BANK CAPITAL, BANK LENDING AND MONETARY POLICY IN THE UNITED STATES

by

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Abstract

This paper examines the relationship between banks lending and monetary policy for banks with different level of capital ratio. We study the relation using the sample of U.S. banks over the period 1994 to 2010. We choose short term interest rate, deposit, security and GDP as components of monetary policy. We use bank loan change as the dependent variable, short term interest rate, deposit, security, GDP change and 1 year lagged change as independent variables for the regression model. Our model returns significant results for all independent variables except security change lagged variable for all three categories and short term interest rate variable for best-capitalized banks. Out finding shows that the monetary policy change will significantly affect bank lending change with strongest effect on least-capitalized banks and weakest effect on best-capitalized banks.

Keywords: Bank capital · Bank Lending · Monetary Policy

Table of Contents

1.Introduction

The importance of banks play in the changes of monetary policy has been a very hot topic among researchers and economists for over 40 years. In the 1950s, for instance, proponents of the "availability doctrine" argued that a bank credit channel provided the Federal Reserve with additional leverage in conducting monetary policy. There is a controversial debate on the exactly role the banks play. The emphasis of this debate is whether there is a relationship between bank lending and monetary policy. So the effects of the monetary policy have been widely studied in macroeconomics. Recently, the credit channel draws great attention in the debate (Charles S. Morris and Gordon H. Sellon, Jr,1995). Credit channel of monetary policy transmission is an indirect amplification mechanism that works in tandem with the interest rate channel. The credit channel affects the economy by altering the amount of credit firms and/or households have access to in equilibrium.

Researchers have tested the effectiveness of bank credit channel of monetary policy transmission based on the bank-specific data. Earlier empirically tests on the existence of the bank credit channel in the United States, Europe and some other countries have proved that this credit channel exists. The bank credit channel of monetary policy transmission exists because of controversial information in the credit market; banks play a unique role by providing loans to some firms which have difficulty in getting money from the capital market. This indicates that monetary policy influents the credit market (i.e. how much money banks can offer these firms), thus negatively affect the performance of these firms. In fact, a failure in banking system may lead to the failure

of the economy. However, recently, the financial deregulation has changed the credit market in a way which should weaken this credit channel overtime (Thornton,1994, and Bernanke and Gertler,1995).

Banking system has many factors influence the bank behavior. Among these factors, bank capital is the main factor partly because of market, technological and regulatory forces. Bank capital plays a very important role in banks' risk management. Banks are motivated to minimize capital and given the "liquidity" support extended to them by the central bank during the crisis, they are incentivized to turn away offers for recapitalization and instead slowly recapitalize by borrowing from the central bank and lending out to low-risk ventures such as T-Bonds or AAA Bonds. Bank capital has played a vital element in banks' regulation. Both empirical and theoretical studies on the effects that bank capital on bank behavior (i.e. capital requirement under Basel Ⅱ&Ⅲ) have attracted more and more attention in recent years (Youbaraj Paudel,2007, and Paula Antão and Ana Lacerda,2008).

This paper primarily focuses on the factors that affect bank lending and whether these effects are different among different bank capital amount. It tests the banking system in USA between 1994 and 2010. Our message is that the level of bank capital did matters the relationship between monetary policy change and bank lending change. The monetary policy has strongest effect on least-capitalized banks compare to the weakest effect on best-capitalized banks. We find the best-capitalized banks are stable and low risk tolerance while the least-capitalized banks are unstable and high risk tolerance. Most variables are significant except the security change lagged for all three categories and the short term interest rate change for best-capitalized banks. At the same time, data shows

the adjustment of short term interest rate will take effect in 1 period after. Overall to say, our model successfully prove the relationship between monetary policy and bank lending, also shows the difference between different capital levels which confirm the bank capital level did affect bank lending and monetary policy in the United States.

The remainder of this paper is organized as follows. Section 2 reviews previous theoretical and empirical studies on the relationship of bank lending, monetary policy and bank capital. Section 3 explains the variables used in this paper and the summary statistics. Section 4 shows and discusses the empirical results by dividing the data in to least-capitalized, medium- capitalized and most-capitalized. And compare the results among different bank capital. Section 5 is a conclusion part. Appendices part provide several tables about how to definition of variables, the empirical studies used in this paper and the correlation between factors in the model.

