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THORBECKE, Willem
RIETI

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Non-traditional Monetary Policy and the Future of the Financial Industries[1]

Willem Thorbecke
RIETI

ABSTRACT

This paper investigates how expansionary monetary policy after the Global Financial Crisis (GFC) has affected the U.S. banking sector. In response to the GFC the Federal Reserve first lowered the overnight federal funds rate from 5.25% in August 2007 to zero in December 2008. It then turned to quantitative easing, purchasing housing agency debt, mortgage-backed securities, and longer-term Treasury bonds to stimulate the economy. While these policies helped the overall economy to recover, they may have harmed the banking sector. Banks accept safe short-term deposits and transform these into risky longer-term loans. They make a profit on the difference between the interest rate they earn on longer-term assets and the rate they pay of short-term deposits (the net interest margin). Low short-term interest rates and compressed spreads between long- and short-term interest rates may impair bank profitability. Bernanke and Gertler (1995) have shown that reduced bank profitability can hinder their ability to extend loans.

Bernanke (1993) noted that this is problematic because banks play a special role in channeling savings to promising borrowers. Financial markets are plagued by information imperfections. Savers release funds today for the promise of obtaining funds later. Whether they get repaid depends on the character of the borrower, the quality of the investment, the collateral that the borrower can provide, and other factors. The lender needs to consider these items and not just interest rates. Asymmetric information can thus hinder the flow of funds from savers to small businesses and other borrowers whose quality is hard to evaluate. Banks can bridge imperfect information problems because they have a comparative advantage because of: 1) economies of specialization, as lending officers gain expertise in a particular industry; 2) economies of scale, as it is cheaper for bank to evaluate a loan than for small savers to; and 3) economies of scope, as it is cheaper to provide lending services together with other services.

This paper investigates how lower short-term rates and falls in the spread between long-and short-term rates affect bank profitability. To do this it investigates how these variables affect bank stock prices. Stock prices provide valuable information since they are the expected present value of future cash flows. The results indicate that falls in short rates and in the spread have caused large drops in bank stock returns after the GFC. Banks are also facing competitive pressures from Fin Tech firms and big technology firms. Their performance after the GFC has lagged other parts of the U.S. economy. They are thus vulnerable to negative shocks that could arise during a downturn or a crisis. The Fed should take account of the impact of their policies on the banking sector, since an interruption on the flow of credit through the financial system could prevent funds from going to the most promising firms. This misallocation of resources could then hinder long-term economic growth.

Key words: Banks, Quantitative easing, Monetary policy
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1. Introduction

As the Global Financial (GFC) crisis emerged, the U.S. Federal Reserve first lowered the federal funds rate, the overnight interest rate, by more than 500 basis points between August 2007 and December 2008. After the funds rate reached zero, they turned to purchasing housing agency debt, mortgage-backed securities, and longer-term Treasury bonds to stimulate the economy. The U.S. economy recovered quickly from the GFC. Many expressed concern, however, about the impacts that unconventional monetary policy is having on the banking sector.

Banks channel saving to alternative borrowers. If there are complete markets and perfect information, then the financial system is a veil.[2] Modigliani and Miller (1958) showed that, under these assumptions, whether a firm raises funds through debt or equity does not affect the firm's cash flow and thus its value. Fama (1980) extended this result to banks. He showed that whether the public holds bank deposits or common stocks affects only the labeling of ownership claims and not macroeconomic outcomes. These depend on the tastes and endowments of economic agents and on the state of technology.

Akerlof (1970) demonstrated that asymmetric information could overturn these efficiency results. In his example, a seller lowering the price of a used car can cause buyers to lose interest because of concerns that the car is a "lemon." Prices may thus be unable to clear markets. Additional factors such as an independent mechanic may be needed for the market to function efficiently.

Financial markets are plagued by imperfect information. Savers release funds today for the promise of obtaining funds later. Whether they get repaid depends on the character of the borrower, the quality of the investment, the collateral that the borrower can provide, and other factors. The lender needs to consider these items and not just the price (i.e., interest rate). Asymmetric information can hinder the flow of funds from savers to small businesses and other borrowers whose creditworthiness is hard to evaluate.

Financial institutions can bridge imperfect information problems. As Bernanke (1993) noted, banks have a comparative advantage because of: 1) economies of specialization, as lending officers gain expertise in a particular industry; 2) economies of scale, as it is cheaper for bank to evaluate a loan than for small savers to; and 3) economies of scope, as it is cheaper to provide lending services together with other services. Banks may play a role in bridging information asymmetries analogous to role of an independent mechanic in the market for used cars.

Petralia et al. (2019) highlighted why banks may play a unique role in channeling funds from savers to borrowers. Banks accept safe short-term deposits and transform these into risky longer-term loans. They make a profit on the difference between the interest rate they earn on longer-term assets and the rate they pay of short-term deposits (the net interest margin). They

[2] The next few paragraphs draw on Bernanke (1993).

screen borrowers and monitor their financial conditions. They also manage their loan portfolio and diversify away idiosyncratic risk. In addition, their ability to pool funds from many depositors allows them to provide liquidity and payments services. If banks are special, then an interruption in their intermediation may disrupt the wider economy.

