Government Failure Redux:
Why Did Federal Spending Lose Stimulative Traction?

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Abstract

An increase in federal spending should boost the economy according to macroeconomic theories. Some economists, however, argue that recent increases in federal funding seem to have lost its stimulative traction compared to the last several decades. Some might indicate that it could be attributable to the declining productivity of business investment. However, as we evidence from some empirical findings of this paper, business productivity might have in fact improved. In this paper, we find that anomalous economic behaviors of financial institutions might have made federal spending less effective. We formulate a dynamic macroeconomic model based on structural vector autoregressive (SVAR) model to test the impacts of the economic behaviors of U.S. financial institutions. Our SVAR model uses such five macroeconomic variables as GDP, Inflation rates, Federal funds rate, Investment, and Borrowing. By imposing some long-run and short-run restrictions, we show that increases in federal spending in the U.S. mostly flowed into financial sector to increase the profits of the U.S. financial sector instead of stimulating the real sector of the economy through business investment.

I. Introduction

Standard macroeconomic theories predict that injection of the Federal Reserve’s credits as well as governmental spending would boost business investment, autonomous consumption spending, and as a result the national economy (Hall and Lieberman 2013, 423-431; Krugman and Wells 2013, 447-459; Mankiw 2013, 327-342). However, massive federal spending has recently lost stimulative traction (Stratman and Okolski 2010). Some indicate that the less effective impact of federal spending on the economy might be attributable to the declining productivity of business investment (Riedl 2010). However, as we evidence from the empirical findings of this paper, business productivity might have in fact improved. Why did federal spending lose stimulative traction, then? We find an answer
from anomalous economic behaviors of financial institutions. Financial institutions have shown aggressive and greedy economic behaviors of using federal credits for purchasing financial assets including risky but profitable financial derivative assets. We assume that the 1999 repeal of the Glass-Steagall Act via the Financial Services Modernization Act might have further stimulated the economic behaviors of financial institutions, not the economy (Roubini and Mihm 2010, 72-76).

The 1999 repeal of the Glass-Steagall Act allowed commercial depository banks to do investment-banking business, for instance purchasing mortgage-backed securities (Hall and Lieberman 2013, 382-386; Krugman 2009, 153-176). As Minsky (1982, 1986) indicates, purchasing financial derivative assets is much like speculative funding or Ponzi funding. Such purchasing is more about speculation rather than business investment that can boost the productivity in the real sector of the economy. Increased federal credit supply will therefore be trapped in the financial sector, captured by the financial institutions. If so, the increased credits do not necessarily boost business investment and GDP.

Bankers have tried to keep their business in writing derivatives in the shadows of market systems. Sellers constantly trade them while buyers only episodically enter the trade market. This pattern leaves billion dollar profits to bankers (Stiglitz 2012, 35-36). Banks can borrow from the Fed at near-zero interest rates and then buy government bonds or lend to triple-A rated firms with huge arbitrage earnings. In particular, large banks used the cheap credit for speculation, trading, and bonuses, rather than lending. The increasing financialization of the economy is attributable to deregulation of the financial sector. Therefore, banks have been aggressively engaged in predatory lending. The Dodd-Frank Act of 2010 gave much of regulatory power to the Fed but bankers have ironically captured the Fed itself (Stiglitz 2012, 245-248). These anomalous economic behaviors of financial institutions ended up in what we define in this paper as “financial institution shocks:” federal credits were stuck in the financial sector.

There is another potential source of financial institution shocks. Non-banks in the shadow banking system rapidly grew larger during the 1990s and 2000s. Non-bank financial intermediaries, or non-banks, in the shadow banking system also rely on short-term liabilities and long-term
assets, like regular banks. However, short-term liabilities do not come from customer’s deposits. Non-banks borrow from regular banks, pension funds, money market funds, individual households, etc. Most markedly, the government does not insure the funds, which non-banks borrowed, and does not tightly regulate non-banks, either. The latter mechanism rendered risky profit maximization on their side. Non-banks invest their borrowed funds in a variety of assets like mortgages, mortgage-backed securities, commercial real estate, or other long-term financial assets. Lehman Brothers had been known for taking advantage of an auction-rate security since 1984, which is just one example of numerous financial derivatives (Hall and Lieberman 2013, 381-383; Krugman 2009, 158-162; Roubini and Mihm 2010, 61-114). We assume that substantial parts of funds, which were made available to non-banks, came from commercial depository banks that in turn borrowed significantly from the Fed. In addition, we broadly define the financial institutions to include depository institutions and non-banks primarily and all similar financial entities, which were involved in profit seeking with federal credits, secondarily.