2. Literature Review

2.1 Theoretical Literature Review

The lending activity of banks has been attracted considerable attention as an important part to the performance of the economy. At late 1994, people noticed that the standards for credit risk is too loose as the bank lending becomes larger (see, John A. Weinberg,1995).

More and more people put a lot of attention to the monetary policy after then. How the monetary policy works? Two main ways that bank leading may influence the monetary policy transmission process through bank lending.

First, when the Fed decreases reserves, this strict the amount of loan supply and then cut down the bank lending---this is the bank lending channel (see, Jeremy C. Stein, 1998). The bank lending channel theorizes that modifications in monetary policy will change the supply of credit, especially credit supply in commercial banks. Any changes in monetary policy may affect the supply of loanable money available to banks (i.e. a bank's liabilities), and then the total amount of loans banks can make (i.e. a bank's assets). That is to say, a bank lending channel thinks a tight monetary policy will reduce their loan amount due to the decrease in total amount of money that is available to lend.

However, researchers then concerned about whether or not the monetary policy has a direct impact on bank liabilities. The relation between monetary policy and deposits is caused by two mechanisms. Traditional thoughts are focus on the ability of the central bank can directly control the amount of deposit by regulating banks capital reserve and the money multiplier mechanism. Another thought is portfolio substitution arguments which show that the monetary policy changes the rate of deposits relative to other assets thus change public's willingness to hold them. Both of the ideas reveal that monetary policy tightening results in reduction of deposits and then condense loan supply. Recently, Researchers argue that the emphasis on monetary policy leads to change in deposits is misunderstood. They wonder maybe policy has a reverse affect on bank deposits (Piti Disyatat, 2011). Furthermore, alternatives in the willingness and the amount banks like to

lend, and the movements in interest rate spreads are likely to become a part of macroeconomic model.

Besides, a bank balance sheet channel theorizes that there should be a negative relationship between the size of the external finance premium and the borrower's net worth (Townsend, Robert. 1979 and Bernanke, Ben, Mark Gertler, and Simon Gilchrist. 1996). For instance, the greater the net worth of the borrower, the more likely she/he uses self-financing. Higher net worth borrowers have more collateral for the money they borrowed. Thus lenders assume lower risk when lending to higher net worth borrowers. The cost of raising external funds will be lower for higher net worth borrowers.

Changes in financial positions of borrowers affect their credit and thus induce changes in their investment and spending decisions. This idea is like the financial accelerator. The mechanism of financial accelerator states that firms' ability to borrow largely depends on the market value of their assets (i.e. their net worth). This relationship is expressed as a "collateral-in-advance" constraint (Hart, Oliver and John Moore. 1994). An increase in interest rates will reduce the firm's ability to purchase inputs.

From a regulatory perspective, capital requirement set the minimum capital the bank should hold relative to risk weighted assets. Bank capital is advantageous since it reduce the cost of bank failure. But at the same time it costs more because the increase in bank capital decreases bank deposits (Gary Gorton and Andrew Winton,2000). Interest rate mismatch is one factor of asset-liability mismatch which is the key motivation for the bank's balance sheet position changes (Yener Altunbaş, Gabe de Bondt and David Marqués-Ibáñez, 2004). According to this theory, if banks failed to hedge the interest

rate risk, a variation in monetary policy induces the interest rate mismatch of banks. This in turn affects the value of bank capital and loan supply. Generally speaking, restrictive monetary policy leads to loan defaults, and then has an impact on bank capital.

2.2 Empirical Literature Review(还没有完成)

3. Sample and variables

3.1 Data sources

In this paper, we use OLS regression method in Matlab to test the impact of monetary policy on bank lending. We get the panel data from different sources. First, we obtain a sample data of banks from the Wharton Research Data Service (WRDS) database during 1994 to 2010. In beginning, we have 1357 banks in our data base. But the 2010 data shows there are only 1009 banks for our analysis due to acquisitions, mergers and bankrupts. We gain the annual data (including loan, deposit and securities) of each bank through the Consolidated Financial Statements for Bank Holding Companies (FR-Y9C). Then we achieve the short term interest rate from the Federal Reserve System database. Finally, we obtain the GDP growth rate in accordance with the Bureau of Economic Analysis.