Contractionary monetary policy may hinder the flow of financial intermediation. As Bernanke and Gertler (1995) discussed, this can happen if it raises the external finance premium. The external finance premium is the difference between the cost of funds raised externally (e.g., through equity, debt, and bank loans) and the opportunity cost of internal funds. These costs can differ because of informational asymmetries and other imperfections.

Bernanke and Gertler (1995) noted that the external finance premium should fall as borrowers' net worth increases. Higher net worth implies that borrowers can post more collateral, provide larger down payments, and take other steps to improve the terms of the loan. If the central bank raises interest rates, then firms face higher interest payments and lower cash flow. This worsens their financial positions and the terms of available loans. As some firms forgo loans, financial intermediation declines.

Expansionary monetary policy that pushes short rates low or negative and that reduces the spread between long- and short-term rates may reduce the net interest margin that banks receive. This can reduce their profitability and capital. As Bernanke and Gertler (1995) observed, a decline in bank capital can impair the ability of banks to attract funds and thus to make loans.

The Fed implemented expansionary policy to fight the GFC. It first lowered the federal funds rate from 5.25% in August 2007 to zero in December 2008. It then turned to quantitative easing (QE), purchasing housing agency debt, mortgage-backed securities, and longer-term Treasury bonds to stimulate the economy. As Table 1 shows, QE was implemented in three stages: QE1 from November 2008 to November 2009, QE2 from August 2010 to November 2010, and QE3 in 2012.

Glick and Leduc (2012) investigated how Fed announcements of QE between November 2008 and November 2010 affected asset prices. They included five events from QE1 and five from QE2. They reported that news of looser monetary policy caused the 10-year Treasury rate, the value of the dollar against several currencies, and the S&P Goldman Sachs Commodity Index to fall.

Gagnon, Raskin, Remache, and Sack (2011) noted that Fed asset purchases reduce the available supply of long duration assets and increase the supply of bank reserves with zero duration. Assuming that longer-term assets and bank reserves are not perfect substitutes, these purchases should reduce the risk premiums on longer-term assets and thus reduce longer-term yields. They examined the response of interest rates using one-day windows around eight important announcements during QE1. They found cumulated interest rate drops of 91 basis points for ten-year Treasury yields, 156 basis points for ten-year agency debt yields, and 113 basis points for mortgage-backed security yields. They also reported a 57 basis point drop in the ten-year Treasury yield relative to the two-year Treasury yield. Using Kim and Wright's

(2005) estimates of the term premium that investors require to hold longer-term assets, they concluded that the drops in long-term Treasury yields primarily reflected declines in the term premium rather than declines in expected future short-term interest rates.

Roache and Rousset (2013) employed the events for QE1, QE2, and QE3 that are included in Table 1. They examined how these events affected asset price risk by employing risk-neutral density functions estimated from options prices. They reported that "tail risk" fell after announcements of unconventional monetary easing by the Fed and concluded that LSAP increased market confidence during times of uncertainty.

When Federal Reserve Chairman Ben Bernanke announced on 22 May 2013 that the Fed may taper its bond purchases as a step towards normalizing monetary policy, the spread between 10-year and 3-month Treasury security yields rose 9 basis points. When he repeated the same message on 18 June 2013, the spread rose 13 basis points. Because of the strong market reaction, this episode was dubbed the "Taper Tantrum". When Bernanke repeated the same message on 18 June 2013, emerging market stocks fell again. He then announced on 18 September 2013 that any tapering of bond purchases by the Federal Reserve would be delayed. The spread then fell 17 basis points. The Fed began tapering its bond purchases in December 2013 and concluded bond purchases in October 2014.

Figure 1 shows that, apart from increases during the temper tantrum period and a few other periods, the spread has decreased steadily from 400 basis points at the beginning of 2010 to -20 basis points at the end of September 2019. Figure 2 shows that the three-month Treasury bill rate and the federal funds rate. It shows that the 3-month Treasury rate moves closely with the federal funds rate. For instance, when the Fed raised the funds rate from close to zero in December 2015 to 2.4 percent in January 2019, the 3-month rate increased almost in lockstep. As the Fed subsequently lowered the funds rate to 1.8 percent in September 2019, the three-month rate also moved with it.

The spread is closely related to banks' net interest margins. This paper investigates how changes in the spread, in Fed policy, and in other events have affected U.S. bank profitability after the GFC. To do this, it estimates a multi-factor model to explain the return on bank stocks in the U.S. Stock prices are the expected present value of future cash flows. Thus investigating how changes in the spread and in other factors affect bank stock returns can shed light on how they influence bank profitability.

The results indicate that the spread and the level of the 3-month Treasury interest rate both influence bank stock returns. The changes in the spread and the low three-month interest rates that are clear in Figures 1 and 2 have thus harmed banks. These changes are partly due to Fed policy. Banks are also facing competitive threats from companies using digital technology and big data and from technology giants. Given the special role that banks play in the economy, the monetary authorities should keep a close eye on the health of the banking system going forward.

