Erasmus School of Economics

Master Thesis – Financial Economics

Macroeconomic Differences in Bank Lending Volumes between the United States and Japan

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Abstract

The objective of this paper is to answer the research question of: “To what extent do different levels of interest rates and inflation rates affect bank lending practices in the United States and Japan?”, in both a qualitative and quantitative analytical manner. In the last 4 years, macroeconomic variables such as the interest rate, the inflation rate, the unemployment rate and GDP, have changed considerably. Financial disruptions have been consequences of the COVID-19 crisis. The paper aims to draw a connection between how these macroeconomic variables have impacted the financial sector, in particular the bank lending volume of banks in the United States and Japan. Previous variations in research conclusions were used as a basis for the research model performed. The results highlight the positive correlation between the interest rate and bank lending volume in the United States, and the positive correlation between the inflation rate and bank lending volume in Japan. Lastly, the paper investigates the economic and financial implications of the results found for both the U.S. and Japan.

Table of Content

Chapter 1: Introduction

1.1 Contextual Background

Inflation and Interest rates

The financial health of the banking sector is dependent on multiple macroeconomic factors. When one of those factors changes substantially, the banking sector adapts to this through different practices. One of the most important macroeconomic factors is the interest rate. The interest rate affects targeted inflation levels, as well as bank lending practices. The recent Covid crisis provides a global example of an economic downturn, in which multiple economic variables that affect the financial world have changed, including the interest rate and inflation rate. This leads to the outspread topic of discussion that has been the rapidly rising inflation, seen after the pandemic. Many countries have been affected by this, one being the United States. In the last two years, the country has experienced some of its highest inflation rates from the past 40 years. This year in January rates have reached a high of 5.4 percent (Federal Reserve, 2023), and in 2022 this number was even higher, reaching a high of 8.6 percent (Katz, 2022). One can observe this rising trend in the inflation rate in many regions of the world. Similarly, in Japan the inflation rate has risen as well, reaching 3.5 percent in January 2023 (Trading Economics, 2023). In 2022, Japan's inflation levels were 2.2 percent, considerably lower than the ones in the U.S. and close to its 2 percent inflation target (Katz, 2022). From this, it is evident that even though inflation increased in Japan, the country experienced less rapid inflationary pressure than what is observed in the U.S. or the European Union.

Central banks around the globe have a common objective to keep inflation under a target limit through monetary policy (through both conventional and unconventional policies). Both the Federal Reserve and the Bank of Japan have an inflation target objective of 2 percent. In this paper, the focus is on the conventional monetary policy, setting the interest rate, also called the federal funds rate or the nominal rate. This rate indicates the interest rate at which banks can borrow from one another. Looking at the relationship between inflation and interest rates, these follow a similar trend. In response to rapid inflationary pressure, central banks raise interest rates to bring down inflation. Using contractionary monetary policies (raising interest rates) central banks establish price stability by decreasing price growth.

In efforts to maintain the inflation rate under the desired target rate, in the U.S., the short-term interest rate has been increased to 5.08 percent (The Federal Reserve, 2023). Countries like Japan have taken a different monetary interest rate approach. In Japan, since 2016 the short-term rate has been set to -0.1 percent, much lower than the one in the U.S. (Bank of Japan, 2023). From these observations, several questions such as: "What lies at the base of these interest rate and inflation rate differences?", "How do these differences in the interest rate affect bank lending practices (volumes) in those respective countries?" and "What economic implications do different interest rate levels create for the financial sector, households and companies?" arise. These sub-questions lead to the main research question of the paper:

To what extent do different levels of interest rates and inflation rates affect bank lending practices in the United States and Japan?

General Causes of High Inflation and Interest Rates Globally

It is important to recognize the main reasons for the recent inflation, to understand what lies at the root of the recent interest rate hikes. There are several general reasons for the recent high inflation rates and interest rates. Firstly, at the start of 2020 the COVID-19 pandemic put a stop to the economy worldwide, causing a recession. To minimize the negative consequences of a recession and increase economic activity, governments and central banks provided expansionary monetary and fiscal policies. During this, government spending and money supply increased. Secondly, due to the strict border controls, the movement of goods decreased. This has caused supply chain blocks which made specific consumer goods scarcer. From this scarcity the price of these goods increased, increasing inflation. In addition, due to health regulations, the labor market experienced lower productivity, further increasing the scarcity of goods and services (U.S. Bureau of Labor Statistics, 2023).

Inflation Gap: United States & Japan

To have a deeper understanding of how inflation affects the banking sector of the U.S. and Japan, the inflation gap (which highlights more sources of inflation) between them needs to

be discussed. As seen above, after the pandemic Japan experienced less inflation than the U.S. However, differences in inflation rates between these countries have been persistent since the 1980s (Amamiya, 2022). The difference between the U.S. and Japan's inflation levels comes from multiple factors. The first factor is the level of GDP growth after the COVID-19 crisis. The U.S. has experienced a rapid increase in aggregate demand, consumption, and economic activity (all increasing GDP). On the other side, the level of GDP in Japan remained at more constant levels and has not recovered to its pre-pandemic level. Secondly, the Deputy Governor of the Bank of Japan, Masayoshi Amamiya (2022) stated, that the rise in economic activity in the U.S. has caused a "decline in supply capacity in terms of labor" in the country. In practice, this has increased the unemployment rate more in the U.S. In Japan, unemployment rates have been more constant, with fewer people leaving their jobs (Amamiya, 2022). This is due to the labor market in Japan being less fluid than the one in the U.S. and experiencing considerable subsidies during the pandemic. Lastly, there has been a demand shift from services to goods in the U.S. As demand increases for these goods, supply shortages cause prices to rise. Not only did Japan not experience this demand shift but also pricing strategies have been more stable, and more consumer-protective focused (Amamiya, 2022). This shows that when there are supply-side shortages Japanese firms increase prices and wages at a lower rate than the U.S., therefore having less inflation. However, Japan has not kept prices constant for all consumer goods. Supply shortages of important goods such as oil, gas, and food saw their prices increase sharply, making it more expensive for Japanese consumer to buy these goods. The prices of such goods increased, and simultaneously the overall consumer demand and consumer spending decreased. This has been the major cause of stagflation in Japan (Amamiya, 2022).

Furthermore, what can be inferred from this inflation gap is that the lack of price stability in the two countries comes from different economic sources. The inflation gap between these two nations demonstrates how different monetary policies and different levels of interest rates provide different macroeconomic outcomes in the economy. The above-mentioned section also demonstrates the concept that the interest rate and the inflation rate and their effects on the financial sector are interwind with other macroeconomic variables, such as GDP and the unemployment rate. Inflation affects the economies of the two countries differently, due to different levels of GDP and unemployment rates. The interaction between these variables expands the analysis beyond how interest rates and inflation rates affect bank lending. Monetary policy has a direct effect on the bank lending channel through the interest rate.

However, as seen above inflation rates, GDP and unemployment rates can also have an indirect effect on the financial sector.

Interest Rate Gap: United States & Japan

Due to the intercorrelation between inflation and interest rates, the expectation is that there is also an interest rate gap between the countries. This interest rate gap is illustrated in the graphs found in Appendix A, showing the difference in the interest rate levels. In addition, the high correlation between "movements in the interest rate gap and movements in the yen to dollar exchange rate" means that as the interest rate gap increases, the value of the yen depreciates in comparison to the value of the dollar (Katz, 2022). This not only provides evidence of the depreciation of the Japanese yen but also explains its negative economic effects. Having this currency depreciation causes foreign investors to withdraw investment from Japan, which increases prices for important consumer goods, lowering Japan's international competitiveness. Besides the after-effects of the COVID – 19 crisis on the macroeconomic factors such as GDP and unemployment rates, the depreciation of the yen and the increase in Japanese consumption tax, have all provided explanations for the inflation and interest rate gaps observed between Japan and the U.S (Katz, 2022). Furthermore, the weakening of the yen reinforces the stagnation and lower GDP in Japan, which itself reinforces the growth of the inflation gap. This further indicates that inflation affects the economy through GDP.

Central Bank Response to High Inflation

The monetary policies taken in response to the COVID-19 crisis helped with the objective of increasing demand, economic activity and investment. However, this also caused the inflation rate to grow, therefore new policies that raised the interest rates were put in action. Because of the different causes of the inflation between the U.S. and Japan, policymakers require different strategies implementations. Even though inflation decreased from 7 percent to 5.4 percent from 2022 to 2023 in the United States, it remains above the target rate of 2 percent. In response to this, the Federal Reserve can further increase its federal funds rate by decreasing its securities holdings from its balance sheet and decreasing the liquidity in the financial sector. In addition, future public expectations are that the interest rate is going to keep increasing (The Federal Reserve, 2023). Looking at the banking sector, this can have the

effect of decreasing lending volume, as borrowing costs increase. The Bank of Japan has taken a different approach than the Federal Reserve and other major central banks. Japan's current interest rate is negative, which in times of high inflation and high currency depreciation of the yen could be seen as an unconventional monetary measure. Therefore, one can ask if such a measure proves to be beneficial. To answer this, the monetary policy of Japan needs to be studied further.

The Bank of Japan has conducted financial forecasts that indicate a higher than-targeted (2 percent) inflation rate for the next two years. This forecast suggests future expectations of interest rate hikes in the first quarter of 2024 (ING, 2023). However, in the short-term prospect (the remainder of the year 2023), the Bank of Japan declared that it would continue to keep interest rates low. The Bank of Japan also stated that it would not be well served to increase the interest rates, as this would decrease consumer demand, which still needs to recover to pre-pandemic levels (Dooley, 2022). Lastly, the former Governor of the Bank of Japan, Haruhiko Kuroda has stated that the current inflation trends in Japan are transitionary, adding to the incentive of the Bank of Japan to not increase interest rates. Interest rate hikes would not be an effective monetary policy for solving Japan's stagflation, and would also contribute to further decreasing consumer demand and GDP. (Katz, 2022). Lastly, after the pandemic crisis, Japan used both quantitative and qualitative easing (unconventional monetary policies) to sustain economic growth. In Japan, these policies influenced the level of the interest rates (by decreasing them), through the demand and supply of government bonds (Tanaka, 2021).