To evaluate the relationship between bank lending and monetary policy, we choose bank's short-term market interest rate (STIR), bank deposits (DEPO), bank securities holdings (SECU), the growth of the gross domestic product (GDP) and their

one-period lag as our independence variables. As we expect to compare the results among least- capitalized, medium- capitalized and most- capitalized, we divide our data into three categories: small, medium and large according to the capital ratio.

3.2 Variables

3.2.1 Dependent Variables

The following variables are defined by pervious researchers Altunbas et al (2002) and Yener Altunbaş, Gabe de Bond and David Marqués-Ibáñez(2004).

Loan change (△loan)

△loan is calculated by dividing a bank's loan amount by the pervious loan amount, then minus 1. This is the definition used in pervious papers from different researchers such as Diana Hancock, Andrew J. Laing and James A. Wilcox(1995) and Yener Altunbaş, Gabe de Bond and David Marqués-Ibáñez(2004). We select △loan to stand for the bank lending since it is an usual way to estimate the relative loan amount between different years.

3.2.2 Independent Variables

Short-term Market Interest Rate (STIR)

Short-term Market Interest Rate shows the monetary policy stance, in line with most studies. STIR is the interest rate on a loan or other obligation with a maturity of less than one year. A commonly followed short-term interest rate is the rate on a Treasury bill.

Short-term interest rates are also called money market rates. In theory, if more people prefer borrowing money to investing money (which indicates higher bank lending amount) the price of borrowing will increase. As a result, Short-term Market Interest Rate goes up.

Why not we use Long-term Market Interest Rate (LTIR)? Since the Interest Rate can be affected by other factors in the long run. If we use the LTIR, we cannot conclude the direct relation between interest rate and bank lending amount.

Bank Deposits (DEPO)

Bank Deposits (DEPO), which is the money placed into a banking institution for safekeeping, indicates the traditional deposit funding effects on loans. In theory, if the Bank Deposits increase, banks have more money available for lending. So the bank lending amount increases. Also, Bank Deposits exist as a liability on the balance sheet of banks and Bank Loan is a asset on the balance sheet. So they should have positive correlation in order for the balance sheet to be balanced.

Bank Securities Holdings (SECU)

Bank Securities Holdings (SECU) are included because securities and loans are both exist as assets in the bank's balance sheet. There is substitution between liquid securities and illiquid loans.

Growth of the Gross Domestic Product (GDP)

Growth of the Gross Domestic Product (GDP) is for controlling demand factors. It is a macroeconomic factor.

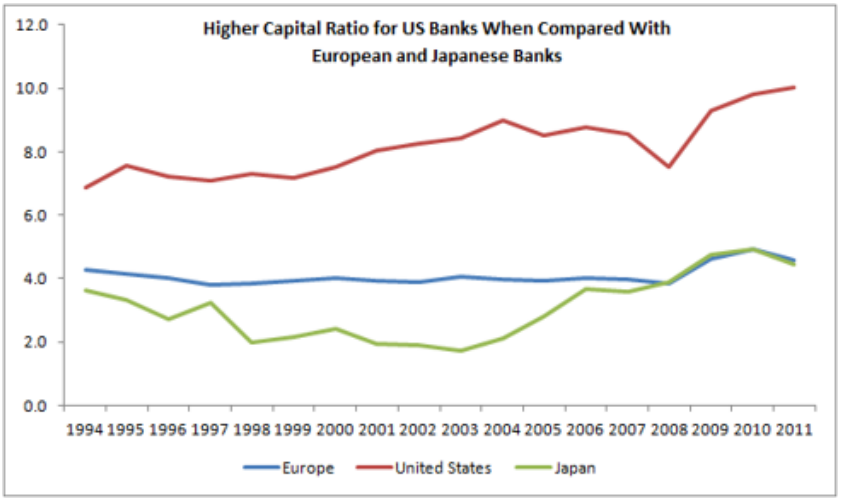
The independence variables we also use are a number of one-period lagged variables, which are to distinguish between instantaneous and lagged responses.