Although the Fed has rarely employed federal discount window lending as a monetary policy tool recently, we investigate how the funds, which depository financial institutions borrowed directly through the federal discount window, affect business investment and ultimately GDP. Since the 1999 repeal of the Glass-Steagall Act might have accelerated financial institutions’ greedy and aggressive hunting for profits from financial derivatives, we conduct our analysis for the period before 1999 separately from the period after 1999, excluding year 1999 when the Glass-Steagall Act was repealed.

However, there is an inherent challenge with this investigation. That is, we lack a relevant macroeconomic framework to model the economic behaviors of the financial institutions. In Section II, we formulate a dynamic macroeconomic model to test the impacts of the economic behaviors of the financial institutions. In Section III, we run the structural vector autoregressive (SVAR) model to empirically analyze the economic behaviors of the financial institutions. In Section IV, we identify restrictions on the macroeconomic dynamics. In Section V, we discuss our estimation results. Finally, we summarize our conclusions in Section VI.
II. Modeling Economic Behaviors of Financial Institutions

We base our macroeconomic dynamics on a combination of two research streams of macroeconomic theories: the new classical theory and the new Keynesian theory. The new classical theory incorporates monetarism that an increase in money supply pushes aggregate demand up by increasing business and household spending through interest rate changes and through the wealth effect. It updates the classical scheme under the rational expectations hypothesis. It is also consistent with the neoclassical theory in accepting market clearing and perfect competition. The new Keynesian theory indicates that wages and prices are not flexible in the short run. The economy is not always in the long-run equilibrium. As a result, market imperfections might explain short-run fluctuations in GDP. It takes a fairly considerable period of time for the economy to adjust to demand shocks. Galí (1992) succinctly summarizes the two research streams in the stylized IS-LM-Phillips model that depicts equilibrium conditions for the goods and asset markets.

We build on and modify the stylized IS-LM-Phillips framework to explain the economic behaviors of financial institutions.

\[ y = \alpha + u_s - \sigma (r - E\Delta p_{t+1}) + u_{ls} \]  
(IS Equation)

\[ I = -\delta r - \omega F(b) + u_I \]  
(Auxiliary IS Equation)

\[ b - p = \varphi y - \lambda r + \theta F(b) + u_b \]  
(Modified LM Equation)

\[ r_t = \gamma p(L) r_{t-1} + \xi (1 - \rho) r_{t-1}^* + u_r \]  
(Monetary Policy Process Equation)

\[ \Delta p = \Delta p_{t-1} + \beta (y - u_s) \]  
(Phillips Curve)

where \( y \) denotes the log of GDP, \( r \) is the actual federal funds rate, \( I \) is the log of business investment, \( b \) is the log of federal discount window borrowing by depository institutions, \( F(b) \) denotes the anomalous economic behaviors of financial institutions (e.g., depository institutions, non-banks, and similar financial entities), which is a function of \( b \), and \( p \) is the log of the price level (e.g., price deflator). All the parameters in the model, \( \alpha, \sigma, \delta, \omega, \varphi, \lambda, \theta, \gamma, \rho, \xi, \) and \( \beta \) are positive, and \( u_{ls}, u_I, u_p, u_r, \) and \( u_s \) are structural shocks defining spending (IS) driving forces (e.g., aggregate demand), business investment, borrowing, monetary policy, and aggregate supply, with \( \Delta \) and \( E \) being the first difference and expectation operators. In Monetary Policy Process Equation, \( \rho(L) = \rho_1 + \rho_2 L + \cdots + \rho_n L^{n-1} \).
where $\rho = \sum_{i=1}^{t} \rho_i \equiv \rho(1)$. This shows that the Federal Reserve adjusts the actual federal funds rate change, $\Delta r_t$, to minimize a fraction of the gap between its current target rate, $r_t^*$, and a linear combination of its past funds rates (Clarida, Gali, and Gertler 2000). The federal funds target rate can be backward looking where the rate responds to lagged inflation and output levels (Taylor 1993). Alternatively, the target rate might respond to the future inflation and output values (Clarida, Gali, and Gertler 1999, 2000).

We pair Auxiliary IS Equation with IS Equation to capture the economic behaviors of the financial institutions. IS Equation depicts the link among federal funds rate, supply shocks, demand shocks, and GDP. Auxiliary IS Equation further indicates that the economic behaviors of the financial institutions in an expectation of potential credit supply, as signaled in potential borrowing from the Fed by depository institutions, are negatively related to business investment. In other words, greedy financial institutions attempt to aggressively obtain upcoming federal credits to purchase risky but profitable financial derivatives, for instance. These behaviors would damage business investment because those credits, which might have been used for business investment, are likely to be used for financial speculation. We also modify LM Equation as Modified LM Equation that defines financial institutions as one of major sources for augmented federal credits. Thus, financial institutions are likely to proactively hunt for cheap credits from the Fed especially under expansionary monetary policy.

