firms find financial adjustment more difficult than others. Not every firm is created equal and corporate businesses have access to financing options that many noncorporate businesses simply do not. Over the decades, everyone has gotten better at making these transition periods much smoother however. The Federal Reserve has improved its ability to stabilize economic growth, firms have improved their ability to fiscally stabilize, and banks have improved their financing capabilities.

The catalyst for and primary literature used in the formation of this research is the 1996 article "The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds" by Lawrence J. Christiano, Martin Eichenbaum, and Charles Evans published in *The Review of Economics and Statistics*. In this article the authors use vector autoregression (VAR) and data from the Flow of Funds to "assess the impact of a monetary policy shock on the borrowing and lending activities of different sectors of the economy (Christiano, Eichenbaum, and Evans, 1996, p. 16)". The two exogenous measures to monetary policy they use are shocks to the Federal funds rate and shocks to nonborrowed reserves while the data they use is quarterly and spans from 1960:I to 1992:IV. One of the main arguments of this research is to prove that the use of a continuous data set over this time period is inappropriate.

In the literature review section, we will discuss the formation of two subsamples from a continuous 1960-2005 data set. Through a narrative and statistical research we will explain why the 1960-2005 time span must be separated and where the separation should occur. Ben S.

Bernanke and Ilian Milhov (1998) provide an analysis of this separation and despite the differences between the two subsamples there is one indicator of monetary policy that can be applied to both.

Next, we will cover why using the Federal funds rate is a good indicator of monetary policy. To accomplish this we will go into three points supported by Ben S. Bernanke and Alan S. Blinder (1992). The three points are (i) the Federal funds rate is a good reduced-form indicator of real economic variables, (ii) the Federal funds rate correctly reflects the Federal Reserve's perception about the state of the economy, and (iii) the Federal funds rate affects reserve supply and not the other way around. Since Bernanke and Blinder make this support for only the pre-1979 period, the article by Bernanke and Milhov will be used to show support for the post-1983 period.

Lastly, a review of the different monetary transmission mechanisms is presented. Both the money view and credit view are explained. Although the money view is not used to interpret the data, it is the most traditional view and lays a solid framework for understanding the opposing, more modern credit view. Details on the two theories within the credit view, the lending channel and the balance sheet channel, are given along with some support made for and against their use.

In chapter III, we consider the formation of the theoretical and empirical model used to capture the structural response of our system to a shock in the Federal funds rate. First, support for utilizing the vector autoregression is provided along with how a structural vector autoregression (SVAR) model can help capture the dynamic structural responses of variables in our system to shocks in the Federal funds rate. Development and support of the theoretical and empirical models follows. The intent of this chapter is to provide a reasonable model for how the economy is affected by policy shocks and some assumptions are given in order to enable a clearer interpretation of the output.

Chapter IV covers the composition of the data. Here, information is given on where data for all the variables comes from. This information includes frequency, conversions, and locations of the variables in the Flow of Funds Account.

Analysis and interpretation of the output is presented in chapter V titled The Results. After all the data is run through the model developed, we begin comparing output from the nonfinancial business sector as a whole. The observations and comparisons made here allow insight into the reactions of liabilities issued by the whole business sector not including financial institutions. Next, we focus our attention to the corporate and noncorporate sectors separately. For the most part, comparisons made between these two sectors will assume that the corporate sector houses "bigger businesses" than that of the noncorporate sector. This distinction will be utilized in order to enhance the argument that the negative effects of contractionary policy are distributed disproportionately throughout the economy.

Chapter VI is the output and graphs are numbered to allow referencing from the results section. A legend for the titles used for the variables is provided in the data section.
A conclusion is found in chapter VII. The theory and empirical results are tied together here. The research performed in this thesis looks deeper into the nonfinancial business sector and how contractionary shocks to the federal funds rate affect the nonfinancial business sector as a whole as well as how they affect the nonfarm corporate business and noncorporate business separately over two subsample periods.

# CHAPTER II

## LITERATURE REVIEW

Using two sample periods in regard to testing a data set spanning from 1960 to 2005 is important. Over this time span there have been five different Federal Reserve chairmen. Starting with the earliest, their names are William M. Martin, Arthur Burns, G. William Miller, Paul Volker and Alan Greenspan. Literature pertaining to breaking up this time period into two separate samples gives credence to the fact that a separation is necessary for clearer results because of distinguishing characteristics that differentiate two regimes.

In the 2000 publication "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory", Richard Clarida, Jordi Gali, and Mark Gertler begin by "demonstrating how there has been a significant difference in the way monetary policy has been conducted pre- and post-1979" (p. 148). This year is the exact same year that Paul Volker became Fed Chairman. When Volker entered as Chairman there was a huge problem with inflation in many industrialized economies around the world including the US economy (Benjamin Friedman and Kenneth Kuttner, 1996) which was reaching roughly a 10 percent inflation rate. This incredibly high rate was partly due to that fact that before Volker took office his predecessors were highly accommodative towards inflation by allowing real short-term interest rates to decline while expected inflation rose (Clarida, Gali and Gertler, 2000). Even though Volker's predecessors, namely Martin, Burns, and Miller, did raise nominal rates they typically did so by an amount less than expected inflation resulting in an even greater devaluation of the dollar. Monetary policy behaviors like these created great economic instability in the pre-Volker period. This instability was characterized by bursts of inflation and output because of the accommodating short-term interest rates. As inflation expectation would rise, individuals could correctly anticipate that the Federal Reserve would let short-term rates decline “which in turn stimulate[d] the rise in aggregate demand and inflation” (Clarida, Gali and Gertler, 2000, p.149). Noticing that inflation was becoming out of control, Congress passed Concurrent Resolution 133 in 1975 which required the Fed to have money growth targets and in 1979 the Fed “publicly declared that it had intensified its dedication to controlling money growth” (Friedman and Kuttner, 1996, p. 79). This leads us back to the period of Paul Volker and Alan Greenspan who chaired the Board of Governors during a period which, described by Clarida, Gali and Gertler, “many economists agree that monetary policy [was] well managed” (p. 148). In comparison to the pre-Volker period, the Volker-Greenspan era did well to head off changes in expected inflation by adjusting the interest rate in a sufficient manner. By making the appropriate adjustments to monetary policy, Volker and Greenspan were able to better mitigate the impact of fundamental shocks to the economy and subsequently create a more stable economic environment.

To properly separate the 1960 to 2005 period without exerting bias it is necessary to have some statistical facts as to why the subsamples are consistent within themselves, otherwise it’s just turning one inappropriately continuous sample into two. Clarida, Gali, and Gertler conduct research on subsample stability and using the General Method of Moments find that in the pre-Volker period there is no significant difference across chairmen as to the values for an inflation target or response to changes in expected inflation. The same test was done for the Volker-Greenspan era and just like the pre-Volker sample, their procedure found no difference in the values for an inflation target or response to changes in expected inflation. Although one significant difference in the Volker-Greenspan era should be noted.Clarida, Gali and Gertler found an increase in the degree of smoothing of interest rate changes under Greenspan. In other words, under Greenspan, changes in the interest rate from one period to the next are much less dramatic that under Volker.

As was stated above, when Paul Volker became chairman there was a huge problem with inflation in the US economy. To combat this problem, Volker induced a “sharp, one-shot disinflation episode” (Clarida, Gali, and Gertler, 2000, p. 163) as the Federal funds rate reached over 20 percent, “which brought inflation down from roughly 10 percent in 1980 to 4 percent in 1983” (Clarida, Gali, and Gertler, 2000, p. 163). Also during the early years of Chairman Volker, it has been announced by the Federal Reserve that their operating procedures involved targeting nonborrowed reserves instead of the previously targeted Federal funds rate. The remarkable disinflation episode and nonborrowed reserves targeting spanned over the period 1974:IV to 1982:IV which brings about the final adjustment to the data set. Omitting the aforementioned time period from the data set brings about two enhancements to the research of this thesis. First, an omission of this time period allows the data for the Volker-Greenspan era to be unaffected by those extraordinary occurrences and therefore increasing subsample stability. Second, Bernanke and Milhov (1998) conclude that using just one policy indicator for the entire sample presented is not justified. In their 1998 article "Measuring Monetary Policy", Bernanke and Milhov find extremely strong evidence of there having been two regime switches occurring around 1979:III and 1982:III. These dates happen to coincide with the conventional beginning and end dates of what is known as the “Volker experiment” or the period of time when nonborrowed reserves were targeted. Omitting the time between 1979:III and 1982:III yields two quantitatively and qualitatively even data sets where one relatively clean measure of monetary policy shocks, namely the Federal funds rate, can be used. Bernanke and Milhov (1998) go on to say that "given these [monetary policy] shocks, standard impulse response functions can be used to provide a quantitative measure of the dynamic effects of policy changes on the economy" (p. 892).

When the Federal Reserve adjusts their monetary policy they do so after interpreting an enormous amount of data. The job of the Fed is not to only change one specific mechanism they have in controlling the monetary base but to tweak several if not all of the controls at their disposal. Over the past 20 years several economists have created ingenious variables in attempts to best illustrate the stance of monetary policy and the magnitude of that stance. One of the most frequently utilized econometric tools incorporated in the use of these variables is vector autoregression which allows one to determine how shocks in the stance of monetary policy affects different areas of the US economy. From nonborrowed reserves to Strongin's measure and from the use of commercial paper in rate spreads to ratios, economists have researched a variety of different methods to better understand what the Federal Reserve is doing and to what degree that affects the US economy. However, the measurement that has stood as the most generally used variable for monetary policy stance, if not the benchmark by which all the other variables are tested, is the Federal funds rate.

Many of the ideas on why the Federal funds rate is chosen as the indicator for monetary policy stance and the channel by which the funds rate affects the economy in this thesis comes from "The Federal Funds Rate and the Channels of Monetary Transmission" by Ben Bernanke and Alan Blinder in 1992. In this article all of their arguments are based on using the Federal funds rate as the measurement of policy stance before 1979. For more information about its use after 1979, the literature review will turn to Bernanke and Milhov (1998) and Christina D. Romer and David H. Romer (2004).

Bernanke and Blinder start off by supporting the statement that "if the funds rate is a measure of policy and if policy affects the real economy then the funds rate should be a good reduced-form predictor of major macroeconomic variables" (p. 903).

A battery of tests are run in support of this statement. The first being a Granger-causality test which is a technique for determining if one time series is useful in forecasting another. Here Bernanke and Blinder show that among M1, M2, the three-month Treasury bill rate, and the ten-year government bond rate the Federal funds rate is by far the most superior in predicting all of the macroeconomic variables considered. Industrial production, unemployment rate, retail sales and consumption are just a few of the macroeconomic variables.

Next, they measure the predictive power by "[constructing a] VAR with orthogonalized residuals (p. 906)" with the percentage of the variance of the forecasted variable displayed. The results from this test were not as striking as in the Granger-causality test nonetheless Bernanke and Blinder could still "strongly support the view that the Federal funds rate is an informative variable (p. 907)".

Finally, the authors go on to perform the same series of tests against the predictive power of an interest-rate-based variable created by taking the spread between the six-month commercial paper rate and the six-month Treasury bill rate (denoted as CPBILL). Much of the work done supporting the predictive power of this indicator was done by Stock and Watson (1989). After running the same Granger-causality and VAR analysis, Bernanke and Blinder find that although CPBILL outperformed Federal funds rate in the Granger-causality test, the Federal funds rate carried more information in the VAR analysis especially when placed ahead of CPBILL. They go on to further interpret these results by pointing out that CPBILL "tends to rise most sharply during Fed-induced 'credit crunches' (p. 910)", so:

> "if the Federal funds rate is a measure of monetary policy and that monetary policy works largely by inducing 'credit crunches,' whose occurrences are sensitively recorded in CPBILL. Then the Federal funds rate should lose its marginal forecasting power in regressions that contain CPBILL because the latter already captures the impact of monetary policy. At the same time, however, the Federal funds rate should remain informative in a variance-decomposition sense, because it is the most direct indicator of Federal Reserve policy (Bernanke and Blinder, 1992, p. 910).

The second statement Bernanke and Blinder support deals with the assumption that if Federal funds rate was a good measurement of monetary policy then it should correctly reflect the Fed's perception about the state of the economy. To support this idea they estimate policy reaction functions using the following equation:

$$(1)\ \mathbf{P}_t = \mathbf{D}_0\mathbf{Y}_t + \mathbf{D}_1\mathbf{Y}_{t-1} + \mathbf{GP}_{t-1} + \mathbf{v}_t$$

where **Y** is a vector of nonpolicy variables, **P** is a vector of policy variables, and **v** is the orthogonal disturbance. When administering the VAR test, the authors place the unemployment rate and inflation rate after the policy variable in the ordering to determine the response of the Federal funds rate against state of the economy variables. The results are reasonable as unemployment shocks push the funds rate down and inflation shocks drive the funds rate up. Another experiment was run using a latent-variable measure of the Fed's policy explored by Robert B. Avery (1979). Latent variable measurement is beyond the scope of this paper due to its length and difficulty; however, the result yields an important assessment. Conducting the test over the pre-1979 period showed that the Federal funds rate is a reasonable measurement of the Fed's policy stance before 1979. Indeed this result is also supported in Bernanke and Milhov (1998).

The last point Bernanke and Blinder support relates to their position that Federal funds rate affects the supply of reserves and therefore is a good predictor of movement in the economy. On the other hand, "the funds rate would not be a good measure of monetary policy if its information content stemmed from shocks to reserve demand (Bernanke and Blinder, 1992, p. 914)". Using the equation,

$$(2)\quad \mathbf{Y}_t = \mathbf{B}_0\mathbf{Y}_t + \mathbf{B}_1\mathbf{Y}_{t-1} + \mathbf{C}_0\mathbf{P}_t + \mathbf{C}_1\mathbf{P}_{t-1} + \mathbf{u}_t$$

in conjunction with equation (1) they can convert this system into a standard VAR. Before doing so they first make the assumption that policy shocks are contemporaneously unaffected by economic disturbances implying that there is no feedback from the economy to policy actions within the same period. This assumption is exemplified by setting $\mathbf{D}_0 = \mathbf{0}$. Substituting (1) into (2) Bernanke and Blinder obtain:

$$(3)\quad \mathbf{P}_t = \mathbf{D}_1\mathbf{Y}_{t-1} + \mathbf{G}\mathbf{P}_{t-1} + \mathbf{v}_t$$

$$(4)\quad \mathbf{Y}_t = (\mathbf{I} - \mathbf{B}_0)^{-1}[(\mathbf{B}_1 + \mathbf{C}_0\mathbf{D}_1)\mathbf{Y}_{t-1} + (\mathbf{C}_0\mathbf{G} + \mathbf{C}_1)\mathbf{P}_{t-1} + \mathbf{u}_t + \mathbf{C}_0\mathbf{v}_t]$$

While these equations are utilized by the authors in order to prove their point in the case of required and nonborrowed reserves they also provide an alternative identifying assumption that will be used by this thesis later in the modeling process which incorporates the idea that contemporaneous policy variables do not enter equation (2) and therefore $\mathbf{C}_0 = \mathbf{0}$. Simply put, policy actions can affect real variables but with a lag. With the adjustments made, the equations look like:

$$(5)\quad \mathbf{Y}_t = (\mathbf{I} - \mathbf{B}_0)^{-1}[(\mathbf{B}_1\mathbf{Y}_{t-1} + \mathbf{C}_1\mathbf{P}_{t-1} + \mathbf{u}_t]$$

$$(6)\quad \mathbf{P}_t = (\mathbf{D}_1 + \mathbf{D}_0(\mathbf{I} - \mathbf{B}_0)^{-1}\mathbf{B}_1)\mathbf{Y}_{t-1} + (\mathbf{G} + \mathbf{D}_0(\mathbf{I} - \mathbf{B}_0)^{-1}\mathbf{C}_1)\mathbf{P}_{t-1} + \mathbf{v}_t + \mathbf{D}_0(\mathbf{I} - \mathbf{B}_0)^{-1}\mathbf{u}_t$$

making it easy to see that $\mathbf{P}_t$ is also now affected by contemporaneous macro shocks $\mathbf{u}_t$. "Put differently, any contemporaneous correlation between the VAR disturbance to the policy variable and the indicator of aggregate production is assumed to reflect causation from production to the policy variable (Christiano, Eichenbaum, and Evans, 1998, p. 18)."

To check and see if shocks to required or nonborrowed reserves contemporaneously affected the Federal funds rate, Bernanke and Blinder ran a VAR on weekly data, and as they predicted both of the reserve variables were almost completely uncorrelated with innovation in the funds rate before 1979. "This is consistent with the view that the Fed was targeting the funds rate during the pre-Volker period (Bernanke and Blinder, 1992, p. 917)."

For an analysis supporting the use of the Federal funds rate as a measurement of monetary policy post-Volker, the article aptly titled "Measuring Monetary Policy" by Bernanke and Milhov in 1998 provides tremendous insight. Bernanke and Milhov state that they "develop and implement a general, VAR-based methodology in which the indicator of monetary policy stance is not assumed but rather is derived from an estimated model of the central bank's operating procedure (Bernanke and Milhov, 1998, p. 872)."

The VAR-based methodology they refer to starts off with the same two equation strategy presented in Bernanke and Blinder by using equations (1) and (2) and applying the identifying assumptions made in the "alternative approach" where $\mathbf{C}_0 = \mathbf{0}$. Some of the econometric tools used in their models and strategies further in the article are beyond the scope of this thesis, and presenting them would add very little in the way of augmenting points made in the modeling or results later on; however, the conclusion from these methods is vastly important. Following their application of what Bernanke and Milhov term as a "semi-structural VAR (p. 872)" approach, they come to the conclusion that "for practitioners looking for a simple indicator of policy stance (p. 899)", their results reveal that using the Federal funds rate prior to 1979 and after 1982 will give reasonable results. In additional support of this finding Romer and Romer (2004) state that an interest rate measure is more likely to be consistent over time than other candidates, whereas quantity variables such as reserves or monetary aggregates may reflect very different intentions even in nearby periods.

So far the support presented has shown that the funds rate is capable of being a highly reasonable candidate for the measurement of monetary policy stance. Although in both Bernanke and Milhov (1998) and in Romer and Romer (2004) they present evidence that their findings have revealed even more appropriate variables for this measurement. These new findings might be more appropriate, and are certainly argued forcefully, but for the use of this thesis the Federal funds rate is a much more suitable tool. This claim is based on the correlation between the Federal funds rate and the transmission mechanism through which the variables in this thesis are affected.

In order to clarify the point that the Federal funds rate affects business sector financing differently across firm types and across time periods, it is essential to present a reasonable assumption for how this transmission mechanism works. First, it must be said that for the purposes of this research a mechanism that describes how monetary policy affects real GDP is not of importance. The intent here is to define mechanisms which make clear reasons for how monetary policy affects loans for corporate and noncorporate businesses differently.

The traditional money view "attributes the force of policy entirely to change in the money supply, which changes interest rates and spending in turn" (Morgan, 1998, p.102). According to this view, whether or not policy has an effect on the reorganization of financial portfolios is irrelevant, because of the assumption of a perfect financial market. This means that all funds maintain perfect substitutability. Well received literature has argued against the idea that all funds are perfect substitutes. Ben Bernanke and Mark Gertler (1995), Bernanke and Blinder (1998), and Donald Morgan (1998) all prove the presence of credit effects in the transmission mechanism and show that information problems (Anil K. Kashyap, Jeremy C. Stein, and David W. Wilcox, 1991) in financial markets generate two additional credit channels known as the "lending channel" and the "balance sheet channel".

Morgan states that "monetary policy will operate through a lending channel if changes in policy affect the supply of bank loans and if some borrowers depend on banks for credit" (p. 104). If bank-dependent borrowers are indeed a reality then bank loans for small firms would increase during a monetary contraction. Even though the heightened funds rate would cause bank loans to become more expensive they would still be relatively inexpensive as compared to other forms of external finance available to them because of information problems in financial markets. Many non-bank-dependent, large firms have access to alternative forms of financing and can issue debt at a less expensive rate than that of bank loans. Less expensive loans include instruments like commercial loans which are documented to increase during periods of monetary stringency (Kashyap, Stein, and Wilcox, 1991).

Balance sheet mechanisms work through broader credit effects. As monetary policy tightens, balance sheets begin to deteriorate as cash flow decreases for borrowers with short-term or variable-rate debt (Morgan, 1998). In turn, reduced cash flow leads to more borrowing which raises the premium on external funds and further amplifies the negative effect on spending. Effects felt from this concept are distributed among small and large firms more equally than the lending channel. In periods of tight policy businesses as a whole have reduced cash flows.

Both of the credit channels will be used in the analysis of output in the results section. The lending view has some conjectures about its statistical significance. Adam B. Ashcraft (2003) argues against the lending view by first distinguishing between two types of banks. There are small, stand-alone, illiquid banks and large, affiliated, liquid ones. Whereas the loan growth of small banks falls by one percentage point to a one percentage point increase in the Federal funds rate, Ashcraft shows that large bank loan growth is almost unaffected. He goes on to conclude that bank loans are not special enough to be an important part of the transmission mechanism because the elasticity of real output to loan supply is small. However, Ashcraft does agree with the fact that monetary policy affects aggregate bank lending and for our purposes the response of output is not under scrutiny. It is the composition of the debt portfolios of businesses that is under consideration.

Patrick Bolton and Xavier Freixas (2006) focus their article on making improvements to the lending channel. Their model of corporate finance takes a deeper look at what distinguishes bank debt from corporate bond financing. Flexibility of the two modes of financing is the difference where bank loans are easier to restructure but there is an endogenous price to this flexibility. "Firms with higher default risk are willing to pay this intermediation cost (Bolton and Freixas, 2006, p.831)" but just as the demand for bank debt increases it is offset by a decrease in bank lending. This increase in demand and decrease in supply leads to a crowding out of the riskier firms. Smaller, riskier firms therefore bear the brunt of policy tightening and normally they are the most bank-dependent. Firms with little default risk and access to the corporate bond market will shift away from bank loans to bonds as they find bonds to be less costly. Gertler and Gilchrist (1993) and Morgan (1998) both agree that smaller, bank-dependent firms are the ones that are affected the most by contractionary monetary policy and disproportionately so.

# CHAPTER III

# THE MODEL

Works discussed in the literature review section provide insight for why choosing the Federal funds rate is used as the measure of monetary policy stance, separating the data into two data sets is appropriate, and how monetary policy affects the liability portfolio of nonfinancial businesses. In most of the literature reviewed, the econometric tool used to discover the influence policy shocks have on other variables is vector autoregression. This section aims at showing why vector autoregression is used and what variable ordering is suitable. A theoretical and empirical model will also be provided.

## A. Structural Vector Autoregression

A structural vector autoregressive (henceforth SVAR) model is built off of a simpler vector autoregressive (henceforth VAR) model but with some identifying assumptions to help with the interpretation of the variance-covariance matrix. Without the addition of these identifying assumptions the noise terms in $\boldsymbol{\varepsilon}_t$ will be mutually correlated making the interpretation of the dynamic responses by the variable of interest very difficult if not impossible.

The mathematical setup for a VAR is

$$(7)\quad \mathbf{Y}_t = \mathbf{B}_1\mathbf{Y}_{t-1} + \mathbf{B}_2\mathbf{Y}_{t-2} + \cdot\cdot\cdot + \mathbf{B}_p\mathbf{Y}_{t-p} + \boldsymbol{\varepsilon}_{t,}$$

where $\mathbf{Y}_t$ and $\boldsymbol{\varepsilon}_t$ are vectors and the **B**s are $k \times k$ matricies. The variance-covariance matrix can be obtained by

$$(8)\quad E\boldsymbol{\varepsilon}_t\boldsymbol{\varepsilon}_t' = \Sigma.$$

The problem with the mutually correlated noise terms can be resolved by forming the following SVAR process:

$$(9)\mathbf{A}_0\mathbf{Y}_t = \mathbf{A}_1\mathbf{Y}_{t-1} + \mathbf{A}_2\mathbf{Y}_{t-2} + \cdot\cdot\cdot + \mathbf{A}_p\mathbf{Y}_{t-p} + \mathbf{u}_{t,}$$

where

$$(10)E\mathbf{u}_t\mathbf{u}_t' = \mathrm{I}$$

and $\mathbf{A}_0$ is a $k$ *x* $k$ matrix that describes the contemporaneous relations between the $k$ variables in the model. The assumption in (10) enables the formulation of meaningful economic interpretations.

After applying lag polynomials to (9) and pre-multiplying both sides of the equation by $\mathbf{A}_0^{-1}$the following equation is obtained:

$$(11)\mathbf{Y}_t = \mathbf{A}_0^{-1}\mathbf{A}_1\mathbf{Y}_{t-1} + \cdot\cdot\cdot + \mathbf{A}_0^{-1}\mathbf{A}_p\mathrm{Y}_{t-p} + \mathbf{A}_0^{-1}\mathbf{u}_t,$$

where

$$(12)\mathbf{A}_0^{-1}\mathbf{u}_t = \boldsymbol{\varepsilon}_t\ .$$

It is now possible to estimate the **B**s and Σ using an equation-by-equation least squares method; however, to fully describe (9) we need to identify $\mathbf{A}_0$ by applying some short-run assumptions. Turning to the methodology Christoper A. Sims proposes in 1980, identifying $\mathbf{A}_0$ relies on the Choleski decomposition of Σ.

First, it is necessary to formulate a reasonable assumption about the contemporaneous impact of the variables under investigation. If the assumption is made, for instance, that a policy variable affects a real variable only with a lag then placing the policy variable after the real one in the ordering of the $\mathbf{Y}_t$ vector will cause the $\mathbf{A}_0$ matrix to be lower triangular. The same goes for the $\mathbf{A}_0^{-1}$matrix.

From equations (8), (10) and (12),

$$(13)\quad \mathbf{A}_0^{-1}\mathbf{A}_0^{-1\prime} = \Sigma$$

can be inferred, and by exploiting the fact from Choleski decomposition that a symmetric and positive semidefinite matrix is unique it follows that since $\Sigma = \mathbf{PP}'$ then $\mathbf{P}^{-1} = \mathbf{A}_0$ . With the identification of $\mathbf{A}_0$ known and the estimation of the $\mathbf{B}$s and $\Sigma$ found by the least squares method, the recursive substitution of a VAR process will yield $\mathbf{B}_1^j\mathbf{Pu}_t$. That is, the impulse-response function of $\mathbf{Y}_{t+j}$ is $\Psi_j = \mathbf{B}_1^j\mathbf{P}$.

