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The impact of interest rates on bank stock returns

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ABSTRACT:

The interest rate has a wide impact in the financial world, the center of which is banks and monetary policy. A rise in interest rates has generally been found to have a negative effect on stock returns, but there have been different research results over the course of the stock market history. Especially during various crises, such as the 2008 financial crisis and during Covid-19, central banks have had to take measures to calm the situation, in which case interest rate changes are often part of monetary policy, affecting particularly banks. This study examines banks' operations and especially, examines the effects of interest rate changes on bank stocks returns. The focus is on US banks of different asset sizes to gain relevant information extensively. This study examines the period after the financial crisis to maximize the evidence and reliability.

The thesis is divided into three parts; understanding banking operations, understanding how interest rates are formed, and the effects of changes in interest rates on bank stock returns. In general, theory suggests that banks are different from other industries because of their balance sheet and interest rate sensitivity; almost all cash flows are linked to different interest rates. It is generally known that changes in the interest rate have historically had an impact on the returns of bank shares as well as other shares, but based on previous studies, the effect of the interest rate on the returns of bank stocks is time dependent. In other words, bank returns react differently to interest rate changes in different periods. Additionally, it also matters whether the changes are surprising, whether long-term or short-term, and how big the change is. However, research shows that banks today are well protected from interest rate changes, and gives references, that banks may create positive stock returns, despite changes in interest rate.

KEYWORDS: Banking, Interest rate, Bank Stock Returns, S&P 500, 10-year T-Bill.

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1 Introduction

In the financial crisis of 2008, the problems of the banking system spread throughout the economy. The result was a recession, rising unemployment and taxpayers had to bail out banks to avoid a worse situation and the rescue of certain banks led to the debt crisis, for example in Ireland and Iceland. After the hardest times, politicians' conclusions were clear: the banking system must be strengthened for the possible future crisis by monetary policy. This meant, globally, that an attempt was made to reduce the interest rate levels. As a result, there has been only one increasing in interest rates by FED or European Central Bank after financial crisis and the interest levels has remained to be historically low almost for the decade.

However, the interest rate, or the price of money, is one of the most important factors in the current market economy. Without interest, there would be no economic reason for borrowing money, as it is return on the amount of money borrowed. The current market economy is based on efficient wealth allocation, where the role of interest is to direct investments by allocating investment opportunities from surplus operators to deficit operators. Interest affects the lives of almost every person, as they the loans are linked to reference rates and the deposits are also paid interest. In practice, interest rate changes affect every working person and student in the world.

Despite the difficulties of banks and the development of European financial markets over the last decade, Europe remains to be a very bank-centred economic area. The majority of corporate finance continued to come from banks. Brexit and the Italian debt situation are hanging over the European economy and banking system at same time than we are afraid of the new recession.

Thus, the rise in interest rates seems to be moving further into the future. For a mortgage debtor, this can be good news, as rising interest rates will increase the cost of a mortgage. Thus, the decline in banks' stock prices has been explained by lower interest rates and sluggish economic growth. As interest rates have fallen as a result of monetary policy

easing, banks' ability to make a profit on net interest income has been weakened. This possibly means that in the future traditional banks have to improve and extend their services to remain profitable.

Similarly, financial market instruments such as derivatives, bonds, loans, corporate loans and stock valuation are tied to interest. In addition, in current unusual interest rate environment, where companies and economists widely expect rates to increase rather than decrease, the spread between the cost of long-term borrowing and short-term borrowing defer to grow. That is why it is very interesting to study the impact of interest rate risk on the stock market, and especially on the banking sector, to gain information on how interest rate changes are reflected to their returns.

1.1 Purpose of the thesis

The purpose of the thesis is to find out how interest rate changes have affected stock returns in US listed banks during the years 2012-2021. Additionally, the thesis explains how banks have reacted to interest rate changes, and whether the reaction has been different between small, midsize and large banks, measured by the size of assets.

The research period in question is special because the interest rate has been very low all that time, with only minor fluctuations. Additionally, during the studied period, the market has risen significantly since the financial crisis, so it is interesting to find out how much the market has explained bank stock returns, versus changes in interest rates.