$F(b)$ in Auxiliary IS Equation implies that $F(b)$ affects business investment negatively through anomalous economic behaviors. $F(b)$ in Modified LM Equation implies that it induces exogenous money supply to grow. We assume that parts of $u_t$ and $u_b$ capture the potential impacts of $F(b)$ on the macroeconomic dynamics (i.e., financial institution shocks) if we omit $F(b)$ in both Auxiliary IS Equation and Modified LM Equation. Since there are no available data to measure $F(b)$ yet, we resort to a proxy strategy. We will impute the impacts of $F(b)$, or financial institution shocks, from the estimation results for the two different time periods: before and after 1999.

Instead of a money supply equation (Gali 1992), we employ Monetary Policy Process in terms of actual federal funds rate following
Clarida, Galí, and Gertler (1999, 2000). By doing this, we can first show whether and why monetary policy, measured in terms of federal funds rate, lost stimulative traction “in general.” The amount of borrowing by the depository institutions is likely to be a part of the total amount of money supply. By carving out depository institutions’ borrowing, we therefore intend to estimate the financial institution shocks, separate from the general impact of the monetary policy.¹ Aggregate supply function is expressed in the standard Phillips curve notation.

In sum, this paper attempts to answer two questions:

a. What are the impacts of monetary policy, measured as actual federal funds rate, on business investment and ultimately GDP before and after 1999?

b. The economic behaviors of financial institutions affect first, borrowing by depository institutions and second, business investment via the borrowing. What are the impacts of the borrowing on business investment and ultimately GDP before and after 1999?

III. The Model

We use the structural VAR model for analysis because reduced-form VAR model cannot identify the true structure and shocks of the economy.

To describe the mechanism of the structural VAR model, we use the following equation:

\[ BX_t = \Gamma_0 + \Gamma_1 X_{t-1} + \Gamma_2 X_{t-2} + \ldots + \Gamma_k X_{t-k} + \varepsilon_t \]  

1 Gali (1992) estimates his model using money supply as a monetary policy variable. The use of money supply as a monetary policy variable in our model instead of federal funds rate does not significantly change our estimation results.
where \( E(\varepsilon, \varepsilon') = D = \begin{pmatrix} \sigma^2 & 0 \\ 0 & \sigma^2 \end{pmatrix} \), \( B = \begin{pmatrix} b_{11} & b_{1n} \\ b_{n1} & b_{nn} \end{pmatrix} \). \(^2\) We assume that \( B^{-1} \) exists, which implies that \( |B| \neq 0 \). We also assume that the variance-covariance matrix of \( \varepsilon_t \) is diagonal, which means that all the disturbances are uncorrelated at all leads and lags. Equation (1) is called a structural VAR because this model is based on some underlying economic theory. We can rewrite equation (1) as a reduced-form VAR model

\[
X_t = B^{-1}\Gamma_0 + B^{-1}\Gamma_1 X_{t-1} + B^{-1}\Gamma_2 X_{t-2} + \cdots + B^{-1}\Gamma_k X_{t-k} + B^{-1}\varepsilon_t \\
= A_0 + A_1 X_{t-1} + A_2 X_{t-2} + \cdots + A_k X_{t-k} + \varepsilon_t,
\]

(2)

where \( \varepsilon_t = B^{-1}\varepsilon_t \), \( A_i = B^{-1}\Gamma_i \), for \( i=0,1,2,...,k \) and \( \varepsilon_t \sim iid(0,\Omega) \). The variance-covariance matrix of the reduced-form VAR model is defined as \( \Omega = B^{-1}DB^{-1} \) and the components of \( \varepsilon_t \) are linear combinations of the structural errors in \( \varepsilon_t \). Clearly, if we do not impose some restrictions, the parameters of the structural VAR are not identified. The reduced-form VAR model has fewer parameters than the structural VAR. With \( n \) variables in the model, we need at least \( n(n-1)/2 \) number of restrictions on the parameters of the structural VAR model to identify the structural parameters using reduced-form parameters. Several approaches have been developed about how to impose restrictions. Sims (1986) and Bernanke (1986) propose contemporaneous restrictions derived from economic theory on the \( B \) matrix. Blanchard and Quah (1989) use long-run restrictions that demand shocks have zero long-run impact on the level of output. Galí (1992) utilizes both contemporaneous (or short-run) and long run restrictions.

\[\]

\(^2\) In equation (1), we could reparameterize \( D \) as \( D = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \) without loss of generality.
A. Long-Run and Short-Run Restrictions on the Structural VAR

We estimate a structural model of GDP growth, inflation rate, federal funds rate, depository institutions’ borrowing, and business investment. We make both contemporaneous (or short-run) and long-run restrictions to identify the SVAR model.