The variables always nested in $\mathbf{Y}_t$ for the purposes of this research are log real GDP (RGDP), log of the GDP deflator (DEF), log of the index of commodity prices (PCOM), Federal funds rate (FFR), minus the log of nonborrowed reserves (NBR), log of total reserves (TRES), and some other additional variable (X). Minus the log of nonborrowed reserves is used instead of the log of nonborrowed reserves to facilitate comparisons between the results of this research and that of Christiano, Eichenbaum, and Evans (1996). With the Federal funds rate being specified as the policy variable, the estimated responses in $\mathbf{u}_t$ are found using the following ordering of the variables in

$$(14)\quad \mathbf{Y}_t: [RGDP_t, DEF_t, PCOM_t, FFR_t, NBR_t, TRES_t, X_t].$$

Ordering similar to the one implemented in this VAR is used and supported in the research of Christiano, Eichenbaum, and Evans (1996), Romer and Romer (2004), and Bernanke and Milhov (1998). On one occasion the ordering is adjusted, placing the unemployment rate (UNEMP) in front of the policy variable because it is deemed as being an indicator of aggregate production activity. Using Sims (1980) methodology, the lower triangular matrix of $\mathbf{P}$ implies that FFR has no contemporaneous effect on RGDP, DEF, PCOM, or UNEMP. Positive shocks to FFR are interpreted as being contractionary monetary policy movements and the dynamic responses to these shocks are reported in the output section.

B. Theoretical and Empirical Model

Some modeling of how the economy works is needed to take the reduced-form responses to monetary policy shocks as the correct measurement of dynamic structural effects from a contractionary change. Thinking about how the Federal Reserve constructs policy can provide some basic intuition. When the Federal Open Market Committee meets they are given information about the state of the economy. Since the development of computers and electronic messaging, it is not inconceivable to think that the Fed has access to up to the minute information. Therefore, it is reasonable to believe that contemporaneous macroeconomic shocks have some bearing on policy design. Those within period effects only work in one direction however as it is widely accepted that there is a time lag between policy implementation and the effect on real variables. Applying these two simple notions, a rough model of policy formulation can be constructed.

Christiano, Eichenbaum, and Evans (1996) identify a policy shock similar to the following regression equation:

$$(15)\quad p_t = \Psi(\boldsymbol{\Omega}_t) + \sigma\boldsymbol{\varepsilon}_{st}$$

Here they define $p_t$ as the Federal funds rate while $\boldsymbol{\Omega}_t$ is the set of information available to the FOMC and is a linear function as denoted by $\Psi$. The exogenous policy shock $\boldsymbol{\varepsilon}_{st}$ is assumed to be orthogonal to the elements of $\boldsymbol{\Omega}_t$. This assumption supports the idea that changes in policy have no effect on the real economic variables in $\boldsymbol{\Omega}_t$ within the same period. Also, $\boldsymbol{\varepsilon}_{st}$ reflects the assumption that random factors not included in $\boldsymbol{\Omega}_t$ effect policy decisions, such as the "personalities and intellectual predilections of policy-makers, politics, data errors and revisions, and various technical problems (Bernanke and Milhov, 1998, p. 874)."   To further extrapolate on this model, Bernanke and Milhov (1998) develop the following equations for representing the "true" economic structure:

$$(16)\quad \mathbf{Y}_t = \Sigma^k_{i=0}\mathbf{B}_i\mathbf{Y}_{t-i} + \Sigma^k_{i=0}\mathbf{C}_i p_{t-i} + \mathbf{A}^y\mathbf{v}_t^y$$

$$(17)\quad p_t = \Sigma^k_{i=0}\mathbf{D}_i\mathbf{Y}_{t-i} + \Sigma^k_{i=0}\,\mathbf{g}_i p_{t-i} + \upsilon^p{}_t$$

Equation (16) shows how real macroeconomic variables at time t are a linear function of present and past values of themselves ($\Sigma^k_{i=0}\mathbf{B}_i\mathbf{Y}_{t-i}$), the Federal funds rate ($\Sigma^k_{i=0}\mathbf{C}_i p_{t-i}$), and mutually, uncorrelated structural error terms ($\mathbf{v}_t^y$).  This equation is unrestricted and in order to match the assumptions made above, implementing the restriction that $\mathbf{C}_0 = 0$ causes policy shocks to not influence the macro variables contemporaneously.  Equation (17) displays the linear equation for policy construction.  Another assumption made, however not a restriction, is the fact that $\upsilon^p{}_t$ is uncorrelated with the elements of $\mathbf{v}_t^y$.  Bernanke and Milhov (1998) believe this to be more definitional assuming that "independence from contemporaneous economic conditions as part of the definition of an exogenous policy shock (p. 874)."  This is not to say that contemporaneous economic conditions don't come into play as affecting policy design.  In the model section it was shown that combining equations (16) and (17), or in the literature review section equations (3) and (4), allows current period macro shocks to affect the Federal funds rate shown here:

$$(18)\quad \mathbf{P}_t = (\mathbf{D}_1 + \mathbf{D}_0(\mathbf{I} - \mathbf{B}_0)^{-1}\mathbf{B}_1)\mathbf{Y}_{t-1} + (\mathbf{G} + \mathbf{D}_0(\mathbf{I} - \mathbf{B}_0)^{-1}\mathbf{C}_1)\mathbf{P}_{t-1} + \mathbf{v}_t + \mathbf{D}_0(\mathbf{I} - \mathbf{B}_0)^{-1}\mathbf{u}_t$$

where the $\mathbf{u}_t = \mathbf{v}_t^y$ in this case.  Bernanke and Milhov go on to make the following statement:

> "Estimation of the resulting system by standard VAR methods, followed by a Choleski decomposition of the covariance matrix (with the policy variable ordered last) yields an estimated series for the exogenous policy shock $\upsilon^p$.

Impulse response functions for all the variables in the system with respect to the policy shock can then be calculated and can be interpreted as the true structural responses to policy shocks." (Bernanke and Milhov, 1998, p.874)

Knowing that the model is a reasonable method for policy design and the restrictions enable the results to correctly reflect the true dynamic responses of the economy, running the data through the model will allow proper and appropriate interpretations. Provided below is an example of the SVAR used in this thesis. For the $X_t$ term in the example, nonfinancial business liabilities, BLIAB, is used. The structure of this equation is consistent throughout all the variables used, with the exception of unemployment which was once again placed ahead of the Federal funds rate.

$$(19)\quad \begin{bmatrix} RGDP_t \\ DEF_t \\ PCOM_t \\ FFR_t \\ NBR_t \\ TRES_t \\ BLIAB_t \end{bmatrix} = \boldsymbol{B_0}\begin{bmatrix} RGDP_t \\ DEF_t \\ PCOM_t \\ FFR_t \\ NBR_t \\ TRES_t \\ BLIAB_t \end{bmatrix} + \boldsymbol{B_1}\begin{bmatrix} RGDP_{t-1} \\ DEF_{t-1} \\ PCOM_{t-1} \\ FFR_{t-1} \\ NBR_{t-1} \\ TRES_{t-1} \\ BLIAB_{t-1} \end{bmatrix} + \boldsymbol{B_2}\begin{bmatrix} RGDP_{t-2} \\ DEF_{t-2} \\ PCOM_{t-2} \\ FFR_{t-2} \\ NBR_{t-2} \\ TRES_{t-2} \\ BLIAB_{t-2} \end{bmatrix} + \boldsymbol{B_3}\begin{bmatrix} RGDP_{t-3} \\ DEF_{t-3} \\ PCOM_{t-3} \\ FFR_{t-3} \\ NBR_{t-3} \\ TRES_{t-3} \\ BLIAB_{t-3} \end{bmatrix} +$$

$$\boldsymbol{B_4}\begin{bmatrix} RGDP_{t-4} \\ DEF_{t-4} \\ PCOM_{t-4} \\ FFR_{t-4} \\ NBR_{t-4} \\ TRES_{t-4} \\ BLIAB_{t-4} \end{bmatrix} + \mathbf{C_1}FFR_{t-1} + \boldsymbol{C_2}FFR_{t-2} + \boldsymbol{C_3}FFR_{t-3} + \boldsymbol{C_4}FFR_{t-4} + \mathbf{A}^y\mathbf{v}_{\boldsymbol{t}}^{\boldsymbol{y}}$$

$RGDP_t$, $DEF_t$, $PCOM_t$, $FFR_t$, $NBR_t$, and $TRES_t$ are time series with a constant term but without trend.

# CHAPTER IV

# THE DATA

The inspiration for much of this data came from "The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds" by Christiano, Eichenbaum and Evans. A quarterly frequency was applied to this data and was collected from either the FRED® database or the 2010 Flow of Funds Account issued by the Federal Reserve. The time periods chosen for the data sets are 1960:I to 1979:III and 1983:I to 2005:IV giving them 79 and 92 observations, respectively. For more accurate output, all of the data, except for the Federal funds rate, is either adjusted into 2005 dollars using the GDP deflator or turned into a level variable by using natural logs. All of the data is seasonally adjusted except for commodity prices which was not available. Most of the data taken from the FRED® database pertains to broad economic data. This includes real GDP, GDP deflator, commodity prices, Federal funds rate, nonborrowed reserves, total reserves, and unemployment. One variable that may not fall under the term of "broad" but still collected from the FRED® database is corporate profits. All of these except unemployment and corporate profits are used in every empirical analysis. Further information as to why the use of this strategy is discussed in the model section. Also, all of the aforementioned variables were transformed to natural logs in order to mitigate the influence their trend plays in determining the output. Corporate profits were transformed into 2005 dollars.

Flow of Funds Account data is collected in a way to illustrate a breakdown of the nonfinancial business liabilities category. Since the primary focus is to observe the response of liabilities to interest rate shocks, a clear picture as to what specific categories of liabilities are affected is instrumental in assessing the overall transmission of a contractionary policy stance. The following legend is provided to better understand the composition of each variable taken from the Flow of Funds Account (FOFA) and where they can be located for future reference. The variables have similar nomenclature so in an effort to decrease length the nonfinancial business variables, located in table F.101 of the FOFA, will be discussed in detail while the others can be inferred. Every variable listed below represents the real value in 2005 dollars.

A. Variable Legend

BLIAB – denotes the real net increase in liabilities located on Line 27 of the FOFA.

BLONG – denotes real long-term liabilities and described by Christiano, Eichenbaum, and Evans (1996) as "equaling funds raised by issuing equity plus funds raised by issuing long-term debt".

BEQUITY – denotes real funds raised by issuing nonfinancial corporate equities located on Line 35.

BDEBT – denotes real funds raised by issuing log-term debt and describe by Christiano, Eichenbaum, and Evans (1996) as "composed of tax-exempt debt, corporate bonds, and mortgages". Tax-exempt debt in this case is municipal securities located on Line 30, corporate bonds are located on Line 31 and mortgages are located on Line 34.

BSHORT – denotes real short-term debt composed of funds raised by issuing commercial paper (Line 29), bank loans (Line 32), and other loans and advances (Lines 33).

BBLOANS – denotes real funds raised by issuing bank loans.

The following are variables representing nonfarm nonfinancial corporate business found on table F.102 of the FOFA.

CBONDS – denotes real funds raised by issuing corporate bonds located on Line 43.

CMUNSEC – denotes real funds raised by issuing municipal securities located on Line 42.

CPAPER – denotes real funds raised by issuing commercial paper located on Line 41.

COTHLOANS – denotes real funds raised by issuing other loans and advances located on Line 45.

CMORT – denotes real funds raised by issuing mortgage loans located on Line 46.

CLIAB (Line 37), CLONG, CDEBT, CEQUITY (Line 39), CSHORT, CBLOANS (Line 44)

The following are variables representing nonfarm noncorporate business found on table F.103 of the FOFA.

NCLIAB (Line 22), NCSHORT, NCBLOANS (Line 24), NCMORT (Line 26)

The following are variables representing all commercial banking found on table F.109 of the FOFA.

COMASSETS – denotes real net acquisition of financial assets found on Line 3.

COMBLOANS – denotes real bank loans found on Line 13.

# CHAPTER V

## THE RESULTS

The SVAR results are found in the output section. Our analysis employs quarterly data using two different data sets, 1960:I through 1979:III and 1983:I through 2005:IV. The data was also run using four lags of the variables in the system. When analyzing the output, we will focus our attention on two aspects. First, we want to reason how the use of certain loan types has changed between the earlier and the later data set. Using the definition and composition of variables along with references from other works, we reason why some adjustments have been made towards utilizing certain loan devices across time. For the second aspect, we want to interpret how corporate and noncorporate businesses are affected differently across time periods. The final portion of the analysis will investigate how movements in the Federal funds rate affect the real GDP, GDP deflator, M1, nonborrowed reserves and total reserves.

To start off, we will analyze the effects of the Federal funds rate on the nonfinancial business sector as a whole. According the Flow of Funds Account, this sector is comprised of nonfarm nonfinancial corporate business, nonfarm noncorporate business, and farm business. Even though we are primarily focused on researching how a constriction in monetary policy affects nonfarm nonfinancial corporate business and nonfarm noncorporate business it would be ideal to only have those two sectors representing business as a whole. However, farm business hardly affects the analysis since over a 10 year span in both data sets farm liabilities only accounted for 3% and 1% of the total financial liabilities issued in the respective periods[1]. Now, in order to facilitate the analysis we begin with the broadest category and systematically breakdown its components. The broadest category is the net increase in financial liabilities.

The output for the net increase in financial liabilities for the nonfinancial business sector can be located in Figure 1. In the earlier sample, liabilities increase to over 10 billion dollars in the first quarter after a contractionary shock to the funds rate. Funding either increases or stays the same for three quarters with a drop into negative responses at the end of the first year. This initial increase in liabilities is not an uncommon result as several authors cited in this thesis have come to find out.[2] The idea that liabilities increase during policy tightening is also consistent with the balance sheet view transmission mechanism. Tight policy reduces cash flow which in turn causes businesses to increase their borrowing. With the highest increase in borrowing occurring in the first quarter, it could be assumed that firms in the 1960-1979 period tried to cover their costs early and decreased their costs over time eventually allowing them to reduce the amount of liabilities by the end year one. By the end of the third year after the shock, net liabilities seem to return to their previous level. The response by businesses in the 1983-2005 period is dramatically different. Liabilities initially increase by roughly 30 billion dollars and go on to increase by nearly 60 billion dollars in the third quarter. After this peak, loan increases begin to fall but with the exception of quarter eight never dip into a negative response. There is a similarity between the two data sets. Volume increases the most early in the response cycle which is once again consistent with other findings. A notable difference between the two graphs deals with the number of quarters it takes for them to reduce from their initial peaks. The earlier sample returns to the zero mark by quarter four whereas the later sample doesn't return until

[1] The 10 year spans are 1965-1974 and 1985-1994.
[2] Christiano et al. (1996) and Bernanke and Blinder (1992) to name a couple.

quarter eight. Analyzing the variables that comprise financial liabilities would help reason why businesses in the 1983-2005 sample are able to increase their liabilities for so long.

The liabilities we are mainly concerned with can be broken down into two groups consisting of long-term and short-term. Examining long-term liabilities[3] we can see in the 1960-1979 sample they are highly volatile and for the most part react negatively to the positive funds rate shock. Volatility can be attributable to the enormous discrepancy between responses of long-term debt for corporate and noncorporate businesses for the 1960-1979 time period. Figuring out what is happening during this time span requires a better understanding of the responses by the two separate sectors of business which will be addressed shortly. On the other hand, the later sample seems to show that businesses initially lowered their long-term debt issues but gradually moved back towards them. Quarter five begins the time when businesses start increasing volume of long-term liabilities they hold and hovers around a 5 billion dollar increase from then on. Both samples showed an early increase in total liabilities though, meaning that firms must be offsetting these early decreases in long-term debt with short-term debt. A result we will address soon. BDEBT and BEQUITY compose the types of long-term liabilities businesses can issue. BDEBT is includes municipal securities, corporate bonds, and mortgages. The results for BDEBT[4] have a similar structure to that of their BLONG counterparts. One major difference can be seen in the initial negative response between BDEBT and BLONG for the 1983-2005 sampling period. Here BLONG's negative response reaches over 15 billion dollars in quarters two and three where BDEBT only decreases by 5 billion dollars in those same quarters. This same discrepancy cannot be seen in the earlier sampling period because of the marginal responses by BEQUITY during this time. Results for BEQUITY are located in Figure

[3] Found in Figure 2
[4] Found in Figure 3

4. Another noticeable disagreement by businesses between time periods, the issuance of corporate equity in the 1960-1979 sample starts with decreases but by quarter seven converts to increases. The variability is marginal however, peaking at fewer than one and a half billion dollars and decreasing by less than one billion dollars. Mark T. Leary (2005) shows that during this time period, bank-dependent corporations relative to non-bank-dependent corporations were more likely to issue equity as a means of substituting away from bank debt. He also points out that a delay in this substitution is reasonable "given the institutional arrangements required to issue external equity, any change in financial policy would not be immediately reflected (p. 19)." Perhaps during this time period bank-dependent corporations were more common than not. This is certainly not the case for the 1983-2005 period though. BEQUITY in this sample almost immediately plummets reaching a decrease of around 14 billion dollars in quarter three. The enormous fall in corporate equity issuance stays negative throughout every response but recovers over half way back to its original state by quarter seven. An information problem may be to blame for this striking reaction. With the idea that tight monetary policy leads to a large reduction in corporate profits[5] notions arise that once safe firms may now be risky. Hysteresis in market beliefs about a corporation issuing more equity during a monetary contraction is likely to be interpreted as a bad signal (Bolton and Freixas, 2006). This notion can cause a devaluing of corporate equity directing firms away from issuing more equity to raise funds, especially since they have several other options.

Short-term liabilities[6] are an interesting complement to long-term liabilities and provide a good understanding to the way businesses finance themselves after a positive movement in the Federal funds rate. For the 1960-1979 period, businesses, once again, increase liability growth

[5] Found in Figure 26
[6] Found in Figure 5

over the first year. Quarter five brings upon negative loan growth where it stays until recovering around the end of year four. The only increase in liabilities after quarter four is corporate equities which merely average between a half and one and a half billion dollars and are only represented in the corporate sector. This proves that cutting costs in years two and three was a major response to policy tightening for nonfinancial businesses as a whole. Businesses in sample 1983-2005 appear to take a different approach. Instead of reducing overall liabilities after the first year, they sustain a moderate increase. Firms appear to perform this task by gradually reducing short-term debt and at the same time increasing their long-term debt. We can see that as the initial increases in short-term debt begin to lessen so do decreases in long-term debt. A closer look into the features of long-term debt is presented when we take a look at just the corporate business sector. To further compare findings in this research to findings in others, the results from business bank loans (BBLOANS) will be discussed. The structure of the graphs for bank loans[7] and short-term liabilities are analogous in the 1960-1979 sample. Further analysis reveals that bank loan issues are more heavily associated with the downswing in years two and three than they are with the earlier increases of year one. Contrasting this result with the result for the 1983-2005 sample, it becomes clear that the migration away from bank loans is less intense because businesses are able to find bank loans in the first year and then gradually shift away from them. Near the end of year three firms have all but fully readjusted their short-term loan portfolio to its original condition. Bank loans are classified as short-term liabilities by Christiano, Eichenbaum, and Evans (1996) and are often discussed in literature pertaining to how business debt is affected by policy. In similar literature, commercial loans, also short-term debt instruments, are said to be appropriate substitutes for bank loans as in Kashyap, Stein, and Wilcox (1993). Commercial loans are not available to noncorporate businesses so comparing

[7] Found in Figure 6

them to all nonfinancial business bank loans would be inappropriate; however, a comparison will be done in our corporate business analysis.

Corporate liabilities[8] can be interpreted in the same way as overall business liabilities could. As a matter of fact, the output for corporate liabilities in the earlier sample is nearly identical to that of business liabilities. A small difference being that CLIAB doesn't completely dip into negative responses until quarter six, whereas BLIAB's negative reactions begin in quarter four. The two quarter difference comes from significant negative responses by noncorporate businesses. The same can be said for the later sample since all of the CLIAB responses are actually greater than BLIAB.

Long-term liabilities for corporate businesses[9] present a surprising result for the 1960-1979 sample. Because BLIAB and CLIAB were so similar, a natural assumption would be to think that CLONG would also be similar to BLONG, however this is not the case. CLONG maintains a positive response throughout, except for once in quarter 5. This is a big difference from what was observed with BLONG implying that a large negative reaction from noncorporate long-term liabilities is impending. The output for the 1983-2005 sample is not as striking because of its similarity to BLONG leading us to infer that the respective response from noncorporate long-term liabilities is much less severe. CDEBT[10] for the earlier sample explains virtually all the response in CLONG. Upon further inspection, corporate bonds[11] show moderate adjustments beginning with negative responses but start increasing by quarter three. Municipal securities[12] provide only negligible responses, but mortgages[13] experience substantial increases.

[8] Found in Figure 7
[9] Found in Figure 8
[10] Found in Figure 9
[11] Found in Figure 10
[12] Found in Figure 11
[13] Found in Figure 12

Municipal securities' inconsequential movement in this earlier period is attributable to the fact that they were not issuable until the second quarter of 1971 therefore providing values of zero to the data set from 1960 to 1971. Mortgages, though, dramatically increase during the first year and display moderate increases for some time. The 1983-2005 sample for CDEBT shows early decreases followed by large increases starting in quarter four. When assessing the different components we find that mortgages respond positively in the first year with consistent negative responses after year two. Municipal securities seem to gain favoritism now that they have entered the entire sample, but corporate bonds during this era are the most favored reaching and sustaining increases of around 10 billion dollars. The other aspect of CLONG is CEQUITY[14] which is an identical output to that of BEQUITY so further analysis is unnecessary.

Inspecting the structure of CSHORT[15] we can see that both graphs react in a similar way. A couple noticeable differences come from the differing quarters which they cross over the zero line into the negatives. In the 1960-1979 sample, this occurs at quarter five and in the later sample this occurs at quarter six. It's obvious that corporations in the most recent period keep their short-term liabilities higher for longer. Breaking this variable down into its components will provide additional insight into what short-term loans are preferred by corporations over others and if there is any correlation between CBONDS and CBLOANS. Bolton and Freixas (2006) argue that there is an intermediation cost to using bank loans because of their flexibility. Corporate bond issues do not have this flexibility and therefore firms with higher default risk may have an incentive to pay this intermediation cost. On the other hand, this implies that firms with a lower chance of default will switch away from bank loans to corporate bonds. This movement is consistent with Leary (2005) who points out that during a policy contraction "firms

[14] Found in Figure 13
[15] Found in Figure 14

with access to the public debt markets are expected to substitute away from bank debt towards public debt (p. 2)"  He goes on to say that the transaction costs associated with issuing public debt may cause firms to issue larger amounts.  This assumption does not seem to reflect in the 1960-1979 sample for CBLOANS (located in Figure 15) and CBONDS.  Once again, volume for bank loans rises in the first year but when those responses turn negative they reach close to 10 billion dollars with a negative response of around 6 billion dollars into the fourth year.  If Leary's comments appeared true then we should see an increase in CBONDS issues during those same quarters of 6 billion or more.  CBONDS only shows increases of 3 billion in year two and even if these were augmented with the increases to CMORT the amount still would not reach an increase of 6 billion.  His statement does show some truth in the 1983-2005 sample though. CBLOANS during this era decrease to the tune of 6 billion dollars while at the same time CBONDS increase responses to roughly 10 billion dollars.  Commercial paper[16] and other loans and advances[17] are two more liabilities that corporate businesses have the option of substituting bank loans for.  In the earlier period the increases in CPAPER and COTHLOANS are volatile and of smaller amounts.  Although CPAPER does in fact increase during the same time that bank loans decrease which provides some support for the findings of Kashyap, Stein, and Wilcox (1993).  The output for the later period shows more intense responses as commercial paper issues jump between 6 and 8 billion dollars in the first three quarters.  COTHLOANS show substantial increases too after the first quarter and through quarter five where they eventually return to their original state.

To get an overall view we will recap the output for corporate business liabilities.  For the 1960-1979 time period, CLONG stays elevated because of the initial increase in mortgage loans

[16] Found in Figure 16
[17] Found in Figure 17

and then the eventual increase of corporate bonds accompanied by slight increases in corporate equity.  CSHORT starts with increases in short-term debt but leads to overall decreases as the fallen CBLOANS are not offset by equal increases in commercial paper or other loans.  This implies that corporate businesses during this time increased both long- and short-term financing in the first year; however, as the monetary contraction begins to gain momentum at the beginning of year two businesses decrease their short-term debt holdings while keeping long-term debt in place with increases in corporate bonds and sustained increases in mortgages.  The long-term debt does not completely counteract the decreases of short-term debt and overall liabilities become negative in quarter six.  For the 1983-2005 time period, CLONG begins with a negative response but turns positive by quarter five.  The negative response is primarily due to the large decreases in equity issuance as firms fear issuing undervalued stock for additional financing. This initial decline in equity is somewhat mitigated by increases in municipal securities and mortgages.  Mortgage increases begin to lessen as corporate bond issues rise by quarter four. CSHORT experiences overall increases for the first year caused by the increases of all three short-term loans over this time.  As bank loans start to decline the increases in commercial paper or other loans and advances do not offset it.  Similar to the earlier sample both long- and short-term liabilities show increases for the first year and as the policy takes effect short-term debt decreases but in this case long-term debt appears to appropriately offset its decline.  Overall corporate business liabilities are much higher than the offsetting of long-term liabilities accounts for showing that another liability or liabilities are reacting in a largely positive manner to the policy change.