The next section presents the data and methodology. Section 3 presents the results. Section 4 considers why interest rates are so low and how banks will weather the challenges from financial technology and Big Tech firms. Section 5 concludes.

2. Data and Methodology

How do interest rates, interest rate spreads, Fed policy, and other variables affect the banking sector? This question can be addressed by examining how these variables affect bank stock prices. Economic theory implies that stock prices equal the expected present value of future net cash flows. Thus factors that affect bank stock prices also influence banks' long run profitability. This paper uses the return on U.S. bank stocks as the dependent variable.

Petralia et al. (2019) noted that smaller banks rely more on traditional banking activities such as taking in retail and wholesale deposits and making loans. Larger banks also generate substantial earnings from offering wealth management and other fee based services. Smaller banks may thus be more exposed to their net interest margin. To examine this issue, the returns on both smaller and larger banks are used.

Petrilia et. al. reported that interest rates and interest rate spreads matter even for the largest banks. Examining the factors affecting net interest rate margins for the 120 largest global banks over the 1990-2017 period, they reported that increases in the ten-year minus 3-month Treasury spread and increases in the short-term Treasury rate are strongly positively correlated with the net interest margin. This study thus includes the spread between the 10-year and three-month Treasury rates and the three-month Treasury rate as explanatory variables to explain bank stock returns. Since banks also transform safe short-term deposits into risky long-term loans, the spread between BAA corporate bond yields and federal funds rate is also used as an explanatory variable.

Measuring change in Fed policy after the GFC is tricky. Thorbecke (2018) investigated how each of the events listed in Table 1 affected inflation expectations. If investors believed that the news would raise inflation, they would sell assets exposed to inflation and purchase inflation hedges. This would lower the prices of assets that are harmed by inflation and raise the prices of assets that benefit from inflation. Examining the relationship between asset price changes and inflation sensitivities can thus shed light on how financial markets process LSAP news. Results across 60 assets indicate that sometimes the events raised inflationary expectations, sometimes they lower them, and sometimes they did not affect them. Wright (2011) similarly calculated the degree of monetary surprise in these events using interest rate futures and high-frequency data. He reported that sometimes the events represented expansionary monetary policy surprises and sometimes they represented contractionary surprises. The events in Table 1 thus contain very different types of information.

In contrast, the events during the Taper Tantrum in 2013 were very consistent. The 22 May and 18 June events were clear times when markets expected more contractionary monetary policy and the 18 September event was a time when markets expected more expansionary policy. Dummy variables equaling 1 for the first two events, -1 for the third, and zero otherwise are included as explanatory variables to measure unconventional Fed policy.

Several control variables are included in the regression. These include the return on the U.S. stock market (ΔR_{US}), the return on the world stock market (ΔR_{World}), the change in the log of the Chicago Board Options Exchange volatility index (VIX), the change in the log of the price of West Texas Intermediate (WTI) crude oil, and the change in the log of the Federal Reserve Board nominal effective exchange rate against major currencies (NEER).

The equation to be estimated is:

$$\Delta R_j = \alpha_0 + \alpha_1 \Delta Spread + \alpha_2 \Delta i_3 + \alpha_3 \Delta Baaffr + \alpha_4 Taper + \alpha_5 \Delta R_{US} + \alpha_6 \Delta R_{World} + \alpha_7 \Delta WTI + \alpha_8 \Delta VIX + \alpha_9 \Delta NEER, \quad (1)$$

where ΔR_j is the return on bank j (or on an index of bank stocks), $\Delta Spread$ is the change in the spread between the 10-year Treasury rate and the 3-month Treasury rate, Δi_3 is the change in the interest rate on 3-month Treasury securities, $\Delta Baaffr$ is the change in the spread between BAA corporate bond yields and the federal funds rate, Taper is a dummy variable equaling one when markets expected the Fed to reduce bond purchases, -1 when they expected the opposite, and 0 otherwise, ΔR_{US} is the return on the U.S. stock market index, ΔR_{World} is the return on the world stock market index, and the other variables are defined above. The focus on this paper is on α_1, α_2, α_3, and α_4. If α_1, α_2, and α_3 are greater than zero, then increases in the spread between the 10-year and the 3-month rate, the 3-month rate, and the spread between the BAA corporate bond yields and the federal funds rate, respectively, will increase bank stock returns. If α_4 is greater than zero, then news that the Fed will reduce bond purchases will increase bank stock returns.

Data on $\Delta Spread$, Δi_3, $\Delta Baaffr$, and NEER come from the Federal Reserve Bank of St. Louis FRED database. All of the other data come from the Datastream database.

During the GFC there were wild swings in bank stocks and in the other variables. These could cloud inference. This paper thus focuses on the period after the GFC. The sample period includes daily data from 1 June 2010 to 30 September 2019. There are 2201 observations.

3. Results

Table 2 presents the results from estimating equation (1) using the return on an index of U.S. bank stocks as the dependent variable. The adjusted R-squared is 0.70. This is a high value for daily stock returns.