We let \( X_t = (\Delta y_t, \Delta p_t, \Delta i_t, \Delta b_t, \Delta inv_t) \), where \( \Delta y_t \) is the first difference in \( y_t = \log \) of GDP, \( \Delta p_t \) is the first difference in \( p_t = \log \) of the implicit price deflator for GDP, \( \Delta i_t \) is the first difference in \( i_t = \) federal funds rates, \( \Delta b_t \) is the first difference in \( b_t = \log \) of depository institutions’ borrowing from the Fed, and \( \Delta inv_t \) is the first difference in \( inv_t = \log \) of business investment. We apply Augmented Dickey-Fuller unit-root test to all five variables of \( y_t, p_t, i_t, b_t, \) and \( inv_t \), and find that all of them are nonstationary. However, their first differences are stationary. Thus, they are integrated of order 1. It follows that all five variables of \( X_t \) are stationary.

Data come from various sources. Data on GDP, the implicit price deflator for GDP, and business investment are obtained from the Bureau of Economic Analysis. Federal funds rate data are obtained from the Federal Reserve Bank of St. Louis. Data on depository institutions’ borrowing are obtained from the Board of Governors of the Federal Reserve System. We

3 Table 1.1.9. Implicit Price Deflators for Gross Domestic Product): [accessed May 21, 2015]


5 We use the total borrowing from the Federal Reserve in the file, Aggregate Reserves of Depository Institution and Monetary Base (H-3): [accessed May 20, 2015]
use quarterly observations of all these variables from 1980Q1 to 2014Q4, while excluding the year 1999 as indicated earlier. All dollar values are converted to 2014 Q4 constant dollar values, by using the deflator for GDP.

We start with equation (1). Note that we use Blanchard and Quah’s (1989) conventional normalization of identity covariance matrix to calculate the standardized magnitude of shocks. Next, we re-estimate equation (1) to calculate the standard deviation of each shock.

In equation (1), we have ten more parameters than in equation (2). Therefore we need to impose ten restrictions on equation (1) to recover the structural parameters. We impose both contemporaneous and long-run restrictions to identify the structural parameters. They are explained in the next section. We rewrite equation (2) using lag operator, $L$, as

$$ (I - A_1 L - A_2 L^2 - ... - A_k L^k) X_t = A_0 + e_t, \quad (3) $$

Pre-multiplying both sides of equation (3) by $(I - A_1 L - A_2 L^2 - ... - A_k L^k)^{-1}$, we have

$$ X_t = (I - A_1 L - A_2 L^2 - ... - A_k L^k)^{-1} (A_0 + e_t). \quad (4) $$

To impose the restrictions, we use the Wold (or moving average) representation of the reduced-form of equation (4) as follows:

$$ X_t = \mu + \Psi(L) e_t, \quad (5) $$

where

$$ \mu = (I - A_1 - A_2 - ... - A_k)^{-1} A_0, \quad \Psi(L) = (I - A_1 L - A_2 L^2 - ... - A_k L^k)^{-1} = \sum_{k=0}^{\infty} \Psi_k L^k, $$

and $\Psi_0 = I$. The error terms are generally contemporaneously correlated.
and have covariance matrix $\Omega$. We can also derive the structural moving average representations of equations as follows:

$$X_t = \mu + \Theta(L)\varepsilon_t,$$  \hspace{1cm} (6)

where

$$\Theta(L) = (I - A_1L - A_2L^2 - \ldots - A_kL^k)^{-1}B^{-1} = \Psi(L)B^{-1} = \Theta_0 + \Theta_1L + \Theta_2L^2 + \ldots,$$

and $\Theta_0 = B^{-1} \neq I$.

Finally, we need to determine the optimal lag length (or the value $k$) of equation (1). Using Akaike’s Information Criterion and Schwarz’s Bayesian Criterion, we find the optimal lag length to be two (or $k=2$) in equation (1).

### B. Structure and Shocks

We decompose shocks and the structure of the economy to estimate the above structural VAR following James (1993). James (1993) separates the contribution of changes in the nature and magnitude of the disturbances themselves from that of changes in “structure” using the structural VAR technique developed by Bernanke (1986) and Sims (1986). He imposes structural and theoretical contemporaneous restrictions on the VAR residuals and finds the structural disturbances. He considers two possible explanations: shocks have changed or the structure of economy has been changed. Following James (1993), we estimate the structural parameters

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6 James (1993) then compares the relative importance of different structural disturbances in order to measure the shocks’ contribution to increased variability of output growth in the 19th century. He also compares the pattern of the impulse response functions to given shocks, because impulse response functions provide the path of propagation of shocks to return to the equilibrium when each variable is shocked by one unit or one standard deviation of the structural shock. If the impulse response functions of two periods have different shapes, then this is an example of a changing economic structure. He concludes that the increased variability of output
and impulse response functions using equation (6) because those results provide the changes in the propagation mechanism of the economy. The changes in the propagation mechanism describe the changes in the response of the system to shocks. For example, if the central bank sets a different monetary policy, then the shocks will lead to different results.