Noncorporate businesses include institutions like sole proprietorships and partnerships. These are not incorporated and therefore some if not all of the liability taken on can fall on the owners in the case of a default. This can have important implications pertaining to the types and magnitude of debt issued. Also, noncorporate businesses can be considered small businesses since they have virtually no access to the public markets for liabilities. The only long-term debt available is mortgages and short-term liabilities simply include bank loans and other loans and advances. Small firms are also considered for the most part to be bank-dependent. Implying that a firm has "scarce cash reserves and without ready access to public bond and commercial paper markets (Kashyap, Stein, and Wilcox, 1993, p. 96)." With so few options for debt and such a high reliance on loans to stay afloat it is no wonder why authors like Kashyap, Stein, and Wilcox (1993) agree with the lending view on how monetary contraction is disproportionately concentrated among bank-dependent firms. Taking a look at noncorporate business liabilities[18] we can see that these firms certainly feel the brunt of the contraction as liabilities are at a perpetual decrease in the earlier sample and in the most recent period only find increase funding at the end of year one. The result for the 1960-1979 noncorporate mortgage responses[19] paints a clear picture on the availability of loans during a tightened policy. Initially responding with decreases of around 10 and 12 billion dollars, it is debatable on whether proprietors of small businesses just do not want to put their personal possessions at increased risk by taking out asset-backed debt or do not have the availability of mortgage loans in the face of smaller profits. The 1983-2005 period reacts differently with some increases in mortgages but not by very much. This could come from the fact that noncorporate business owners are willing to take on the risk of more mortgage debt during this time or banks have more mortgage loan availability. It is the opinion of this research that what is happening here is a greater availability. Owners in the earlier period had a greater incentive to take out long-term debt because of the increasing

[18] Found in Figure 18
[19] Found in Figure 22

inflation rate along in combination with predictable Federal Reserve policy movements as discussed in the literature review. If owners could take out loans they would have but there must have been a decrease in loan supply possibly because of the fact that small businesses can become crowded out as safer firms absorb all the available loans. In the most recent period however it comes as no surprise that banks have become larger and with that comes more capital and hence more loans. A similar assessment can be made about the supply of short-term loans. In NCSHORT[20] the earlier time period displays a small variation in both increases and decreases around firm's original loan pattern. Taking a look at NCBLOANS[21] and NCOTHLOANS[22] it's easy to see that firms in the 1960-1979 era were able to access a small increase in loans during the first year but fall short in years after. In order to compensate for this decreased loan supply in combination with smaller profits and an already small stock of cash reserves, noncorporate businesses would need to employ serious cost cutting measures. Small businesses during the 1983-2005 era don't seem to have a problem accessing bank loans with moderate increases of all three loan types investigated; however, this fails to explain why total liabilities during this time drop for the most part. Liabilities reaching and sustaining a negative response of 4 billion dollars by quarter five prove this to be true. An explanation of this occurrence could come in the form of decreases in trade payables, miscellaneous liabilities, or proprietors' net investment being that these are instruments also found under net liabilities. These additional liabilities are not run as part of our model because causation related to increases in the Federal funds rate cannot be well formulated.

[20] Found in Figure 19
[21] Found in Figure 20
[22] Found in Figure 21

A final analysis into the market for bank loans comes as we take a look at the responses of commercial bank assets[23] and commercial bank loans[24]. Commercial bank assets are examined because they are the category that houses all the loans commercial banks actually lend out, and even though they don't represent all bank lending available they do make up a large portion. In the 1960-1979 sample COMASSETS are consistently lower after a policy shock. We can interpret this as a decrease in loan availability. This assumption is augmented by the graph for COMBLOANS. Bank loans in particular increase for about a year before massive decreases are implemented. Following suit, both corporate and noncorporate businesses increase their holdings of bank loans in the first year when it is available and decrease holdings afterwards. The 1983-2005 sample proves to be much different. Over the first year, commercial assets are increased tremendously as are commercial bank loans. In the first year of both corporate and noncorporate business, mortgages and bank loans increase which enables them to shrink less considerably. COMBLOANS never reduce as well, conflicting with the money view as a transmission mechanism and supporting the idea that small businesses take advantage of loans if they are available. This is shown by the persistent increase in bank loan volume among noncorporate businesses over the 1983-2005 time period. Increasing loan availability from the earlier sample to the later could potentially have an important impact on the state of the economy.

A reference back to the business sectors analysis would help explain this impact. CLIAB and NCLIAB for both samples experience a greatly reduced volume of liabilities during quarters five, six, and seven from volumes of those just two quarters back. Assuming that the quantity of loans received in the first year were needed to maintain a certain level of business then it would

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[23] Found in Figure 23
[24] Found in Figure 24

be fair to say that a reduction in this volume would mirror a reduction in the level of business. A contracting business needs fewer employees so during the same quarters there should be a steady increase in the unemployment rate. The graph for the unemployment rate is located in Figure 25. We can see that the most dramatic increases in unemployment for both samples are found in quarters five, six and seven. Bernanke and Blinder (1992) find the same correspondence to occur. They first note that "the effects of the unemployment rate are essentially zero during the first two or three quarters after the shock to the funds rate; but at about the nine-month point, unemployment begins to rise, building gradually to a peak after about two years (Bernanke and Blinder, 1992, p. 919)." As we can see this is very similar if not identical to the unemployment output presented in this research. They continue to explain how well the timing of the unemployment rate corresponds to the estimated timing of the effect a policy shock has on loans or in our case liabilities in general. Bernanke and Blinder go on to say that although loans do not Granger-cause unemployment it is circumstantial evidence that shocks to the Federal funds rate operate at least in part through the credit view.

We have shown here that our results are consistent with the credit view as the transmission mechanisms, lending and balance sheet, are represented in the findings above. The balance sheet mechanism is characterized by the increase in loans during the first year after a policy tightening. The supply condition of the lending channel seems to be in practice more during the 1960-1979 sample than in the 1983-2005 one since tight policy seems to reduce the availability of loan supply. The bank-dependent borrower condition is satisfied in the later sample though, since corporate firms adjust away from bank loans while noncorporate firms adjust towards bank loans. Assuming that business owners have not become more risk-loving between the two periods, one can see that the newfound availability of loans in the more recent era is utilized by the small noncorporate businesses through mortgages and bank loans.

Now we will turn to the broad macroeconomic variables chosen to be involved in all the SVAR models. Just to reiterate, these variables were chosen because of their use in literature researching similar topics.[25] Of the six macroeconomic variables, we will discuss the responses of real GDP, GDP deflator, M1, nonborrowed reserves and total reserves.[26] Commodity prices will not be discussed because of its use in resolving the "price puzzle". The price puzzle is associated with a prolonged rise in the price level following positive orthogonalized innovations to the Federal funds rate.[27]Christiano, Eichenbaum and Evans (1996) point out that

> "Sims (1992) conjectured that this response reflects the fact that the Fed has some indicator of inflation in its reaction function that is missing from the VAR underlying the policy shocks measure. Consistent with this conjecture, we find that when PCOM is included in the VAR, the response of the price level to measured monetary policy shocks is no longer anomalous." (Christiano, Eichenbaum and Evans, 1996, p. 18)

A deeper look into the use of commodity prices and its affiliation with the price puzzle is beyond the scope of this paper. More information on the use of commodity prices as a resolution for the price puzzle can be found in Christopher Sims and Zhou (1994).

Real GDP[28] is the first variable discussed while also being the most intriguing. The 1960-1979 period provides responses that are consistent with view that the economy will produce less following a constriction in monetary policy. Immediate decreases in RGDP can be

[25] This literature includes Bernanke and Milhov 1998 and Christiano, Eichenbaum and Evans 1996.
[26] The responses to these variables to a shock in the Federal funds rate were given after running the SVAR with only the 6 macroeconomic variables discussed: {RGDP, DEF, PCOM, FF, NBR, TRES}
[27] A similar statement is found in Christiano, Eichenbaum, and Evans (1996).
[28] Found in Figure 28.

seen in the first year but the largest quarter to quarter decrease is seen in the time between quarter four and quarter five. A huge negative shock over this time is not surprising as this is the same time that businesses are transitioning away from short-term debt while unemployment increases dramatically as well. For the 1960-1979 era, the time between quarter four and five characterizes when businesses begin to feel the full effects of contractionary policy. RGDP for the 1983-2005 period reacts in a very unexpected way. After a positive shock to the Federal funds rate, real GDP actually rises slightly. Explaining this result can come from either the belief that the model is set up incorrectly or the belief that the negligible response is merely inconclusive. Upon discovering the odd response by real GDP, an extensive review of the data and coding used was conducted. The exhaustive review brought forth nothing in the way of a problem with the data or the method by which the results were obtained. Therefore, it is the opinion of this author that the unusual response by real GDP can be attributed to some abnormal conduct in the data during this time period rendering the output for RGDP inconclusive.

GDP deflator is a measure of the price level as a ratio between nominal GDP and real GDP. Therefore, increases in the deflator relate to increases in inflation. On that note, we inspect the response of the GDP deflator[29] in the 1960-1979 period. A contractionary shock to monetary policy appears to increase the rate of inflation as the GDP deflator responds with percentage increases. This result yields support for an idea presented in the literature review section. During this time period, Friedman and Kuttner (1996) point out when the funds rate was raised it was done so by less than expected inflation subsequently causing an even greater devaluation of the dollar a result seen in our output. As for the later time period, DEF declines after contractionary shocks. Knowing that Volker and Greenspan were more aggressive with

[29] Found in Figure 29.

adjustments in the funds rate to counteract inflationary pressure, this result remains consistent with our literature review.

Money growth was a growing concern during the earlier time period too as the Federal Reserve publically announced in 1979 to intensify their dedication in controlling it. Their dedication is exemplified by the contrast between the graph for M1[30] in the earlier and later time periods. The 1960-1979 era shows M1 largely unchanged until the middle of year three where it begins to grow. Volker and Greenspan seem to manipulate policy more appropriately in the later era. A contractionary stance causes M1 to decrease and continue to decrease year over year in a gradual, steady movement providing greater stability to the economy.

The economic stability brought during the Volker-Greenspan era is illustrated even more through the graphs for nonborrowed reserves[31] and total reserves[32]. If there is a positive shock to the Federal funds rate the Federal Reserve can further enforce the contractionary effects of this shock by decreasing total reserves. Both graphs for total reserves reflect this idea. The earlier graph however shows that decreases in total reserves were not by very much and the responses were volatile from one quarter to the next. The Volker-Greenspan era graph offers a different analysis. Total reserves here fall by substantial amounts soon after the contractionary shock and the percentage decreases increase gradually across time. Similar to total reserves, nonborrowed reserves respond erratically over time after a policy shock. Percentage increases to nonborrowed reserves following an increase in the Federal funds rate is attributable to the fact that the number of borrowed reserves is decreasing. Diminishing volumes in borrowed reserves reflects the assumption that loan volumes are reducing, thus supporting the lending channel. This correlation is found in the 1960-1979 period when total reserves decrease and nonborrowed

[30] Found in Figure 27.
[31] Found in Figure 30.
[32] Found in Figure 31.

reserves increase the most from quarter four to quarter five while over the same time span commercial bank loans decrease substantially. The 1983-2005 sample once again appears to prove something entirely different. TRES and NBR decrease and increase, respectively, in a smooth pattern however COMBLOANS never react negatively. On the contrary, commercial bank loans remain at an increase of around 3 billion dollars after quarter six. A large decline in its increases does occur between quarters four and five bringing bank loan increases down from 12 billion to 6 billion but they are still responding positively nonetheless. Since commercial banks can be characterized as large banks, we find that Ashcraft (2003) supports this surprising bank loan result for the later sample. In his article, Ashcraft goes on to prove that loan growth for affiliated banks are largely unaffected by a monetary contraction. The ability for large banks to remain unaffected by monetary policy tightening is a fascinating adjustment in the way our economy works, and corresponds well with some of the other findings about corporate and noncorporate businesses.

# CHAPTER VI

# CONCLUSION

The object of this paper is to use a structural autoregressive model in order to better understand how the liabilities of the nonfinancial business sector react to contractionary shocks in the Federal funds rate. We presented evidence about why the Federal funds rate is a good indicator of the Federal Reserve's stance on monetary policy. After performing this, results can be interpreted as how the market for liabilities adjust with respect to the business sector to a one-percent contractionary shock in policy stance. Separation of the dataset into two subsamples is a well-supported alteration, which enhances our understanding of funding preference over two distinct regimes. Our results yield support for several different theories and provide insight into the overall movements of the liabilities market in the nonfinancial business sector that to my knowledge were not already identified.

As a whole, nonfinancial businesses initially increase liabilities in the first few quarters for both samples. Obviously, the later sample showing much higher and more persistent increases. This yields support for the balance sheet channel of the credit view which argues that tight policy reduces cash flow and therefore increases the need for loans. Corporate businesses in 1960-1979 increased both their short- and long-term liabilities immediately. The immediate increases in short-term loans came from all three short-term loan types examined while early increases in long-term loans came primarily from mortgages. As time went on short-term loans fell because of CBLOANS dramatic decrease, but mortgages along with the other long-term liabilities continued to display elevated numbers.

Corporations in 1983-2005 react to contractionary policy by decreasing long-term debt initially and increasing short-term debt. Decreases in the long-term debt are mainly attributable to the large decreases in corporate equity. Increases in the short-term debt occur primarily through the increases in commercial paper and other loans and advances.

Since corporate and noncorporate businesses essentially "fought" over loans from banking institutions in the earlier era, using the responses from noncorporate businesses and their corporate counterparts over the two samples, we show why noncorporate firms are not affected as disproportionately as they once were.

Access to long-term liabilities by noncorporate businesses is limited to mortgages. In the 1960-1979 sample, noncorporate businesses had to decrease their mortgage loans substantially in the first four quarters. The term "had to" is used here because it was made clear in the results section that if noncorporate firms have access to loans they will utilize them. Corporate firms over the first four quarters increase their mortgage loan volume in a nearly identical pattern with that of the decreases in noncorporate mortgage lending. Such an incredible similarity gives credence to the assumption that mortgage lenders shifted loans away from small firms as they were considered riskier during contractionary policy shocks. Large firms searching for additional funding in the early quarters were now much safer establishments by comparison and preference was offered to them for mortgage loans. Bank loans for both corporate and noncorporate businesses react alike, rising initially and then falling. Movements parallel to that of commercial bank loans showing how availability lessened after the first year. The market for mortgage loans enables us to see how riskier firms were disproportionately affected by the policy tightening especially with reference to long-term liabilities.

Corporate firms in 1983-2005 shifted their loan portfolios away from banking loans. Bank loans and mortgages display modest increases in the first year but more notably bank loans decrease considerably and mortgage volume remains largely untouched after the year one. These decreases in bank loans are met with increases in commercial paper and corporate bond issuance consistent with the claim that firms move away from bank debt to public debt, if available. Bank loans, now more accessible, are snatched up by noncorporate businesses. Increases in NCBLOANS are seen during and after the first year. Similarly, mortgages for smaller firms are able to increase slightly since larger firms in the 1983-2005 sample do not increase their mortgage loans. Instead larger firms concentrate long-term loan increases on corporate bonds. Even though commercial bank loans during the later sample show persistent increases, corporate firms still move away to public debt despite the obvious availability.

Within long-term liabilities, we found out that corporate businesses in the 1960-1979 sample showed much more favor in increasing their financing by issuing corporate equity than the 1983-2005 sample. The later sample's movement away from corporate equity as a means of funding makes a case for how different the market for corporate equity has changed between the two samples. Why such a large discrepancy in preference?

Equity is a component of "long-term" liabilities. Equity issuance is essentially the act of giving firms money in exchange for a stake in the business. It follows that selling a percentage of a business is unlike other loans located under long-term liabilities. Where corporate bonds, municipal securities, and mortgages can eventually be paid off, equity issued will remain sold to the holder characterizing this particular liability with more permanence and limitedness. These characteristics drive issuers of equity to pursue the most capital possible per share sold. Under the idea that market hysteresis during an increase in equity issues drives prices down (Bolton and Freixas 2006), we can conclude that hysteresis was not a huge a factor between 1960 and 1979. Corporations in the earlier period seem to have little trouble obtaining a price per share they deem appropriate. The 1983-2005 sample, on the other hand, shows a strong affinity against corporate equity and therefore support for hysteresis. The later period offers a far less accommodative environment which can be seen by the huge reductions in equity issues after a Federal funds rate increase. It is interesting to see how the market for equity has changed and further research into the hysteresis theory over the two subsamples would be an appropriate expansion to this research.

Tying the graphs for liabilities of both corporate and noncorporate businesses together with the graphs for unemployment and commercial bank assets, we can begin to see how the market for financing has affected the nonfinancial business sector differently over the years. Because we believe the balance sheet channel is at work, increases in liabilities over the first year are assumed to be necessary in order to maintain a certain level of business activity. Since COMASSETS during 1960-1979 basically decrease the better part of the first two years a reasonable assumption could be made about the lack of availability of commercial bank financing instruments. The combination of increased need and decreased availability required firms to employ drastic cost cutting measures during the second year after a contractionary shock to policy. Cost cutting can be seen through the unemployment rate as the largest increases occurred during the second year. Large percentage increases in the unemployment rate correlate with the timing of both corporate and noncorporate businesses' inability to acquire suitable financing in the earlier era. These correlations are consistent with the idea that there is a reduction in the supply of loans, a condition within the lending channel portion of the credit view.

The 1983-2005 era brings about changes to commercial banks' capacity to meet the financial needs of the business sector. COMASSETS now display sizeable increases over the first year. Total reserves do not increase though. Decreasing total reserves tells us that the additional financing capability of commercial banks must be coming from an internal pool of excess capital created by banks' own means of obtaining more liabilities. Although the later era still has the largest increases in unemployment occurring in year two, the increases are not nearly as drastic. COMASSETS sizable increase allows small, bank-dependent firms to acquire much needed additional funding during the first year while supplying the economy with additional capital as well. This added liquidity mitigates the severity of the recession felt after the first year and enables businesses to refrain from drastic layoffs.

The information presented through this research provides support to the credit view of the monetary transmission mechanism. Credit view theory contains two possible credit effects. Support for the balance sheet mechanism occurred when nonfinancial businesses increase their financing, if available, during the first year after a monetary policy tightening. The lending channel mechanism, composed of two sub-conditions found support from the interpretation of COMASSETS. A lack of loan supply, the first condition, was seen in the 1960-1983 era as COMASSETS decreased leading to drastic cost cutting. Limited availability and limited access to loan markets for noncorporate business applied added strain on them, a trait disproportionately felt by smaller firms in the earlier time period. Bank-dependent firms, the second condition, found support in the 1983-2005 era as COMASSETS increased and noncorporate businesses took advantage of the new banking loan availability. Corporate firms in 1983-2005 also began to move away from bank debt into public debt seen by the movement of long-term liabilities from mortgages to corporate bonds.  This movement along with an increase in bank loan availability caused the market for commercial banking loans to be more accessible to noncorporate firms.

The last interesting and informative correlation comes from the market for corporate equities.  Such a remarkable difference in preference between corporations across periods lends itself to the need for further research.  A greater understanding about the composition changes that have happened over the subsamples in the market for corporate equity would provide useful evidence on how those changes may have affected corporate preference and market hysteresis.

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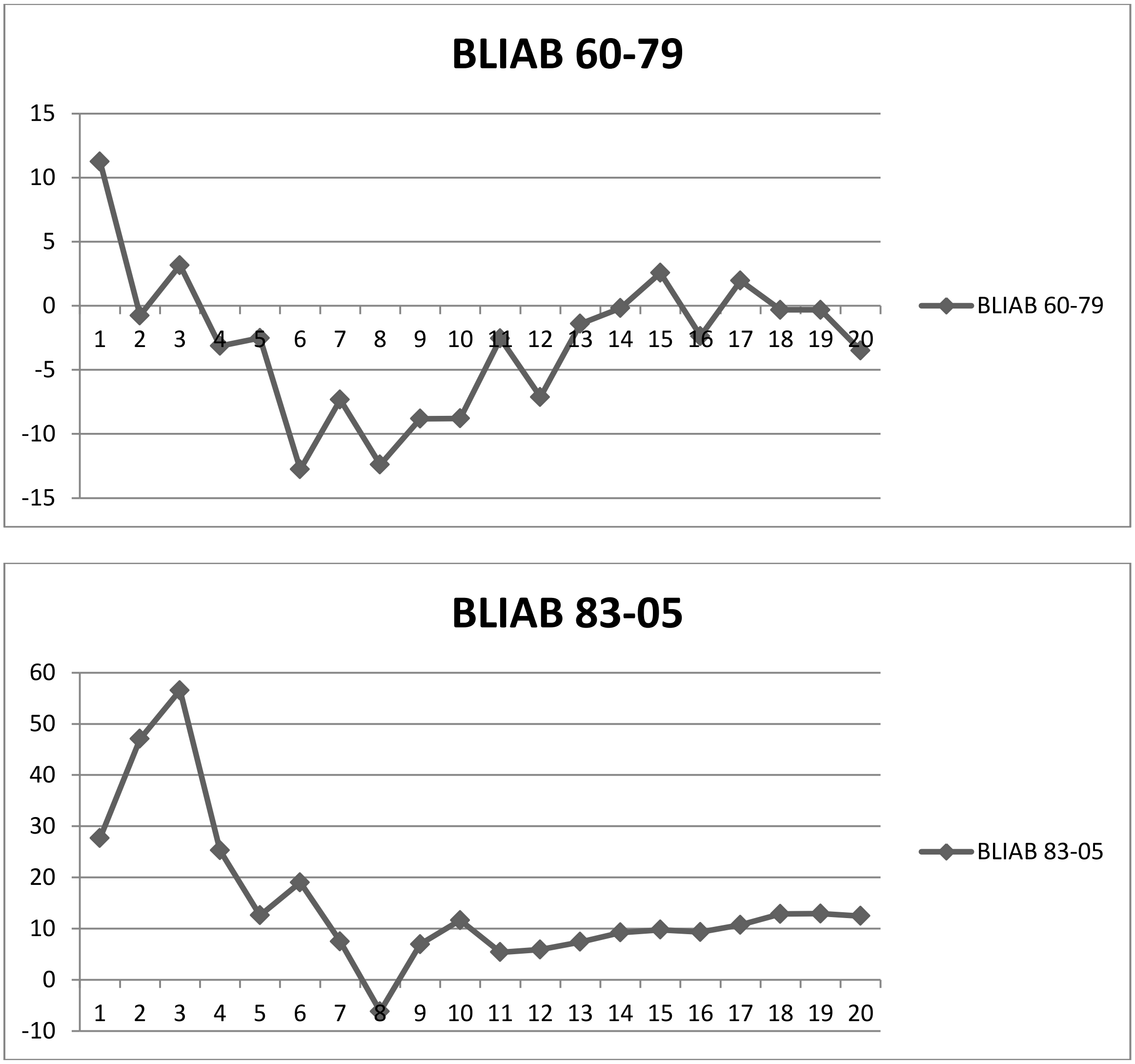
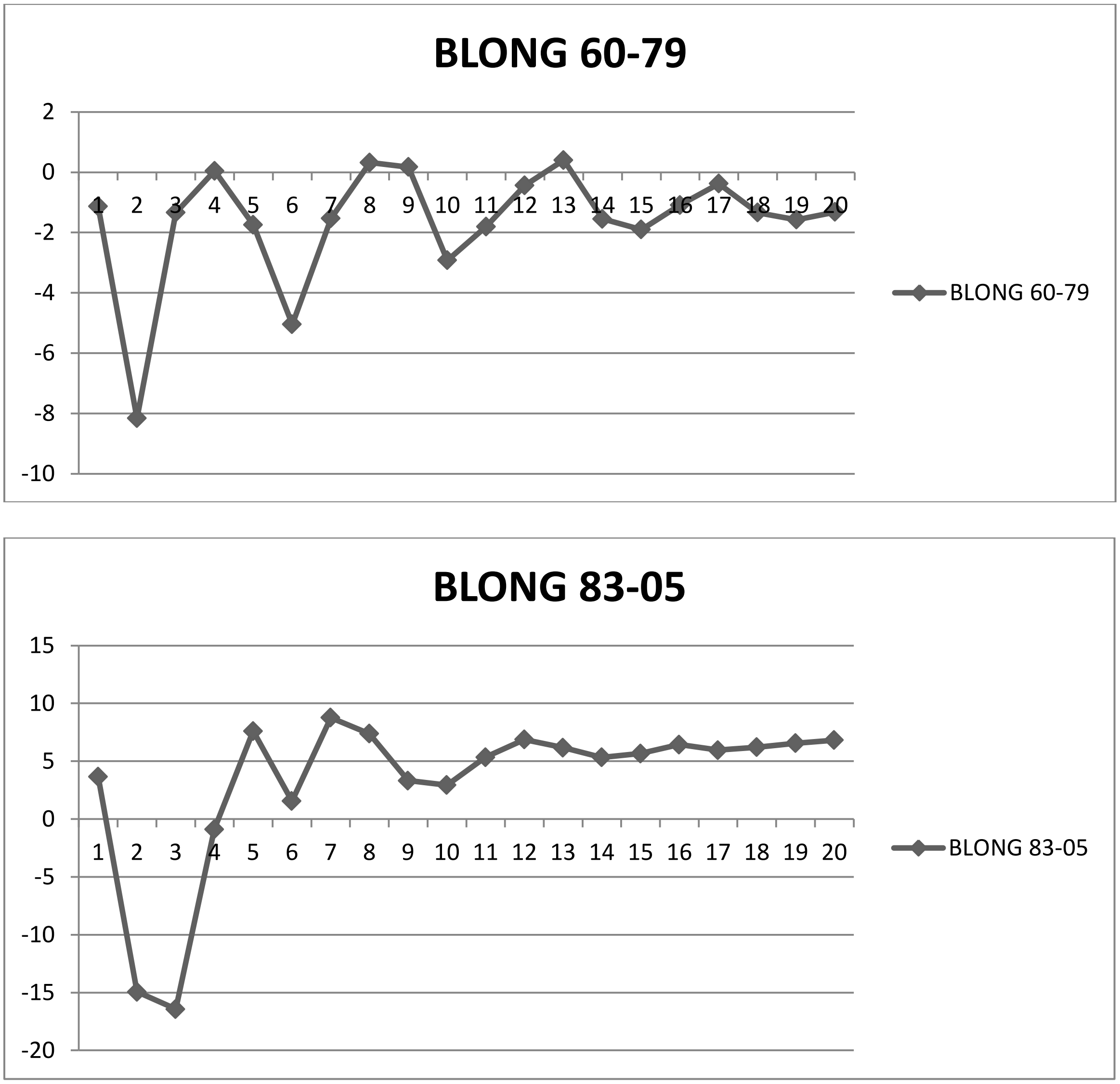
FIGURE 1: Impulse Response Functions for Nonfinancial Business Liabilities[33]



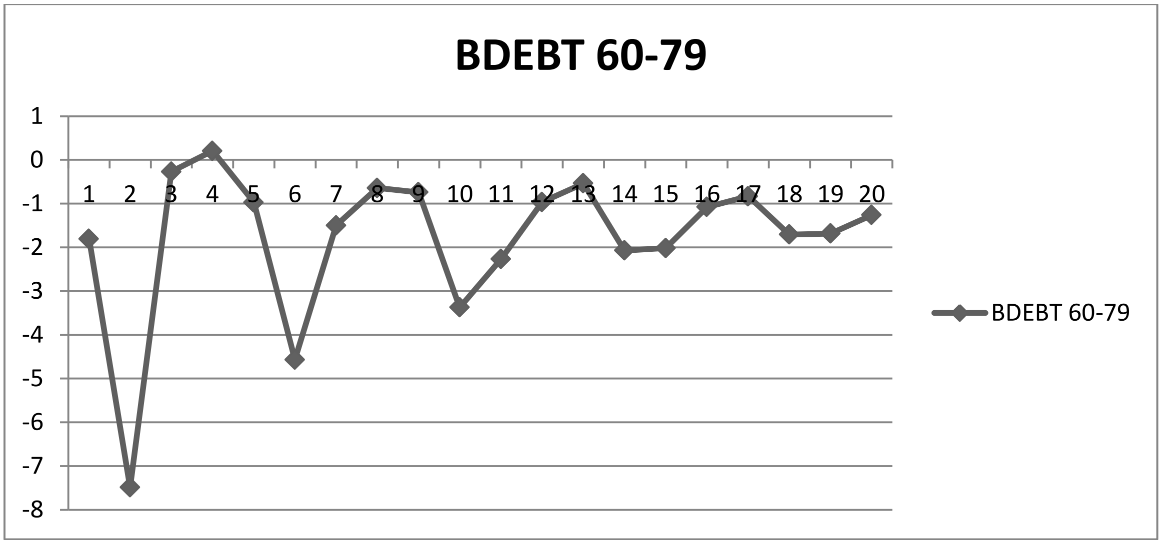

[33] These two graphs show the impulse response functions of nonfinancial business liabilities in the two sample periods after a 1% increase in the Federal funds rate.