3.2.3 Other Variables

Capital Ratios

Capital Ratio is the key financial ratio measuring a bank's Capital Adequacy or financial stability. As a general rule, the higher the ratio, the more sound the bank. A bank with a high capital-to-asset ratio is protected against operating losses more than a bank with a lower ratio, although this depends on the relative risk of loss at each bank. Capital Ratios have long been a valuable tool for assessing the safety and soundness of banks. Arturo Estrella, Sangkyun Park, and Stavros Peristiani (2000) discuss the Capital Ratios as Predictors of Bank Failure.

The following figure is the capital ratio in US, Europe and Japan.



It shows the capital ratio in US bank is much higher than other places and there is an upward trend.

Table 1 is the definition and calculation of the variables.

3.3 Summary Statistics

Table 3.1, 3.2 and 3.3 illustrate the summary statistics for least-capitalized, medium-capitalized and best-capitalized banks. We divide the banks into 3 categories with capital ratio less than 5% as the least-capitalized banks, with capital ratio between 5% and 10% as the medium-capitalized banks and with capital ratio more than 10% as the best-capitalized banks. As shown in the table, we have 827, 12745 and 5576 observations separately.

The dependent variable is loan change. The mean of loan change is 0.0798, 0.1139 and 0.0837 which show no obvious trend among three categories. The least-capitalized banks has the largest standard deviation which shows the stability of least-capitalized banks is less than medium and best capitalized ones. This is also confirmed by independent variables.

The independent variables we choose are the change and 1 year lagged change of short term interest rate, deposit, security and GDP. From three tables we can see that there is obvious trend in standard deviation for deposit and security variables. The least-capitalized banks have largest standard deviation compare to medium and best capitalized banks. Considering the situation of the smallest sample size of least-capitalized banks, we can say that there are more extreme data in least-capitalized banks than others. Also from table 3.2 and 3.3, we can tell that the mean and standard deviation of deposit and security change for best-capitalized banks are also smaller than medium ones. This is consistent

with our conclusion above that those banks with better capital ratio will also have batter stability.

Table 4.1, 4.2 and 4.3 illustrate the correlation matrix of main variables for three types of banks. The dependent variable loan change is positively related to all independent variables except GDP change. This is interesting because GDP change lagged is positively related to loan change. This means when GDP increase, the loan of the current year will decrease while it will increase in the coming year. Our guess is the industry will operate well in the current year because of the good economy and need to expand in the next year. This will be discussed in detail in empirical results part. The loan change is most related to deposit change with correlation 0.6830, 0.6865 and 0.6467. This shows the bank will increase their loan amount if their deposits increase. Another thing which caught our attention is the relationship between GDP change and deposit change. It is -0.1546 for least-capitalized banks and -0.0535 and -0.0798 for medium and best capitalized banks. This shows people are tend to deposit their money more in larger capitalized banks when the economy slowdown because that's safer. However when economy is well they are more willing to deposit in least-capitalized banks since they probably will provide better interest rate to attract more deposits.

4. Empirical Results

To examine the effect of monetary policy on bank lending for different capitalized banks, we use a multivariate panel regression model. The equation is as follows:

$$+\beta_5 SECU_{i,t} + \beta_6 SECU_{i,t-1} + \beta_7 GDP \quad \beta_8 GDP$$

Bank Lending is measured by loan change of a bank every year. The $\beta's$ are vectors of coefficients to be estimated. We use our 4 independent variables all lagged by 1 year also to find the level of effects of monetary policy change in period t-1 on bank loan change in period t. We implement Ordinary Least Squares, also known as OLS to estimate the regression equation. The software we use to do the OLS is MATLAB.

Table 5 shows the regression result for least, medium and best capitalized banks separately. The first line of every independent variable is the coefficient and the second line is p-value. We use level of significant 95% to do the regression, thus an independent variable with p-value less than 0.05 will be considered as significant.