In recent history, researchers have obtained different results on how changes in interest rates have affected the returns of bank stocks. The general prevailing perception is that a rise in the interest rate has historically caused a fall in the stock market, but for banks, varying results have been obtained, and it would seem that the effect of the interest rate change is tied to the studied period. For example, Saunders and Yourougou (1990) stated that the interest rate linkage of bank share returns varies over time,

which is why it is very interesting to study what kind of results are obtained when interest rates are historically low.

In the first empirical part of this thesis, I form three portfolios of bank stocks listed on US stock exchanges. The portfolios are formed according to the size of the banks' assets, the assets of small banks are less than 8 billion dollars, the assets of medium-sized banks are 8-60 billion dollars, and the assets of large banks are more than 60 billion dollars. The portfolios have been formed in order to find out whether the banks' different balance sheet structure has an effect on the change in the interest rate. After this, I calculate the monthly returns for each portfolio and the market index (S&P 500), after which a statistical test is performed by the regression analysis. A 10-year T-Bill is used as the interest rate in the regression analysis. Regression analysis is used to find out, whether the findings of the empirical study are statistically significant.

For the empirical study, the following hypotheses are set based on the historical studies:

H1: The change in the interest rate can explain the returns of the U.S. bank stocks.

H2: There is a negative relationship between returns of U.S. Bank stocks and U.S. 10-year Treasury bill rate.

1.2 Structure of the thesis

The rest of this thesis is organized as follows: In the first theory chapter, the operations of banks are reviewed, as well as how banks' balance sheets and profits are formed. The same chapter also briefly discusses banks' risk management, mainly from the perspective of the interest rate factor. After the theory part of banking, the thesis deals with interest theory, how different interest rates are formed, and which factors are most relevant to it. The fourth section deals with the different ways of valuing a company's share

in order to gain a better understanding of all the factors affecting not only interest, but also stocks' returns.

After the theory section, previous studies on the relationship between bank stock returns and interest rates are reviewed. First, it is looked at how interest rates have generally affected stock markets worldwide, giving the reader a clear understanding of how interest rates affect the stock market. After that, it has looked further into how banking stocks have reacted to changes in interest rates. This leads to a deeper understanding of the relationship between interest rates and bank stock returns.

2 Banking system

The main task of the banking system can be said to be the first two things; offer a variety of payment options and provide opportunities for lending and borrowing. The role of the banks can be further refined into three groups, which are finance brokerage and related services, payment movement and risk management services. The development of a modern banking system began in most industrialized countries in the 19th century. Banks have played an important role in the development of financial markets. They are intermediaries whose assets consist mainly of loans that are issued to a variety of borrowers, whose debts consist mainly of deposits. Thus, it can be said that the banking system connects people and companies who wants to save their funds for later returns, for those who currently need funds for investment. (Alhonsuo, Nisen, Nousiainen & Sandberg, 2012:47-52.)

Usually banking is exactly this idea. The bank carries out its business by buying money from companies and individuals, as well as offsetting interest and keeping money safely. The money that the bank buys will be lend to the entities who need it at a higher interest rate, and that is how they get the income they need for their business. In addition to the above, the bank's main tasks include financial intermediation, payment transactions and risk management. (Alhonsuo et al. 2012.)

Banks are independent institutions, but they are strictly governed by policy and regulations. For example, banking system in the Europe can be divided into three groups: central banks, other monetary financial institutions and other financial intermediaries. The Central Banking Group includes both the bank of Finland and the European Central Bank. The bank of Finland's task is to implement the monetary policy defined by the European central bank, for example, to issue money and to manage and hold foreign exchange reserves. (Kontkanen, 2009)

2.1 Bank's balance sheet and income structure

Banking has faced challenges in maintaining profitability during the downturn and increased regulation. Banks' profitability is increasingly responsive of commission income, as low interest rates keep loan interest margins low. Today, banking continues to include more and more ancillary products, in addition to the traditional way of depositing and borrowing money. In the current millennium, banks' income has come not only from interest income, but also from investment income, commissions and insurance business. (Lepetit, Nys & Tarazi, 2008.)