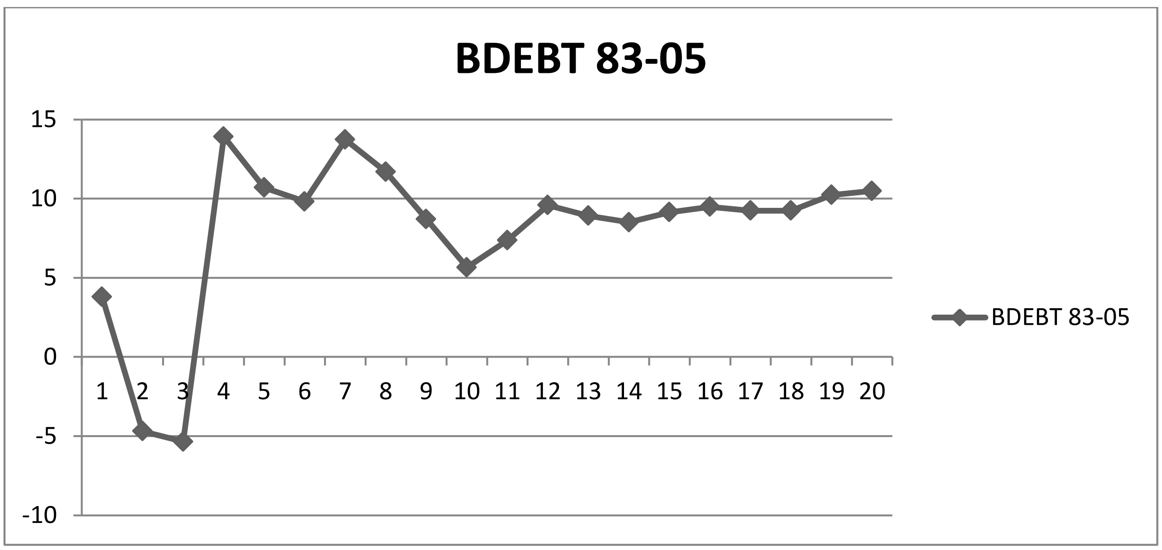
FIGURE 2: Impulse Response Functions for Nonfinancial Business Long-Term Liabilites[34]




[34] These two graphs show the impulse response functions of nonfinancial business long-term liabilities in the two sample periods after a 1% increase in the Federal funds rate.

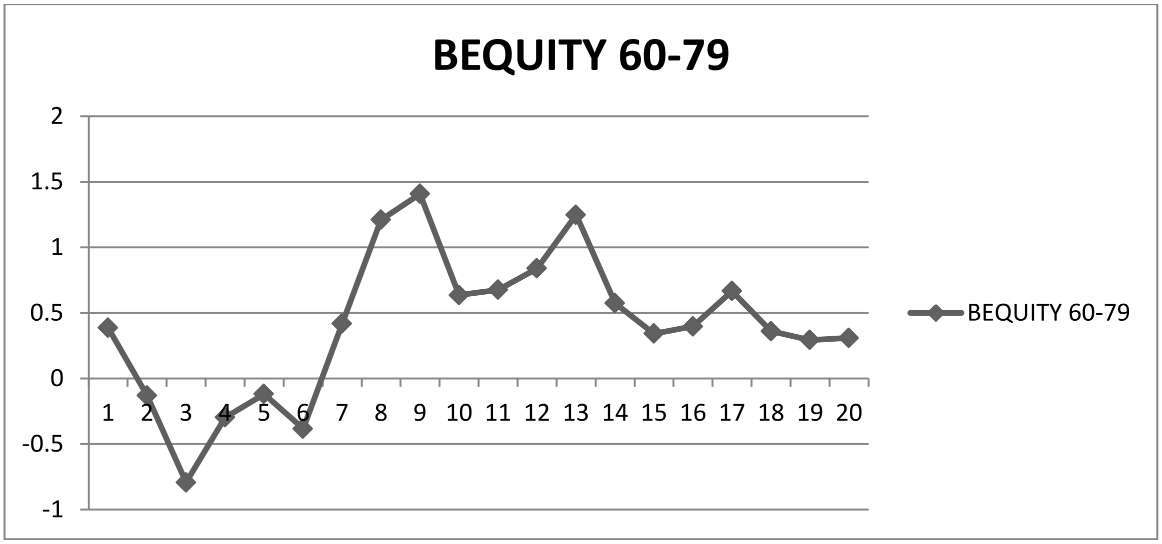
FIGURE 3: Impulse Response Functions for Nonfinancial Business Long-Term Debt[35]

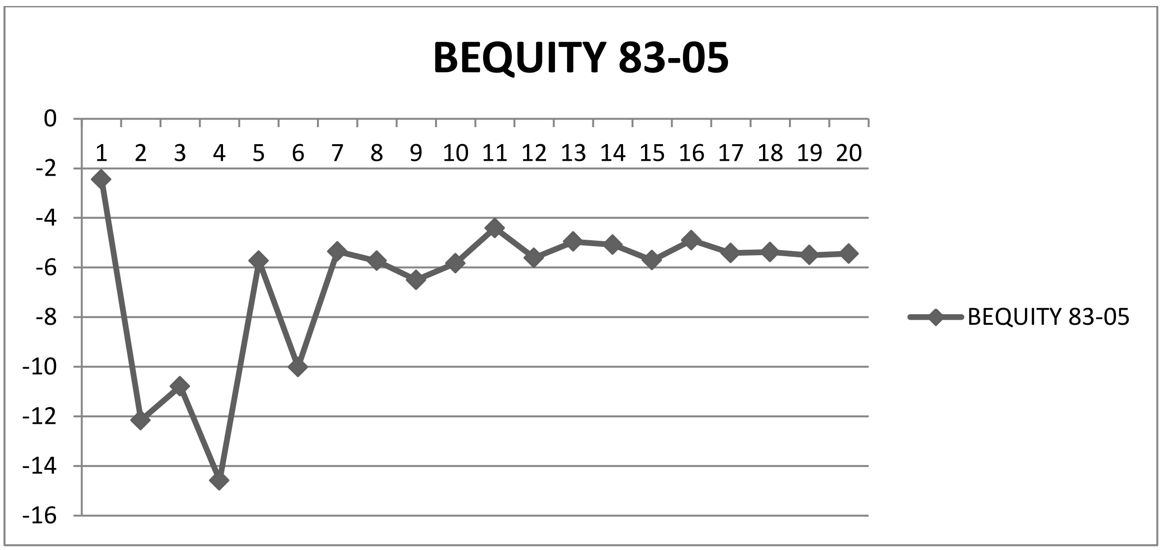



[35] These two graphs show the impulse response functions of nonfinancial business long-term debt in the two sample periods after a 1% increase in the Federal funds rate.

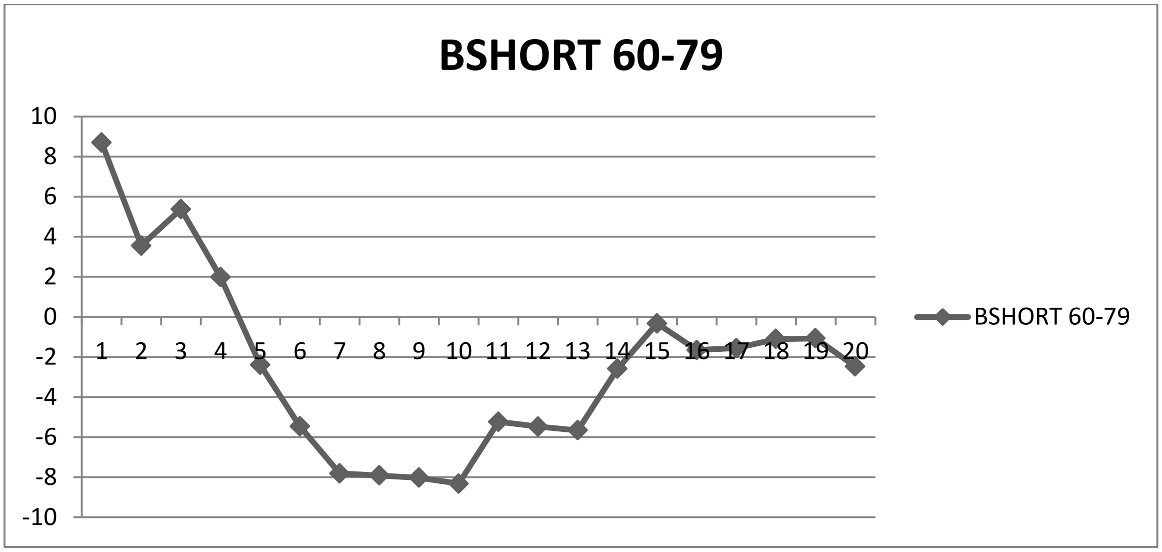
FIGURE 4: Impulse Response Functions for Nonfinancial Business Equity[36]

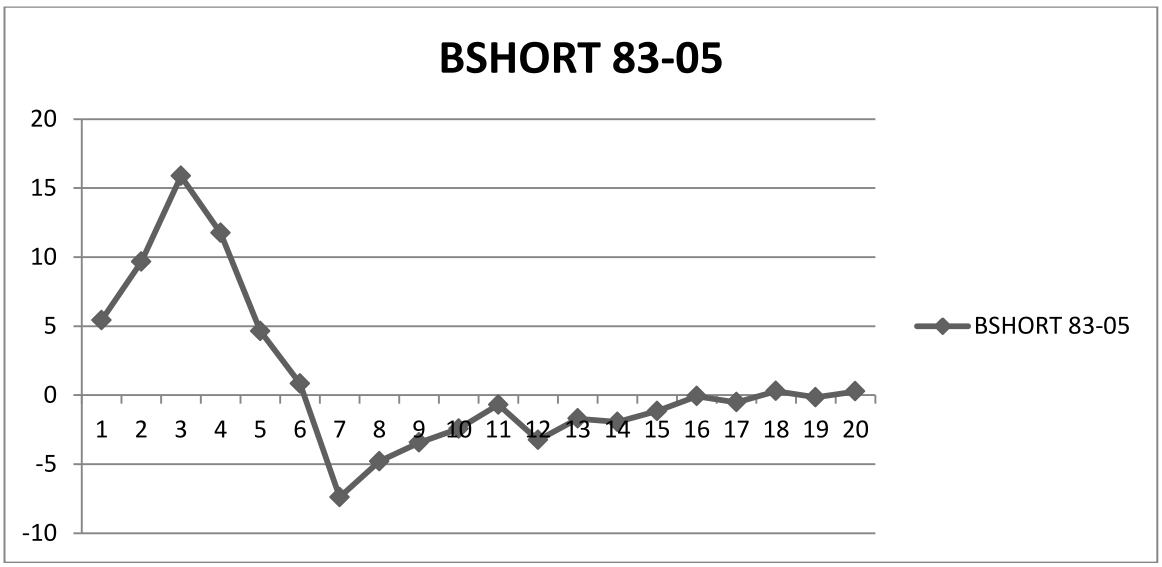



[36] These two graphs show the impulse response functions of nonfinancial business equity in the two sample periods after a 1% increase in the Federal funds rate.

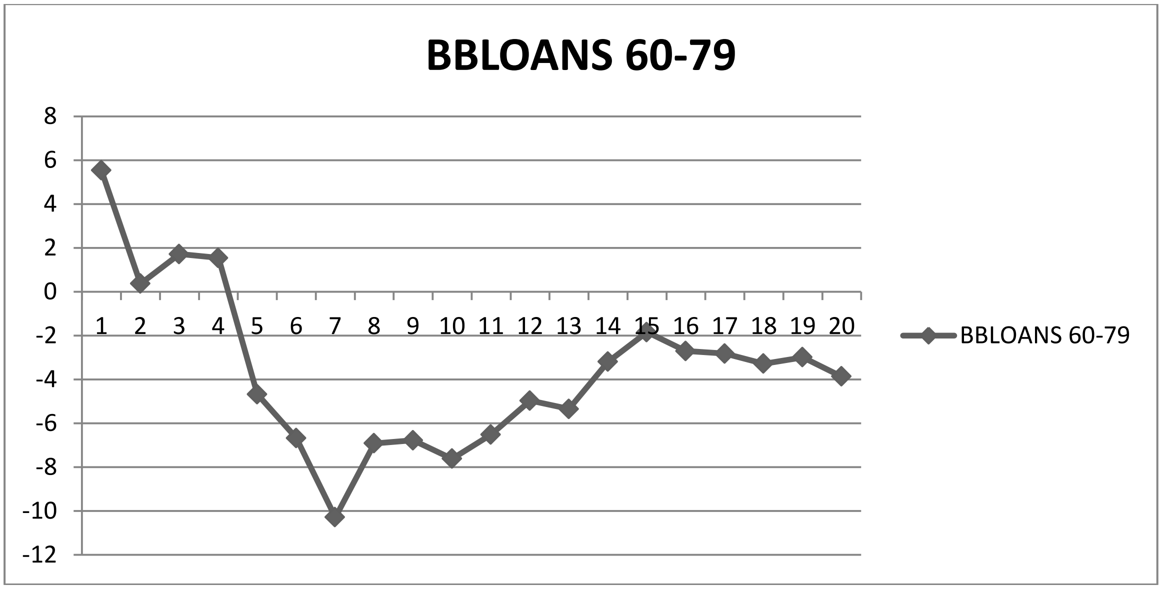
FIGURE 5: Impulse Response Functions for Nonfinancial Business Short-Term Liabilities[37]

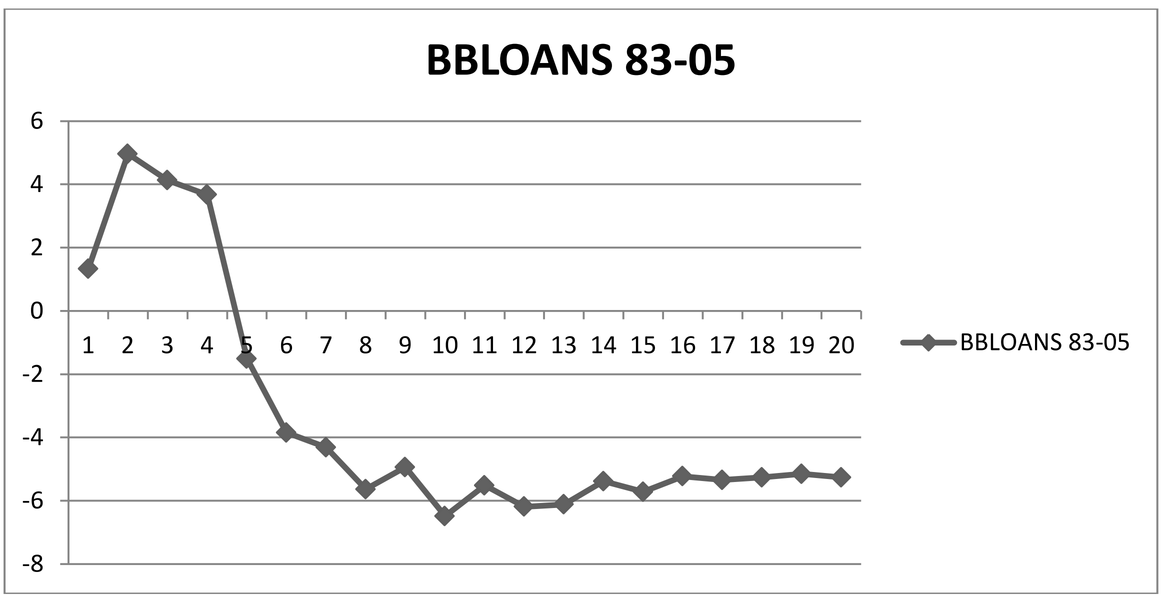



[37] These two graphs show the impulse response functions of nonfinancial business short-term liabilities in the two sample periods after a 1% increase in the Federal funds rate.

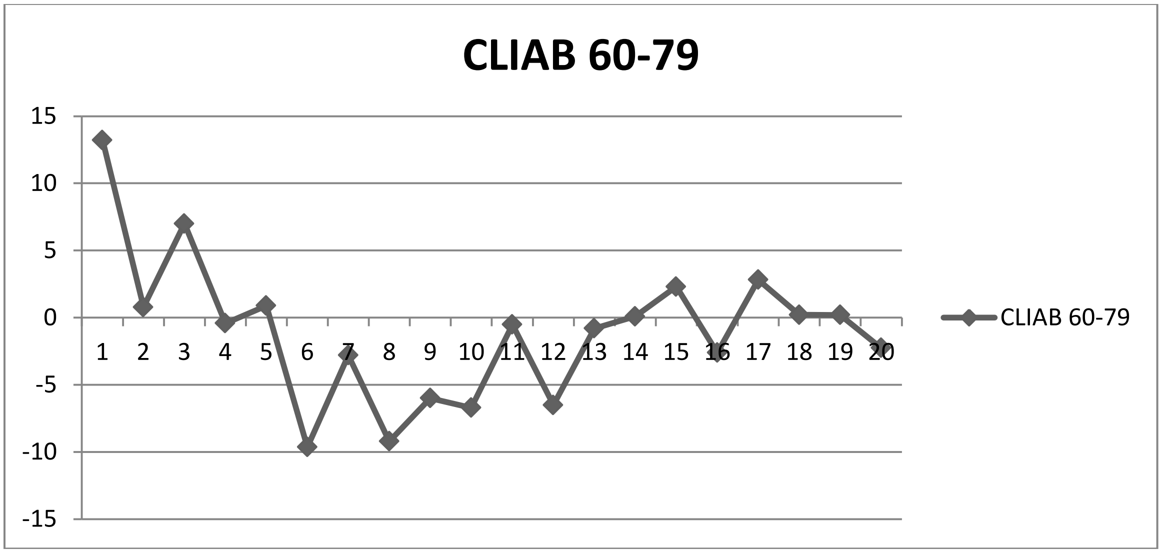
FIGURE 6: Impulse Response Functions for Nonfinancial Business Bank Loans[38]

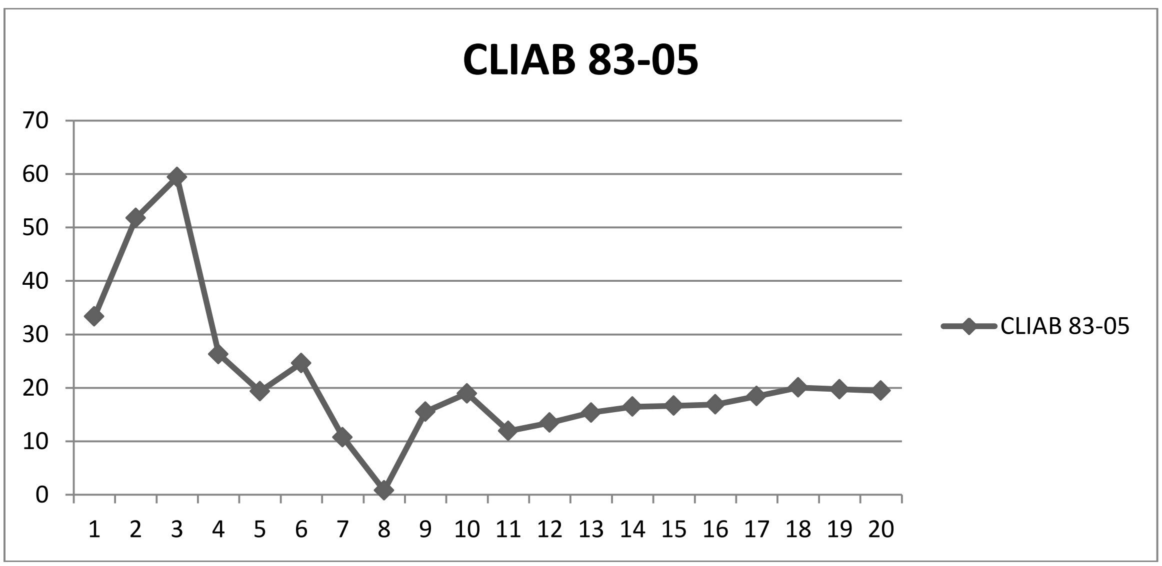



[38] These two graphs show the impulse response functions of nonfinancial business bank loans in the two sample periods after a 1% increase in the Federal funds rate.

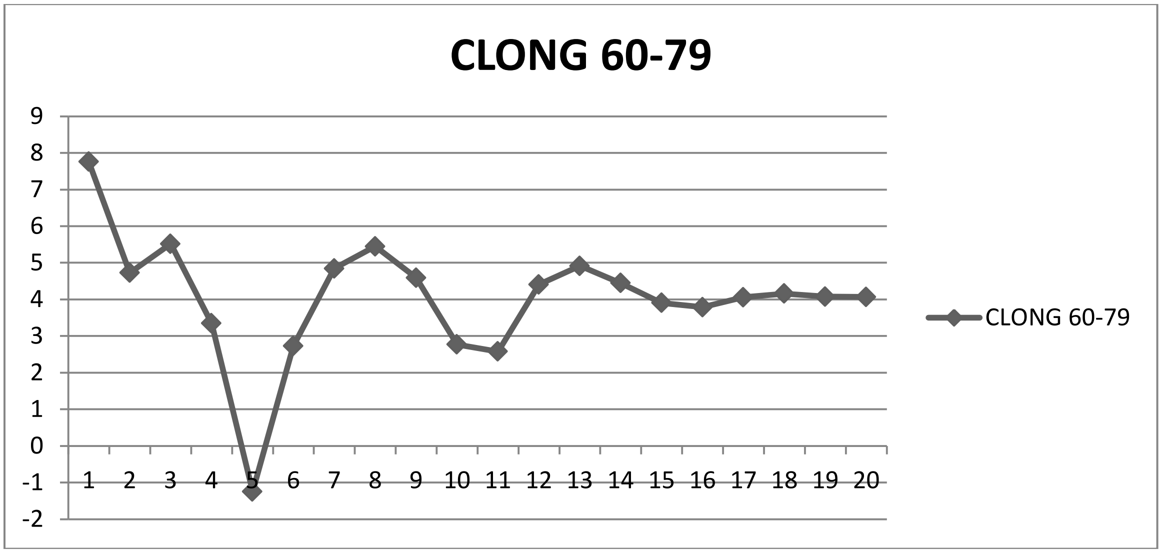
FIGURE 7: Impulse Response Functions for Corporate Liabilites[39]

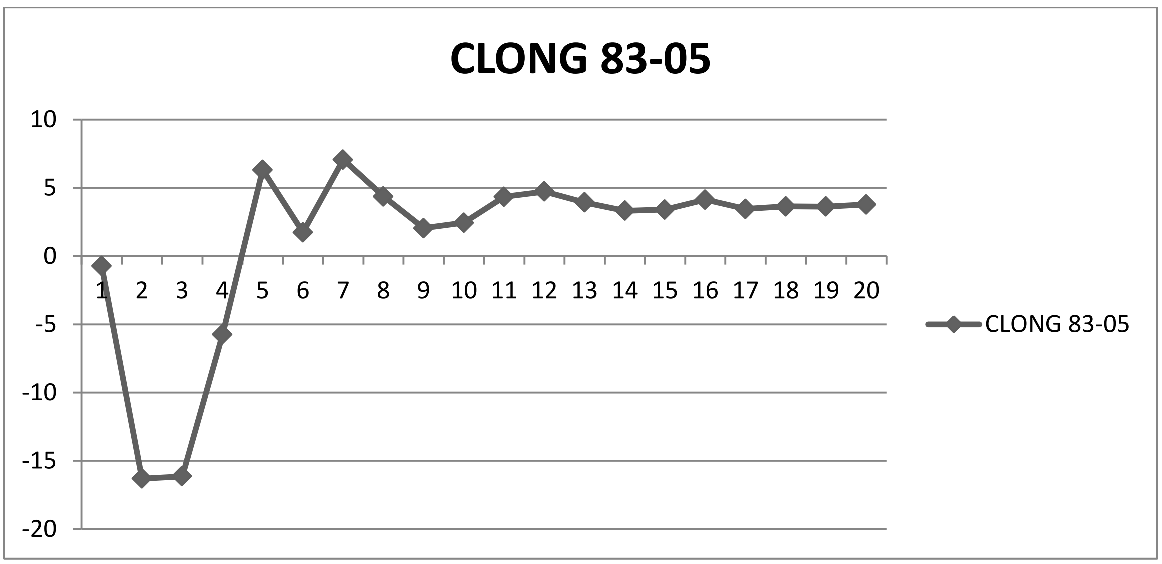



[39] These two graphs show the impulse response functions of corporate liabilities in the two sample periods after a 1% increase in the Federal funds rate.