IV. Identifying Restrictions

In line with typical frameworks in structural VAR, we impose an orthogonality condition among the five structure shocks. This implies that there are channels that the structural shocks can ultimately affect the entire macroeconomic dynamics regardless of the restrictions set below.

Consistent with the new Keynesian perspective, we assume that aggregate demand shocks and nominal variables would not affect GDP in the long run. With this assumption alone, we have four long-run restrictions in our macroeconomic dynamics at the beginning. Inflation shocks, federal funds shocks, borrowing shocks (partly including financial institution shocks), and investment shocks (also partly including financial institution shocks) do not affect GDP in the long run.

Just-identification of the structural VAR model with five variables requires ten restrictions in total, so we need six more restrictions. We propose imposing six short-run restrictions. Demand shocks generally tend to affect GDP in the short run, albeit slowly, as we noted in Section II. However, we use quarterly data to test our research questions. Therefore, it is reasonable to assume that some of demand shocks are unlikely to affect GDP in the “very” short run like quarter. We apply this line of expectation to three credit-related variables: federal funds shocks, borrowing shocks, and investment shocks. According to monetarism, long lags exist with the impact of governmental intervention on the economy due possibly to the fact that people revise and form their expectations adaptively. Monetarists typically contend that policymakers should not change policy from month to month or even from year to year. Thus, monetary policy, measured in terms of federal funds rate, is less likely to affect GDP in the “very” short

growth in the 19th century was due to changes in the propagation mechanism as opposed to changes in the nature of the shocks themselves. That implies that the structure of the economy has changed.
Due to individuals’ adaptive expectations, we can readily assume that borrowing by depository institutions cannot garner attention from business investors quickly enough so that business investors can borrow from depository institutions’ borrowing from the Fed. In addition, there might be numerous institutional hurdles, which both depository institutions and business investors should go through to access the federal credits. Even when investors can get the credits, it is hard to assume that the credits can be quickly dispatched to investment expansion within a quarter or in the very short run. These observations lead us to assume no contemporaneous impacts of both borrowing and investment on GDP.

We need three more restrictions. Given our Monetary Policy Process equation, it is hard to assume that the Fed makes quick adjustment to their target rate and as a result influence actual federal funds rate in response to investment shocks in the very short run. A corollary is that investment shocks are hard to affect borrowing by depository institutions due possibly to both the Fed’s incapacity to make the quick adjustment and depository institutions’ incapacity to maneuver for federal credits in such a short time period. With the time lag between federal funds shocks and investment shocks, we have our final restriction. Federal funds shocks would not have contemporaneous impacts on business investments within the same quarter.

Table 1 summarizes both long-run and short-run restrictions but there is one observation worth additional attention with respect to $-\omega F(b)$ in our Auxiliary IS Equation. Financial institutions, including banks, non-banks, and other financial entities will keep all eyes and ears toward expected potential credits flowing from the federal discount window. Their aggressive and greedy economic behaviors leave no reason why they would not move ahead of the financial game and might not take advantage of upcoming federal credits at a minimal signal of potential federal credit flowing even within the same quarter. This scenario led us to leave the contemporaneous impact of borrowing on investment open and unrestricted even in the very short run. Of course, this part of financial institution shocks will stay dormant in $u_t$ if $F(b)$ is not adequately controlled for.
Table 1: Identifying Restrictions

<table>
<thead>
<tr>
<th>Long-run restrictions</th>
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<tbody>
<tr>
<td>LR1: no long-run impacts of inflation shocks on GDP</td>
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<tr>
<td>LR2: no long-run impacts of federal funds shocks on GDP</td>
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<tr>
<td>LR3: no long-run impacts of borrowing shocks on GDP</td>
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<tr>
<td>LR4: no long-run impacts of investment shocks on GDP</td>
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</tbody>
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<tr>
<th>Short-run restrictions</th>
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<tr>
<td>SR1: no contemporaneous impacts of federal funds shocks on GDP</td>
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<tr>
<td>SR2: no contemporaneous impacts of borrowing shocks on GDP</td>
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<tr>
<td>SR3: no contemporaneous impacts of investment shocks on GDP</td>
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<tr>
<td>SR4: no contemporaneous impacts of investment shocks on federal funds rate</td>
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<tr>
<td>SR5: no contemporaneous impacts of investment shocks on borrowing</td>
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<tr>
<td>SR6: no contemporaneous impacts of federal funds shocks on investment</td>
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</tbody>
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V. Estimation Results

A. Responses to Federal Discount Window Borrowing: Before 1999

Figure 1 shows the accumulated impulse responses of the macro-economy to the federal discount window borrowing by depository institutions before and after 1999. The money supply disturbance caused by the discount window borrowing affects the shocks in GDP, federal funds rate, business investment, and inflation. Unlike our expectation, the discount window borrowing decreases GDP before 1999. In Quarter 1, its impact on GDP is about zero. The accumulated impacts of the discount window borrowing decrease by about three basis points in Quarter 4. The accumulated impacts then gradually increase until they decrease by about one basis point in Quarter 20.