The coefficient on the change in the spread between the 10-year and the 3-month rate is highly statistically significant and greater than 0.05 in three of the four specifications. This implies that the 400 basis point drop in the spread between the beginning of 2010 and September 2019 that is evident in Figure 1 caused bank stocks to drop by 22 percent. The

drop in the spread has thus been painful for the banking industry.

The coefficient on the Taper variable is only significant when the spread variable is not included. This suggests that news of Fed policy is affecting bank stocks through its influence on the long-short interest rate spread.

The coefficient on the change in the three-month Treasury security rate is highly statistically significant in three of the four specifications and significant at the 10 percent level when the spread variable is excluded. In the three specifications where it is highly statistically significant its values range from 0.059 to 0.064. These values imply that the 240 basis point rise in the three-month rate between December 2015 and December 2018 caused a 15 percent increase in bank stocks. Since the increase in the 3-month rate at this time was driven by Fed increases in the funds rate, this implies that the Fed's low interest rate policy has harmed banks.

The coefficient on the change in the spread between the Corporate Baa bond yield and the federal funds rate is only significant when the change in the spread between the 10-year and the 3-month rate is excluded. This suggests that the slope of the term structure rather than the spread between risky and riskless rates is what matters for bank profitability.

Table 3 presents the results from estimating equation (1) for individual bank stocks. The coefficient on the change in the spread between the 10-year and the 3-month rate is positive and statistically significant for 39 of the 41 banks. The coefficient on the 3-month interest rate is positive and statistically significant for 36 of the 41 banks. The magnitudes of the coefficients are in most cases similar to those reported in Table 2. Thus indicates that interest rate spreads and the short-term interest rates that are influenced by monetary policy exert import effects on almost all of the banks in our sample.

Are smaller banks more exposed than larger banks to interest rates and interest rate spreads? To investigate this we can compare banks' market capitalization (cap) with their betas to the interest rate spread and the 3-month interest rate.

The results for banks' betas to the spread (β_{Spread}) are:

$$\beta_{Spread,i} = \underset{(0.004)}{0.059***} - \underset{(0.000019)}{0.000013cap_i}$$

Adjusted R-squared = -0.023, Standard error of regression = 0.023, Number of observations = 41, Heteroskedasticity and autocorrelation consistent standard errors in parentheses. *** denotes significance at the 1% level.

The results for banks' betas to the 3-month Treasury rate (β_{Three}) are:

$$\beta_{Three,I} = \underset{(0.005)}{0.065***} - \underset{(0.000021)}{0.000009cap_i}$$

Adjusted R-squared = -0.025, Standard error of regression = 0.027, Number of observations = 41, Heteroskedasticity and autocorrelation consistent standard errors in parentheses. *** denotes significance at the 1% level.

The results reported in this section indicate that, while almost all of the banks are harmed by reductions in the long-short interest rate spread and in the short rate, larger banks tend to be harmed to the same degree as smaller banks. This implies that, even though large banks such as JP Morgan Chase earn significant revenues from wealth management and other non-traditional activities, they are still highly exposed to interest rates and interest rate spreads that affect traditional banking activities such as taking in deposits and extending loans.

4. Discussion

The results reported above indicate that the fall in short-term interest rates and interest rate spreads have been painful for U.S. banks. How much of the responsibility for low interest rates can be ascribed to Federal Reserve monetary policy?

Low long-term rates are a global phenomenon, indicating that U.S. monetary policy alone cannot explain them. Bernanke (2005) ascribed low interest rates in the first decade of the 21st century to a "global savings glut". By this he meant an excess of desired saving over desired investment in the world. He argued that much of this came from China and emerging Asia. In 2015, he observed that China's current account surplus had fallen but that Germany's had soared (Bernanke 2015a). He argued that Eurozone surpluses were continuing to provide excess saving to the world and to depress interest rates

Brad Setser (2019), updating the data to 2019, noted that China has run a current account surplus of USD 250 billion over the last four quarters and that South Korea, Japan, Taiwan, Singapore, and other East Asian countries also run large surpluses. He observed that these trade imbalances are likely to get worse before they get better. In addition, he documented that Northern European Eurozone countries are running current account surpluses of about USD 350 billion. These large surpluses continue to depress long-term interest rates worldwide.

However, the Fed has also contributed to low U.S. interest rates. Gagnon, Raskin, Remache, and Sack (2011) reported that QE1 announcements reduced the ten-year Treasury security yield relative to the two-year yield by 57 basis points. Bonis, Ihrig, and Wei (2017) found that the Fed's large security purchases under QE1, QE2, and QE3 lowered the term premium in long-term bonds by 0.9%. The Fed also directly controls the short rate, and has driven it down several times in recent years.

Bernanke (2015b) argued that the Fed is only seeking to hit the Wicksellian natural rate when it lowers short- and long-term interest rates. However, there is considerable uncertainty about the natural rate, and the Fed often must make educated guesses. While targeting interest

rates that are too high may slow the overall economy, targeting interest rates that are too low will harm the profitability of the banking sector and hence the flow of financial intermediation.