Besides monetary policy, fiscal policy is also an option to decrease inflation. In the case of Japan, low interest rates, create low rates on return of capital. As a result, private investment decreases. In order to keep demand from falling, the government could implement fiscal policies to boost the economy. However, in the aftermath of the COVID-19 crisis Japan, had one of the highest national debts among developed countries. Based on this theory, Japan's accumulation of government debt would represent a constraint on the government budget and its spending through fiscal expansionary policies. However, Tanaka (2021) suggests that if the causes and factors that affect positive and negative interest rates are identified, increasing fiscal spending in Japan could become a viable solution for increasing demand and GDP. Even though government debt is high, interest rates are low. In the academic paper written by Tanaka (2021), he provides an explanation of why interest rates do not rise. This is due to the

future expectations of investors, relating to fiscal consolidation in the future, the national burden ratio being low, and the short-term holding periods investors have in government bonds (Tanaka, 2021). These expectations have the effect of keeping interest rates low. Even though the financial risk increases due to an increase in government debt, interest rates stay constant.

Sovereign Spillover Effect

Furthermore, besides macroeconomic variables, such as GDP and the unemployment rate, having an indirect effect through inflation on the economy, there can also be cross-border effects between nations due to their monetary and fiscal policies. This is known as the sovereign spillover effect (Tanaka, 2021). Given the globalized financial sector worldwide, are there sovereign spillover effects between the U.S. and Japan, and could their banking systems be affected on a cross-border level? The degree to which spillover affects these two countries is dependent on the national effects of home bias (Tanaka, 2021). When the home bias and information asymmetry are strong the sovereign spillover effect decreases. Even though in the study the spillover effect of interest rate movements was found to be significant during the European debt crisis (concentrated in the European Union area), and "the spillover effect could exert upward pressure on interest rates in Japan" in the near future (Tanaka, 2021).

1.2 Motivation & Contribution

The main motivation for researching and writing about the mentioned research question highlights the importance of the monetary transmission channel, which is the interest rate, and how the inflation rate is affected by this as well. Understanding how monetary policy, in particular how the interest rate affects a significant element of the financial sector, the lending sector, is important as it leads to improved market and economic decisions and improved policy implementation. The financial sector of each country represents the base for financial stability as well as economic growth. Therefore, the effects of implemented financial decisions and policies are essential and relevant to study, to prevent and counteract the effects of financial crises and recessions. Choosing to study the interest rate in the current economic situation brings relevance to the topic and leads to new perspectives on the response of the financial sector to a health crisis, which in turn led to an economic slowdown.

Furthermore, as discussed above there are several macro-economic factors that can affect bank lending, besides the interest rates. These macro-economic factors include the inflation rate, GDP growth and the unemployment rate. Therefore, these variables are also examined in the paper. How each one of these factors affects bank lending practices (loan volumes) represents sub-questions to the overall research question. The answers to those sub-questions will provide a mechanism for not only understanding how these factors affect the banking sector differently but also what the implications of those effects are. Lastly, by adding these new variables, the macroeconomic analysis expands and goes beyond solely the monetary system. This will help provide meaningful answers to the research question. Including more independent variables in the regression also eliminates more bias and increases the accuracy of the results and correlations. In addition, how debt origination is affected by monetary policy also represents relevance for the public (households and corporations) and its interactions with the financial sector. Understanding these effects can, therefore, lead to improved decisions regarding credit and investment choices for both private households as well as corporations.

Furthermore, the paper studies and analyzes the results of two different countries, the United States and Japan. Deciding to analyze the results of the United States and Japan provides insights into two different countries, with different major economic (monetary and fiscal) policies. The main difference discussed in this paper is the monetary policy, which is different between the two countries. Due to the different policies that the countries implement, the effects of the COVID-19 pandemic have been different as well. The macroeconomic differences of these two countries provide a comparative economic analysis. This contributes positively to the economic relevance and significance of the results found in the thesis. Comparing the results between the U.S. and Japan shows different perspectives and answers to the research question, which gives the reader a deeper understanding of the fundamental elements of how the financial sector works, what are the outcomes of different monetary policies and what are the effects of a crisis, such as COVID-19 on different banks' functionality. Overall, a comparative country analysis gives the reader an understanding of the level of effectiveness of different financial policies and how price stability can be achieved. Given the rising globalization and integration between countries' financial systems, a comparative country analysis adds significance in understanding economic differences and similarities between the two countries. Lastly, given that the U.S. and Japan represent two

major influential economies, other countries can implement and learn from their financial policies.

Lastly, the timeframe chosen to observe also contributes to what general effects a pandemic has on the financial sector. Unlike other previous economic crises, the COVID-19 one was unique in the way it affected the economy. Being initially a health crisis, macroeconomic factors were not the cause of the economic downturn. However, the aftereffects of the crisis did negatively impact the economy. The research on how the COVID-19 crisis affected the financial sector is in continuous development and evolution. Therefore, the effects of macroeconomic variables (after the crisis) on bank lending volume are still questionable. As a result, the paper helps to provide relevant contributions to existing literature and new findings.

1.3 Main Findings and Conceptual Framework

The main findings of the research paper are divided into seven distinct sections. The second chapter presents previous literature research regarding the qualitative analysis and economic effect of the four main macroeconomic variables, the interest rate, the inflation rate, the unemployment rate and the GDP, on bank lending volume. Previous research results are also applied in the U.S. and Japan. The third and fourth chapters describe the data collected, descriptive statistics and how the research model of fixed and random effects models were implemented. The fifth chapter examines and describes the results and discusses the conclusions drawn from the research model. The main findings point out a positive relationship between the interest rate and bank lending volume in the U.S. and a positive relationship between the inflation rate and bank lending volume in Japan. The sixth chapter is a robustness section of the results, followed by the seventh chapter of a discussion of the economic implications of the main results. Lastly, the eighth chapter, provides limitations of the research model, further research opportunities and concludes the answers to the research question.

Chapter 2: Literature Review & Hypotheses

2.1 Effects on Bank Lending Practices

General Theory

The first step in providing a meaningful framework for answering the research question is to analyze existing academic literature. The general evidence from recent existing literature is that in the context of the Covid crisis, bank lending volume has decreased. The degree of how much economies were exposed to this bank lending reduction depended on the severity of the health crisis that each country experienced. National banking regulations, structure of the overall financial and debt markets, stability of public institutions and financial health (all specific to each country) were also factors affecting the degree by which banks were affected by lower lending volumes (Colak & Oztekin, 2021). As explained in the contextual background section, in response to higher inflation rates central banks raise interest rates. Based on economic theory, increasing interest rates, decreases the money supply in the economy, thus decreasing price growth and inflation. Interest rates set by central banks affect the rates at which commercial banks can borrow from each other. If nominal rates increase, so do the costs of banks, thus affecting their profitability. To prevent profitability from decreasing, banks would also adjust their lending interest rates. An increase in interest rates, would increase the borrowing costs of consumers and firms, therefore, decreasing lending volume.

Corporate Lending Volume

A significant element that supports the research is the separation of bank lending volume into total loans, corporate loans and household loans. During the start of the pandemic when the need for liquidity was the greatest one can expect that banks experienced the most liquidity demands. The pandemic crisis put many companies on the verge of closing down and becoming bankrupt. They were in great need of finances, which put pressure on the financial system. This was the case with commercial banks from the U.S. What was observed was that in the first three weeks at the start of the pandemic, there was a massive increase in commercial and industrial loan demand growth from large corporations. The weekly loan growth for this type of loans was larger than any other weekly loan growth since 1973 (Li et al., 2020). Li et al. (2020) argue that this increase in loan volumes comes from drawdowns on

existing credit lines. However, one limitation of the study is that this increase in loan volume cannot be separated into new loan originations and drawdowns on existing credit lines. How did this increase in loan volume impact the banking sector? Banks were seen as a "lender of the last resort" for big corporations, and demand for provided liquidity rapidly increased. During the time of liquidity provision, there was also an increase in bank deposits (Li et al., 2020). As a result, this eased the liquidity risk in the banking sector. Also, the extensive preventative measures taken after the Great Financial Crisis in 2008, in terms of reserve requirements for banks, made it easier for them to adapt to an increase in liquidity requirements (Li et al., 2020). Furthermore, in the academic paper done by Acharya et al., (2022) the problem for commercial banks was not as much in terms of liquidity requirements and lending (as they had high levels of cash reserves) but more in terms of high shadow cost of capital and low stock prices (by Acharya et al., (2022).

To further explore the effect on corporate lending, the FRED database is used to collect official graphs showing total commercial and industrial loans. In the graph below (Figure 1), one can see the trend for corporate lending is aligned with current academic research. In March 2020 there was a sharp increase in loans given, reaching a peak in May 2020. Then loans decreased, followed by a slight increase in 2022 and then a decrease again in 2023 (Board of Governors of the Federal Reserve System US, 2023).

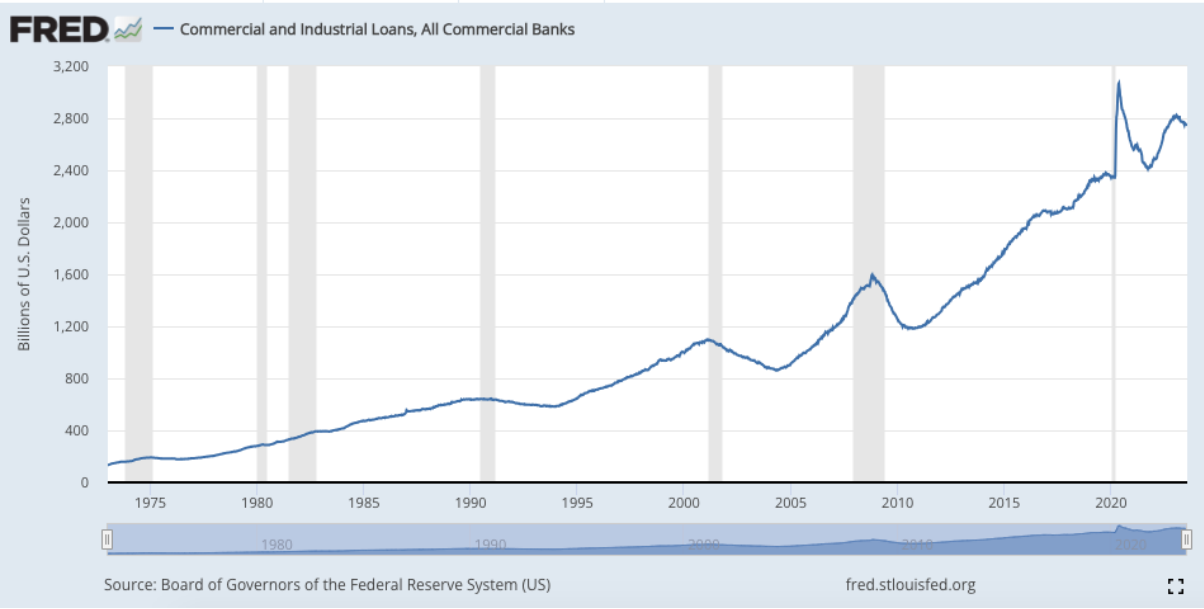


Figure 1. Commercial and Industrial Loans from all commercial banks in the United States

Household Lending Volume

To have a better understanding of whether the general economic theory can be applied to the lending effects on household loans, one can also analyze the FRED database's official graphs. The graph below (Figure 2) shows consumer credit given by the largest commercial banks in the United States. According to the Federal Reserve of Philadelphia (2022), after the Covid-19 pandemic, consumer lending activity has decreased substantially, compared to before. In the graph, the lowest lending activity happens in 2021. This was also the year when inflation reached the highest point in the U.S., similar to an increase in mortgage lending rates. This graph provides evidence of the effect that inflation and interest rates have on lending volume, describing how high levels of both decrease lending.