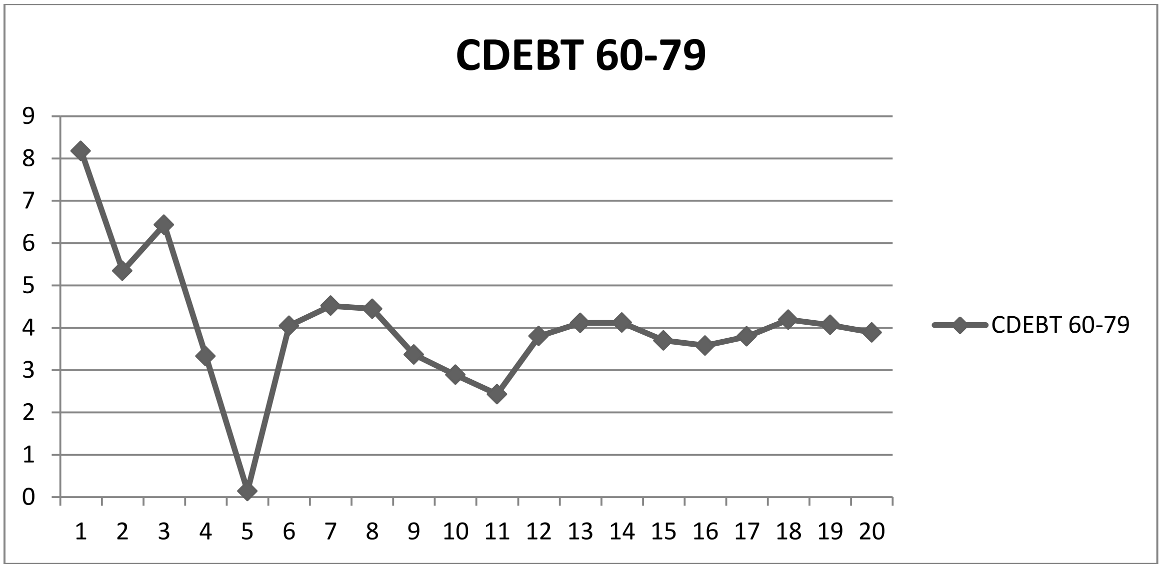
FIGURE 8: Impulse Response Functions for Corporate Long-Term Debt[40]

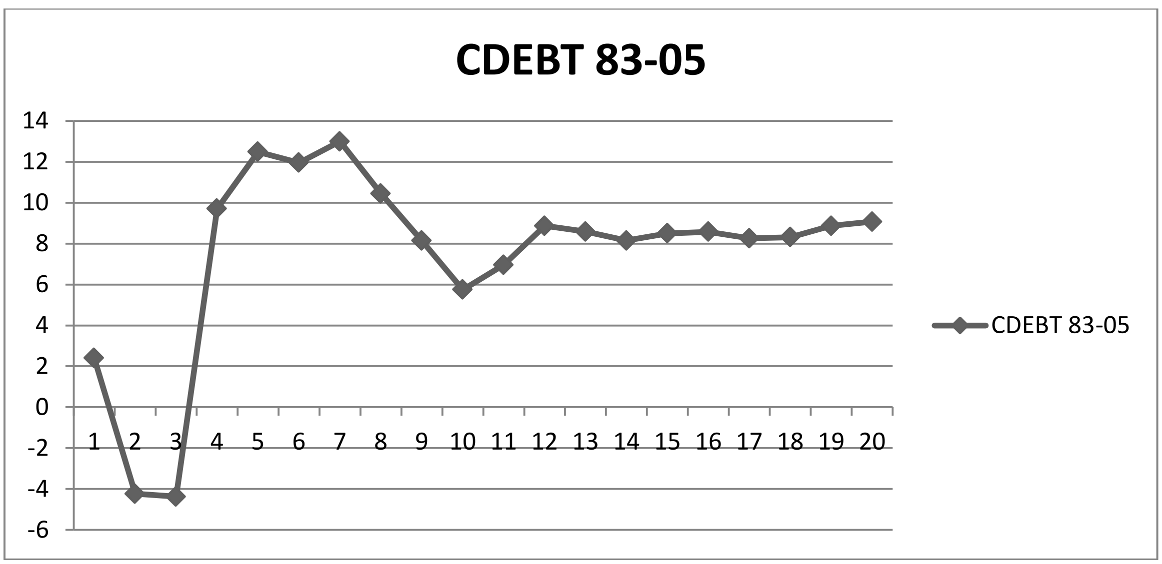



[40] These two graphs show the impulse response functions of corporate long-term liabilities in the two sample periods after a 1% increase in the Federal funds rate.

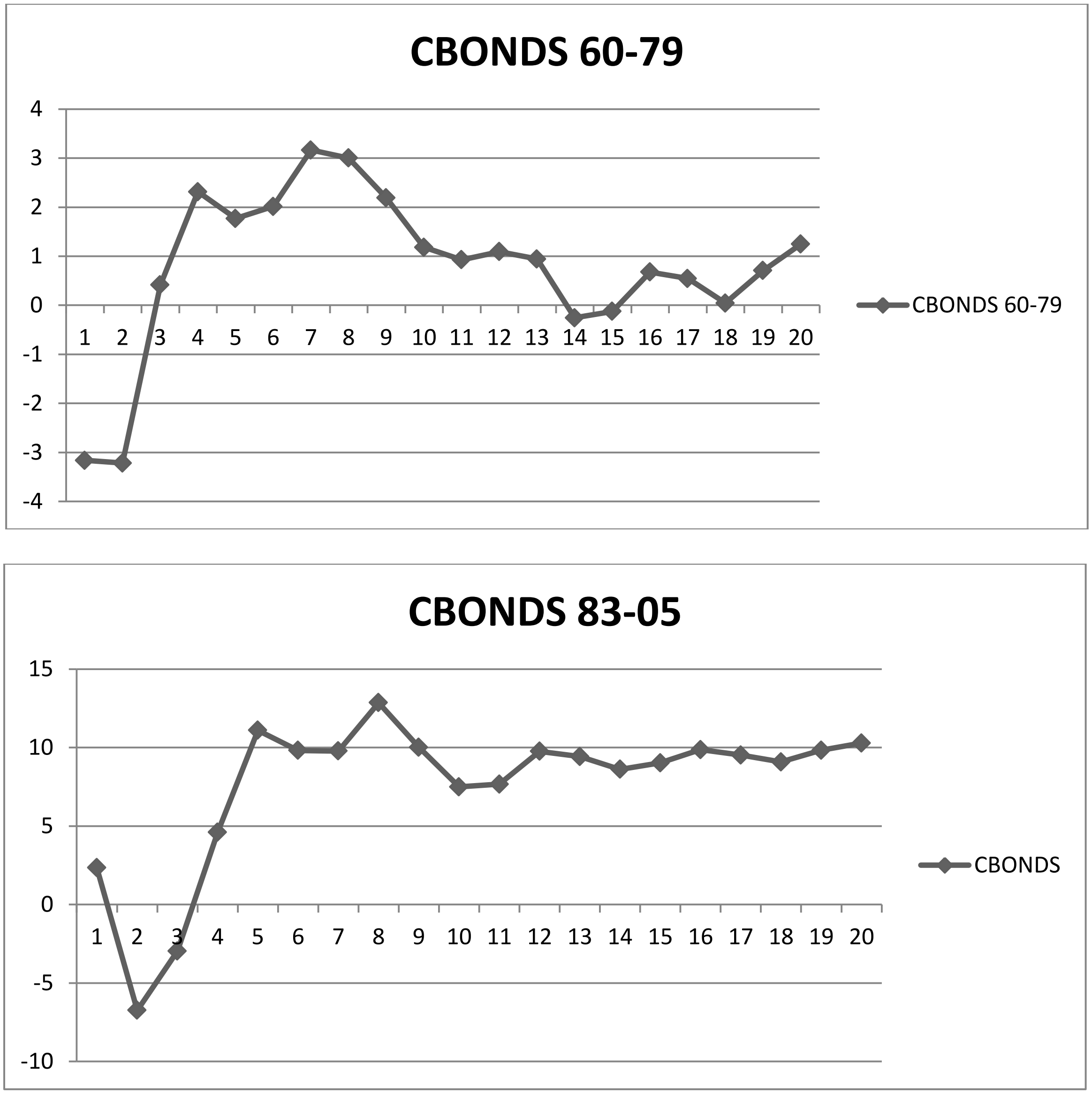
FIGURE 9: Impulse Response Functions for Corporate Long-Term Debt[41]



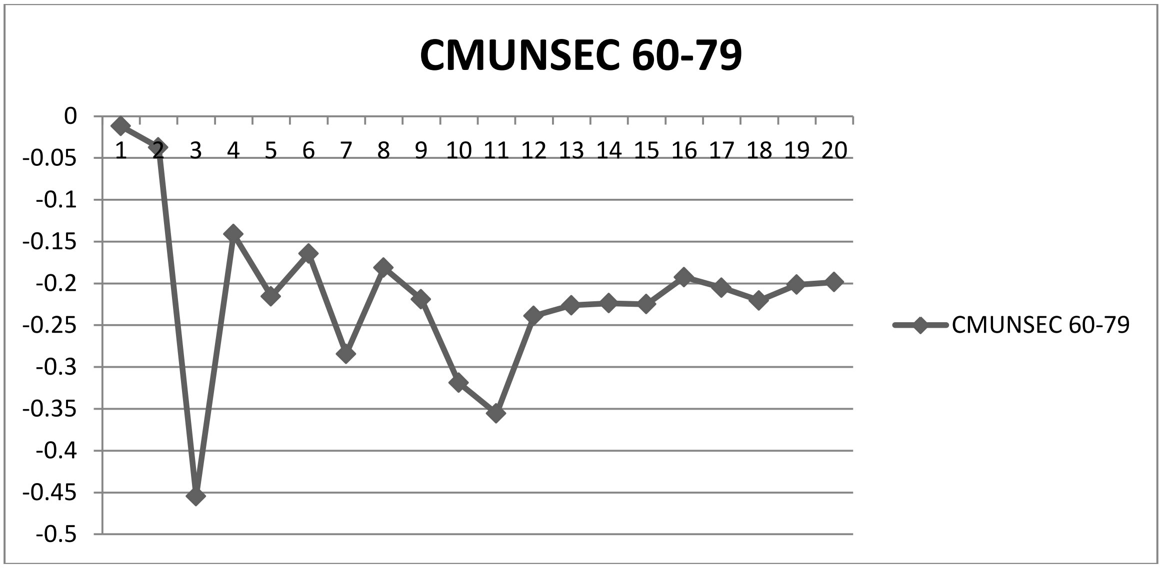

[41] These two graphs show the impulse response functions of corporate long-term debt in the two sample periods after a 1% increase in the Federal funds rate.

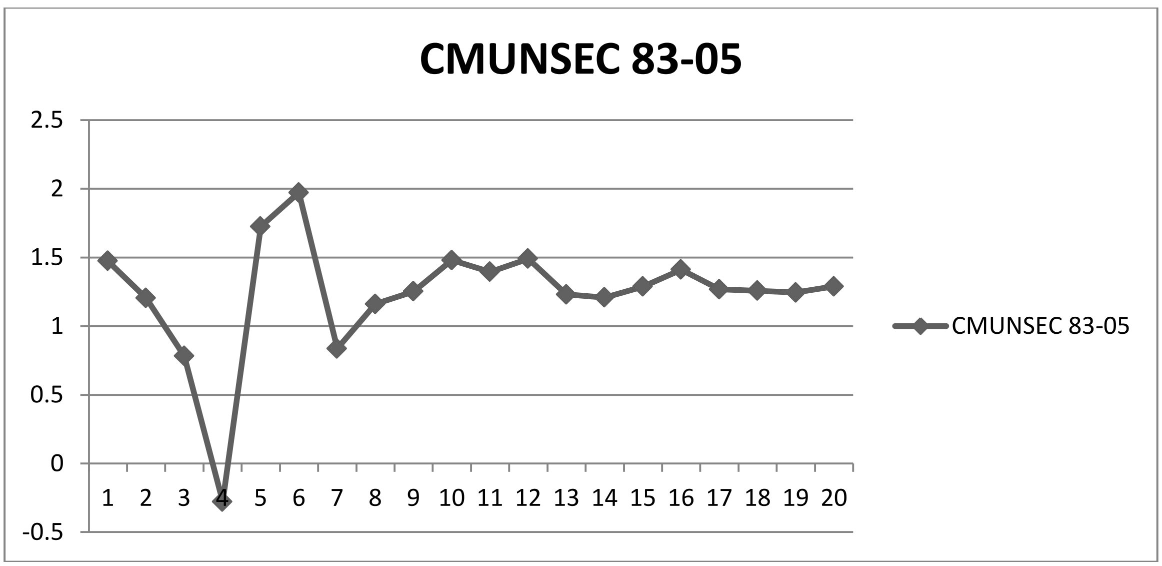
FIGURE 10: Impulse Response Functions for Corporate Bonds[42]




[42] These two graphs show the impulse response functions of corporate bonds in the two sample periods after a 1% increase in the Federal funds rate.

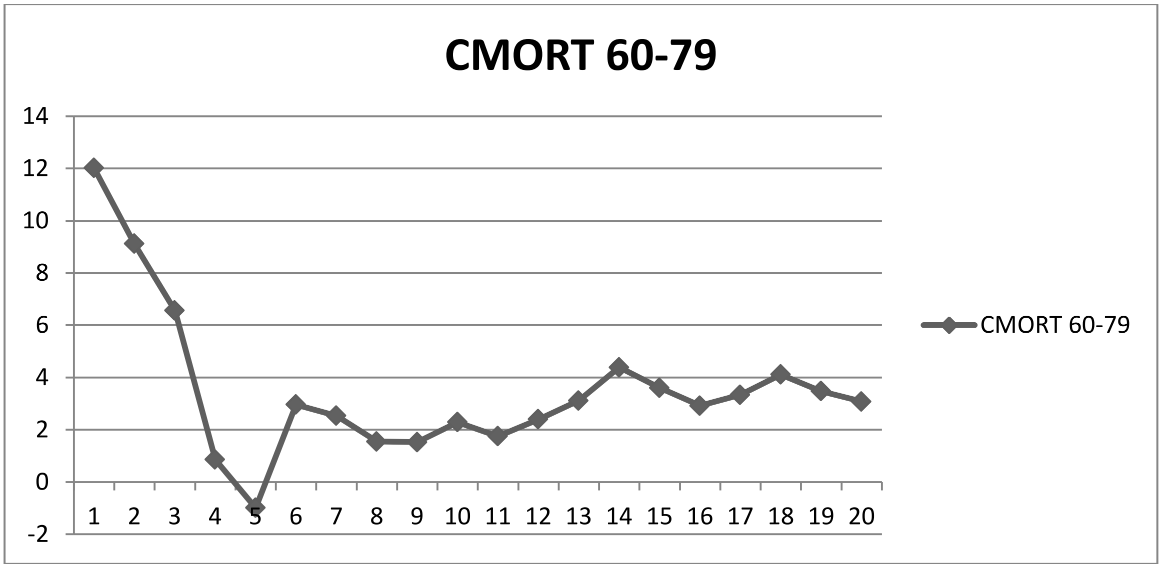
FIGURE 11: Impulse Response Functions for Corporate Municipal Securities[43]

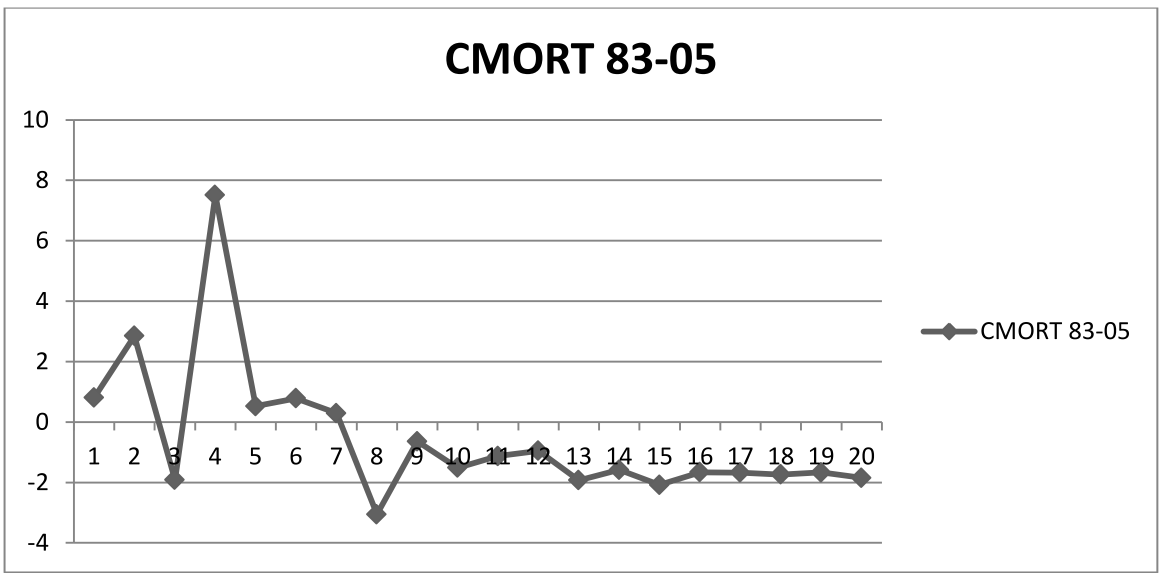



[43] These two graphs show the impulse response functions of corporate municipal securities in the two sample periods after a 1% increase in the Federal funds rate.

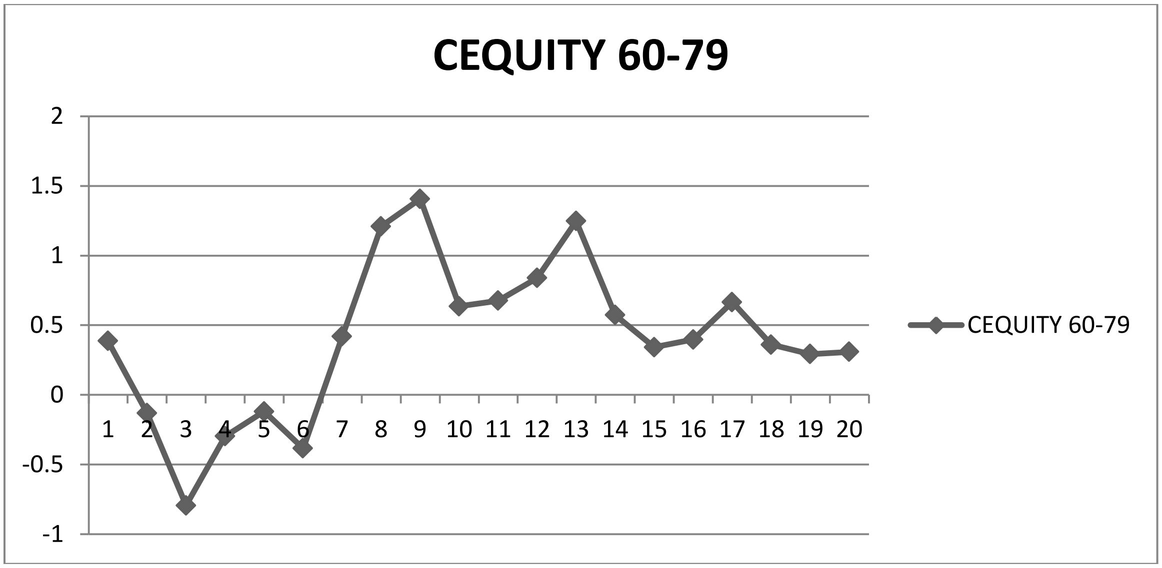
FIGURE 12: Impulse Response Functions for Corporate Mortgages[44]

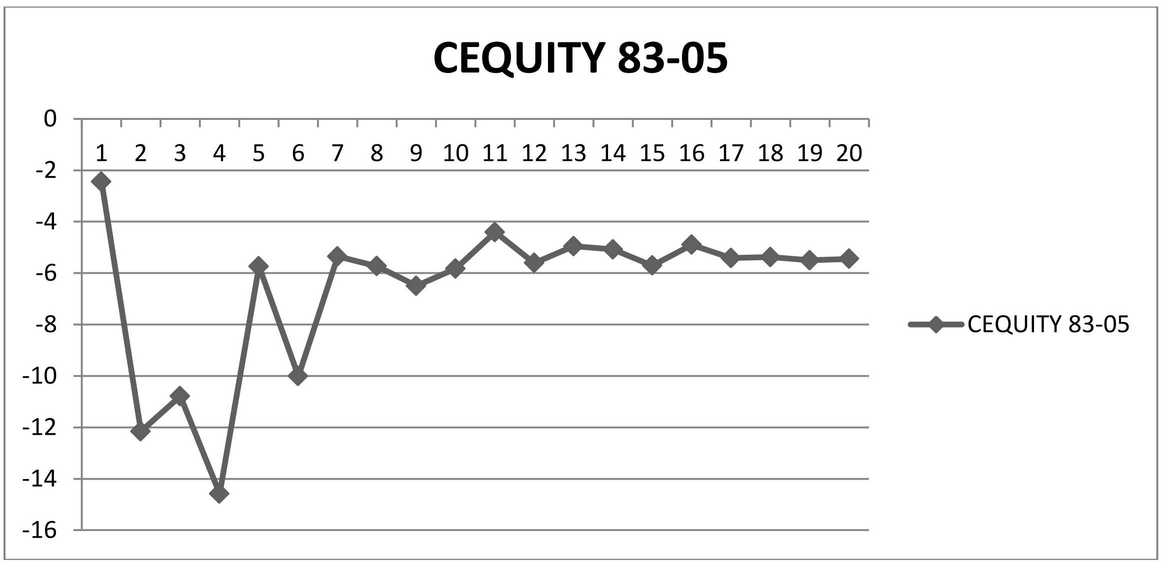



[44] These two graphs show the impulse response functions of corporate mortgages in the two sample periods after a 1% increase in the Federal funds rate.

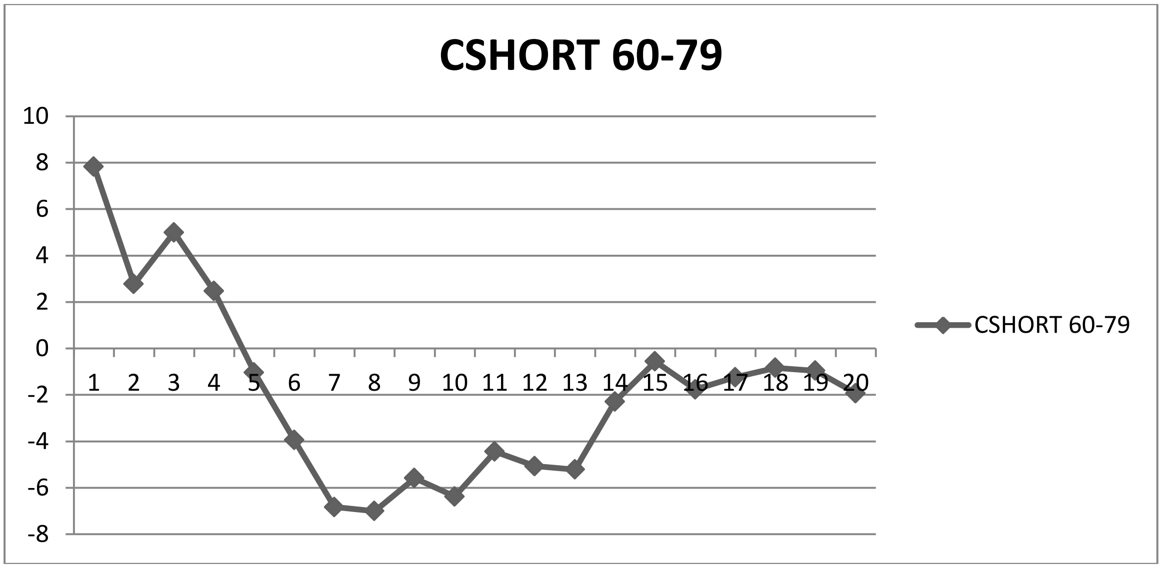
FIGURE 13: Impulse Response Functions for Corporate Equity[45]

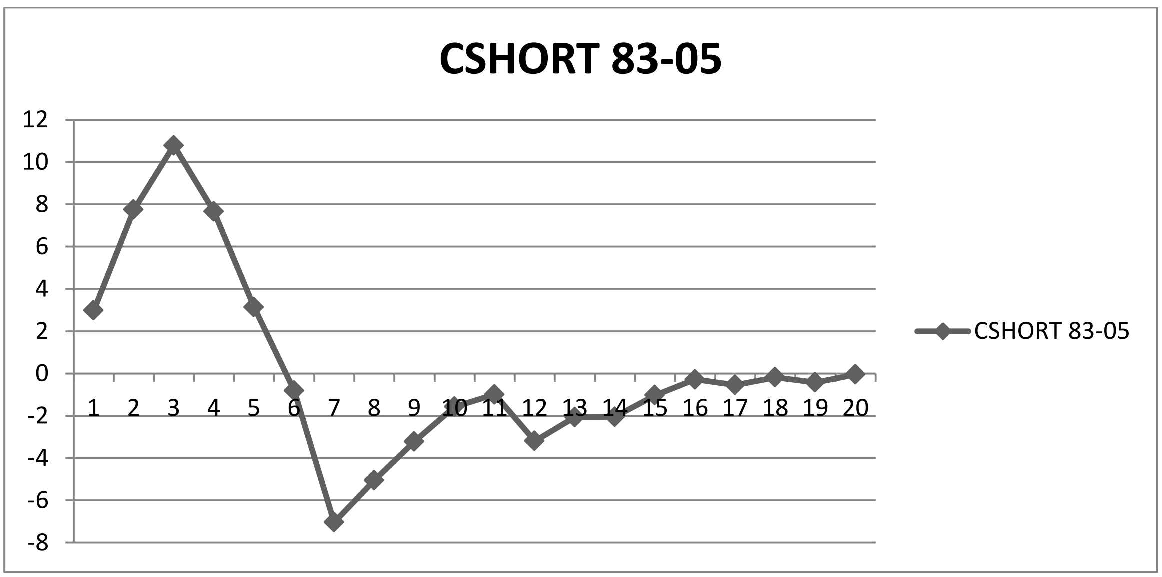



[45] These two graphs show the impulse response functions of corporate equity in the two sample periods after a 1% increase in the Federal funds rate.