4.1 Short Term Interest Rate

The coefficient for interest rate change is (-0.7827, -0.4705, 0.0058). STIR change is significant to least and medium capitalized banks but not significant to best-capitalized banks. The coefficients also show that the interest rate change will more affect banks with less capitalize. Since the banks use short term interest rate to borrow money and use long term interest rate to lend money, when short term interest rate decrease, the interest rate yield between borrowing and lending will increase. Thus the banks will make more profit from lending more money. This is quite risky since the decrease of short term

interest rate will very likely to decrease the amount of deposit. For those better capitalized banks, they are low risk tolerance, thus more focus on maintain their capital ratio and keep safe, so they probably will have their own policy of lending and not to be affected by STIR change. The poorly capitalized banks are more willing to take risk if they can make more profits. This is the reason why the STIR change is not significant to best-capitalized banks and the coefficients show higher level of effect on least-capitalized banks than medium-capitalized banks.

However, the situation changed for STIR lagged variable. The coefficients are (0.9705, 0.7149, 0.7451) and the p-values appear to be significant for all three categories. Especially the coefficient for least-capitalized banks, 0.9705, shows the poorly capitalized banks cannot maintain their expansion of lending for long time because of the lack of deposit and will closely follow the STIR change. Our guess is the increase of lending in the same year when STIR decrease is for short time mortgage. The poorly capitalized banks will not have enough capital to support the continuous increase of lending under the decrease of deposit. On the other hand, the medium and best capitalized banks have lower coefficient show that the higher capital ratio can lower the effect of decrease of deposit. The long time effect of short term interest rate change will be better than the short time effect. This result also shows why Federal Reserve can successfully use the short term interest rate to adjust the deposit and lending amount.

4.2 Deposit

The coefficients for deposit change are (0.6450, 0.7996, 0.8223). The variable is significant for all three categories. From the coefficients, we can see it is consistent with

our conclusion from section 4.1 that the banks with better capitalized will be more likely to make their loan change follow the deposit change. The best-capitalized banks are lowest risk tolerance. On the other hand, the least capitalized banks have high risk tolerance, thus under some specific condition, they will increase lending while the deposit decrease in order to achieve high profit and not willing to increase lending much when deposit increase because the yield between short term and long term interest rate might not be that large and cannot bring them better profit. The relationship between deposit and loan change is not that tide for least-capitalized banks.

However, the deposit change lagged have coefficients (0.1483, 0.1311, 0.0839) and also significant for all three categories. The least-capitalized banks have highest relationship to the deposit change previous year. This is also consistent with our conclusion in section 4.1 that the least-capitalized banks cannot maintain their loan increase while deposit decrease. They have to adjust them to a balance level in the second year.

4.3 Security

The coefficients for security change are (-0.0462, -0.1191, -0.1361) and the variable is significant for all three categories. The securities are negatively related to loan change, this means when security increase, the loan will decrease. Best-capitalized banks have the strongest relationship with security. A likely explanation of this is that the best-capitalized banks have more loan increase come from assets while least ones do not.

The security change lagged for 1-period has p-values (0.8451, 0.4462, 0.4635) which are all not significant with 95% level of significance. This shows that the security change of a bank has no obvious effect on the bank's loan change in the next period.

4.4 GDP

The coefficients for GDP change are (0.6396, 0.5042, 0.3115) and the variable is significant for all three categories. The least-capitalized banks have the strongest positive relationship with GDP change. This means when GDP increase or decrease, the least-capitalized banks will have largest increase or decrease in lending amount. Our guess is when GDP increase, firms will need to expand and need more mortgage. Least-capitalized banks are high risk-tolerance, the difficulty to get mortgage in poorly capitalized banks will be lower than others. On the other hand, best-capitalized firms may refuse to provide large amount of loan to small firms. This will cause firms tend to get the amount of loan they need in least-capitalized banks.

The conclusion is consistent with the GDP change 1 year lagged variable. The coefficients are (2.7130, 1.3083, 0.9776), all significant with positive relationship. Similar to GDP change, the coefficient of least-capitalized banks is larger than medium and best capitalized banks. The only difference is the relationship is much stronger. This shows the GDP change will mostly have effect in the next period. From p-values, we can say that the loan change, no matter what level of capital ratio the bank is, is highly related to the economy situation.