Low interest rates, partly due to Fed policy, have thus harmed the banking sector.[3] Banks are also facing a competitive threat from companies using digital technology and big data (FinTech companies) and from technology giants such as Amazon, Facebook, Google, Alibaba and Tencent. As Stulz (2019) noted, these competitors benefit because they do not face the same regulations and capital requirements that banks do and because they specialize in information technology and analyzing customer data. These will pose additional challenges to banks going forward.

The challenges from FinTech firms include their ability to rapidly employ new technologies, to provide customer friendly interfaces such as aps on a smartphone, and to offer lower costs because they face lighter regulations. They typically compete, though, in niche markets and do not offer the full range of services that banks do.

In contrast, technology giants can compete with banks across a wide range of services including taking in deposits, providing loans, and offering credit cards. They have huge customer bases and vast amounts of information from both the supply and demand sides of the market. This enables them to target financial products to customers who need them most. They also have state of the art technology.

How are U.S. banks doing in the face of all of these challenges? Figure 3 shows that the net interest rate margin was at an all-time low in December 2015 when the Fed began raising the short-term rate in December 2015. It remains far below its historical average. Figure 4 shows the residuals from regressing the log of stock prices for an index of bank stocks on the log of stock prices for the U.S. market. The results show that bank stocks have substantially underperformed the overall U.S. market after the GFC.

U.S. banks are thus not as strong as they have been historically and are facing strong competitive challenges. Their future is also fraught with uncertainty. Trade wars could worsen or a recession could hit and impair the ability of their borrowers to repay. The outlook for collateralized loan obligations could worsen and harm exposed banks. Problems in the shadow banking system could arise and spread to the regulated banking sector. These or other factors could spark a crisis and be deleterious for an already challenged banking system. The Fed should keep this in mind when formulating interest rate policy.

East Asian economies should also seek to reduce global imbalances that are lowering interest rates and contributing to protectionist pressures. Despite large current account surpluses, currencies in Taiwan, South Korea, Singapore, Japan and neighboring countries have not appreciated much. One reason for this is that the U.S. dollar has a high weight in the implicit currency baskets of many Asian countries. Each country resists appreciating against the dollar because it does not want to lose price competitiveness relative to other Asian countries. A better outcome would occur if they assigned more weight to other Asian currencies and less

[3] The next three paragraphs draw on Stulz (2019).

weight to the U.S. dollar. This would enable currencies in the region to appreciate together against the dollar. Thorbecke (2019) found that a concerted appreciation in Asia could reduce imbalances. He also found that a joint appreciation would draw more imports into East Asia, helping the region to function as an engine of growth.

5. Conclusion

In the wake of the GFC, the Fed has kept interest rates low and purchased private and public debt. While these policies have contributed to economic recovery, many are concerned how they impact the banking sector. Banks profit from the difference between the interest they earn on longer-term loans and the interest they pay on shorter- term deposits. Policies that lower short-term interest rates or the interest rate spread may adversely affect bank profitability. If banks become less profitable, this may hinder their ability to extend loans (Bernanke and Gertler, 1995).

To gauge bank profitability, this paper examines bank stock returns. The results indicate that lower short-term rates and falls in the long-short interest rate spread cause large drops in bank stock returns. Since the Fed directly controls the short-term rate and influences the spread, these results indicate that monetary policy has reduced the profitability of the banking sector. Banks are facing additional challenges due to competition from FinTech firms and giant technology firms and due to pervasive uncertainty. They are thus vulnerable if the economy contracts.

If banks' ability to intermediate credit is further hampered, it could adversely affect long-term growth. Banks specialize in screening borrowers and monitoring their financial conditions. This enables them to channel funds to the most promising borrowers. Perennially easy monetary policy may erode bank capital and jeopardize their ability to play this important function in the economy.

Table 1. Announcements of Large-Scale Asset Purchases between 2008 and 2010

Event Number	Date	Phase	Announcement
1	11/25/2008	QE1	The Fed announces it will purchase $100 billion in government- sponsored enterprise debt and $500 billion in mortgage-backed securities.
2	12/1/2008	QE1	Fed Chairman Bernanke states that the Fed may purchase long-term Treasury securities.
3	12/16/2008	QE1	The Federal Open Market Committee (FOMC) first mentions it may purchase long-term Treasury securities.
4	1/28/2009	QE1	The FOMC says it is ready to increase purchases of mortgage-backed securities and agency debt and to purchase long-term Treasury securities.
5	3/18/2009	QE1	The FOMC states that it will purchase $300 billion in long-term Treasury securities and increase its purchases of mortgage-backed securities by $750 billion and its purchases of government-sponsored enterprise debt by $100 billion.
6	8/12/2009	QE1	The FOMC says it will purchase a total of up to $1.25 trillion of mortgage-backed securities and up to $200 billion of government- sponsored enterprise debt and $300 billion in Treasury securities.
7	9/23/2009	QE1	The FOMC says Fed purchases of $300 billion of Treasury securities will be finished by the end of October 2009.
8	11/4/2009	QE1	The FOMC says purchases of agency debt will be reduced to $175 billion. Purchases of mortgage-backed securities and government- sponsored enterprise debt will be completed by the end of the first quarter of 2010.
9	8/10/2010	QE2	The Fed will maintain current holdings of securities by re-investing principal payments from mortgage-backed securities and government-sponsored enterprise debt into longer-term Treasury securities. The Fed will also roll over its holdings of Treasury securities.