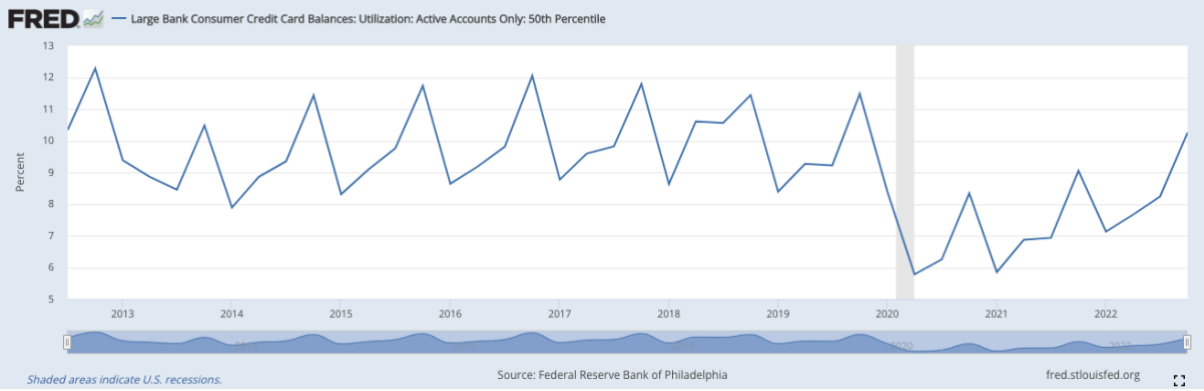


Figure 2. Consumer Credit given by the largest commercial banks in the United States

What about Japan's consumer lending volume trend? As seen, previously in the contextual section, even though Japan also experienced higher inflation after the Covid pandemic, its interest rates were considerably lower than the ones in the U.S. In this case, the economic effect of higher interest and inflation rates corresponding to lower lending activity in the economy would be harder to demonstrate. As observed in the graph below, according to the Bank of International Settlements (2022), credit to the private non-financial sector by banks in Japan did not decrease in 2021 and 2022, after the inflation increased. Figure 3 shows that lending experienced a constant increase after 2016.

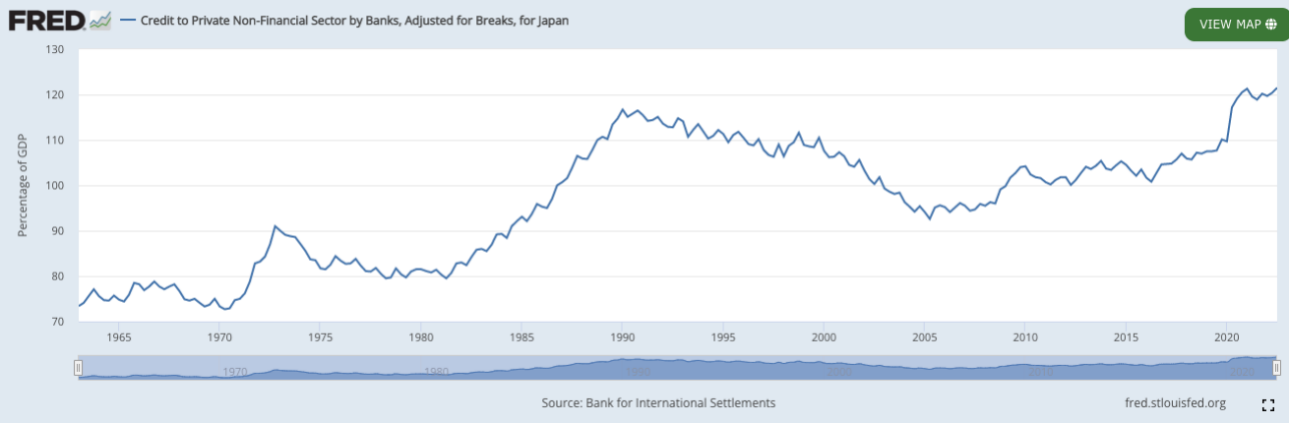


Figure 3. Credit to Private Non-Financial Sector by Banks in Japan

2.2 Effect of Interest Rates

Beutler et al., (2020) have found relevant results for answering the research question in their academic research paper. Their main results and conclusions state that a "1 pp rise in interest rates, decreases bank lending growth by 46 basis points immediately after the shock, and by 300 basis points in a year after the shock" (Beutler et al., 2020). The paper focuses on the effect of interest rates on bank loan growth, considering banks' exposure to interest rate risk. The paper explains that banks' loan growth decreases in response to higher nominal interest rates because the decrease in bank's profitability weakens their capital levels. As a response, banks decrease lending volume to preserve their capital values, to decrease the cost of information asymmetry and to remain in line with capital requirements (Beutler et al., 2020).

Furthermore, another strategy banks adopt is to pass on the increase in costs (due to higher interest rates) to their customers. This allows them to sustain profitability in times of interest rate hikes. This strategy consists of raising the interest rates banks impose on their assets, and the loans given to households and companies (Federal Reserve Bank of San Francisco, 2022). As borrowing costs increase debt becomes more expensive for customers, such as households and companies. If banks would not pass on the costs of higher interest rates to their customers their profitability would decrease. One of the reasons why this is the case is because banks lend their assets in the long term while they borrow their liabilities in the short term. This creates an interest rate time maturity difference. As a result, the value of their assets would decrease more than the value of their liabilities (Beutler et al., 2020).

The findings from this previous research lead to the following hypotheses:

Null Hypothesis:

$H_0 =$ Raised interest rates have no influence on commercial banks' lending volumes to the general public.

Alternative Hypothesis:

$H_1 =$ Raised interest rates have an influence on commercial banks by decreasing lending volumes to the general public.

2.3 Effect of Inflation Rates

The second variable discussed in this paper is the inflation rate and its effect on bank lending. Because inflation rates and interest rates follow a similar trend, one would predict the same effect on lending volume; when inflation rises, bank loans decrease. This inverse relationship between inflation and bank credit was found in various literature across periods of time. In one recent study, bank credit in Mexico was found to be negatively correlated with inflation (Zermeño et al., 2022). Using a pooled OLS methodology their results confirm that when inflation rises, the total amount of bank loans decreases. In addition, by adding dynamic estimators to their research, the effect of time was also accounted for. When the effect of time was included, the results showed that the relationship between inflation and credit is more statistically significant in the long term than in the short term. In response to inflation, credit decreases more in the long term, whereas in the short term credit (short-term loans given to households and firms) increases (Zermeño et al., 2022). Implications from this study show that inflation can influence the levels of total bank credit and that taking a specific study time frame (short term vs. long term) into account can result in different outcomes. From this study, the following hypotheses arise:

Null Hypothesis:

$H_0 =$ High levels of inflation rates have no effect on total loan volume given by commercial banks.

Alternative Hypothesis:

$H_2 =$ High levels of inflation rates decrease the total loan volume given by commercial banks.

The study above shows the effect of inflation on total loan volumes. However, can there be differences in the effects, depending on different loans categories? To answer this, another study conducted by British Columbia University (2022), examined what role inflation has in affecting bank lending practices for commercial U.S. banks. They looked at the inflation hike from 1977. Even though inflation rose, interest rates and currency changes remained constant. Because of this, the effect of inflation was isolated, and therefore it gave a clear understanding of how it impacted banks. The results of the study were the following: banks that had the highest exposure to inflation, were the ones that reduced loan origination the most. Banks exposed to inflation had a loan growth reduction of 2.7 percent, whereas the average loan growth was 19 percent that year (British Columbia University, 2022). In addition, the study also analyzed whether loan growth decreased mainly for household credit or company credit. What was found is that it was mainly household loans that saw a significant decrease in volume. Business credit was less affected. Several reasons account for this: such as the duration of loans (household loans, such as mortgages, having longer maturities) and the nature of the loan agreements (banks have more flexibility in changing the loan agreements for business loans) (British Columbia University, 2022). Based on these findings, credit did decrease in times of high inflation, however, households were more affected by it than companies, due to their maturity and agreement structures. Economic implications of these results can also lead to an increase in the saving rate for the affected households (as it is more expensive for people to take out loans). As a consequence, there is an economic downturn. Differently, investment done by corporations did not decrease, benefiting the financial sector. These findings result in the below-mentioned hypotheses:

Null Hypothesis:

$H_0 =$ Raised inflation rates have the same effect on given commercial banks' household loans and company loans.

Alternative Hypothesis:

$H_3 =$ Raised inflation rates have a different effect on given commercial banks' household loans and company loans.

Additionally, the findings from this literature give rise to several implications. As known, during the great financial crisis when a large segment of the financial sector went bankrupt, inflation was one of the catalysts driving this. More specifically, the housing market experienced a rapid increase in prices, stimulating house price growth. Before the crisis hit, the market also saw a rapid increase in loans given to people, with the purpose of buying a house. As bank lending increased, so did the prices of houses, resulting in inflation. In the case of the study done by British Columbia University (2022), it was found that the bank regions that had the highest inflation exposure, also experienced a reduction in house price growth. Given, that interest rates were constant during those times, another factor besides the interest rates affected bank lending practices and price growth.

Seeing what impact inflation had historically, is important in better understanding what could be the effect nowadays. Nevertheless, one still needs to take into consideration current the economic context (specific to each country), to fully understand the phenomenon and see if the relationship between inflation and bank lending practices found in the past is still significant. According to the Dutch National Bank, Dutch banks are expected to experience different effects from inflation, compared to the effects during the 1970s. For example, during the rapid inflation increase of that time Dutch banks experienced lower profitability, measured by their net interest income. As stated by The Netherlandish Bank (2022), "the steady rise in current interest rates may have a positive impact on banks' net interest income". Whether a positive or negative effect will be seen depends on the extent to which higher interest rates will be reflected on bank's loan books, as well as the credit given by these banks, and whether the banks would be pressured to raise their deposit rates (The Nederlandish Bank, 2022). If the rise in interest rates is reflected in higher loan interest rates margins for commercial banks, then bank profitability goes up, however debt would also increase (U.S. Risk, 2022).