5. Conclusion

Our paper estimates the relationship between bank lending and monetary policy for different level of bank capitals. We separate the banks into three categories by their capital ratio, as least-capitalized, medium-capitalized and best-capitalized banks. We use loan change as dependent variable and short term interest rate, deposit, security, GDP change and 1 year lagged change as independent variables.

For least-capitalized banks, we find they are relatively unstable and high risk tolerance. The coefficients are fairly high means the change in independent variables will make significant change in loan amount. The least-capitalized banks make their loan amount less rely on deposit amount and security change.

For best-capitalized banks, we find they are most stable and low risk tolerance among three types. The short term interest rate change will not affect its loan policy immediately. The loan amount is highly follow deposit and security change.

The medium-capitalized banks are the biggest group. Generally the coefficients are between least and best ones. The p-value shows the regression result is very significant for this group.

Overall, the short term interest rate highly affects least and medium capitalized banks but not best-capitalized banks. Deposit, security and GDP changes are also very significant to all banks with only difference in level of effect. The 1 year lagged variables are all significant except the security change lagged variable. Finally, the regression

results show that the monetary policy changes will affect all banks' loan change with strongest effect on least-capitalized banks and lowest effect on best-capitalized banks.

Appendices

Table 1: Definition of variables

Variable	Definition
Loan change	(Loan in year t / loan in year t-1) – 1
Security change	(Security in year t / security in year t-1) – 1
Deposit change	(Deposit in year t / deposit in year t-1) – 1
Capital ratio	Equity / assets
Interest rate change	Change in the yield on 3-month Treasury securities
GDP growth change	Change in GDP growth rate

Table 2: Number of banks in the sample

Year	Number of observations
1994	1357
1995	1390
1996	1434
1997	1513
1998	1602
1999	1672
2000	1759
2001	1865
2002	2008
2003	2185
2004	2301
2005	2310
2006	986
2007	966
2008	973
2009	1015
2010	1009

Note: Since 2006, many small banks were no longer required to report to the Federal Reserve. That's why the number of banks in the sample significantly reduced since 2006.

Table 3: Summary Statistics

Table 3.1: Least-Capitalized Banks

	Obs.	Mean	Std	25th percentile	50th percentile	75th percentile
Dependent variable						
Loan change	827	0.0798	0.1524	-0.0860	0.0587	0.1902
Independent variables						
Interest rate change	827	-0.0050	0.0144	-0.0125	-0.0037	0.0037
Interest rate change lagged	827	-0.0073	0.0147	-0.0184	-0.0037	0.0037
Deposit change	827	0.1006	0.1364	-0.0185	0.0741	0.1922
Deposit change lagged	827	0.1189	0.1290	0.0203	0.1006	0.2009
Security change	827	0.0879	0.3004	-0.1478	0.0242	0.2627
Security change lagged	827	0.1198	0.2976	-0.1175	0.0738	0.3047
GDP change	827	-0.0001	0.0283	-0.0220	-0.0040	0.0070
GDP change lagged	827	-0.0085	0.0149	-0.0220	-0.0070	0.0070

Table 3.2: Medium-Capitalized Banks

	Obs.	Mean	Std	25th percentile	50th percentile	75th percentile
Dependent variable						
Loan change	12745	0.1139	0.1155	0.0367	0.1001	0.1749
Independent variables						
Interest rate change	12745	-0.0027	0.0137	-0.0061	-0.0029	0.0037
Interest rate change lagged	12745	-0.0029	0.0133	-0.0125	-0.0029	0.0037
Deposit change	12745	0.1023	0.1078	0.0284	0.0803	0.1500
Deposit change lagged	12745	0.1099	0.1098	0.0346	0.0862	0.1597
Security change	12745	0.0958	0.2387	-0.0657	0.0534	0.2138
Security change lagged	12745	0.1001	0.2412	-0.0625	0.0556	0.2183
GDP change	12745	-0.0001	0.0184	-0.0070	-0.0010	0.0080
GDP change lagged	12745	-0.0030	0.0134	-0.0080	-0.0010	0.0070