The accumulated response of business investment to a one percentage change in the discount window borrowing is about 25 basis points up to Quarter 3. It then drops up to Quarter 5 but steadily grows back close to 24 basis points in Quarter 20. Businesses might borrow from what depository institutions have borrowed through the federal discount window lending. The positive responses of business investment to the federal discount window borrowing indicate that businesses might have used the
borrowed funds for their investment. Above, we reported that the federal discount window borrowing dampened the GDP growth rate. There is one, if not the only, potential cause for the unexpected response of GDP to the federal discount window borrowing. The responses of GDP to business investment, which are not reported in this paper, were negative: business investment does not boost GDP. As noted earlier, this is symptomatic for possibly lower business productivity before 1999. Therefore, the federal discount window borrowing might decrease the GDP growth, indirectly through business investment.

The discount window borrowing decreases the federal funds rate. Since we use non-logged federal funds rate, it is reasonable to interpret the response of federal funds rate as the change to a unit change in the differenced log value of discount window borrowing, which is a one percentage change. A one percentage change in the discount window borrowing instantaneously decreases the federal funds rate by about 1.8 percent in Quarter 1. By Quarter 3, the federal funds rate slightly increases but the accumulated response of the federal funds rate stabilizes around -1.1 percent up to Quarter 20. The negative response of the federal funds rate implies a potential substitution effect between the Federal Open Market Operation (FOMO) policy and the discount window borrowing. The discount window borrowing rate tends to be higher than the federal funds rate. The increased discount window borrowing might imply a relatively lower discount borrowing rate. If the FOMO Committee attempts to keep the effective monetary policy through the FOMO, then it might reduce the federal funds rate to counterbalance the increased discount window borrowing.

The response of the inflation rate to the federal discount window borrowing is also somewhat unexpected. In Quarter 1, a one percentage change in the discount window borrowing leads to an about one basis point increase in the inflation rate. After Quarter 2, however, the accumulated response of the inflation rate to the discount window borrowing steadily declines close to -5 basis points in Quarter 20. We will discuss this unexpected response under the interaction between the federal funds rate and the discount window borrowing later in this section.
B. Responses to Federal Discount Window Borrowing: After 1999

The response of GDP to the federal discount window borrowing after 1999 is almost identical to that before 1999. One difference is the magnitude of the response. The accumulated response of GDP decreases by...
close to five basis points in Quarter 4 and then stabilizes around - 3 basis points up to Quarter 20. The response of GDP after 1999, therefore, is approximately two basis points lower than that before GDP.

The accumulated response of business investment to the discount window borrowing after 1999 also supports our main expectation. Up to Quarter 2, the response of business investment remains positive. However, beginning from Quarter 3 the accumulated response of business investment to the discount window borrowing turns negative and stabilizes around - 15 basis points by Quarter 20. This observation indicates that the borrowed funds might not have been used for business investment after 1999. Altogether, these findings suggest that the funds, which depository institutions borrowed through the discount lending, might have been used for purposes other than business investment and the decreased investment directly translates into the lower GDP growth rate. As noted earlier, we assume that depository institutions might have invested the borrowed funds into financial market assets, notably financial derivative assets. There is one more caveat worth further attention. The accumulated response of GDP to business investment after 1999, not reported in this paper, is positive. The positive response of GDP to business investment indicates that business productivity might have improved after 1999 contrary to what some studies alleged. If business productivity declined after 1999 too, the response of GDP to the federal discount window borrowing might have decreased by an even larger magnitude.

The response of the federal funds rate to the discount window borrowing after 1999 is different from that before 1999. Up to Quarter 3, the accumulated response of the federal funds rate hovers around 0.1 percent: a unit change in the discount borrowing (i.e., a one percentage change) leads to about a 0.1 percent increase in the federal funds rate until it reaches about 0.16 percent in Quarter 20. The positive response of the federal funds rate implies that there might be a complementary relationship between the federal funds rate and the discount window borrowing. For instance, the FOMO Committee might interpret the declining (increasing) discount window borrowing as a signal for generally decreasing (higher) demand for credits and as a result, attempts to lower (raise) the federal funds rate. To understand why the response of the federal funds rate after 1999 differs from that before 1999, one needs to pay attention to the economic condition throughout the 2000s. The national economy was in a shaky
condition during the 2000s, so the Fed might have attempted to reign on the declining economy through stronger monetary policy intervention. Instead of making a choice between the discount window lending and the FOMO policy, the Fed might have resorted to both intervention measures. Especially when depository institutions demand credits less, which might also signal a declining aggregate demand and shrinking economy, it cannot help but decrease the federal funds rate to stimulate the economy.