2.4 Effect of GDP

To get a strong understanding of the research question, it is important to also analyze other factors that can influence bank lending practices, besides the interest rate and the inflation rate. Another variable that is taken into consideration is GDP growth. One can assume that during periods of economic booms, when GDP is growing, bank lending would increase, and the opposite if the latter is the case. However, in a study found by Le et al., (2022), the extent to which bank lending is affected by GDP, depends on the competitive environment the bank is in. The more competitive and aggressive the environment of a bank is, the more its lending activities are affected by GDP growth. The results indicate that banks which operate in competitive financial markets increase their lending in times of GDP growth, whereas banks that are in more stable environments have a more conservative approach in times of economic booms. Their lending practices stay stable (Le et al., 2022). Therefore, the effect of GDP growth on banks is not a straightforward one. In this case, the economic competitiveness in which banks are operating plays a critical role. Considering that the period studied in this paper covers both periods of economic upturn and downturn (before and after the COVID-19 pandemic), the results will shed insights on whether GDP influences the overall lending volumes in the United States and Japan. If an effect is found, the regression will indicate whether this is a positive or negative one (taking into consideration different economic periods). Moreover, based on the literature presented one can establish the following hypotheses:

Null Hypothesis:

$H_0 =$ Changes in GDP have no influence on given commercial banks' total levels of loans, household loans and corporate loans.

Alternative Hypothesis:

$H_4 =$ Changes in GDP do have an influence on given commercial banks' total levels of loans, household loans and corporate loans.

2.5 Effect of the Unemployment Rate

Another economic variable discussed in the background section, that can influence bank lending practices is the unemployment rate. In 2020, many countries experienced an increase

in the unemployment rate. With an increase in unemployment, the public's ability to raise capital by taking out bank loans might be limited. As unemployment increases, the financial stability of the economy's population decreases. Consequently, the credit risk (probability that the customer defaults on loans) for commercial banks increases. As credit risk increases, banks would decrease their loan volumes given to the public, to retain liquidity, capital and stability. When examining how unemployment affects bank lending, it is important to acknowledge that the effect might differ depending on different firm industries and population demographics. For example, corporations in the service industry, specifically leisure and hospitality have seen the greatest unemployment rates after the pandemic. Besides firms, households can also be affected by this, not just by receiving fewer loans from banks, but also by drawing down on their savings (Federal Deposit Insurance Corporation, 2021). Therefore, banks can see a decrease in their deposits. This can lead to a further decrease in credit given as banks want to keep their liquidity stable. Based on a study realized by Göçer, (2013) it was found that disruptions in the credit market and lower credit volume affect economic activity negatively, by increasing the unemployment rate.

The results of this paper will indicate whether this found inverse relationship between bank credit and unemployment also holds true when the variables are switched (unemployment is an independent variable instead of a dependent one). Lastly, another academic paper published results on how an economic downturn impacts the banking sector, specifically its liquidity. It was found that an increase in the unemployment rate leads to an increase in non-performing loans. This would decrease banks' liquidity and profitability, therefore their lending (Trenca, et al., 2015). Given that bank practices (affected by economic activity) affect unemployment one can assume the following:

Null Hypothesis:

$H_0 =$ Changes in the unemployment rate have no influence on given commercial banks' total loans, household loans and corporate loans.

Alternative Hypothesis:

$H_5 =$ Changes in the unemployment rate do have an influence on given commercial banks' total loans, household loans and corporate loans.

2.6 Different Studies in the Unites States and Japan

In the Unites States, the interest rate saw an increase recently, while in Japan the interest rate stayed negative since 2016. What's more the central bank in Japan has adopted a low-interest rate policy since the mid-1990s. While in the United States, the interest rate varied over time, in Japan it stayed close to constant. To answer the research, question these differences need to be examined. As assumed above (effect of interest rate section) higher interest rates can affect bank lending practices negatively, by lowering credit supply. Does that mean that one can expect higher loan growth in Japan, due to its lower interest rate?

According to the study done by Balloch and Koby (2020), this is not the case. What was found in their academic paper is that lower interest rates put pressure on the financial system in Japan, increasing costs for banks, and lowering their profitability and their loan supply, in the long run. Thus, in the long run, having a constant low-interest rate has proven not to be beneficial for commercial banks in Japan. In addition, the authors of the paper draw a connection between the market power of banks with their negative loan growth. The market power of these banks depends on their funding spreads and deposit power. One can assume that the more market power a bank has, the higher its capitalization power. A bank's market power depends on the bank's regional regulations, geographic region and market competition. When the interest rate changes, differences in each one of these can result in different effects on bank credit. One of the main results in this paper highlights the importance of market power. The banks that were most exposed to market power, were the ones that were negatively exposed to interest rate cuts. These banks had low rates on their deposits, and therefore they were "less able to pass through interest rate cuts to their expenses" when the interest rates were low (Balloch & Koby, 2020). Lastly, this paper not only brings insights into how Japanese banks were affected by interest rates but also highlights the importance of studying the time dimension (short term vs. long term) of the effects of such an economic factor. When banks are exposed to low-interest rates environments for a long period, the effectiveness of monetary policy decreases (Balloch & Koby, 2020).

The American banking sector has also experienced similar negative effects after the pandemic. Firstly, the paper by Shabir et al., (2023), concluded that banks' profitability and their overall stability decreased. Secondly, the study done by Beck and Keil (2021), focuses

on U.S. banks and how their lending practices were affected by the 2020 crisis. Similar to previous literature reviews, results show that C&I loans have experienced an increase, while household loans have experienced a decrease. These results were independent of the bank's exposure to lockdown or pandemic safety measures. What was found was also that due to government lending programs and subsidies, loan growth saw an increase in special market segments (specifically loans to small businesses). In areas where the government did not help, this was not the case, and the total loan volume decreased specifically for small businesses. These loans also saw interest rate spreads increase, showing signs of a "tighter risk appetite" that banks had (Beck & Keil, 2021). A lower risk appetite can also be understood if banks were exposed to lower equity value and high capital costs. Overall banks were better equipped to manage liquidity shocks, due to cash inflows from the Fed, an increase in depositors and an increase in reserve regulations and requirements (Beck & Keil, 2021).

Chapter 3: Data Information

3.1 Data Collection

Besides analyzing academic literature to answer the research question, it is important to also answer the question by collecting data and constructing a quantitative analysis. To answer: "To what extent do different levels of interest rates and inflation rates affect bank lending practices in the United States and Japan?" three dependent variables and four independent variables will be collected. This will provide a framework for understanding and analyzing the statistical relationship between these variables while testing the null and alternative hypotheses. The time interval for the data collected covers 4 years, from January 2018 until December 2022. In this timeframe, the event of the global Covid pandemic affected various economic factors. Therefore, one can expect different variable levels and results before and after this event. In addition, the data found for the dependent variables levels is general total country-level data (added sum of individual commercial banks data). For both the dependent and independent variables the data is taken at a monthly level. If variables are not collected on a monthly level (but quarterly) then this will be adjusted so that the timeframe of all the variables stays constant.

3.2 Data variables

In the data collection process, there are three dependent variables. The first one is the total lending volume (loan volumes) from commercial banks. Total loan volume refers to the total loan volume given by commercial banks. The second one relates to commercial and industrial loans are corporate loans given to private for-profit organizations (companies). As described on the Eikon database: "loans made to business and industry". The third dependent variable, real estate mortgage loans are loans given to private households to facilitate real estate investments and refer to household loans. The loan volumes from the U.S. are taken in U.S. dollars, while the loan volumes for Japan are taken in Japanese yen. The first independent variable is the level of the federal funds rate. Both interest rate levels are taken from each respective country, U.S. and Japan. The other independent variables are inflation rates, real GDP change, and unemployment rates.

3.3 Sources and Features of Data

After accessing the Eikon database, the first step is to select the "Time Series" request and then "Equities". Then the following selection process was done and the following characteristics were selected in the respective order: specific country, the specific sector "banking", active on market banks, currency specific to the country (yen and USD dollars) and type-equity. From Eikon, the dependent variables data was taken from multiple individual banks. To get a total monthly number, the data from all the individual banks was added. For Japan 75 individual banks were included in the data set, and for the United States 282 individual banks were included. In addition, the number and bank names were the same across all three types of dependent variables (specific to each country). The real GDP (taking into account given inflation) was not given on a monthly basis, but on a quarterly one. Therefore, linear interpolation was used to get the monthly GDP. After all the monthly values were recorded the percentage change in GDP was calculated. Looking at inflation, for the U.S. the United States Consumer Price Index was taken, having the source the U.S. Bureau of Labor Statistics. For Japan, the Japan National Consumer Price Index was taken, with the Ministry of Public Management as the source. When looking at these indices on the database's website, one can see three inflation columns, with "Actual", "Forecasted" and "Previous" inflation. The "Actual" inflation was taken. Lastly, these indices are taken by the market as a proxy for the actual inflation observed in the market.

For the sources of the data variables, all 3 dependent variables are collected from the database Eikon. For the first independent variable, the interest rates; for the U.S. the monthly interest rate was taken from the FRED (Economic Research Federal Reserve Bank of St. Luis) official database; for Japan, the constant interest rate of -0.1 percent was taken from the Bank of Japan. Another variable that was collected from the FRED for both countries is the real GDP. The last independent variable collected from the FRED is the unemployment rate for both countries. For the official monthly inflation (for both countries) this was taken from the Investing.com database.