10	8/27/2010	QE2	Chairman Bernanke says the Fed will roll over its holdings of existing long-term Treasury securities and buy more long-term securities to provide additional stimulus
11	10/15/2010	QE2	Chairman Bernanke says the Fed will provide more quantitative easing and keep interest rates low.
12	11/3/2010	QE2	The FOMC says the Fed will buy $75 billion of long-term Treasury securities per month until June 2011.
13	8/31/2012	QE3	Chairman Bernanke says the Fed will provide additional accommodation.
14	9/13/2012	QE3	The FOMC states the Fed will purchase $40 billion of mortgage-backed securities per month.

Source: Roache and Rousset (2013).

Note: QE1 refers to the first round of asset purchases, QE2 to the second round and QE3 to the third round.

Table 2. The Effect of Interest Rates and Fed Tapering on an Index of U.S. Bank Stock Returns

	(1)	(2)	(3)	(4)	(5)
Spread between the 10-year and 3-month Treasury security yields	0.055*** (0.009)		0.055*** (0.009)	0.051*** (0.007)	0.043*** (0.007)
Taper Tantrum variable	-0.000 (0.002)	0.004*** (0.002)		-0.000 (0.002)	0.001 (0.002)
3-month Treasury security yield	0.064*** (0.014)	0.021* (0.011)	0.063*** (0.014)	0.059*** (0.013)	
Spread between the Corporate Baa bond yield and the federal funds rate	-0.006 (0.005)	0.030*** (0.005)	-0.006 (0.006)		0.004 (0.006)
Adjusted R-squared	0.704	0.692	0.704	0.703	0.700
Standard Error of Regression	0.0080	0.0080	0.0080	0.0080	0.0080
Durban Watson Statistics	2.04	2.01	2.04	2.04	2.03
Number of Observations	2201	2201	2201	2201	2201

Notes: The table provides results from a regression of the daily return on an index of U.S. bank stocks on the change in the spread between the 10-year Treasury rate and the 3-month Treasury rate, the change in the interest rate on 3-month Treasury securities, the change in the spread between BAA corporate bond yields and the federal funds rate, a dummy variable equaling 1 when markets expected the Fed to reduce bond purchases and -1 when they expected the opposite (Taper Tantrum variable), the return on the U.S. stock market index, the return on the world stock market index, the change in the log of the Chicago Board Options Exchange volatility index, the change in the log of the price of West Texas Intermediate crude oil, and the change in the log of the Federal Reserve Board nominal effective exchange rate against major currencies. The sample period extends from June 1, 2010 to September 30 2019. Heteroskedasticity and autocorrelation consistent standard errors in parentheses.

*** (*) denotes significance at the 1% (10%) level.

Table 3. The Effect of Interest Rates on Stock Returns for Individual U.S. Banks

Bank Name	Market Capital-ization (billions of USD)	Beta on Spread between the 10-year and 3-month Treas-uries	Stan-dard Error	Beta on 3-month Treas-uries	Stan-dard Error	Adjus-ted R-Squared
JP MORGAN CHASE & CO.	385.49	0.055***	0.009	0.065***	0.015	0.600
BANK OF AMERICA	275.56	0.070***	0.020	0.075***	0.025	0.523
WELLS FARGO & CO	220.17	0.043***	0.010	0.053***	0.018	0.564
CITIGROUP	157.55	0.06***	0.012	0.072***	0.021	0.615
US BANCORP	86.78	0.037***	0.008	0.043***	0.013	0.607
PROSPERITY BCSH.	70.8	0.058***	0.013	0.063***	0.021	0.470
PNC FINL.SVS.GP.	63.9	0.055***	0.009	0.059***	0.014	0.571
BB&T	40.35	0.050***	0.010	0.049***	0.015	0.545
SUNTRUST BANKS	30.14	0.061***	0.011	0.052***	0.017	0.550
M&T BANK	20.35	0.056***	0.010	0.085***	0.016	0.486
FIFTH THIRD BANCORP	19.96	0.081***	0.010	0.080***	0.018	0.521
KEYCORP	17.83	0.072***	0.012	0.067***	0.018	0.532
FIRST REPUBLIC BANK	17.53	0.027**	0.011	0.050***	0.018	0.343
CREDICORP	16.74	-0.016	0.011	-0.024	0.018	0.278
CITIZENS FINANCIAL GROUP	15.79	NA	NA	NA	NA	NA
REGIONS FINL.NEW	15.73	0.081***	0.014	0.092***	0.020	0.509
HUNTINGTON BCSH.	14.73	0.058***	0.013	0.045**	0.019	0.526
SVB FINANCIAL GROUP	10.55	0.096***	0.013	0.111***	0.024	0.499
COMERICA	9.43	0.086***	0.011	0.081***	0.019	0.522
ZIONS BANCORP.	8.05	0.087***	0.011	0.085***	0.019	0.508
COMMERCE BCSH.	6.84	0.043***	0.008	0.052***	0.013	0.519
SIGNATURE BANK	6.64	0.031**	0.012	0.028	0.021	0.389
PEOPLES UNITED FINANCIAL	6.56	0.046***	0.009	0.053***	0.015	0.470