The accumulated response of the inflation rate to the discount window borrowing after 1999 is mostly positive. This also contrasts with the response of the inflation rate before 1999. Although this finding is in line with typical expectations, we will discuss it in more detail under the interaction between the federal funds rate and the discount window borrowing later.

C. Responses to Federal Funds Rate: Before 1999

Figure 2 shows the estimation results for federal funds rate. Before 1999, the accumulated response of GDP to federal funds rate is negative. A one percent increase in federal funds rate dampens the GDP growth rate by about three basis points by Quarter 3. Up to Quarter 20, the response of GDP to federal funds rate steadily grows until the accumulated response decreases by about one basis point. In general, higher federal funds rate denotes a more contractionary monetary policy through the FOMO. Higher federal funds rate leads to decreased money supply which in turn curbs the GDP growth rate. Therefore, the accumulated response of GDP to federal funds rate exemplifies what one might expect from the federal monetary policy. The patterns of business investment’s response to federal funds before 1999 are very close to those of GDP. Up to Quarter 4, the accumulated response of business investment drops by about 15 basis points per a one percent increase in federal funds rate. Up to Quarter 20, it steadily grows until it reaches about -8 basis points. When businesses borrow less from the federal open market as federal funds rate is raised, they are less likely to expand their investment.

The accumulated response of the federal discount window borrowing to federal funds rate is positive. Up to Quarter 2, a one percentage increase in federal funds rate increases the discount window borrowing by about 18 percent. The accumulated impacts drop to about 9 percent by
Quarter 4 but grow again and stabilize around 12 percent up to Quarter 20. This is a mirror image to the response of federal funds rate to the discount window borrowing before 1999, which was reported earlier. The FOMO Committee tends to lower federal funds rate when depository institutions borrow more from the federal discount window lending. Now, the depository institutions borrow more from the discount window lending as the FOMO Committee raises federal funds rate. For the depository institutions, the discount window lending offers another opportunity to borrow when borrowing costs from the FOMO rises. Overall, there is a substitution effect between federal funds rate and the discount window borrowing before 1999.

Before 1999, the accumulated response of the inflation growth rate to federal funds rate is negative. As Figure 2 shows, up to Quarter 3 the inflation growth rate decreases by about 1.5 basis points and thereafter continuously decreases and stabilizes around -5.5 basis points in Quarter 20. This observation is what one might expect from a typical monetary policy. As money supply shrinks in response to higher federal funds rates, inflation is less likely. This is some evidence that the FOMO policy affects the money supply in the economy before 1999.

Figure 2: Accumulated Responses to Federal Funds Rate Before 1999
D. Responses to Federal Funds Rate: After 1999

Figure 2 also shows how GDP, business investment, the discount window borrowing, and inflation respond to federal funds rate after 1999. Unlike the results for the period before 1999, federal funds rate is positively related to both GDP and business investment. The accumulated response of the GDP growth rate to federal funds rate after 1999 reaches about 3.5 basis points up to Quarter 3. From Quarter 4 up until Quarter 9, it steadily increases to around 15 basis points. An almost similar pattern is found for the response of business investment to federal funds rate. As the FOMC Committee opts for a contractionary monetary policy, business investment and GDP ironically grow. Conversely, an expansionary FOMC policy and an increased money supply contracts the real-sector economy. This does not support typical expectations about the federal monetary policy. However, this anomalous observation strongly supports the expectations in this paper. Depository institutions or financial institutions in general might have borrowed from the FOMC market but increased credits do not necessarily translate into the real-sector economy, most likely business investment. As we posited earlier, financial institutions might have attempted to maximize their financial rates of return by investing the borrowed funds into risky but more profitable financial assets, especially financial derivative assets. Along with the anomalous impacts of the federal discount window
borrowing, the increased credit circulation through the FOMO policy stimulates the financial institutions to pursue the maximization of financial profits, not the economic growth.

Figure 2 reports another interesting observation. The accumulated response of the discount window borrowing to federal funds rate after 1999 is negative, which is opposite to that before 1999. However, it is also a mirror image to the complementary response of federal funds rate to the federal discount window borrowing before 1999. Before 1999, as we reported earlier, the FOMO Committee might have interpreted the declining (increasing) discount window borrowing as a signal of economy-wide decreasing (increasing) demand for money and its response might have been lowering (raising) the federal funds rate. This complementary effect between the discount window borrowing and federal funds rate also explains the response of the former to the latter. Greedy and profit-aggressive financial institutions, depository institutions in this case, might have perceived both the FOMO market and the discount window lending as their major sources for borrowing cheap credits after 1999. For instance, when federal funds rate goes down, the discount window borrowing increases. In Figure 2, the accumulated response of the discount window borrowing to federal funds rate drops by about 6 percent by Quarter 2. It then grows and stabilizes around zero percent by Quarter 20. This observation contrasts with how the discount window borrowing reacted to federal funds rate before 1999. Depository institutions just sought for cheap credits from a single source before 1999. After 1999, however, they seem to hunt for credits from any sources, the FOMO market or the discount window lending. We posit that the repeal of the Glass-Steagall Act is partly attributable to their more aggressive pursuit of cheap credits.