Table 3.3: Best-Capitalized Banks

	Obs.	Mean	Std	25th percentile	50th percentile	75th percentile
Dependent variable						
Loan change	5576	0.0837	0.1150	0.0096	0.0670	0.1314
Independent variables						
Interest rate change	5576	-0.0026	0.0133	-0.0061	-0.0029	0.0037
Interest rate change lagged	5576	-0.0034	0.0135	-0.0125	-0.0029	0.0037
Deposit change	5576	0.0698	0.1024	0.0062	0.0456	0.0987
Deposit change lagged	5576	0.0770	0.1065	0.0105	0.0505	0.1055
Security change	5576	0.0614	0.2178	-0.0792	0.0280	0.1555
Security change lagged	5576	0.0671	0.2156	-0.0724	0.0336	0.1586
GDP change	5576	0.0010	0.0198	-0.0070	0.0040	0.0080
GDP change lagged	5576	-0.0034	0.0140	-0.0080	-0.0010	0.0070

Table 4: Correlation

Table 4.1: Least-Capitalized Banks

	Loan Change	Interest Rate Change	Interest Rate Change Lagged	Deposit Change	Deposit Change Lagged	Security Change	Security Change Lagged	GDP Change	GDP Change Lagged
Loan Change	1	0.1903	0.3822	0.6830	0.3818	0.2444	0.2159	-0.0906	0.4940
Interest Rate Change	0.1903	1	0.2975	0.1395	0.1039	0.1011	0.0873	0.3645	0.4112
Interest Rate Change Lagged	0.3822	0.2975	1	0.2608	0.2191	0.1195	0.1337	0.0234	0.5333
Deposit Change	0.6830	0.1395	0.2608	1	0.3664	0.4457	0.2207	-0.1546	0.4067
Deposit Change Lagged	0.3818	0.1039	0.2191	0.3664	1	0.1939	0.3990	-0.1036	0.2320
Security Change	0.2444	0.1011	0.1195	0.4457	0.1939	1	0.1330	0.0191	0.1854
Security Change Lagged	0.2159	0.0873	0.1337	0.2207	0.3990	0.1330	1	-0.0788	0.1880
GDP Change	-0.0906	0.3645	0.0234	-0.1546	-0.1036	0.0191	-0.0788	1	-0.3061
GDP Change Lagged	0.4940	0.4112	0.5333	0.4067	0.2320	0.1854	0.1880	-0.3061	1

Table 4.2 Medium-Capitalized Banks

	Loan Change	Interest Rate Change	Interest Rate Change Lagged	Deposit Change	Deposit Change Lagged	Security Change	Security Change Lagged	GDP Change	GDP Change Lagged
Loan Change	1	0.1212	0.1493	0.6865	0.2842	0.0542	0.0988	-0.0299	0.1947
Interest Rate Change	0.1212	1	0.2652	0.0411	0.0222	-0.0719	0.0099	0.3016	0.5243
Interest Rate Change Lagged	0.1493	0.2652	1	0.0357	0.0572	-0.0778	-0.0648	-0.2222	0.3075
Deposit Change	0.6865	0.0411	0.0357	1	0.2392	0.3919	0.0715	-0.0535	0.0652
Deposit Change Lagged	0.2842	0.0222	0.0572	0.2392	1	0.1079	0.4119	-0.0006	0.0139
Security Change	0.0542	-0.0719	-0.0778	0.3919	0.1079	1	0.0587	0.0332	-0.0409
Security Change Lagged	0.0988	0.0099	-0.0648	0.0715	0.4119	0.0587	1	0.0741	0.0235
GDP Change	-0.0299	0.3016	-0.2222	-0.0535	-0.0006	0.0332	0.0741	1	-0.1775
GDP Change Lagged	0.1947	0.5243	0.3075	0.0652	0.0139	-0.0409	0.0235	-0.1775	1