Chapter 4: Methodology

4.1 Descriptive Statistics

Table I. United States Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Total Loans	180	3.40e	1.76e	1.82e	6.71e
Interest Rate	180	1.25	1.14	0.05	4.33
Inflation Rate	180	3.57	2.63	0.1	9.1
Unemployment Rate	180	4.94	2.34	3.5	14.7
Real GDP Change	180	0.16	0.90	-2.99	2.62

Table II. Japan Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Total Loans	180	3.03e	2.21e	7.40e	6.57e
Interest Rate	180	-0.1	0	-0.1	-0.1
Inflation Rate	180	0.78	1.12	-1.2	4
Unemployment Rate	180	2.73	0.24	2.3	3.2
Real GDP Change	180	-0.08	0.79	-2.77	1.86

4.2 Panel Data Regression Models: Fixed Effects vs. Random Effects Model

The data collected and analyzed in this paper is panel data, showing multiple dependent (three different types of loan categories for two different countries) and independent variables (different types of macroeconomic country variables) over a specific period of time (4 years). Panel data is a combination of cross-series data and time-series data. Three different types of loans, total loans, corporate loans and real estate loans are observed over a specified period of time. When analyzing results from the panel data several regression models can be used. Panel data allows the use of regression models with a higher complexity, that examine the results in more depth, than solely an OLS regression model (Ordinary Least Squares). Therefore, in this paper panel data models are performed and analyzed. The most significant panel data models are the fixed effects and the random effects regression models. The fixed effect regression model is an example of the OLS regression model, and it assumes that differences across the cross-data can be accommodated by different intercepts. It focuses on the time-specific effects and individual-specific variation. The random effects regression model uses the concept of general least squares, and it assumes that variables are interconnected "between time and between individuals", (time-specific and individual-specific effects) (Zulfikar, n.d.). It assumes differences across the three categories of the dependent variable. The random effects model also examines unobserved heterogeneity across the three loan categories. Both models analyze the linear relationship between the dependent and independent variables. In addition, the random effects model accounts for both fixed effects and random effects, which increases the accuracy and efficiency of the results (compared to a fixed effect model). In the paper the following regression models are analyzed, firstly a fixed effect model, and secondly a random effects model.

An important step before conducting panel data regression models is to ensure that the independent variables are stationary. This step is important in verifying the validity and accuracy of the data and results presented. Stationarity relates to the time series element of the data. It represents time series variables that have a constant mean and variance. One method to check the stationary level of variables is to graph them and observe the time series trend. To illustrate an example, Appendix B shows the variables of the interest rate for the U.S. and the inflation rate in Japan graphed. In the graphs there is a trend visible for these variables, therefore these two variables are non-stationary. The same graphs were repeated to conclude that all the independent variables are non-stationary. To eliminate this trend, one needs to remodel these variables and transform them into a stationary form. This is done

through differencing. After all the independent variables are differenced, new independent variables are formed and used to run the two regression models. To verify stationarity, these new variables are then graphed again to analyze their time series trend. As seen in Appendix B, the interest rate for the U.S. and the inflation rate for Japan are now stationary variables.

4.3 Fixed Effect Model vs Random Effect Model: Formulas

The data for panel data regression models is organized into long format. In Stata, all three types of loan categories (total loans, corporate loans and real estate loans) are recorded in one column. Two separate columns are created to differentiate between these group categories (different entities) one with rows labeled 1 (total loans), 2 (corporate loans) and 3 (real estate loans), and another one with rows labeled "Total Loans", "Corporate Loans" and "Real Estate Loans" respectively. When setting the data in Stata, to classify it as panel data, the data is shown to be highly balanced, meaning that all group types are observed over all sample time periods. Both the fixed effects model and the random effects model have the same regression formula. Hence, the following regression formula is used for the United States and Japan:

Regression Formula:

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + u_i + e_{it}$$
$$i = 1, 2, 3; t = 1 \dots T$$

Source: Torres-Reyna (2007)

The formula is explained as follows: Y_{it} is the dependent variable for group category i (total loans) at time t, i represent the specific group category, α is the intercept of each group category, u is the within groups error term and e is the overall error term. All the β values explain the slope coefficients of the respective independent variable. The independent variable is the interest rate, this is described as the X_1 number. The remaining components of the formula X_2, X_3, X_4 relate to the independent variables of real GDP change, inflation rates and unemployment rates, respectively. This model estimates the model parameters of the variables, and it indicates whether the relationship between the interest rates and the loan volume is found to be significant or insignificant. In case it is significant then the alternative hypotheses are found to be true, whereas if it is insignificant then the null hypothesis holds

true. Lastly, the equation above is replicated two times, one time looking at the regression for the U.S. and another time looking at the regression for Japan.

4.4 Interpretation: Fixed Effects Model vs. Random Effects Model

Once the data is collected and the regressions are run, the results from both the fixed effects model and the random effects regression models are analyzed and interpreted. Firstly, in the results tables, the goodness-of-fit of the overall model is analyzed. This involves observing the R-squared values, in particular the within groups and between groups R-squared values. A higher value of this variable means that a large proportion of the dependent variable variation is explained by the independent variables, which indicates a better fit of the model. Following this, the F statistics (for the fixed effects model) and the Prob > chi2 test (for the random effects model) are observed to determine the overall statistical significance of the models. Thereafter, the p-values are examined to determine whether the relationship between the independent variables and the dependent ones is statistically significant. If this p-value is below the significance level of 0.05, then the null hypothesis is rejected, and the relationship between the variables is statistically significant. Otherwise, if this p-value is above the significant level, the null hypothesis is not rejected, consequently, the relation is insignificant. Lastly, the coefficients of the independent variables are observed. These are explained by how much the dependent variable is increasing or decreasing when the respective independent variable is increasing by one unit (while the other variables are held constant). In addition, the sign of the coefficient of the independent variable also shows whether the variables have a positive or negative correlation.

Lastly, in the results section only the fixed effects model is analyzed. The results of the fixed effects model are recorded in the first column and the random effects model results are recorded in the second column of the results tables. These results of the two models are the same (with small coefficient variations), therefore only one model is interpreted. The implications of these results are further discussed in the next section.

Chapter 5: Discussion of Results

5.1 Fixed Effects vs. Random Effects Model Results

Table III. Fixed Effects and Random Effects Regression Models for the United States

Table III. shows the fixed effects model (first column) and random effects model (second column) regression results. The total loan volume (including all three loan group categories) for the United States is taken as a dependent variable. The independent variables are differenced interest rate, the differenced inflation rate, the differenced unemployment rate and the differenced real GDP change. The independent variables are differenced to change them from non-stationary variables to stationary variables. The table shows the coefficients of each independent variable. The asterisk indicates the p-value and the significance of each coefficient at each significance level, namely 0.10, 0.05 and 0.01. In parenthesis, the standard errors are shown. The total of observations are 180, with 60 observations per loan group, therefore three number of groups.

	Fixed Effects Model	Random Effects Model
	Total Loans United States	Total Loans United States
Diff. Interest Rate	2.63251888.9***	2.74827672.1**
	(6.6879261.7)	(1.29329352.0)
Diff. Inflation Rate	-4.6132419.4	-3.6272544.4
	(4.3257430.4)	(8.3648162.7)
Diff. Unemployment Rate	-4719407.1	-4006742.1
	(3.0087057.7)	(5.8183338.5)
Diff. Real GDP Change	5314468.1	5704171.9
	(5.0327344.9)	(9.7324720.3)
_cons	3.40115e+09***	3.40068e+09***
	(2.4042529.5)	(1.51533792.8)
N	180	180
$R^{2within}$	0.094	0.093
$R^{2\ between}$	0.99	0.99
$R^{2\ overall}$	0.01	0.01
F	4.47***	
Wald Chi		5.5***

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The table above first shows the three number of groups (three different entities), which represent the total loans, the corporate loans and the real estate loans, with 60 observations per group. Secondly, the within R-squared is 0.094, while the between R-squared is 0.99. This implies that the independent variables in the model explain more of the effect between the three different groups than within the different groups. The variation in the dependent variable is mostly explained by the model between the groups. Thirdly the Prob > F (from the F statistic value of 4.47) is equal to 0.0018. As this value is less than the significance level of 0.05, it indicates that the overall model and effects of the independent variables on the dependent one are statistically significant. The null hypotheses can be rejected. Fourth looking at the individual p-values of the independent variables one can see that for the interest rate this is 0.000, also indicating statistical significance. The interest rate null hypothesis can be rejected. What is found is that the interest rate has an effect on total loans. However, looking at the coefficient of the interest rate, the effect is different than predicted in the alternative hypothesis. As this coefficient is 2.63, it shows a positive correlation. As the interest rate increases by 1 percent, the total loans increase by 2.63 percent. The p-values of the other three independent variables are not statistically significant as they are bigger than 0.05. Lastly, the coefficient seen for the inflation rate indicates a similar overall effect on lending as expected in the alternative hypothesis.

Table IV. Fixed Effects and Random Effects Regression Models for Japan

Table IV. shows the fixed effects model (first column) and random effects model (second column) regression results. The total loans for Japan are taken as dependent variables. The independent variables are the interest rate (not differenced due to being constant), the differenced inflation rate, the differenced unemployment rate and the differenced real GPD change. The table shows the coefficients of each independent variable The asterisk indicates the p-value of each coefficient at each significance level, namely 0.10, 0.05 and 0.01. In parenthesis, the standard errors are shown. The total of observations are 180, (60 observations

per loan group.

	Fixed Effects Model	Random Effects Model
	Total Loans Japan	Total Loans Japan
Interest Rate	0	0
	(.)	(.)
Diff. Inflation Rate	1.12233e+10***	1.12071e+10***
	(3.37212e+09)	(3.24420e+09)
Diff. Unemployment Rate	-8.65035e+09	-8.66378e+09
	(1.25618e+10)	(1.20853e+10)
Diff. Real GDP Change	1.46813e+09	1.46734e+09
	(1.92529e+09)	(1.85225e+09)
_cons	3.02976e+11***	3.02976e+11***
	(5.67711e+10)	(1.41047e+09)
N	180	180
$R^{2\ within}$	0.071	0.071
$R^{2\ between}$	0.940	0.940
$R^{2\ overall}$	0.005	0.005
rho	0.99	
F	4.430***	
Wald Chi		12.33***

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results for the Japan fixed effects model, show similar trends as the results seen for the U.S. Considering that there is no variation in the interest rate of Japan (constant value), the fixed effects model does not give results regarding its coefficients and p-values. By observing the R-squared results there is a within value of 0.071 and a between value of 0.94. This explains that the variation in the dependent variable is explained more by differences between different loan categories, than by differences within these loan categories. As the R-squared between number is close to 1, this suggests goodness of fit for the model. The low within value is also consistent with the high rho value of 0.99, indicating high unexplained variation within the three loan type groups and high explained variation between loan type groups. The p-value is statistically significant for the inflation rate, as 0.01 is smaller than 0.05. The coefficient of this variable is 1.12. The positive correlation indicates that as the inflation rate increases by 1 percent, total loans increase by 1.12 percent. Therefore, the null hypothesis is rejected. Even though the inflation rate does have an effect on the total loans, this effect is different than the expected alternative hypothesis. The alternative hypothesis predicts a negative effect, not a positive one. The other two variables are not statistically significant; however, they show similar correlation trends as the ones in the U.S., with the employment rate having a negative effect and the GDP changes having a positive one. These findings are also consistent with previous academic literature discussed.