According to Lepetit et al. (2008), expenses are related to interest paid on deposits, salaries, premises and capital. When looking at the bank's balance sheet, the result is the difference between interest on assets and interest on debts. Banks need to remember to keep non-interest bearing or low interest-bearing assets as well, because customers need possibly to be able to convert their deposits into cash quickly. The banks' debts and assets are, therefore, subject to different interest rates. Some assets and liabilities are linked to fixed interest rates, so that their return or cost is known for a certain peri-od. Similarly, some assets and liabilities are linked to floating rate products and these assets and liabilities are also more sensitive to interest rate risk. (Lepetit et. al. 2008.)

Table 1. Balance sheet of the bank. (Somashekar, 2009)

Balance sheet	
Assets	Liabilities
- Property & Goods (office buildings, cash, government bonds, other financial assets, etc)	- Capital
	- Reserve fund
- Investments	- Deposits
- Other's debts to the bank (loans, mortgages, overdrafts etc.)	- Loans from other banks
	- Profit/loss

According to Shomashekar (2009), banks' balance sheet has a lot of similarities to other firms and financial institutions. What's special about banks is that the difference between assets and liabilities often consists of interest rates. In addition to interest income, the bank's assets consist of various fees and other services. The costs, on the other hand, come from deposit rates paid by banks, salaries and commissions of employees, premises and interest on loans paid to other banks (Shomashekar, 2009). Indeed, Howells and Bain state in their book (2008) that the difference between banks' income and expenses, that is, their earnings are mainly due to interest rates. (Howells et al. 2008.)

Below can be seen the section of OP's income statement to get better understanding how bank's income and expenses are formed.

Table 2. OP's Income Statement (2019)

	2018	**2017**	**Difference %**
Income before taxes	1017	1031	-1,3
Banking	795	619	28,3
Incurance	133	210	-36,7
Wealth management	213	247	-13,7
Other business	-123	-45	172,9
Accumulated bonuses for customers	-230	-220	4,4

As OP's income statement shows, their banking business has been profitable in recent years. Traditional banking itself has continued to account for most of the revenue, but insurance and wealth management have also played a significant role.

The big difference between banking and other companies is the known yield or cost of bank loans and deposits. When taking a loan, it is known how much it will be repaid. The payments of a floating rate loan may change as the interest rate changes, but even so,

this is known as soon as the new interest rate is set. Similarly, when making deposits, it is known how much profit will be made. For example, the difference between investment activities is clear. When making an investment, one cannot be sure of returns and losses. Banks also have investment activities, but from a traditional point of view, this fact distinguishes banks from many financial institutions. (Somashekar, 2009)

2.2 Bank's profitability and returns

After financial crisis in 2008, Europe and the rest of the world introduced a series of new regulations aimed at preventing the financial crisis from recurring. However, increasing regulation combined with competition and weak macroeconomic conditions, has meant that some of the banks' business, such as stock trading, has become significantly more expensive and even unprofitable. These changes in terms and conditions of business have been one of the main reasons for the return of the banking to the classical banking business in recent years. Indeed, the European Banking Authority shows that retail banking is most often referred to as the business segment, which banks are planning to invest in. (Djalilov & Piesse, 2016.)