Table 4.3 Best-Capitalized Banks

	Loan Change	Interest Rate Change	Interest Rate Change Lagged	Deposit Change	Deposit Change Lagged	Security Change	Security Change Lagged	GDP Change	GDP Change Lagged
Loan Change	1	0.1415	0.1944	0.6467	0.1984	0.0356	0.0700	-0.0576	0.1718
Interest Rate Change	0.1415	1	0.2898	0.0196	-0.0012	-0.1015	0.0058	0.2722	0.5128
Interest Rate Change Lagged	0.1944	0.2898	1	0.0665	0.0405	-0.1088	-0.0838	-0.2128	0.3286
Deposit Change	0.6467	0.0196	0.0665	1	0.1981	0.4124	0.0716	-0.0798	0.0262
Deposit Change Lagged	0.1984	-0.0012	0.0405	0.1981	1	0.1044	0.4458	0.0293	-0.0497
Security Change	0.0356	-0.1015	-0.1088	0.4124	0.1044	1	0.0826	0.0346	-0.0814
Security Change Lagged	0.0700	0.0058	-0.0838	0.0716	0.4458	0.0826	1	0.1013	-0.0123
GDP Change	-0.0576	0.2722	-0.2128	-0.0798	0.0293	0.0346	0.1013	1	-0.2306
GDP Change Lagged	0.1718	0.5128	0.3286	0.0262	-0.0497	-0.0814	-0.0123	-0.2306	1

Table 5: Regression Results

	Least-Capitalized	Medium-Capitalized	Best-Capitalized
Interest Rate Change	-0.7827	-0.4705	0.0058
	(0.0170)	(0.0000)	(0.9579)
Interest Rate Change Lagged	0.9705	0.7149	0.7451
	(0.0011)	(0.0000)	(0.0000)
Deposit Change	0.6405	0.7996	0.8223
	(0.0000)	(0.0000)	(0.0000)
Deposit Change Lagged	0.1483	0.1311	0.0839
	(0.0000)	(0.0000)	(0.0000)
Security Change	-0.0462	-0.1191	-0.1361
	(0.0005)	(0.0000)	(0.0000)
Security Change Lagged	0.0026	0.0024	0.0041
	(0.8451)	(0.4462)	(0.4635)
GDP Change	0.6396	0.5042	0.3115
	(0.0001)	(0.0000)	(0.0000)
GDP Change Lagged	2.7130	1.3083	0.9776
	(0.0000)	(0.0000)	(0.0000)
Intercept	0.0278	0.0337	0.0335
	(0.0000)	(0.0000)	(0.0000)
Observations	827	12745	5576
R-squared	0.5598	0.5679	0.5147

Matlab Code for Regression Model

```
% Clear output
clear
close all
clc

% Load formatted data
load dataFinalProject

% Do regression for small cap
Y = smallCap(:,1);
X = smallCap(:,2:end);
statSmall = regstats(Y, X, 'linear');
coefSmall = statSmall.beta;
seSmall = statSmall.tstat.se;
tSmall = statSmall.tstat.t;
pSmall = statSmall.tstat.pval;

% Do regression for medium cap
Y = medCap(:,1);
X = medCap(:,2:end);
statMed= regstats(Y, X, 'linear');
coefMed = statMed.beta;
seMed = statMed.tstat.se;
tMed = statMed.tstat.t;
pMed = statMed.tstat.pval;

% Do regression for large cap
Y = largeCap(:,1);
X = largeCap(:,2:end);
statLarge= regstats(Y, X, 'linear');
coefLarge = statLarge.beta;
seLarge = statLarge.tstat.se;
tLarge = statLarge.tstat.t;
pLarge = statLarge.tstat.pval;

% Correlation
corrSmall = corr(smallCap);
corrMed = corr(medCap);
corrLarge = corr(largeCap);

% Statistics Summary
SmallSum = prctile(smallCap,[25 50 75]);
MediumSum = prctile(medCap,[25 50 75]);
LargeSum = prctile(largeCap,[25 50 75]);
MeanSml = mean(smallCap);
stdSml = std(smallCap);
MeanMed = mean(medCap);
stdMed = std(medCap);
MeanLrg = mean(largeCap);
stdLrg = std(largeCap);
```

References 待补，格式如下　君君你 **introduction** 里还有 **variable** 里引用的文章在这里写一下

Allen, Franklin, and Douglas Gale（2004）. Competition and financial stability. *Journal of Money, Credit and Banking, 36*, 453-480.