The Glass-Steagall Act and U.S. Monetary Policy

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Abstract

The 1999 repeal of the Glass-Steagall Act via the Financial Services Modernization Act might have modified the economic motives and behaviors of financial institutions. The repeal allowed commercial depository banks to do investment-banking business. To our knowledge, however, virtually no studies have yet investigated whether and how the repeal modified the economic motives and behaviors of the financial institutions and as a result, affected the impact of U.S. monetary policy on business investment and GDP. A dynamic macroeconomic model based on structural vector autoregressive (SVAR) estimation indicates that increases in federal spending in the U.S. mostly flowed into the financial sector to increase the profits of the U.S. financial institutions instead of stimulating the real sector of the economy through business investment.

I. Introduction

Many recent empirical studies have reported interesting findings on how monetary policy interventions affect GDP. The studies, which used samples between the 1980s and the late 2000s, found that contractionary monetary policy interventions ironically boosted GDP. The results were almost the same whether they employed the forward looking/forward guiding shock measures or the conventional backward looking shock measures with federal funds rate identification (Barakchian and Crowe 2013; Ramey 2016). The results from these studies starkly contrast with the findings from other studies that employed similar shock measures but used different samples approximately between the early 1960s and 2000. The latter findings consistently reported that positive monetary shocks (i.e., contractionary monetary interventions) decreased GDP, compatible with standard macroeconomic assumptions (Ramey 2016; Christiano, Eichenbaum, and Evans 1996, 1999; Faust, Swanson, Wright 2004; Romer and Romer 2004; Bernanke, Boivin, and Eliasz 2005; Smets and Wouters 2007; Coibion 2012).
In this paper, we select a more specific cutoff year for study samples, which is 1999. We assert that the 1999 repeal of the Glass-Steagall Act via the Financial Services Modernization Act might have modified the economic motives and behaviors of financial institutions. The 1999 repeal of the Glass-Steagall Act allowed commercial depository banks to do investment-banking business, for instance purchasing mortgage-backed securities (Nersisyan 2015; Prates and Farhi 2015; Hall and Lieberman 2013, 382-386; Krugman 2009, 153-176). To our knowledge, virtually no studies have yet investigated whether and how the repeal of the Glass-Steagall Act modified the economic motives and behaviors of the financial institutions and as a result, affected the impact of U.S. monetary policy on business investment and GDP.

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. If so, the increased credits do not necessarily boost business investment and GDP. Federal Open Market Operation's (FOMO’s) federal funds rate targeting has been the major tool of the federal monetary policy through which the financial institutions augment their credits. However, there are abundant reasons why we should also account for the federal discount window borrowing.¹

¹ Scholars indicate that financial institutions are reluctant to borrow directly from federal discount window because regulators, other banks, or investors might get a negative signal about their financial health. Thus, the "stigma" associated with federal discount window borrowing generally discouraged financial institutions from resorting to the federal discount window (Courtois and Ennis 2010). However, during more recent years, especially since the 2007/2008 financial crisis, the federal discount window lending was allowed even to "nonbank" financial institutions through the Fed’s newly created facilities such as the Primary Dealer Credit Facility (TSLF) and the Term Securities Lending Facility (TSLF). These lending was essentially a discount window for the shadow banking system. Furthermore, the Fed established the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF) that granted nonrecourse loans to U.S. depository institutions. The Fed also created the Money Market Investor Funding Facility to
Banks can borrow from the Fed at near-zero interest rates and then buy government bonds or lend to triple-A rated firms with arbitrage earnings. In particular, large banks used the cheap credit from the Fed for speculation in derivative markets rather than lending to the real-sector economy. The increasing financialization of the economy is attributable to deregulation of the financial sector. The Dodd-Frank Act of 2010 gave much of regulatory power over the financialization to the Fed but the power was not as effective as it intended to be (Stiglitz 2012, 35-36, 245-248; Nersisyan 2015; Prates and Farhi 2015).