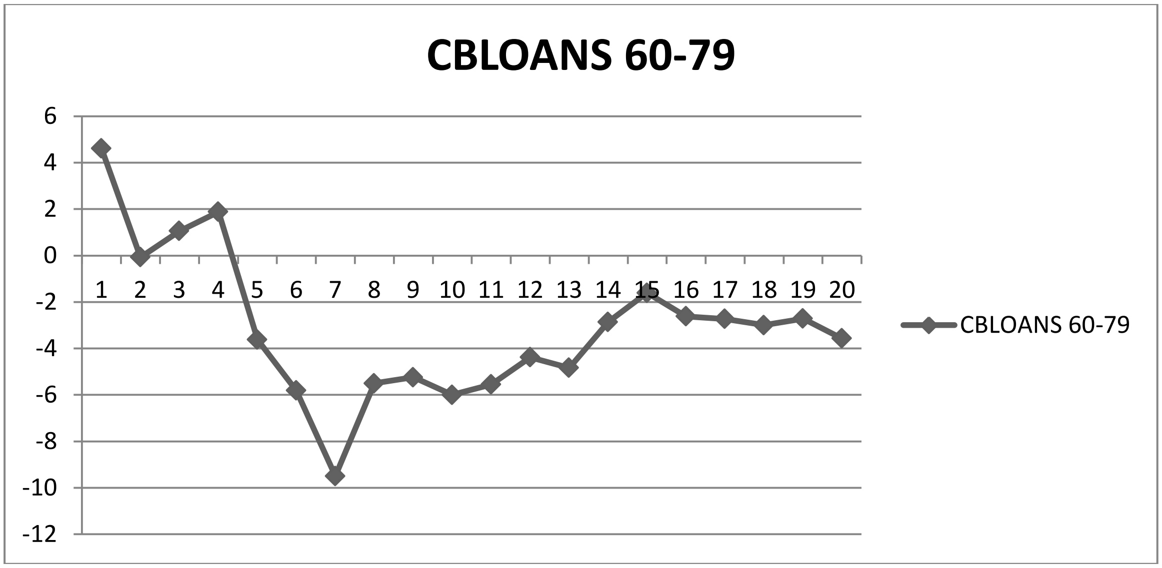
FIGURE 14: Impulse Response Functions for Corporate Short-Term Debt[46]

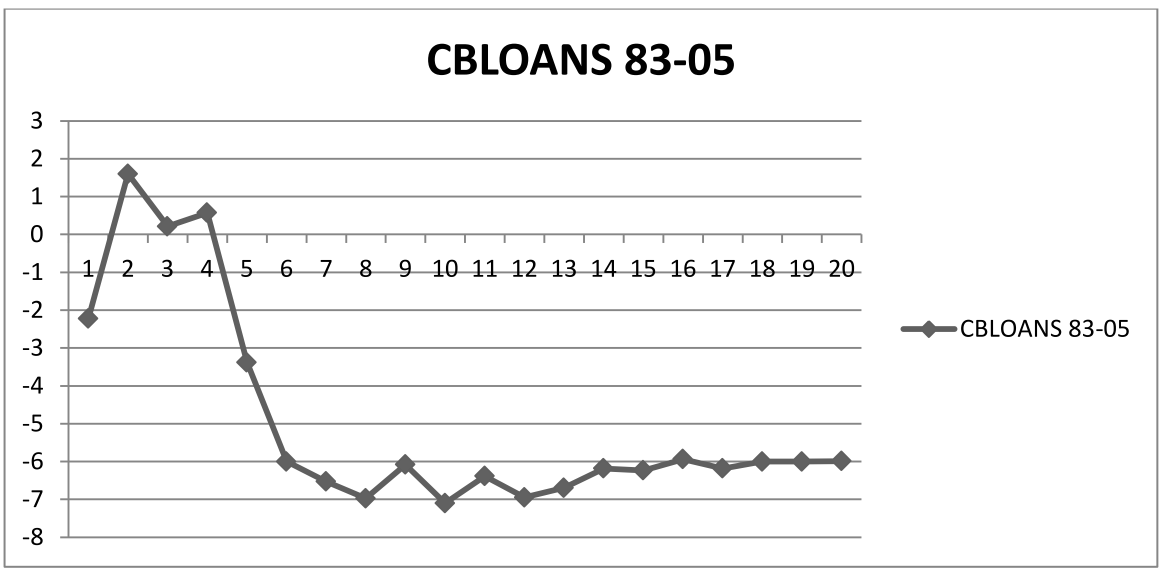



[46] These two graphs show the impulse response functions of corporate short-term debt in the two sample periods after a 1% increase in the Federal funds rate.

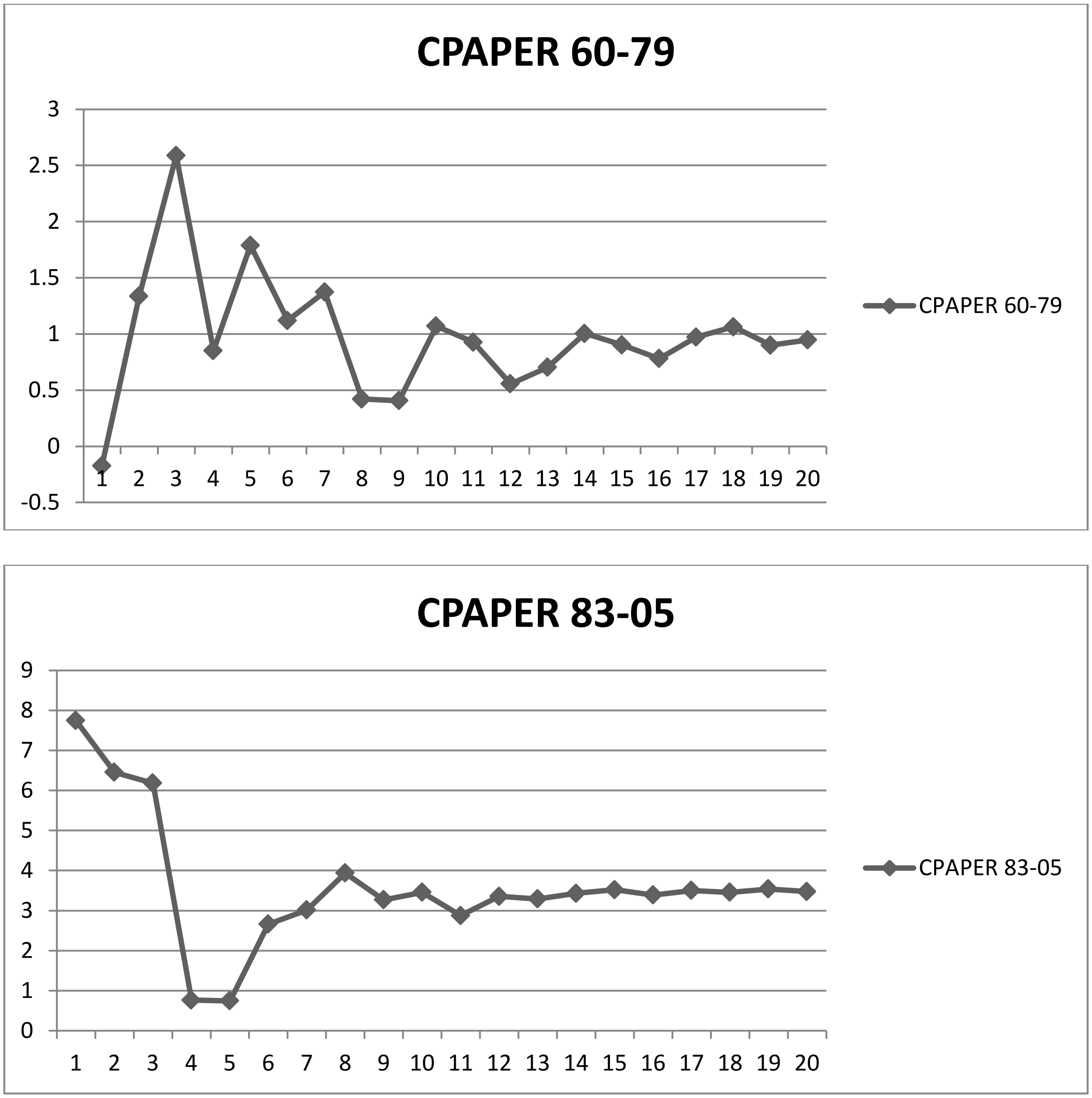
FIGURE 15: Impulse Response Functions for Corporate Bank Loans[47]



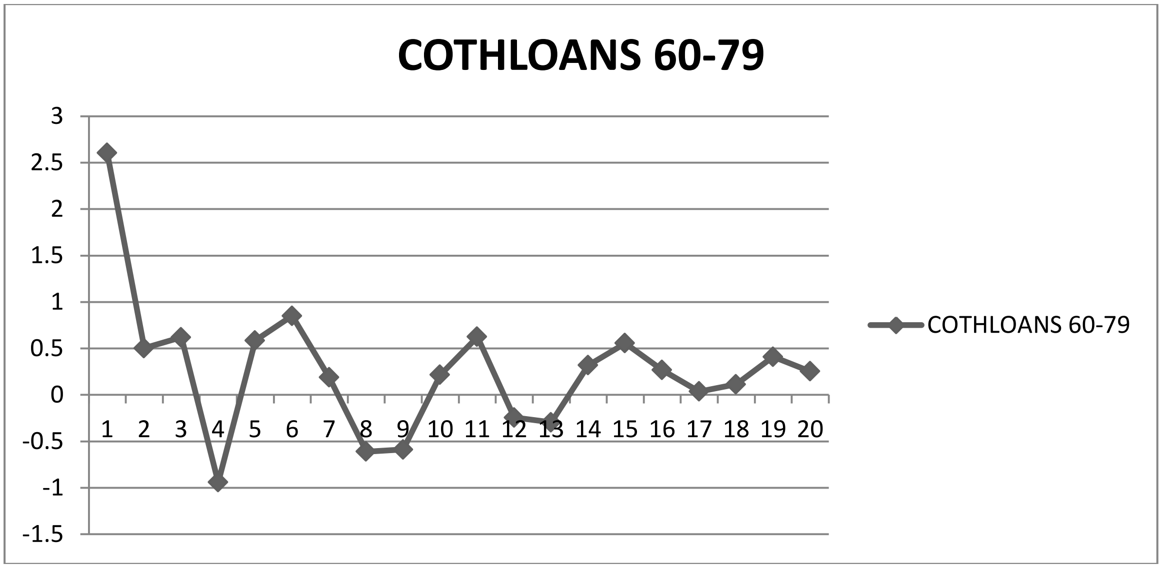

[47] These two graphs show the impulse response functions of corporate bank loans in the two sample periods after a 1% increase in the Federal funds rate.

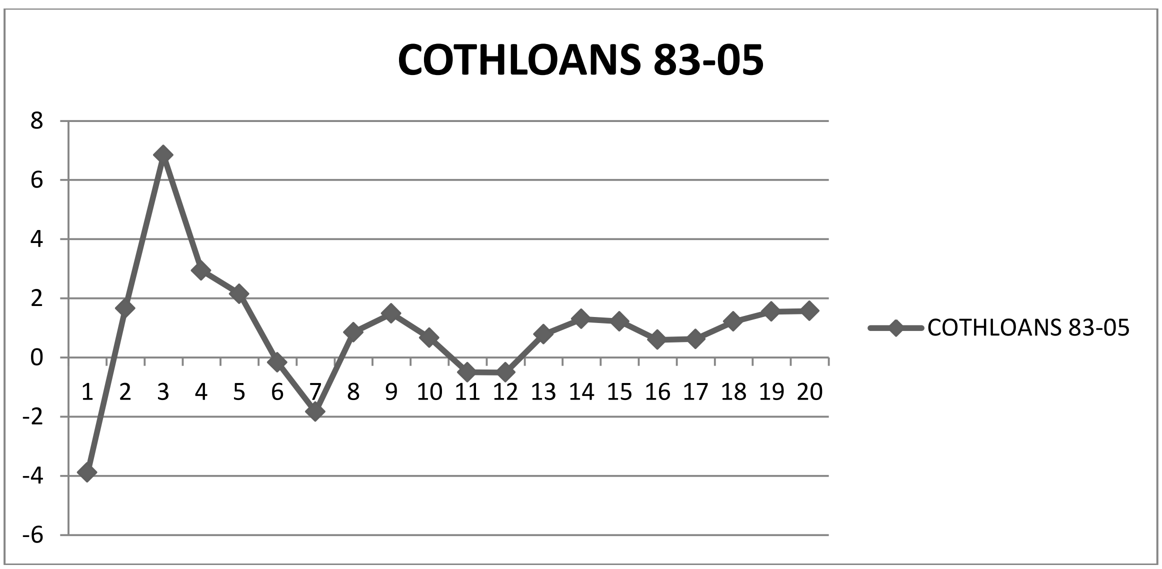
FIGURE 16: Impulse Response Functions for Corporate Commercial Paper[48]




[48] These two graphs show the impulse response functions of corporate commercial paper in the two sample periods after a 1% increase in the Federal funds rate.

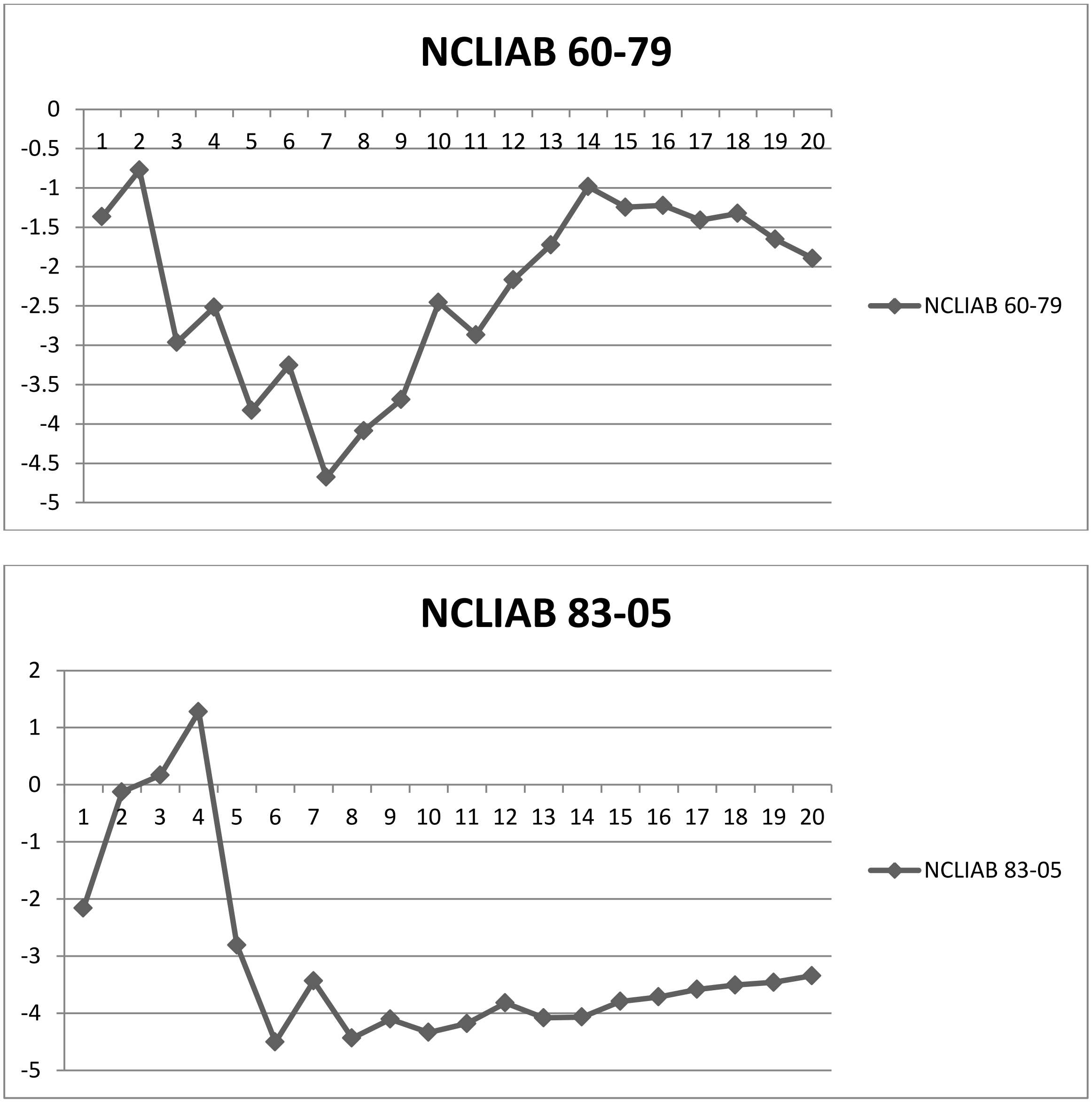
FIGURE 17: Impulse Response Functions for Corporate Other Loans and Advances[49]



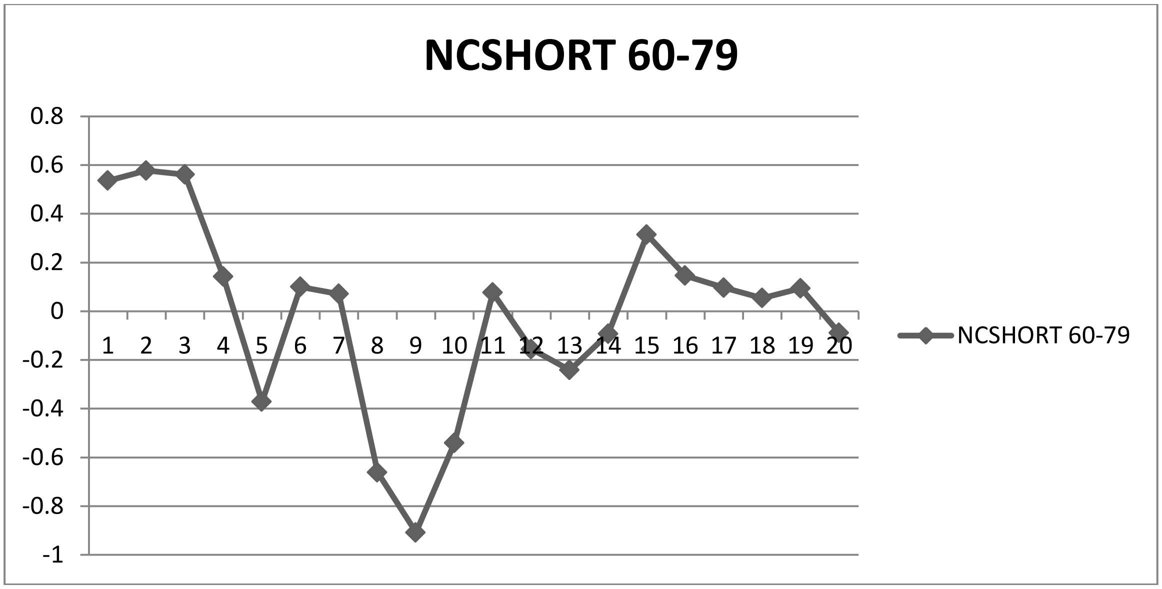

[49] These two graphs show the impulse response functions of corporate other loans and advances in the two sample periods after a 1% increase in the Federal funds rate.

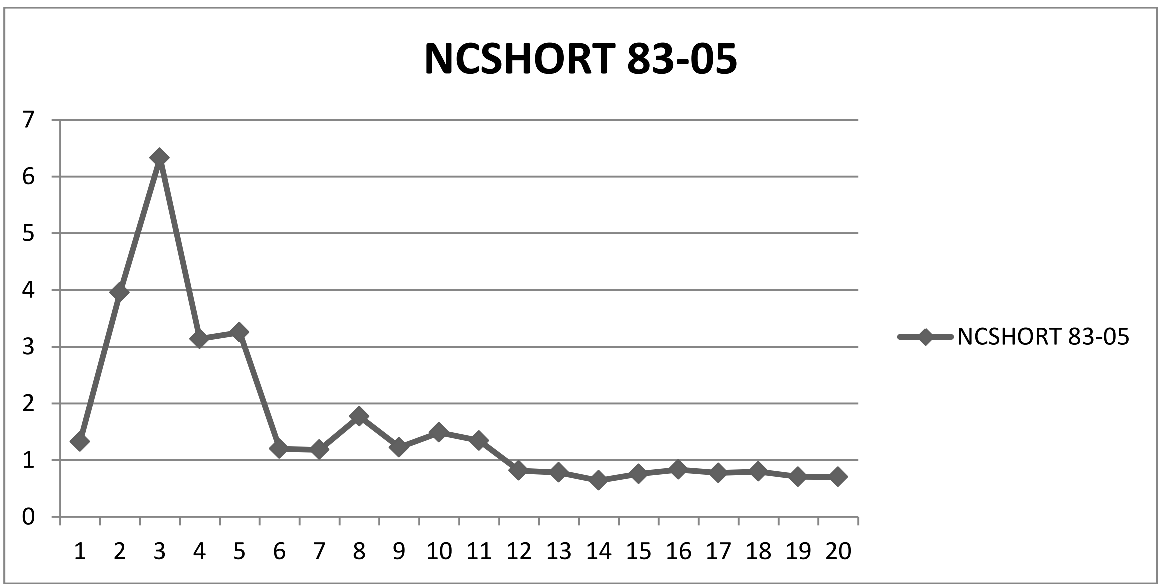
FIGURE 18: Impulse Response Functions for Noncorporate Liabilities[50]




[50] These two graphs show the impulse response functions of noncorporate liabilities in the two sample periods after a 1% increase in the Federal funds rate.

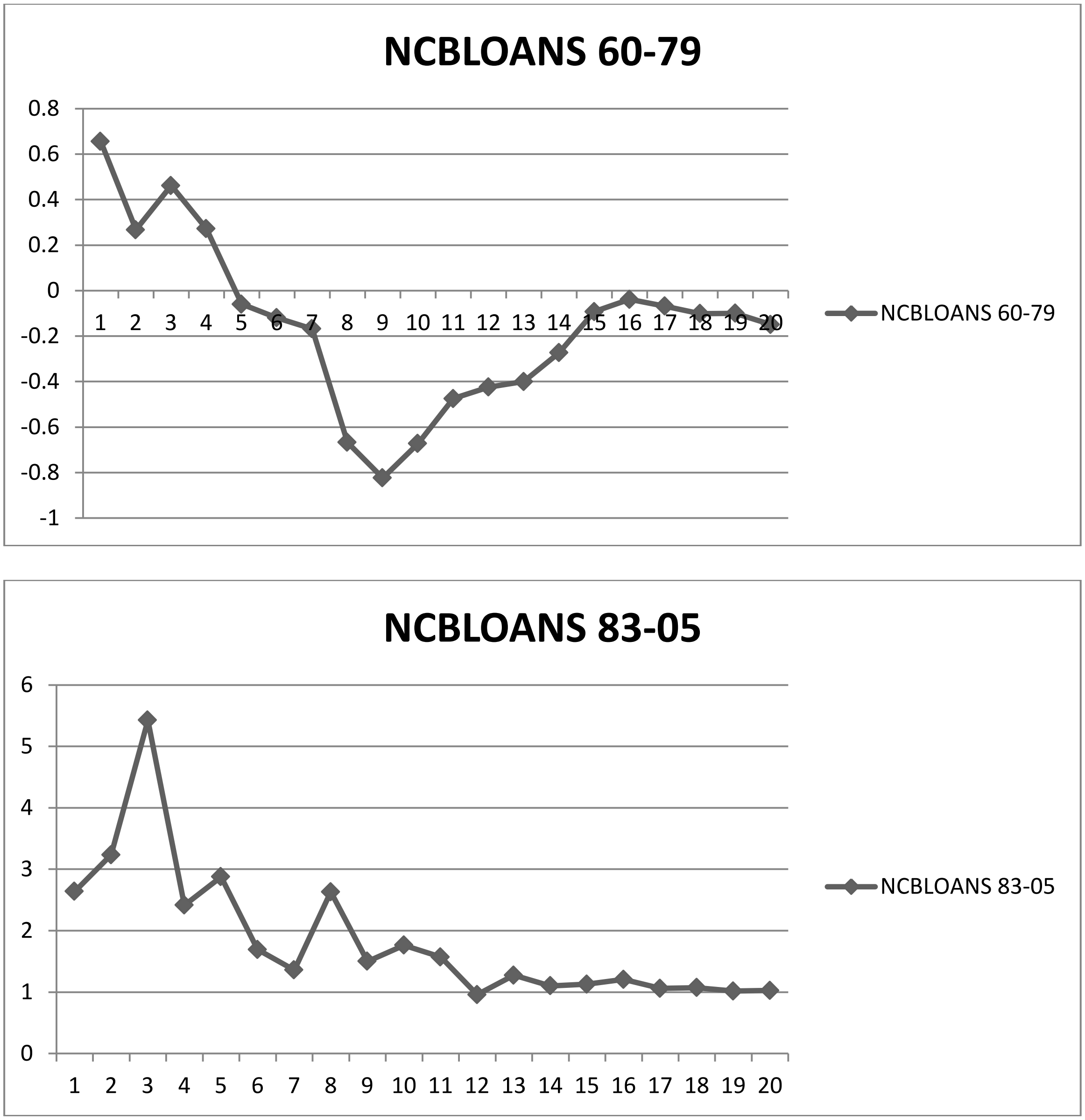
FIGURE 19: Impulse Response Functions for Noncorporate Short-Term Liabilities[51]



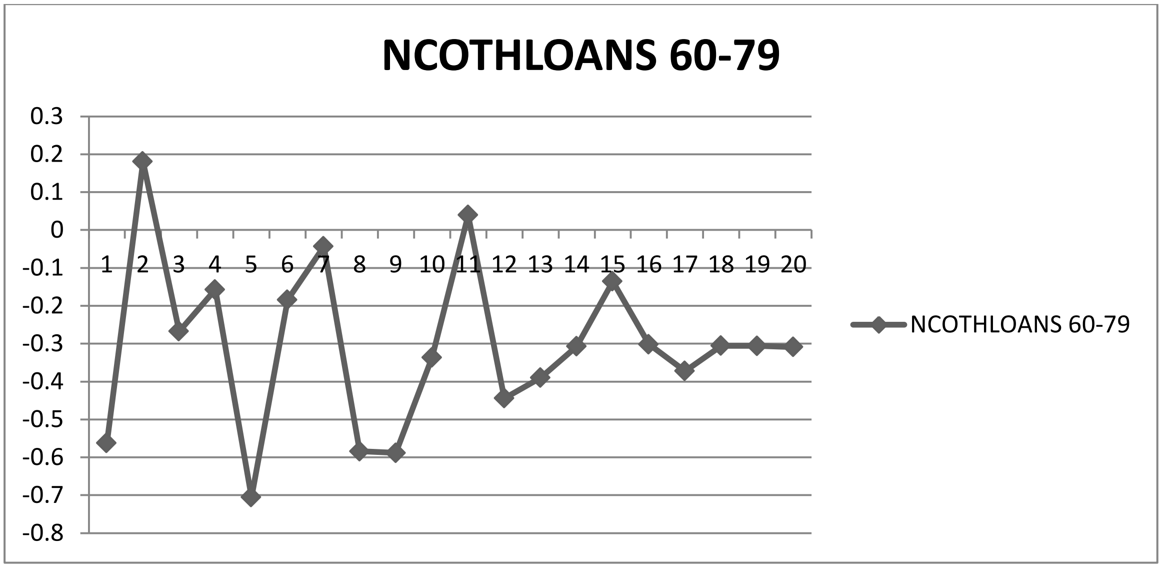

[51] These two graphs show the impulse response functions of noncorporate short-term liabilities in the two sample periods after a 1% increase in the Federal funds rate.