5.2 Similarity of Model Results

Lastly, another discussion of the results found is the degree of similarity between the two-panel data models. Generally, when analyzing panel data and deciding between a fixed or random effects model, performing a Hausman Test (Hausman's specification test, 1978) is an adequate test to analyze and indicate which model is better to use, given the research data. If the p-value observed from the Hausman Test is higher than 0.05, then the random effects model is chosen and if the p-value is less than 0.05 then the fixed effects model is used. The null hypothesis of the Hausman test is that the random effects model is more appropriate to use. The alternative hypothesis indicates that the fixed effects model is more appropriate. The following formula is used for the Hausman Test:

$$H = [(\beta_{RE} - \beta_{FE})(\mathrm{V}(\beta_{RE}) - V(\beta_{FE})](\beta_{RE} - \beta_{FE})$$

Source: Stata Manual (2022)

To conduct the Hausman Test on Stata firstly the two random and fixed effects regressions are run and stored. Because the results from both the fixed effects and random effects models are the same, when trying to perform the specification test in Stata, the test fails to run, due to the given similarity of the results. Such a result can be expected when considering that the Hausman test assumes differences between the fixed and random effects model results.

The similarity of the regression model results further implies another relevant assumption about the data. Given the similarity of the two model results, the individual effects are not correlated with the independent variables. Furthermore, this assumption is consistent with the random effects assumption that the individual effects (unique errors) are also not correlated with the independent variable, these individual-specific effects are treated as random variables. On the other hand, the fixed effects model assumes that the individual effects are correlated with the independent variables. Therefore, one can assume that the random effects model is more efficient to use, with the given data structure and model specifications. In addition, the random effects model can also be considered more efficient as it takes both within and between group variation into account, whereas the fixed effects model only takes within group variation into account. This is also relevant given that, for both countries the between R-squared had higher values, than the within R-squared.

Chapter 6: Robustness Checks

6.1 OLS Model

Besides the two panel data regression models performed, further robustness checks were performed to support the reliability of results and to check the possibility of bias in the results. To expand on the research a normal OLS regression was performed, applying the following formulas. Unlike the panel data regression, each dependent variable was analyzed separately as its individual entity, therefore the data becomes time series. This expands the research by examining whether the effects of the macroeconomic variables differ depending on the addressed loan groups. The linear regression for the general OLS model is derived from the following formulas:

U.S. Regression

$$Y_{tus} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_i$$

Eq.1

$$Y_{ius} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_i$$

Eq.2

$$Y_{hus} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_i$$

Eq.3

Japan

$$Y_{tjp} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_i$$

Eq.4

$$Y_{ijp} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_i$$

Eq.5

$$Y_{hjp} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_i$$

Eq. 6

The only difference between the formulas of the OLS model and the panel data model is that: Y_t is the total loan volume in the given country, Y_i is the loan volume given to households and Y_h is the loan volume given to companies. The results can be seen in Appendix C. Based on the tables for both the U.S. and Japan the same variables show statistical significance, as in the panel data models. For the U.S. the interest rate is statistically significant for all three loan groups. The biggest positive correlation is seen in the loan group of total loans with a coefficient of 6.28. In addition, the tables inferred that, while the interest rate does influence corporate and real estate loans, the effect on each loan type is similar. This means that the null hypothesis (stating that there is a different effect of the interest rate on these two loan types) cannot be rejected. One difference that can be observed is the coefficient of the inflation rate. For the fixed effects model, this was negative, while for the OLS model, it is positive. However, due to the high p-values, this result cannot be regarded as statistically significant. For Japan, similarly to the fixed effects model, the inflation rate is statistically significant. Here, the interest rate is left out due to collinearity. Looking at the positive effect of the inflation rate, this is the highest for corporate loans with a coefficient of 8.85, followed by a smaller positive effect of 5.35 for real estate loans.

6.2 Multicollinearity Test

Besides expanding the regression models, another robustness method is used to analyze the multicollinearity of the variables included. Multicollinearity describes a high intercorrelation between the independent variables. This would affect the interpretation of results negatively,

as the variables' coefficients would not be an accurate representation of the correlation effect, (the coefficients would not be uniquely determined). As seen in the background and literature review section of the paper, the independent variables examined are interconnected with each other and have interconnected effects. This would increase the probability of multicollinearity. To check the data multicollinearity, the Variance Inflation Factor (VIF) test was performed in Stata (after variables were regressed). When the test results levels are above 10 for each independent variable, then the data would have a high degree of multicollinearity. Below the results for the U.S. and Japan are illustrated. The tables show that there is a low degree of multicollinearity as all the numbers are below 10.

Table V: United States (uncentered – no constant term) and Japan Multicollinearity Test VIF

	United States VIF	1/VIF	Japan VIF	1/VIF
Inflation Rate	2.22	0.45	1.16	0.86
Unemployment Rate	2.21	0.45	1.31	0.76
Interest Rate	1.82	0.55	0	0
GDP	1.31	0.76	1.14	0.88
Mean VIF	1.89		1.20	

Chapter 7: Discussion of Economic and Financial Implications of Results

7.1 United States and Japan Results

Based on the results in both the fixed effects and the random effects model, as well as in the OLS regression model, for the U.S., the interest rate is statistically significant with a positive correlation with loan volumes (Table III). Comparing Figure 1 and 2 with Figure 1 found in Appendix A, one can also see this positive correlation graphically. Even though the interest rate is increasing in 2022, loan volumes also show an increasing trend from 2022 onwards. The results found reaffirm previous research done in the literature review, showing the

statistically significant effect of the interest rate on loan volumes. The academic study evidence was mixed on whether higher interest rates increase or decrease loan volume. Some literature (Beutler, 2020) points out a negative effect of the interest rate on loan volumes. However, this negative effect result is dependent on the bank's degree of exposure to interest rate risk. Other literature highlights a positive effect, showing the significant increase of loan origination shortly after the COVID -19 crisis (Li et al., 2020).

Even though the literature discusses variations in the effect of the interest rate, economic theory generally explains that a higher interest rate would increase the costs of borrowing for consumers, and therefore decrease lending volume. In this paper, the results show that interest rates have a positive correlation on loan volumes. Therefore, as the interest rate increases in the U.S., the loan volume increases as well. Given that loan origination volume increases the money supply, inflation increases as well. As discussed in the background section, the interest rate level can be used as a monetary policy channel to influence price growth, through the bank lending channel. Based on these results, given that the central bank's objective is to decrease price growth and inflation, doing so through the interest rate and the bank lending transmission channel might not be as effective. These results further imply a low pass-through rate of the federal funds rate to corporate loans and real estate rates. However, there are other policies that the central bank can implement to control rising inflation (besides the bank lending channel). The lending volume and loan originations can be also controlled through lending policies, such as macroprudential policies. In the paper written by Acharya et al. (2022), the results show how price growth decreased in the housing market, due to the implementation of new lending policies (loan-to-income and loan-to-value limits). These lending policies did not specifically target an overall lower loan origination. Their objective focused on decreasing loan originations on a specific population demographic and market, which was the primary source of the rising inflation. This study shows that to be effective in lowering inflation, a thorough analysis of the primary source of inflation is important. The inflation source in this paper was the urban market, concerning the lower-income population. Once the source of inflation is found, targeting it through specific lending policies and credit controls and decreasing it becomes more effective. Therefore, inflation can also be controlled through other monetary policies (targeting commercial banks) besides the interest rate. Negative effects of such polices include lower economic activity and a shift in higher risk tolerance for corporate lending and loans (Acharya et al., 2022). These effects decrease GDP and increase credit risk. Another method of decreasing inflation is by

managing the exchange rate. The stronger a currency is, the lower the import prices of goods become. As an effect, this decreases inflation.

Looking at the results for inflation, this shows a negative correlation (Table III). As inflation increases, the lending volume decreases. This effect is consistent with most previous literature found. With the increase of inflation in the economy, consumers are negatively affected, as their purchasing power decreases. Therefore, they are less likely to take out loans. In addition, the expectations of inflation, (to decrease in the future as interest rates rise) could also offset some consumers from taking out new loans at the current high-interest rates. Further evidence for this is reported in the decrease of home prices, in the U.S. from 2022 to 2023, which could incentivize the public to wait for lower interest rates and further price decreases (FRED, 2023). This home price decrease is also consistent with the lower real estate lending, as seen in Figure 2. However, even though a negative effect of inflation was found, this was not statistically significant. Therefore, other macro and micro economic variables drive the decreasing trend in bank lending activity in the U.S.

Analyzing different monetary policies that can decrease inflation besides the interest rate is also relevant and applicable to Japan's found results. This is especially relevant considering the future expectations that the interest rate will stay constant. For Japan, the findings point out to a significant positive correlation of the inflation rate on loan volumes for the fixed effects, random effects and the OLS regression models (Table IV). As seen in the literature review interest rates and inflation rates follow a similar trend in the economy. Therefore, considering that the interest rate is constant for Japan, the inflation rate serves as an adequate proxy for the interest rate effect on loan volumes. The findings seen for Japan contradict the overall literature theory which highlights that as the inflation rate rises, loan volume decreases. The results show that when the inflation rate rises, so does loan volume. Looking back at the literature review, one study (Zermeño et al., 2022) points out that the time duration of the study is important when determining the effect of inflation. In the short term corporate loans and household loans were seen to increase when inflation increased. Taking into account that four years as a period studied in this paper can be considered a short-term period, the results found reaffirm these findings. The results are also consistent with Figure 3 where it can be seen that even though inflation rose in Japan, consumer lending activity did not decrease. Furthermore, as seen in the background section Japan's economic context and its inflation sources are different from the U.S. In Japan, economic activity has been on the

lower side, as well as consumer demand. Therefore, lending policies, aiming at decreasing lending (which might be appropriate to implement in the U.S.), might not be economically and financially efficient in Japan, as these would further decrease GDP and consumer investment. The central bank can take a different lending policy approach, and introduce credit easing policies (in addition to low interest rates) that make borrowing even more accessible for Japanese consumers. Moreover, consumers that have already corporate loans or a real estate loans at low fixed 30-year interest rates, could benefit from the rise of inflation as their interest rate costs decrease with the rise of inflation. Lastly, based on the study of Balloch and Koby (2020) it was found that in the long term, low-interest rates decrease the profitability and increase costs of Japanese banks (Balloch & Koby, 2020). This is important to acknowledge, as a lower bank profitability could imply lower loan origination growth in the long run for Japan.