In addition, non-banks in the shadow banking system rapidly grew larger during the 1990s and especially 2000s (Nersisyan 2015; Prates and Farhi 2015). Non-bank financial intermediaries, or non-banks, in the shadow banking system 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 that 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 (Prates and Farhi 2015; Krugman 2009, 158-162; Roubini and Mihm 2010, 61-114). We assume that substantial

stimulate short-term credit markets. As nonbank financial institutions can borrow directly from the Fed, conventional banks were competing with nonbank financial institutions for the Fed's credits. In fact, the proliferation of nonbank financial institutions greatly picked up thanks to the repeal of the Glass-Steagall Act in 1999 (Nersisyan 2015). We assume that these contingent developments in the financial sector might have lessened the stigma that the financial institutions perceived. In addition, our main research question is not whether they borrowed more or less from the discount window but whether the credits flowed into the real sector economy or risky but profitable derivative markets.
parts of funds, which were made available to non-banks, came from commercial depository banks that, in turn, borrowed directly from the Fed as well as through FOMO.

Therefore, we broadly define the financial institutions to include depository institutions, non-banks, and all similar financial entities, which were involved in profit seeking with federal credits. Since the 1999 repeal of the Glass-Steagall Act might have accelerated financial institutions’ assertive investment in 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.

In Section II, we formulate a structural vector autoregressive (SVAR) model to test the impacts of the economic behaviors of the financial institutions on business investment and GDP. In Section III, we impose identifying restrictions for the SVAR model. In Section IV, we discuss our estimation results. Finally, we summarize our conclusions in Section V.

II. The Model

We use the structural VAR model for analysis because the 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:

\[
BX_t = \Gamma_0 + \sum_{i=1}^{k} \Gamma_i X_{t-i} + \epsilon_t
\]

(1)
where \( E(\varepsilon, \varepsilon') = D = \begin{pmatrix} \sigma^2 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \sigma^2 \end{pmatrix} \)

\( B = \begin{pmatrix} b_{11} & \cdots & b_{1n} \\ \vdots & \ddots & \vdots \\ b_{n1} & \cdots & b_{nn} \end{pmatrix}. \)

We assume that \( B^{-1} \) exists, which implies that \( |B| \neq 0 \). We also assume that the variance-covariance matrix of \( \varepsilon \) 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

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

where \( \varepsilon_t = B^{-1} \varepsilon_t, A_i = B^{-1} \Gamma_i, \) for \( i=0,1,2,\ldots,k \) and \( \varepsilon_t \sim iid(0, \Omega) \). The variance-covariance matrix of the reduced-form VAR model is defined as \( \Omega = B^{-1} DB^{-\top} \) 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.

\[ \text{In equation (1), we could reparameterize } D \text{ as } D = \begin{pmatrix} 1 & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & 1 \end{pmatrix} \text{ without loss of generality.} \]
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, based on the literature (Clarida, Galí, and Gertler 2000; Knotek et al. 2016; Galí 1992; Taylor 1993). 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 $i_t = \log$ of federal funds rates, $\Delta b_t$ is the first difference in $b_t = \log$ of depository institutions’ “actual” 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.

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 use

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3 Table 1.1.9. Implicit Price Deflators for Gross Domestic Product): http://www.bea.gov/itable/itTable.cfm?ReqID=9&step=1#reqid=9&step=3&isuri=1&904=2013 &903=13&906=q&905=1947&910=x&911=0 [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): http://www.federalreserve.gov/datadownload/Download.aspx?rel=H3&series=1a060b2cd736560 ba2f82fd1299c648&filetype=spreadsheetml&label=include&layout=seriescolumn&from=01/01 /1960&to=05/31/2015 [accessed May 20, 2015]
quarterly observations of all these variables from 1959Q1 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

$$ (I - A_1L - A_2L^2 - \ldots - A_kL^k)X_t = A_0 + \epsilon_t, $$

(3)

Pre-multiplying both sides of equation (3) by $(I - A_1L - A_2L^2 - \ldots - A_kL^k)^{-1}$, we have

$$ X_t = (I - A_1L - A_2L^2 - \ldots - A_kL^k)^{-1}(A_0 + \epsilon_t). $$

(4)

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

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

(5)

where $\mu = (I - A_1 - A_2 - \ldots - A_k)^{-1}A_0$, $\Psi(L) = (I - A_1L - A_2L^2 - \ldots - A_kL^k)^{-1} = \sum_{k=0}^{\infty}\Psi_kL^k$, and $\Psi_0 = I$. The error terms are generally contemporaneously correlated and have covariance
We can also derive the structural moving average representations of equations as follows:

\[ X_t = \mu + \Theta(L)e_t, \]  

(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 the economy has been changed.\(^6\) Following James (1993), we estimate the structural parameters and

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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
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.