The accumulated response of the inflation rate to federal funds rate after 1999 also supports our expectations. Up to about Quarter 2, federal funds rate negatively affects the inflation rate as was observed for the period before 1999. After Quarter 3, however, the response of the inflation rate to federal funds rate is positive although a one percent increase in federal funds rate increases the accumulated response of the inflation rate by just about 0.75 basis points. This observation is also discussed in the next section.
E. Interactions between Federal Discount Window Borrowing and Federal Funds Rate

In addition to our main findings, there are two more interesting observations. First, as noted earlier, before 1999 increased discount window borrowing decreases inflation, which is inconsistent with standard expectations. We interpret the borrowing as a triggering mechanism for inflation. Increased discount window borrowing triggers federal funds rate to decrease, which leads to higher inflation (i.e., negative impact of federal funds rate on inflation). Decreased federal funds rate also translates into lower discount window borrowing (i.e., positive impact of federal funds rate on the borrowing) but the positive impact of federal funds rate on the borrowing is much stronger than the negative impact of the latter on the former in absolute value. Therefore, decreased discount window borrowing in turn leads to lower inflation, which is reflected in the negative impact of the borrowing on inflation.

Although not reported above, federal funds rate reduces the discount window borrowing by about 6 to 10 percent after 1999. Thus, a lower (higher) federal funds rate boosts (reduces) the borrowing, which in turn leads to higher (lower) inflation. The increased borrowing also raises federal funds rate, as we reported earlier, which might cause federal funds rate to tap some of the positive impact of the borrowing on inflation after 1999 (note that the negative impact of federal funds rate on the borrowing is much stronger than the positive impact of the latter on the former in absolute value). As we posited earlier, the Fed strengthened its monetary policy intervention during the 2000s, so federal funds rate seems to be a triggering mechanism for inflation. This aspect contrasts with the observation that the discount window borrowing seems to be the initiating shocks for inflation before 1999.

VI. Conclusions

The key finding from the estimated results in this paper is that the federal monetary policy does not stimulate the real-sector economy after 1999 when the Glass-Steagall Act was repealed. We find a potential reason for this anomaly from the greedy and aggressive behaviors of financial institutions. When they borrow through the federal monetary policy, they
might invest the borrowed funds in financial assets, more likely financial derivatives. As a result, the funds do not flow into the real-sector economy.

After 1999, federal funds rate positively affects both business investment and GDP. As the FOMO Committee pursues a contractionary monetary policy, business investment and GDP ironically grow and vice versa. The accumulated response of business investment to the discount window borrowing after 1999 also confirms our main expectations. Beginning from Quarter 3, it starts declining and stabilizes around -15 basis points by Quarter 20. The accumulated response of GDP to the federal discount window borrowing after 1999 is similar to that of business investment to the borrowing. It decreases by about three to five basis points in twenty quarters. If business productivity after 1999, measured in terms of the impact of business investment on GDP, decreased as was the case before 1999, the negative impact of the discount window borrowing on GDP as well as business investment might have been even larger after 1999. All these observations, combined, strongly support our main expectations in this paper that the federal stimulus funds might not have been used for the real sector of the economy.

While our main findings reveal what main stream economic theories did not identify, we have a few more interesting future research agendas. First, we can also test whether and how the FOMO policy affects business investment and GDP. Instead of using the discount window borrowing as we did in this paper, we can use the amount of funds that financial institutions directly and indirectly borrow from the FOMO market. Based on our hypotheses, we expect to find empirical observations similar to those in this paper.

Second, while we test the ten restrictions summarized in Table 1, there are alternative routes of restrictions. $\theta F(b)$ in our Modified LM Equation implies that financial institutions might attempt to convey strong signals that they need federal credits to depository institutions whenever they expect potential rounds of federal credits, especially during the time of economic downturn. Given their aggressive financial strategies to hunt for cheap credits, financial institutions are very likely to convey their desire of borrowing to the depository institutions even within the same quarter. They might attempt to out-speed business investors over cheap credits. This scenario leaves open the contemporaneous impacts of investments on
borrowing, the sign of which we predict to be positive: depository institutions might perceive additional demand from the financial institutions (i.e., the financial institutions broadly defined to further include non-banks and similar institutions), which the former interprets as coming from heightened business investment via various venues. It is also tempting to test another restriction. The new classical perspective under the rational expectations hypothesis predicts federal funds shocks might not exert long-run impacts on business investment as well as GDP. Altogether, testing these restrictions would present interesting clues to modify the current macroeconomic theories.

References