In addition, considering that the Japanese yen has experienced a significant depreciation, which makes imported goods more expensive for consumers (decreasing consumer demand), economic policies intended to strengthen and stabilize the national currency would be appropriate. For example, an appreciation of the yen would make imported goods in Japan cheaper for the consumers, increasing their consumption. However, this would also increase inflation. Nonetheless, having a depreciated currency can also be beneficial as it makes exports from Japan to other countries cheaper, therefore increasing trading, the trading balance and surplus, economic growth and economic production, all increasing GDP. Given that the U.S. is one of the major trading partners of Japan, a currency appreciation of the yen, could have further spillover effects on decreasing Japanese exports in the U.S., as these become more expansive. Lastly, monetary policies in Japan can also be implemented in coordination with fiscal policies to decrease inflation and increase price stability, recognizing that consumer spending should not be decreased further. Examples of such policies include decreasing government spending, subsidies and borrowing. This is beneficial given the fiscal debt of the country. The costs of fiscal debt of the country could also be decreased through an appreciation of the yen. Fiscal policy can also be used to impose price controls, to decrease price growth for consumer goods. Furthermore, even though price stability is the main objective of the central bank, given that inflation in Japan is not as high as in other countries, monetary policies aimed at increasing GDP and economic activity (which increase inflation) could be regarded as more appropriate in this case, then solely focusing on decrease inflation. Lastly, it is important to consider that the economic implications of the main results found for

the United States and Japan cannot be taken in isolation. The similarity between the results found for the U.S. and Japan can be explained by the globalized nature of the financial system. Given this similarity, looking at the results of the U.S., one can also assume that an increase in the Japanese interest rate could increase its loan volume. However, given the uncertainty of how an increased interest rate might affect Japanese consumers, an interest rate increase might not resolve the problem of lower economic activity. Moreover, given the close international ties between the two countries and their shared banking branches domestically and internationally, significant changes in the banking sector of one country need to be acknowledged by policymakers in both countries.

Chapter 8: Conclusions

8.1 Limitations & Recommendations

One limitation of the research is detected in the goodness of fit measure of the regression models for both the U.S. and Japan. Both regression models had a low overall R-squared. This indicates that there is a large proportion of unexplained variable variation. Total loan volume and the observed changes in the volume values are possibly explained also by other independent variables than the ones included in the models. This relates to the possible issue of omitted variable bias. One method of improving the efficiency of the regression models could have been to include more macroeconomic variables into the model and observe their effects on the loan volumes. In addition, a regression model that analyzes the interaction between these macroeconomic variables could have been also implemented. This would have also added insights into the sovereign and monetary spillover effect between the U.S. and Japan, enhancing the comparative analysis. In addition, another possible improvement is to extend the timeframe in which these variables were studied, such as including more months in the data. A longer timeframe including years prior to 2016, could also include times when the interest in Japan was not constant. This would extend and add significance to the interest rate effects seen in Japan. In addition, it would have increased the sample size. An increased sample size would have also improved the accuracy of the data and decreased the margin of error, improving the quality of the data and results. Including these model specification changes (more independent variables and a longer time frame) could have resulted in different results for the fixed and random effects model, which could have completed the analysis of the Hausman test. In addition, after conducting a Sharpio – Wilk test the normal distribution of residuals assumption can also be questioned, as the p-value from this test is

small and the W test value is also less than 1. Lastly, additional robustness checks for heteroskedasticity, such as the Breusch-Pagan test, could have been applied to the data.

8.2 Further Research

For the U.S. 30-year fixed rates for mortgages, there is a general decrease from 2018 until the end of 2021. From December 2021 until the present-day mortgage rates see an increase, up to a high of 7.19 percent. (FRED, 2023). In 2021 December, in Japan the 10-year fixed rate for mortgages has been at a lower value of 3.3 percent and stayed moderately constant this year (Statista, 2023). From these rates, one can assume that mortgage rates move in the same direction as interest rates. As the interest rate has increased in the United States rapidly, so did the mortgage rates. In Japan, both rates have also followed a similar trend. They have remained low, bringing the borrowing costs for the public lower. From observing these rate movements, one would assume a high pass-through rate of the interest rate in both studied countries. From the OLS regression, the same findings apply, one can see a similar movement between the total loans and the real estate loans. This brings the research to the concept of the pass-through rate of the interest rate.

When analyzing the main effects of the interest rate another important factor to consider is the so-called “pass-through” of the interest rate. How much of the Federal Reserve interest rate is passed down to interest rates given to total loans, corporate loans and real estate loans? In case this “pass-through” rate is low, then the monetary transmission channel of the interest rate is not as effective in controlling bank lending volume and practices (as rates on mortgages and corporate loans would be less affected). In one paper by Gigineishvili (2011), it was found that the strength of the pass-through rate is different depending on each country’s market variables and economic situation. However, some common effects across different countries were found. What was observed is that GDP per capita and the inflation rate have positive effects on the pass-through rate, whereas market volatility has a negative effect. In addition, bank competition strengthens the pass-through rate, while bank excess liquidity has the opposite effect (Gigineishvili, 2011). Given this positive relationship found between GDP per capita and inflation, one would expect a high pass-through rate of the interest rate in the United States (given the increase in GDP and inflation). Lastly, another element to consider is the timing of the pass-through rate. Even though banks adjust their lending rates in accordance with monetary policies, different banks might implement interest

rate changes faster than others, therefore being more profitable. The degree to which these banks hedge against interest rate risk is also influencing their market power and profitability.

In another academic paper by Gregor & Melecky (2018), it was concluded that in the long-term other variables besides the monetary policy rate can influence the rates banks set for mortgages and corporate loans. The spread between government bond yield and the monetary policy rate was found to have a significant positive effect on the mortgage rates (a one percent increase in the spread, increases mortgage rates by 70 basis points). There was also a positive effect on corporate rates, however, the effect is less significant. Furthermore, the shift in the pass-through rate is explained by a bank's deleveraging model. Lastly, another macroeconomic variable that can have an effect on corporate rates set is the level of FX interventions, which represent unconventional monetary policies (Gregor & Melecky, 2011). Besides setting the interest rate, there are other monetary mechanisms that the central banks adopt to influence price stability and bank efficiency. Besides the conventional practice of controlling the interest rate, central banks can employ unconventional practices, such as macroprudential policies. These policies can also be effective in achieving the objectives of the central banks, decreasing systematic risk and increasing price stability. These practices can target banks in three ways: capital, borrower and liquidity (ECB, 2023). The effectiveness of monetary conventional vs. unconventional bank practices in the bank lending sector is also an area of further exploration.

Lastly, another element of further research are microeconomic bank-specific variables that can be included in the research models (as seen in the limitations). These bank-specific variables describe how internal banking systems work. Therefore, one can assume that these have effects on bank lending volumes. Such variables include non-performing loans, bank liquidity, bank reserves holdings, interest rate margins, bank market share, bank size and deposit rates. The regression model would have to include data on bank level, instead of the country level. These additional variables can give the research a more micro-level analysis, which further adds significant insights into how bank systems function profitably. Lastly, this extension of variables and models (both micro and macroeconomic) could have brought more explanation into the actual decrease seen in Figure 1. and in Figure 2. in loan volume for the U.S.

8.3 Conclusion

To conclude, this paper answers the research question of: “To what extent do different levels of interest rates and inflation rates affect bank lending practices in the United States and Japan?” by analyzing the macroeconomic environment of these two countries and its effect on bank lending volumes. The qualitative chapter first gives the reader background knowledge about interest and inflation rates in the U.S. and Japan. The background section analysis is done taking into consideration the different monetary policies and economic contexts of these two different countries. These differences support the explaining of how the bank lending sector is affected differently. As seen, there are significant economic differences between the U.S. and Japan, seen in the inflation and interest rate gap. These gaps are formed due to different central bank responses and policies after the COVID-19 crisis, as well as different economic effects seen after the pandemic for macroeconomic variables such as GDP growth and the unemployment rate. In the literature review section, all the included macroeconomic variables such as interest rates, inflation rates, unemployment and GDP, are qualitatively analyzed to determine their influence on the lending volumes of commercial banks. Previous academic papers are used to understand this influence and they lie at the basis of the null and alternative hypotheses formulated in this paper. In the majority of the discussed literature, the overall effect of interest rates and inflation rates on bank lending is negative. For the unemployment rate previous results indicate a negative effect, whereas for the GDP, results indicate towards a positive effect. However, these results are dependent on other variables such as the bank competitiveness market level, demographic characteristics, and industry specific financial situations, which are not included in this paper. Therefore, the paper analyzes whether real GDP changes and the unemployment rate have a statistical effect. The results for all three regression models shows insignificance regarding these two macroeconomic variables.

In the quantitative chapter based on the panel data collected, two panel data regression models were run, the fixed effects and the random effects model. The results of these two models were similar, therefore only the fixed effects model was examined in detail. The main findings of the paper demonstrate that in the United States, as the interest rate increases, bank lending volume increases. Separating the three-bank lending volume into three categories, total loans, total corporate loans and total real estate loans, the same results are found. Given the results, an increase in interest rates is not going to decrease lending volume. Therefore, if

the objective is for the inflation rate to decrease, then another economic variable (besides the interest rate), that decreases inflation, should be targeted to lower inflation. Such variables include macroprudential lending policies, that decrease bank credit and exchange rate interventions. In Japan, as the inflation rate increases, bank lending increases as well. The decision of the Bank of Japan to keep a constant low interest rate, can potentially increase the country's inflation levels and boost economic activity. In addition, to fiscal policy intervention Japan can also use similar monetary intervention to the U.S. (exchange rate controls and unconventional monetary policy) to use the banking sector as a transmission channel of its financial policies.

As seen in the background section, inflation in Japan is not as high as in the U.S. Even though the interest rates have been low since 2016, and loans show an increasing trend (Figure 3.), GDP growth has stagnated over the years. Therefore, one can assume that in Japan, monetary policy should prioritize increasing consumer spending and investment in the banking sector, rather than decreasing inflation. Understanding these findings, and acknowledging the limitations as well, provides an opportunity for an informed economic decision-making process for a wide range of financial and public stakeholders. These results also highlight how the lending practices in the economy are reacting towards different policies and changes in the macroeconomic environment. Lastly, understanding how different levels of interest rates and inflation rates affect the banking sector, improves future financial expectations and price stability.