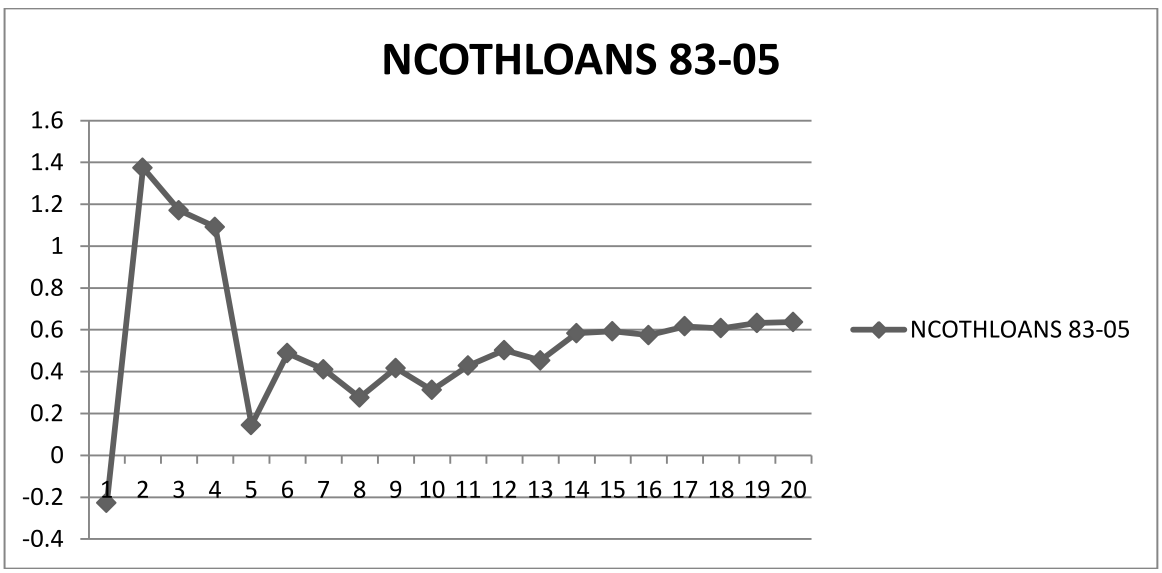
FIGURE 20: Impulse Response Functions for Noncorporate Bank Loans[52]




[52] These two graphs show the impulse response functions of noncorporate bank loans in the two sample periods after a 1% increase in the Federal funds rate.

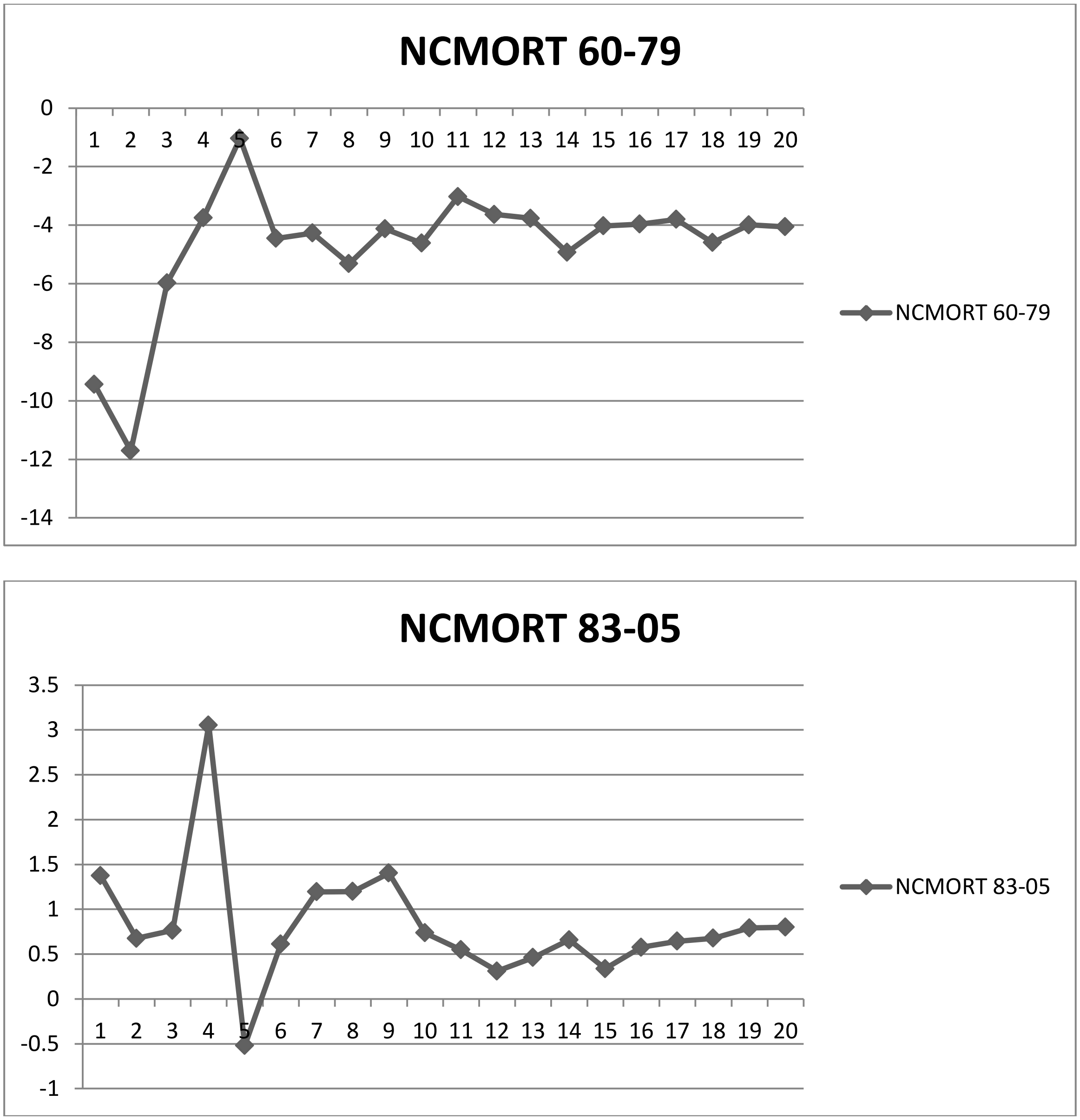
FIGURE 21: Impulse Response Functions for Noncorporate Other Loans and Advances[53]



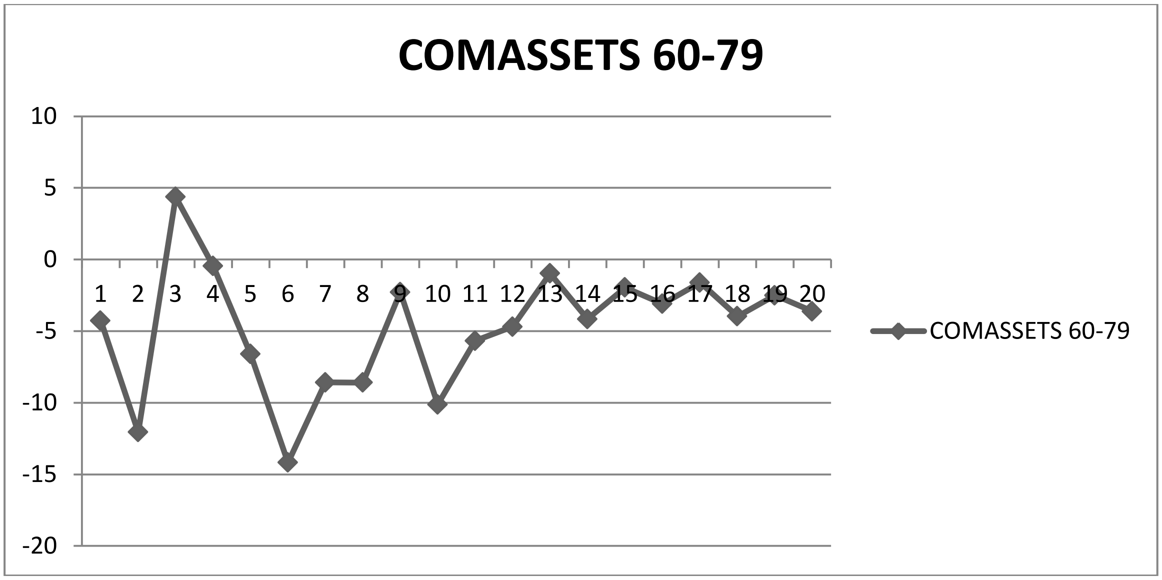

[53] These two graphs show the impulse response functions of noncorporate other loans and advances in the two sample periods after a 1% increase in the Federal funds rate.

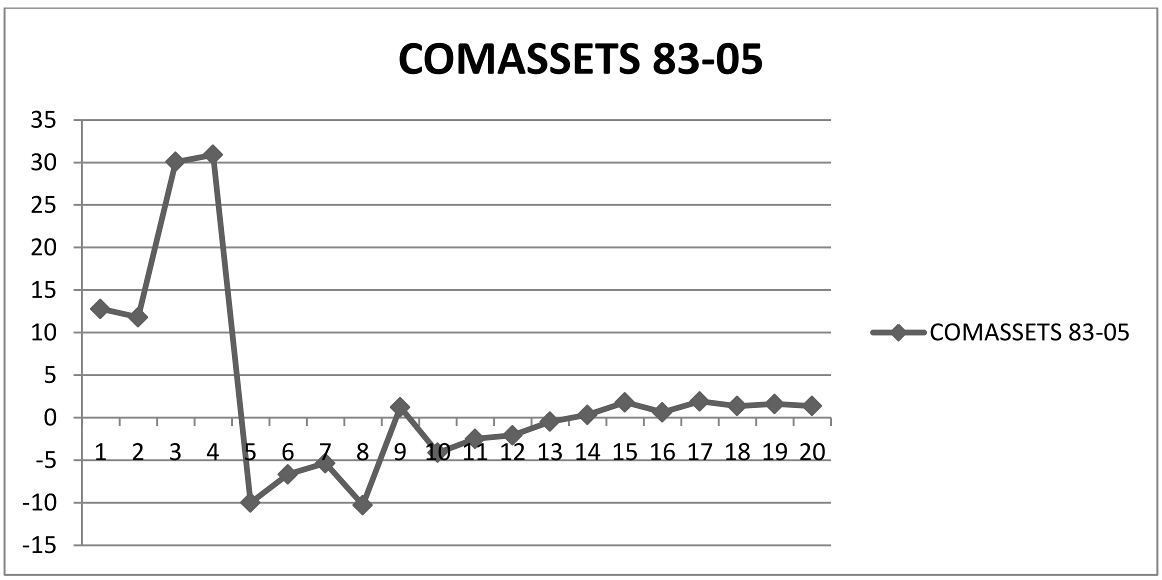
FIGURE 22: Impulse Response Functions for Noncorporate Mortgages[54]




[54] These two graphs show the impulse response functions of noncorporate mortgages in the two sample periods after a 1% increase in the Federal funds rate.

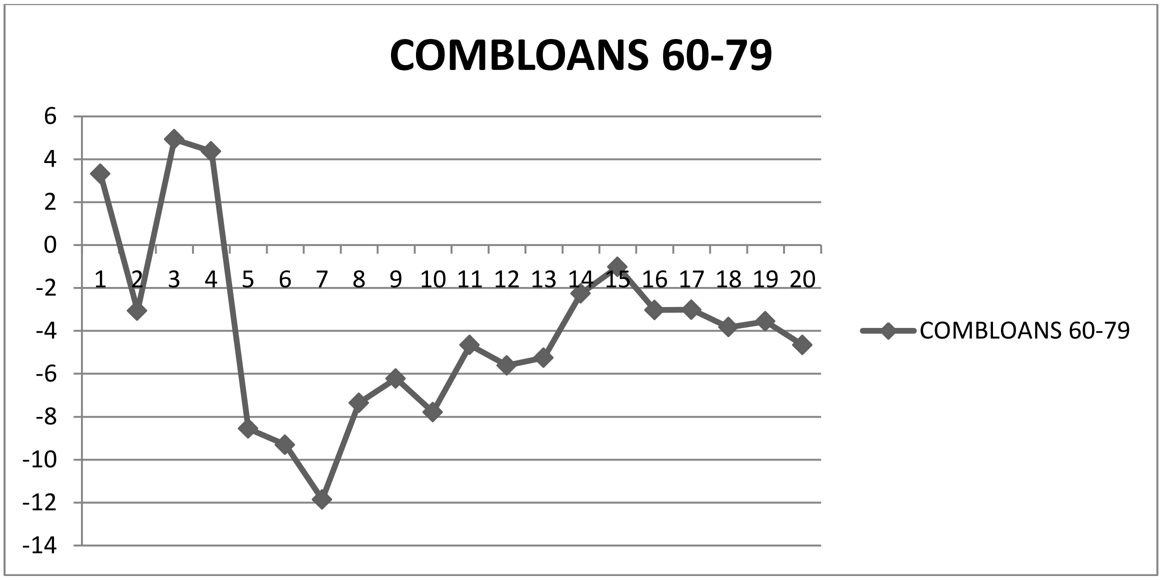
FIGURE 23: Impulse Response Functions for Commercial Bank Assets[55]

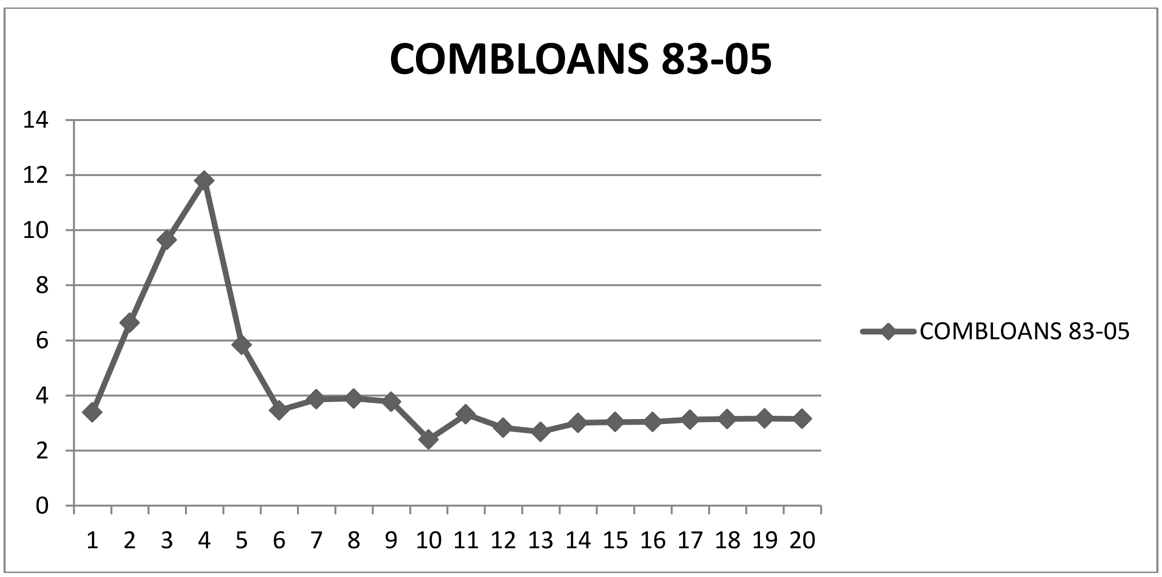



[55] These two graphs show the impulse response functions of commercial bank assets in the two sample periods after a 1% increase in the Federal funds rate.

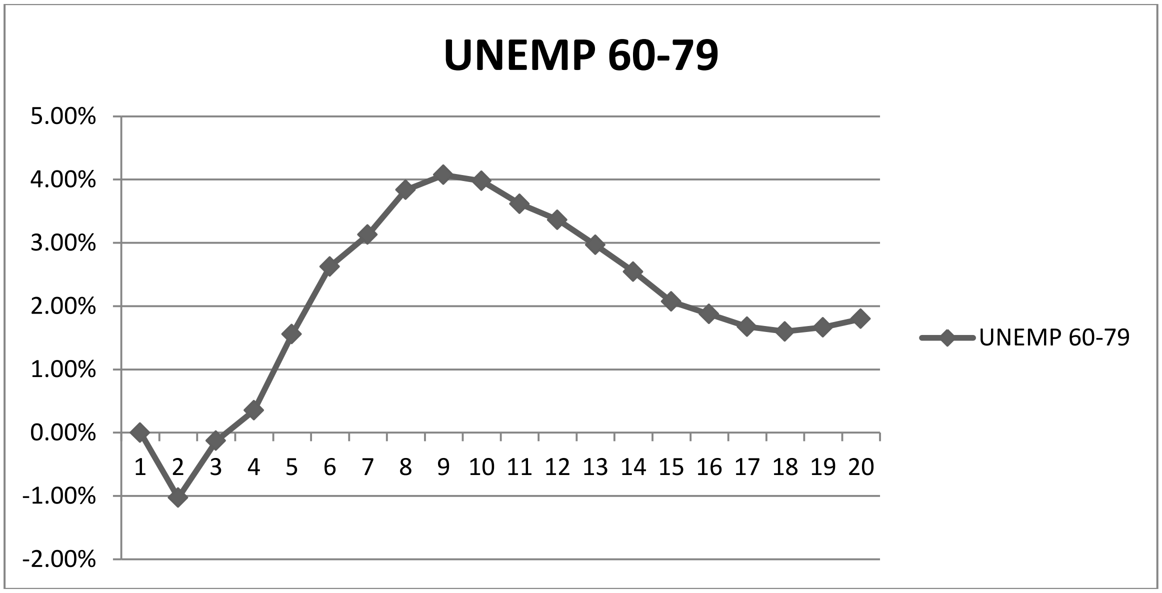
FIGURE 24: Impulse Response Functions for Commercial Bank Loans[56]

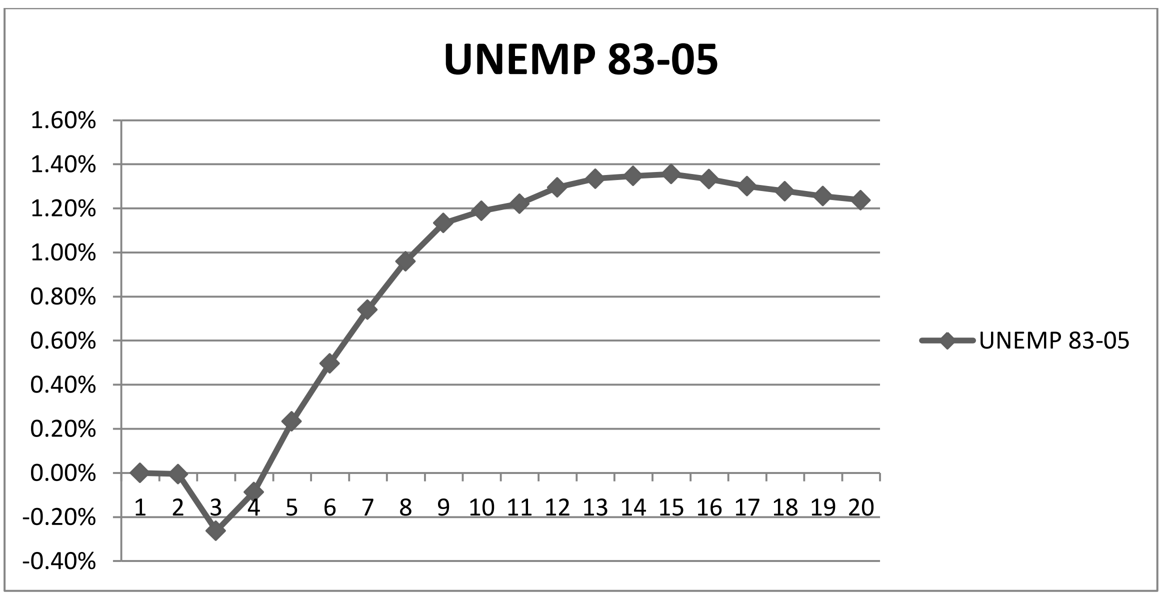



[56] These two graphs show the impulse response functions of commercial bank loans in the two sample periods after a 1% increase in the Federal funds rate.

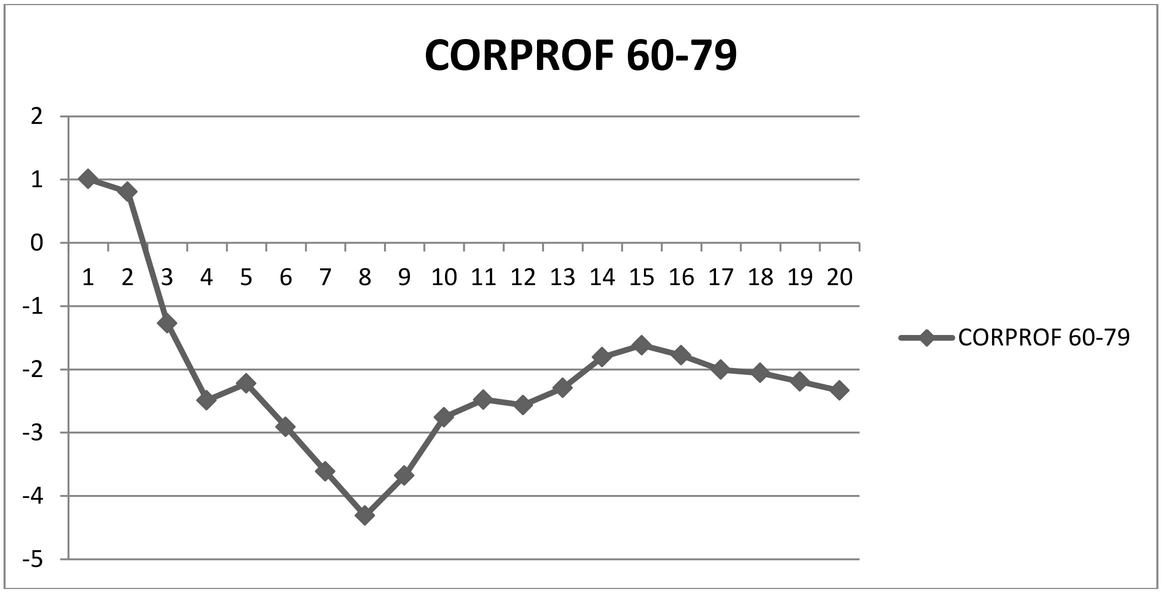
FIGURE 25: Impulse Response Functions for Unemployment[57]

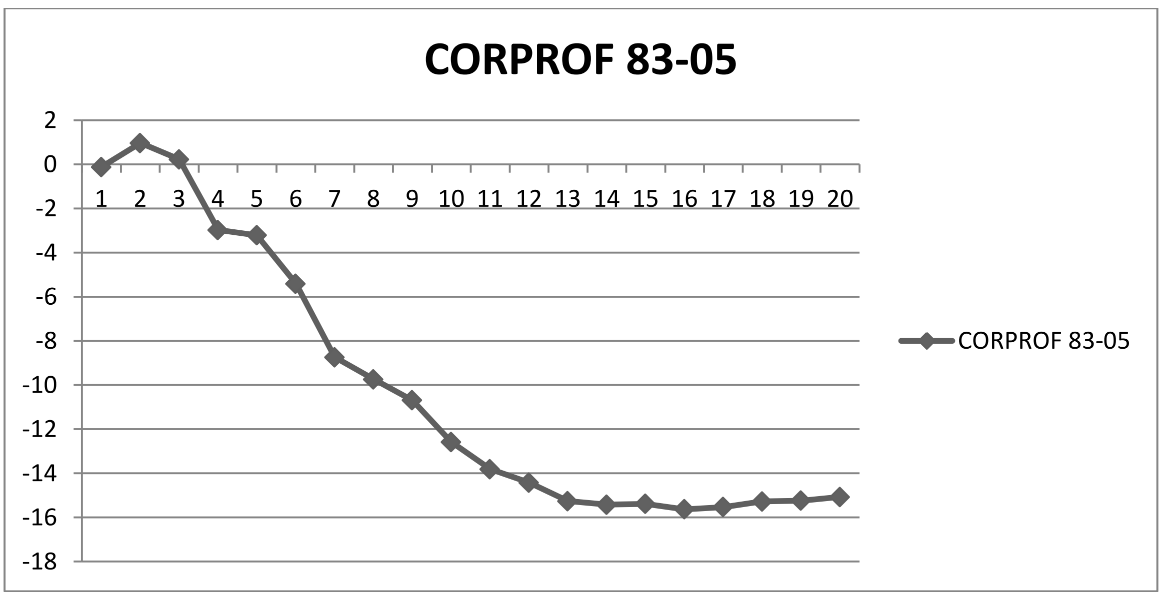



[57] These two graphs show the impulse response functions of the unemployment rate in the two sample periods after a 1% increase in the Federal funds rate.