III. Identifying Restrictions

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

Consistent with the new Classical and Keynesian perspectives, 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, and investment 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. 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 changing economic structure. He concludes that the increased variability of output 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.
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 run. Due to individuals’ adaptive expectations, we can readily assume that borrowing by financial institutions cannot garner attention from business investors quickly enough so that business investors can borrow from financial institutions’ borrowing from the Fed. In addition, there might be numerous institutional hurdles, which both financial 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. Various recent studies were based on similar short-run restrictions (Ramey 2016).

We need three more restrictions. In general, 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 financial institutions due possibly to both the Fed’s incapacity to make the quick adjustment and financial 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 the economic motives and behaviors of the financial institutions. The 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 assertive 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.

### 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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<tr>
<th>Short-run Restrictions</th>
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<tbody>
<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>
</table>

### IV. 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 financial 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 financial 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, and perhaps 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 Riedl (2010) notes, this observation might be attributable to the declining business productivity. 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 the 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 potentially
competitive or substitutive relationship 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.

**Figure 1: Accumulated Responses to Federal Discount Window Borrowing**

**Before 1999**

**After 1999**
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 financial 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 financial 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 either, is positive. The positive response of GDP to business investment indicates that business productivity might have in fact improved after 1999 (Mankiw 2016). 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 insitutions 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, which is consistent with the previous findings introduced earlier. 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 tended to lower the federal funds rate when financial institutions borrow more from the federal discount window lending. Now, the financial institutions borrow more from the discount window lending as the FOMO Committee raises federal funds rate. For the financial 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 from both the Fed's policy perspective and financial institutions' borrowing perspective.

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
After 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: contractionary monetary policy interventions raise 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 FOMO Committee opts for a contractionary monetary policy, business investment and GDP ironically grow. Conversely, an expansionary FOMO 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 FOMO market but increased credits do not necessarily translate into the real-sector economy. They are less likely to translate into 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 after 1999. After 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.
After 1999, profit-seeking financial institutions might have perceived both the FOMO market and the discount window lending as their major sources for borrowing cheap credits. For instance, when federal funds rate goes down, the discount window borrowing increases, which is implied in Figure 2. This observation contrasts with how the discount window borrowing reacted to federal funds rate before 1999. Financial 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 assertive 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 0.65 basis points. This observation is also discussed in the next section.

**E. Interactions between Federal Discount Window Borrowing and Federal Funds Rate**

Eichenbaum (1992) coined the term, Price Puzzle, to explain why contractionary monetary policy shocks raise price levels in the short-run. Our main findings partially explain the price puzzle. However, there are two more interesting observations. Here, we attempt to provide our preliminary interpretations while leaving more thorough investigations to future studies. First, as noted earlier, before 1999 increased discount window borrowing decreases inflation, which is inconsistent with standard expectations. We interpret the discount window borrowing as a
triggering mechanism for inflation. Increased discount window borrowing triggers federal funds rate to decrease (see Table 1 Before 1999), which leads to higher inflation (i.e., negative impact of federal funds rate on inflation - see Table 2 Before 1999). Decreased federal funds rate also translates into lower discount window borrowing (i.e., positive impact of federal funds rate on the borrowing) by a stronger margin (see Figure 2 Before 1999). Therefore, the second-round decreased discount window borrowing in turn leads to lower inflation, which is reflected in the negative impact of the borrowing on inflation.

After 1999, as shown in Figure 2, federal funds rate reduces the discount window borrowing by about 6 to 10 percent. 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, but 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. This explains why federal funds rate is positively related with inflation in Figure 2. 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. Overall, the interactions between federal funds rate and the discount window borrowing, coupled with profit-maximizing behaviors of the financial institutions, provide some additional clues to the so-called price puzzle.

V. Conclusions
The key finding from the estimated results in this paper is that the federal monetary policy did 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 assertive investment of financial institutions in financial asset markets. When they borrow through the federal monetary policy, they might invest the borrowed funds in financial assets, and more likely in 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 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 strongly support our main expectations in this paper that the federal credits might not have been used for the real sector of the economy since the repeal of the Glass-Steagall Act.

References