NEW YORK COMMUNITY BANCORP	6.11	0.023**	0.010	0.032	0.021	0.338
EAST WEST BANCORP	6.01	0.090***	0.013	0.092***	0.021	0.507
CULLEN FO.BANKERS	5.7	0.061***	0.011	0.070***	0.018	0.475
BOK FINL.	5.56	0.059***	0.010	0.079***	0.016	0.472
SYNOVUS FINANCIAL	5.44	0.080***	0.013	0.068***	0.022	0.425
FIRST CTZN.BCSH.A	5.38	0.050***	0.011	0.065***	0.018	0.423
TFS FINANCIAL	5.26	0.021**	0.011	0.045***	0.017	0.293
WESTERN ALL.BANCORP.	4.98	0.098***	0.012	0.113***	0.020	0.465
FIRST HORIZON NATIONAL	4.86	0.066***	0.011	0.084***	0.018	0.453
FIRST FINL.BKSH.	4.74	0.064***	0.014	0.064***	0.022	0.453
PINNACLE FINANCIAL PTNS.	4.47	0.061***	0.013	0.072***	0.021	0.397
PACWEST BANCORP	4.39	0.066***	0.012	0.070***	0.020	0.476
WEBSTER FINANCIAL	4.32	0.074***	0.011	0.073***	0.019784	0.536
STERLING BANCORP	4.15	0.077***	0.012	0.083***	0.0193	0.421
UNITED BANKSHARES	3.92	0.053***	0.012	0.073***	0.018775	0.460
IBERIABANK	3.83	0.055***	0.011	0.064***	0.021	0.422
SLM	3.76	0.019	0.014	0.002	0.027	0.347
BANK OZK	3.71	0.075***	0.012	0.102***	0.023	0.322
WINTRUST FINANCIAL	3.66	0.064***	0.012	0.076***	0.018	0.445
POPULAR	NA	0.053***	0.015	0.045*	0.026	0.334

Notes: The table provides results from a regression of the daily return on the individual bank stock return on the change in the spread between the 10-year Treasury rate and the 3-month Treasury rate, the change in the interest rate on 3-month Treasury securities, the change in the spread between BAA corporate bond yields and the federal funds rate, a dummy variable equaling 1 when markets expected the Fed to reduce bond purchases and -1 when they expected the opposite (Taper Tantrum variable), the return on the U.S. stock market index, the return on the world stock market index, the change in the log of the Chicago Board Options Exchange volatility index, the change in the log of the price of West Texas Intermediate crude oil, and the change in the log of the Federal Reserve Board nominal effective

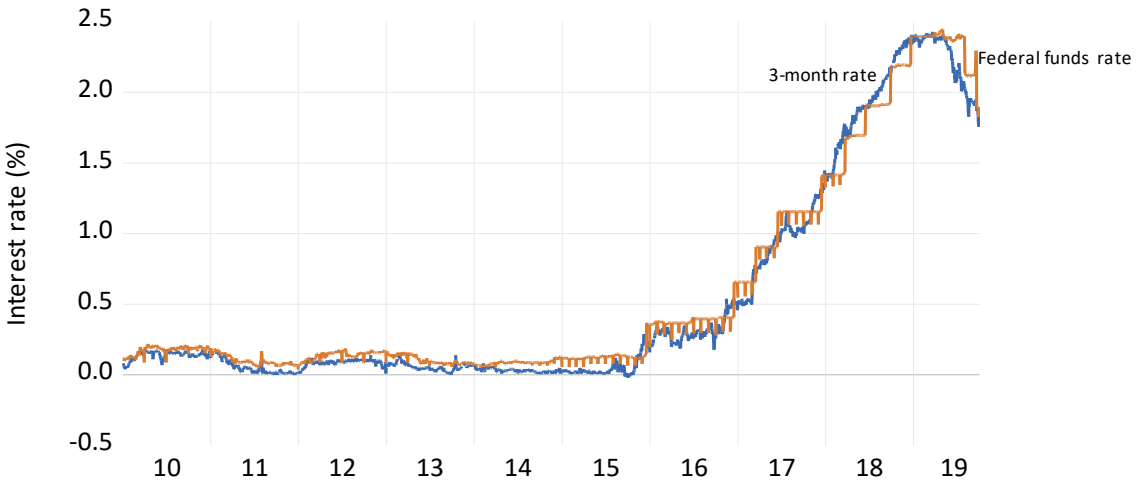
exchange rate against major currencies. The sample period extends from June 1, 2010 to September 30 2019. Heteroskedasticity and autocorrelation consistent standard errors in parentheses.