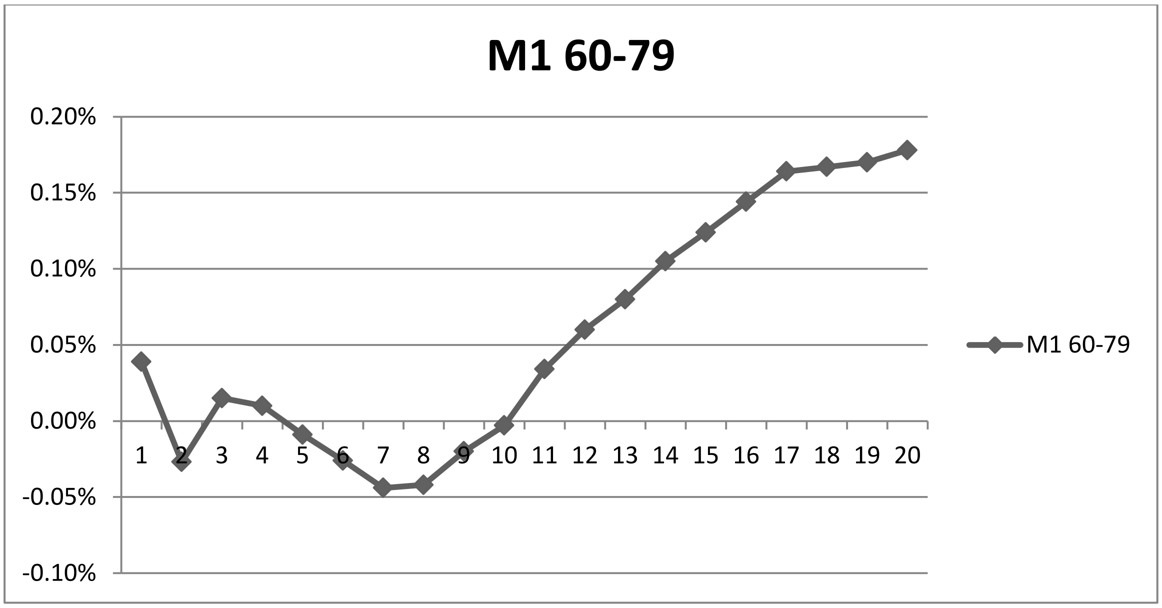
FIGURE 26: Impulse Response Functions for Corporate Profits[58]

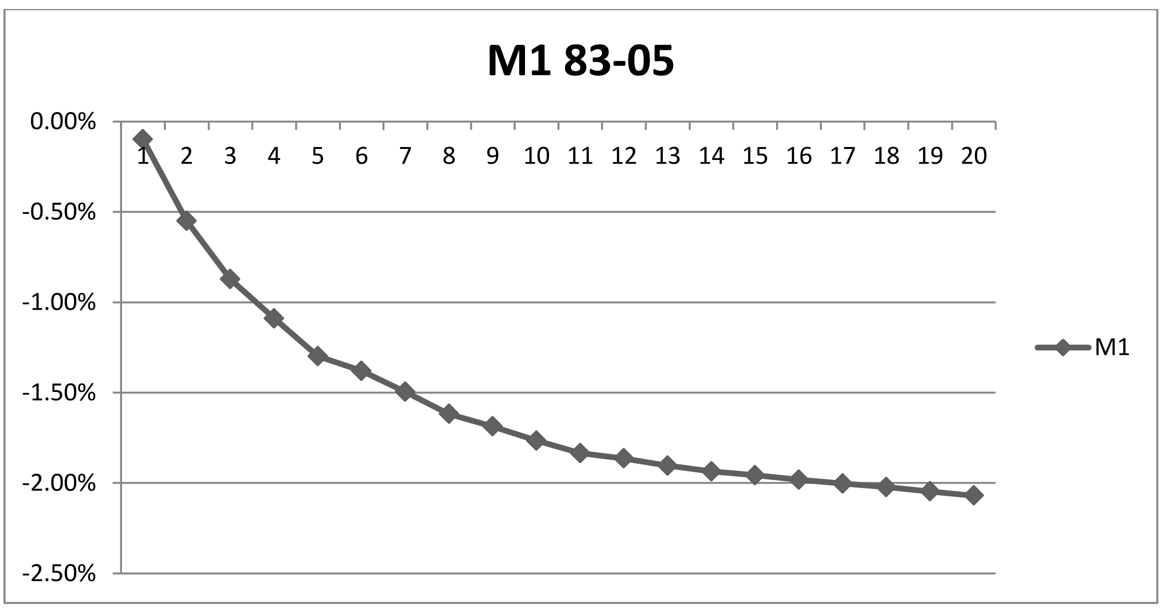



[58] These two graphs show the impulse response functions of corporate profits in the two sample periods after a 1% increase in the Federal funds rate.

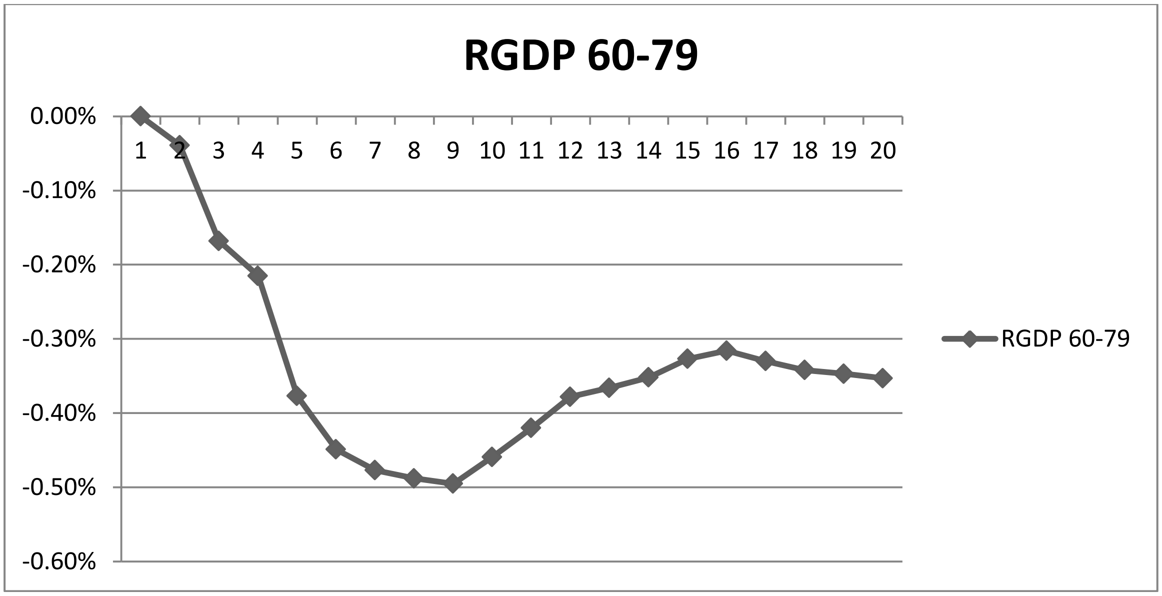
FIGURE 27: Impulse Response Functions for M1[59]

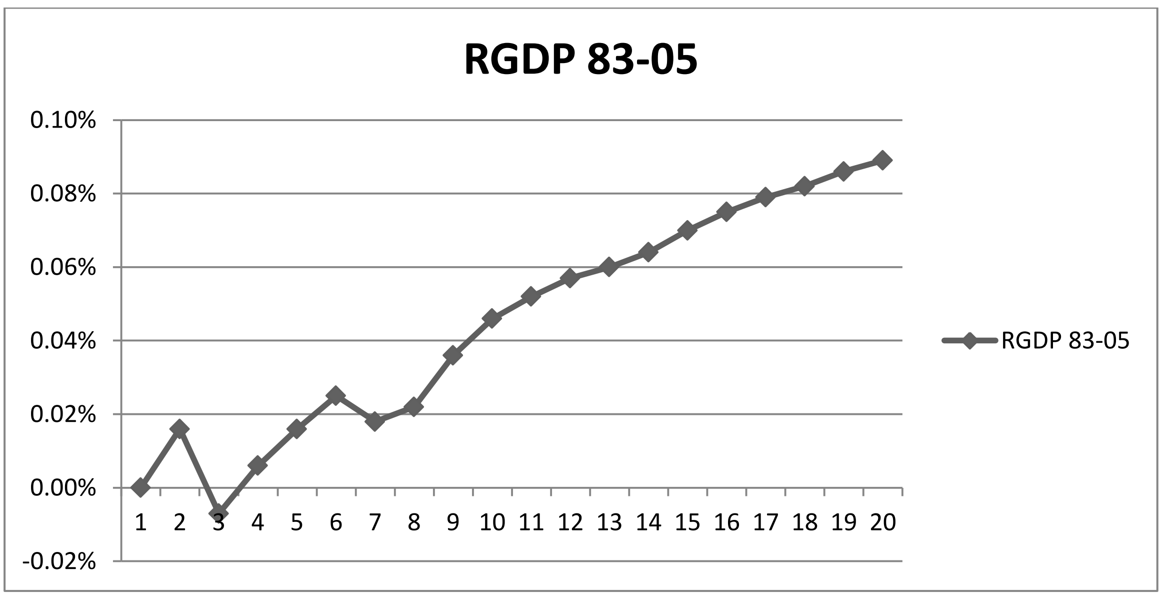



[59] These two graphs show the impulse response functions of M1 in the two sample periods after a 1% increase in the Federal funds rate.

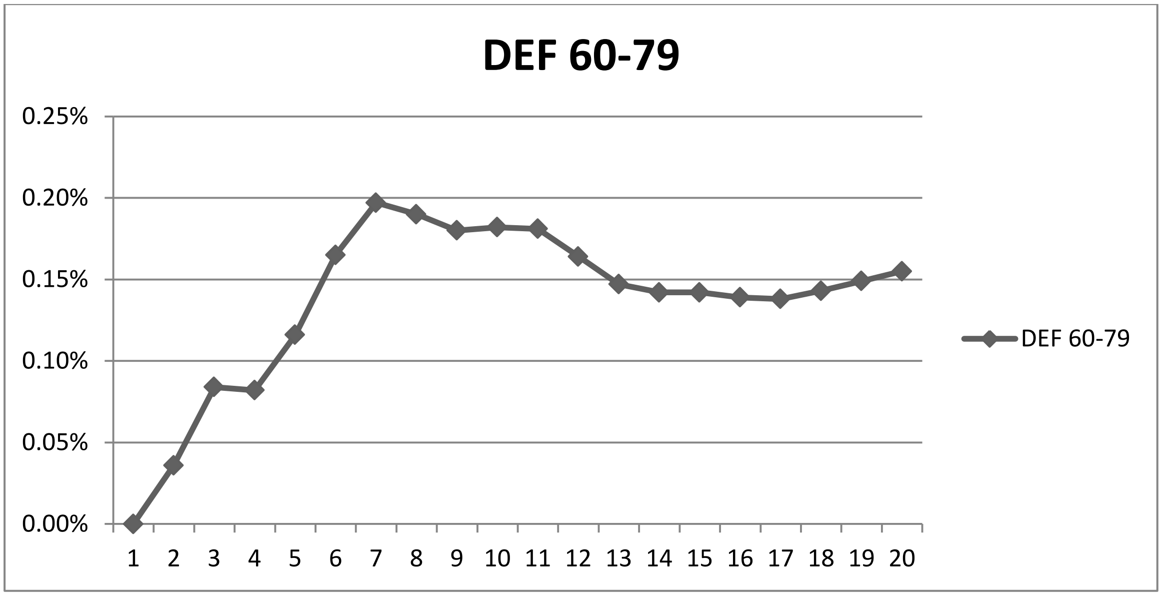
FIGURE 28: Impulse Response Functions for Real Gross Domestic Product[60]

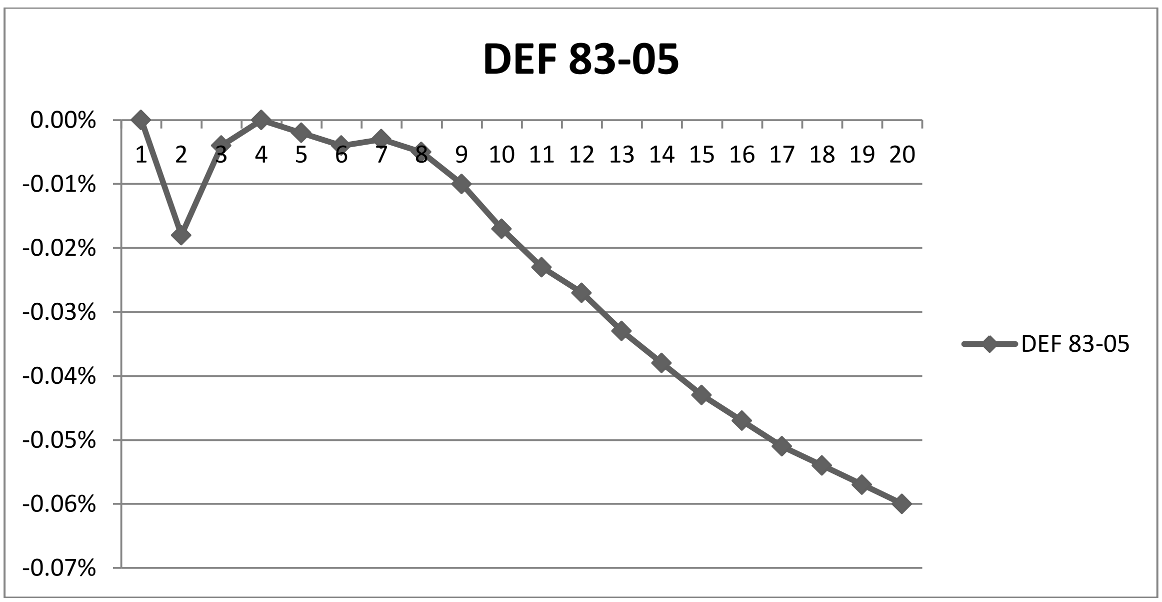



[60] These two graphs show the impulse response functions of the gross domestic product in the two sample periods after a 1% increase in the Federal funds rate.

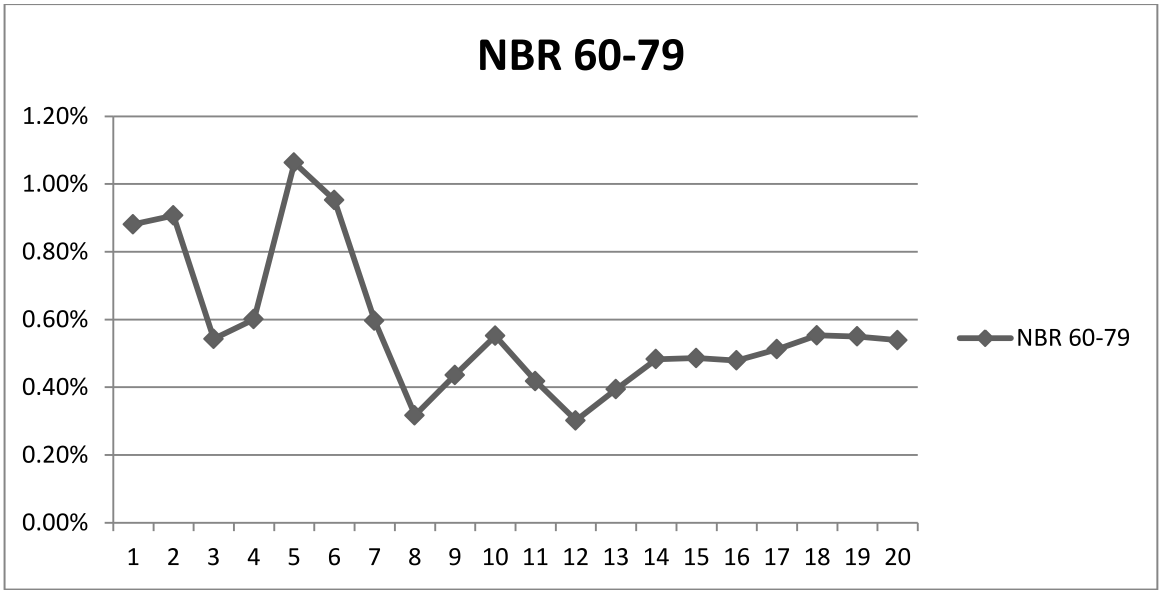
FIGURE 29: Impulse Response Functions for GDP Deflator[61]

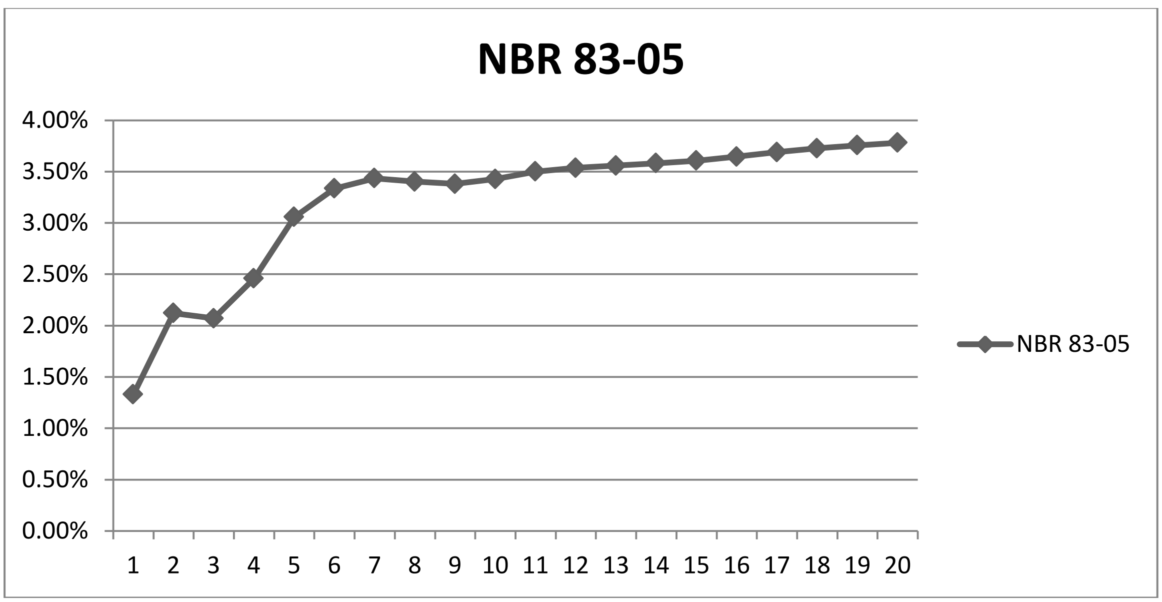



[61] These two graphs show the impulse response functions of the GDP deflator in the two sample periods after a 1% increase in the Federal funds rate.

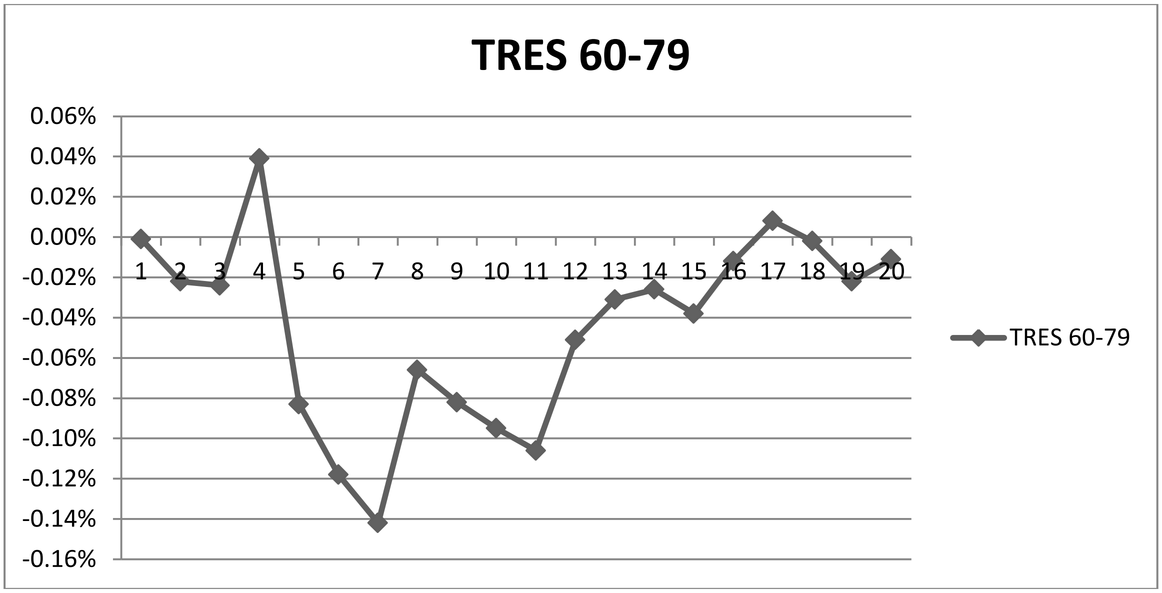
FIGURE 30: Impulse Response Functions for Nonborrowed Reserves[62]

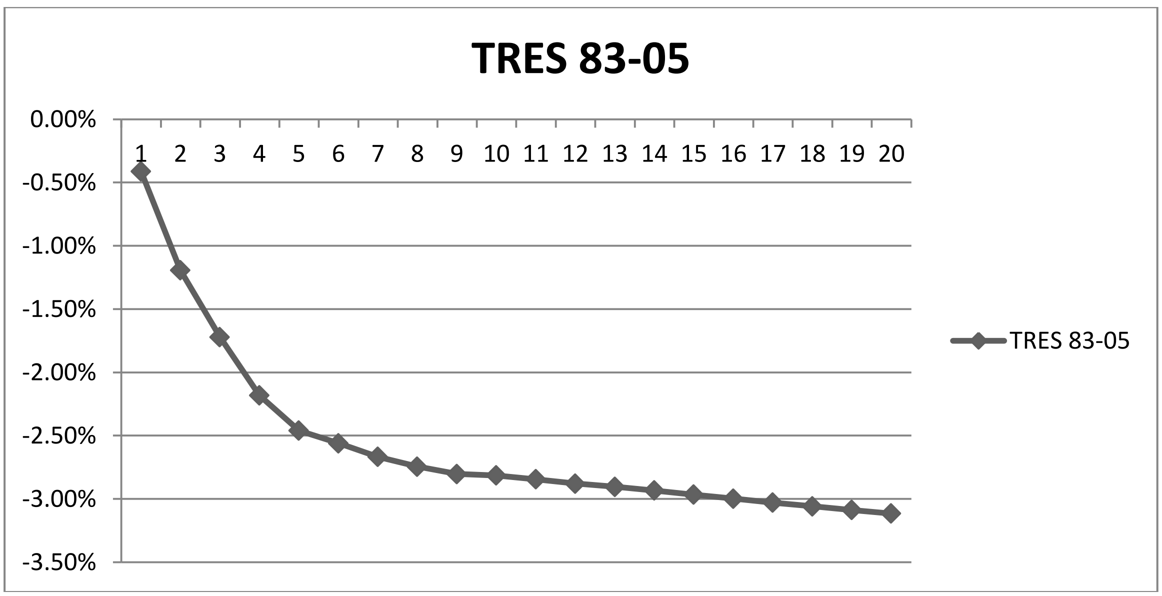



[62] These two graphs show the impulse response functions of nonborrowed reserves in the two sample periods after a 1% increase in the Federal funds rate.

FIGURE 31: Impulse Response Functions for Total Reserves[63]




[63] These two graphs show the impulse response functions of total reserves in the two sample periods after a 1% increase in the Federal funds rate.

Table 1 Descriptive Statistics, 1960-1979 Variables

| | Chosen number of lags | ADF Statistic (t-ratio) | Rho and its Standard Error |
|---|---|---|---|
| RGDP | 1.000 | -1.029 | -0.005<br>(0.005) |
| DEF | 5.000 | 2.144 | 0.006<br>(0.003) |
| PCOM | 5.000 | 1.558 | 0.009<br>(0.006) |
| FFR | 5.000 | -2.187 | -0.107<br>(0.049) |
| NBR | 3.000 | 0.208 | 0.004<br>(0.018) |
| TRES | 4.000 | 0.616 | 0.005<br>(0.008) |

*ADF Test using the General-to-Specific Rule

| 1% | 5% | 10% | Model |
|---|---|---|---|
| -2.56 | -1.94 | -1.62 | Simple ADF (no constant or trend) |
| -3.43 | -2.86 | -2.57 | ADF with constant (no trend) |
| -3.96 | -3.41 | -3.13 | ADF with constant & trend |

Table 2 Descriptive Statistics, 1983-2005 Variables

| | Chosen number of lags | ADF Statistic (t-ratio) | Rho and its Standard Error |
|---|---|---|---|
| RGDP | 1.000 | -0.639 | -0.002<br>(0.003) |
| DEF | 4.000 | 0.364 | 0.001<br>(0.001) |
| PCOM | 1.000 | 1.295 | 0.017<br>(0.013) |
| FFR | 1.000 | -2.023 | -0.040<br>(0.020) |
| NBR | 0.000 | -2.433 | -0.047<br>(0.019) |
| TRES | 5.000 | -2.684 | -0.045<br>(-0.017) |

*ADF Test using the General-to-Specific Rule

| 1% | 5% | 10% | Model |
|---|---|---|---|
| -2.56 | -1.94 | -1.62 | Simple ADF (no constant or trend) |
| -3.43 | -2.86 | -2.57 | ADF with constant (no trend) |
| -3.96 | -3.41 | -3.13 | ADF with constant & trend |

Table 3 Descriptive Statistics, 1960-1979 Variables[64]

| | Chosen number of lags | ADF Statistic (t-ratio) | Rho and its Standard Error |
|---|---|---|---|
| RGDP | 0.000 | -6.780 | -0.748 (0.110) |
| DEF | 1.000 | -1.601 | -0.095 (0.060) |
| PCOM | 6.000 | -2.075 | -0.237 (0.114) |
| FFR | 4.000 | -3.948 | -0.733 (0.186) |
| NBR | 2.000 | -7.683 | -1.638 (0.213) |
| TRES | 3.000 | -3.635 | -0.949 (0.261) |

*ADF Test using the General-to-Specific Rule

| 1% | 5% | 10% | Model |
|---|---|---|---|
| -2.56 | -1.94 | -1.62 | Simple ADF (no constant or trend) |
| -3.43 | -2.86 | -2.57 | ADF with constant (no trend) |
| -3.96 | -3.41 | -3.13 | ADF with constant & trend |

[64] These are the ADF test results for the 1960-1979 differenced variables. Refer to the "ADF with constant (no trend)" line for the asymptotic critical values.

Table 4 Descriptive Statistics, 1983-2005 Variables[65]

| | Chosen number of lags | ADF Statistic (t-ratio) | Rho and its Standard Error |
|---|---|---|---|
| RGDP | 1.000 | -3.897 | -0.436 (0.112) |
| DEF | 2.000 | -2.230 | -0.212 (0.095) |
| PCOM | 0.000 | -6.758 | -0.766 (0.113) |
| FFR | 0.000 | -5.420 | -0.502 (0.093) |
| NBR | 6.000 | -2.623 | -0.562 (0.214) |
| TRES | 4.000 | -2.459 | -0.404 (0.164) |

*ADF Test using the General-to-Specific Rule

| 1% | 5% | 10% | Model |
|---|---|---|---|
| -2.56 | -1.94 | -1.62 | Simple ADF (no constant or trend) |
| -3.43 | -2.86 | -2.57 | ADF with constant (no trend) |
| -3.96 | -3.41 | -3.13 | ADF with constant & trend |

[65] These are the ADF test results for the 1983-2005 differenced variables. Refer to the "ADF with constant (no trend)" line for the asymptotic critical values.