Appendix A: Interest Rate Graph United States vs. Japan – Interest Rate Gap

Figure 1. United States Interest Rate Graph

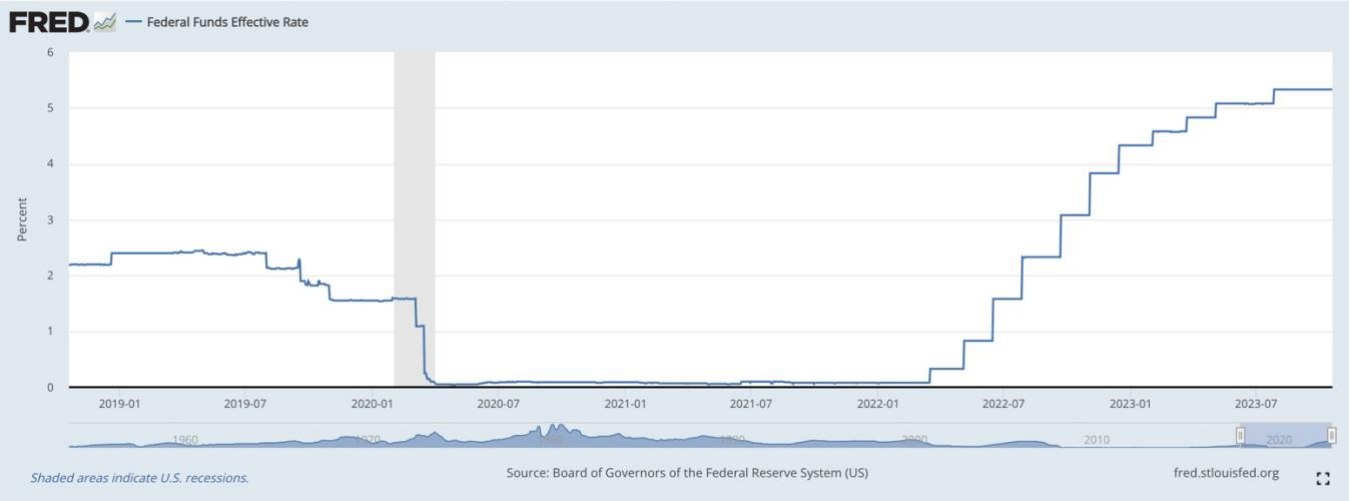
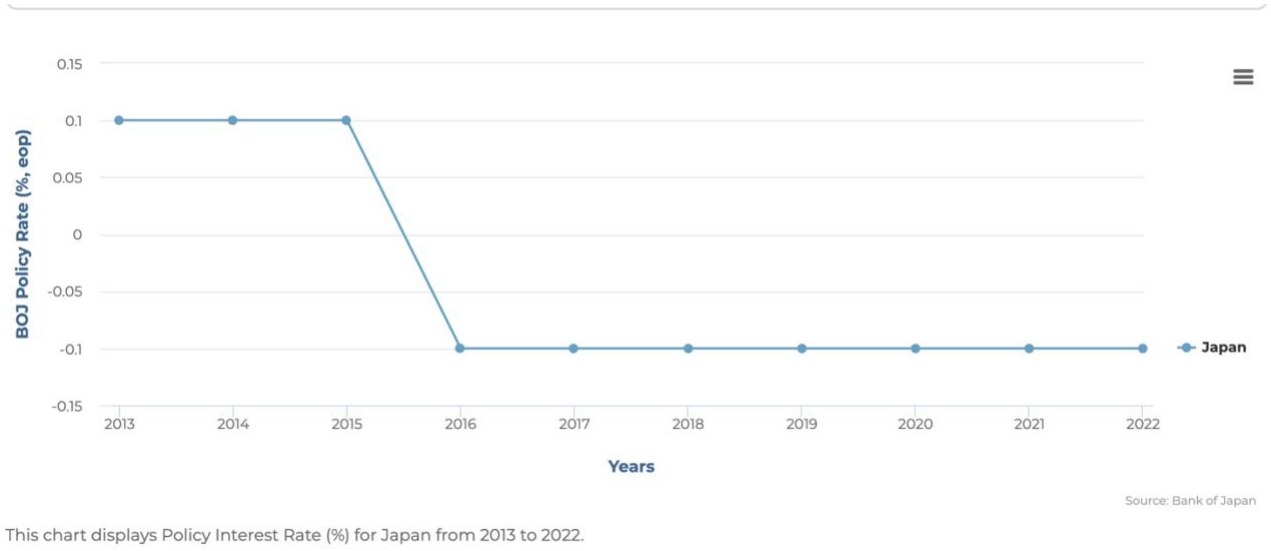


Figure 2. Japan Interest Rate Graph



This chart displays Policy Interest Rate (%) for Japan from 2013 to 2022.

Appendix B: Stationarity of Independent Variables

Figure 3. Japan Non-Stationary Variable Graph

Figure 4. Japan Stationary Variable Graph (differenced variable)

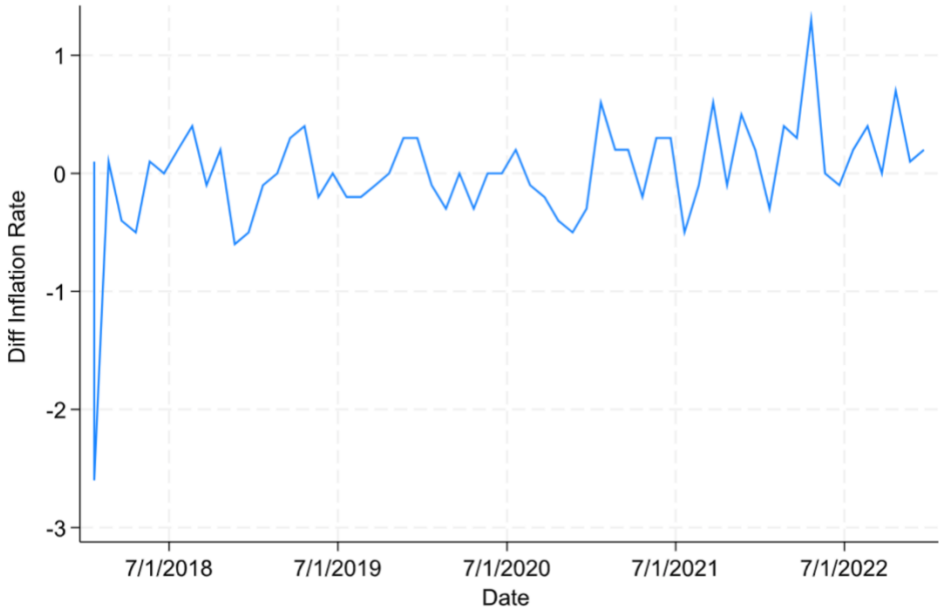


Figure 5. United States Non-Stationary Variable Graph

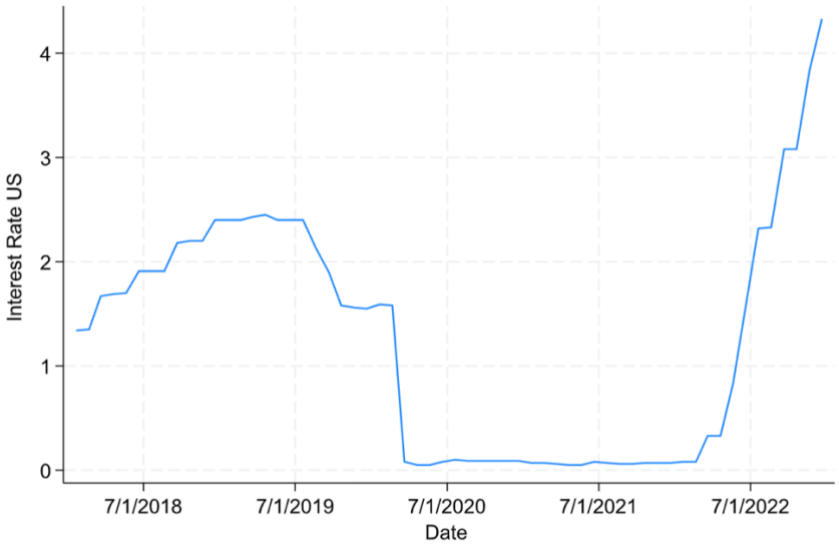
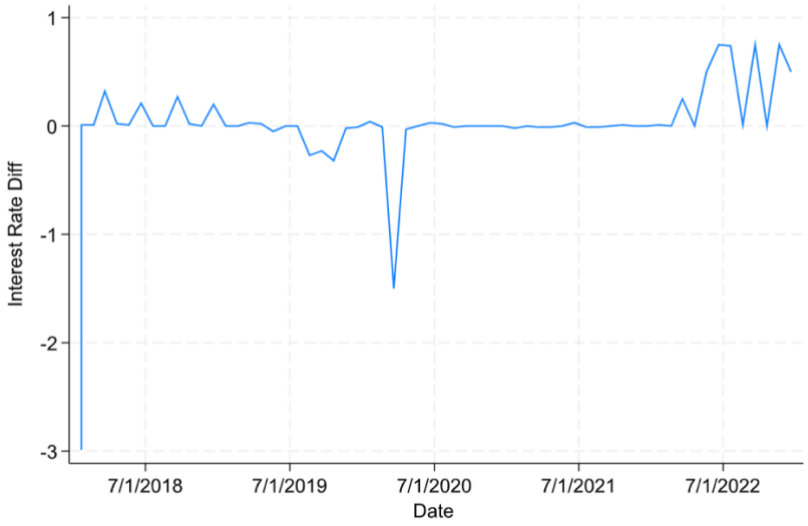


Figure 6. United States Stationary Variable Graph (Differenced)



Appendix C: OLS Regression Results

Table 3. United States OLS Regression Results

	Total Loans	Total Corporate Loans	Total Real Estate Loans
Interest Rate	6.28e+08***	2.71e+08***	2.62e+08***
	(2.08e+08)	(8.98e+07)	(8.06e+07)
Diff. Inflation Rate	1.14e+08	3.44e+07	3.60e+07
	(1.50e+08)	(6.50e+07)	(5.83e+07)
Diff. Unemployment Rate	-1081193	1702411	490872.6
	(7.75e+07)	(3.3e+07)	(3.01e+07)
Diff. Real GDP Change	2.5e+07	7118106	7631080
	(1.29e+08)	(5.60e+07)	(5.03e+07)

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6. Japan OLS Regression Results

	Total Loans	Total Corporate Loans	Total Real Estate Loans
Interest Rate	0	0	0
	(.)	(.)	(.)
Diff. Inflation Rate	3.02e+10***	8.85e+09***	5.35e+09***
	(1.15e+10)	(4.49e+09)	(2.08e+09)
Diff. Unemployment Rate	-1.85e+10	-3.94e+08	-3.68e+09
	(3.30e+10)	(1.29e+10)	(5.95e+09)
Diff. Real GDP Change	2.65e+09	1.84e+09	4.85e+08
	(5.09e+09)	(1.98e+09)	(9.16e+08)

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