***(**)[*] denotes significance at the 1% (5%) [10%} level.

Figure-1: Spread Between 10-year and 3-month Treasury Yields

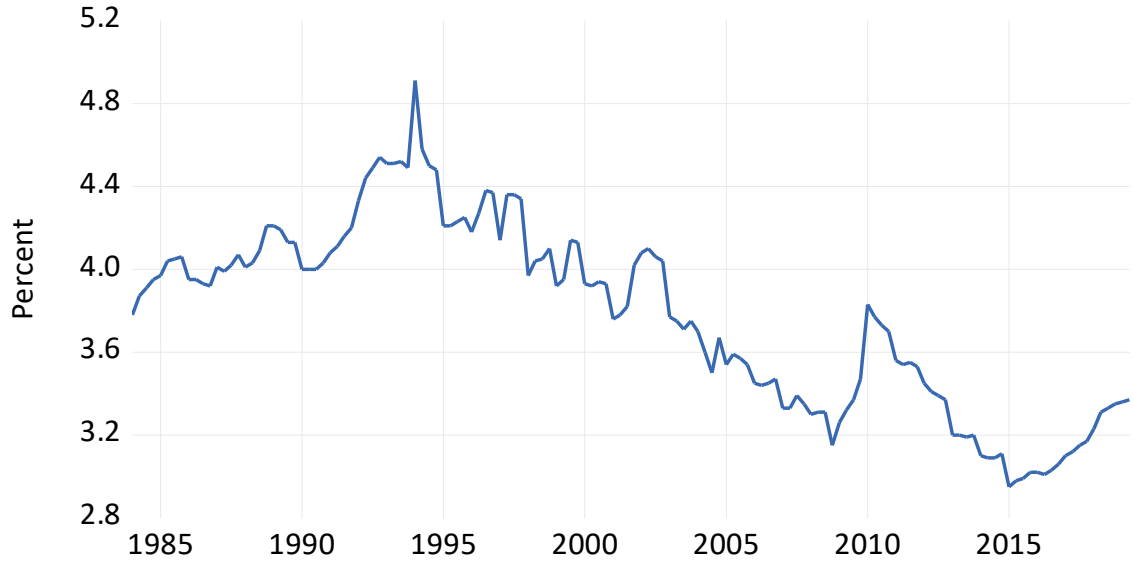
Source: Federal Reserve Bank of St. Louis FRED database.

Figure-2: 3-month Treasury Security Rate and the Federal Funds Rate



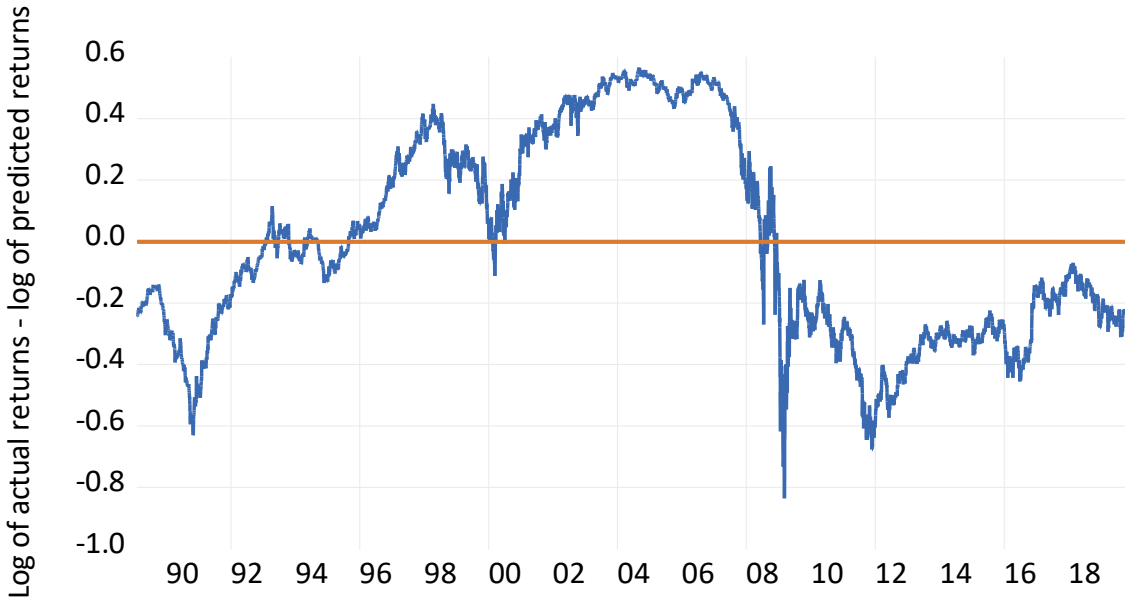
Source: Federal Reserve Bank of St. Louis FRED database.

Figure-3: Net Interest Margin for All U.S. Banks



Source: Federal Reserve Bank of St. Louis FRED database.

Figure-4: Residuals from Regressing a U.S. Bank Stock Index on the Overall U.S. Market



Source: Datastream database and calculations by the author.

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