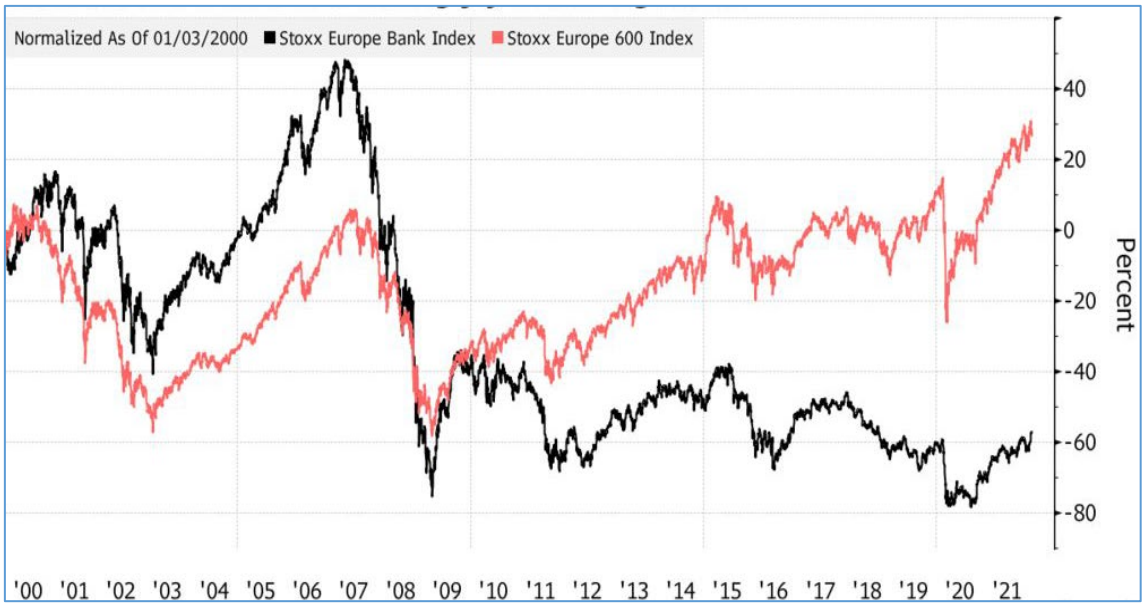

Figure 1. Banking index returns (Bloomberg, 2022)

As can be seen from the figure above, the banking stock index has fallen quite clearly behind the general index. This clearly means that banks have generated less returns than other industries, even negative returns. On the other hand, bank shares distribute averagely more dividends than the other industries, which slightly distorts the price trend. An important issue for the future development is whether capital should be raised at the expense of dividends. (Abreu & Gulamhussen, 2013.)

2.3 Measuring the performance

Like all companies, banks also have an obligation to make a profit for their owners. Owners, customers and the government are interested in banks' earnings and operations, so they also have a number of indicators to measure performance. This section looks at the key performance indicators for shareholders, as the topic of the study is bank returns to their owners.

The equity of a company consists of the owners' initial equity investments and the profits they leave on the company. The rate of return on equity is largely determined by the return requirements set by the owners. As a matter of principle, a company must be able to generate a sufficient return not only on debt but also on equity. Therefore, one of the most important metrics is return on equity (ROE). (Casu et al. 2006: 213–214.)

(1) $$\text{ROE} = \frac{\text{Net Income}}{\text{Shareholder Equity}}$$

(Casu et al. 2006:213.)

ROE is a useful indicator for comparing the success of companies' financial performance in the same industry. This ratio thus roughly represents the amount of income the

company has been able to generate on the equity of its owners. However, ROE is not an absolute truth for the company's financial performance, because sometimes high debt and low equity may distort the ratio better than it is. Then it is also important to know how much debt the company has.

ROE can also be calculated by multiplying the return on total capital and Equity multiplier together. This formula helps you to understand how much your company's debt has affected on the value of ROE.

(2) $$\text{ROE} = \frac{Net\ Income}{Whole\ Equity} * \frac{Whole\ Equity}{Shareholder\ Equity}$$

(Casu et al. 2006:214.)

For this study, Net Interest Margin (NIM) is an important indicator to understand, because one of the bank's most significant sources of income is interest incomes. Banks have to pay interest to their own financiers and then charge interest from their own debtors. The difference between these rates is called the net interest margin. (Casu, 2006:214.)

(3) $$\text{NIM} = \frac{Interest\ Received - Interest\ Paid}{Average\ Invested\ Assets}$$

(Casu et al. 2006:214.)

In recent years, banks' earnings performance has been under pressure due to record-low interest rates. The spread between average interest rates on loans and deposits has narrowed to an exceptionally low level. However, low interest rates are favouring borrowers and will keep demand for mortgages high. As chart 3 shows below, banks'

interest rates have fallen steadily since the 2008 financial crisis. In times of low interest rates, it is important to know what an interest rate risk is and how to bank can protect against it. As stated earlier, a change in interest rates due to changes in the market situation may result in significant costs and directly affecting the bank's earnings.

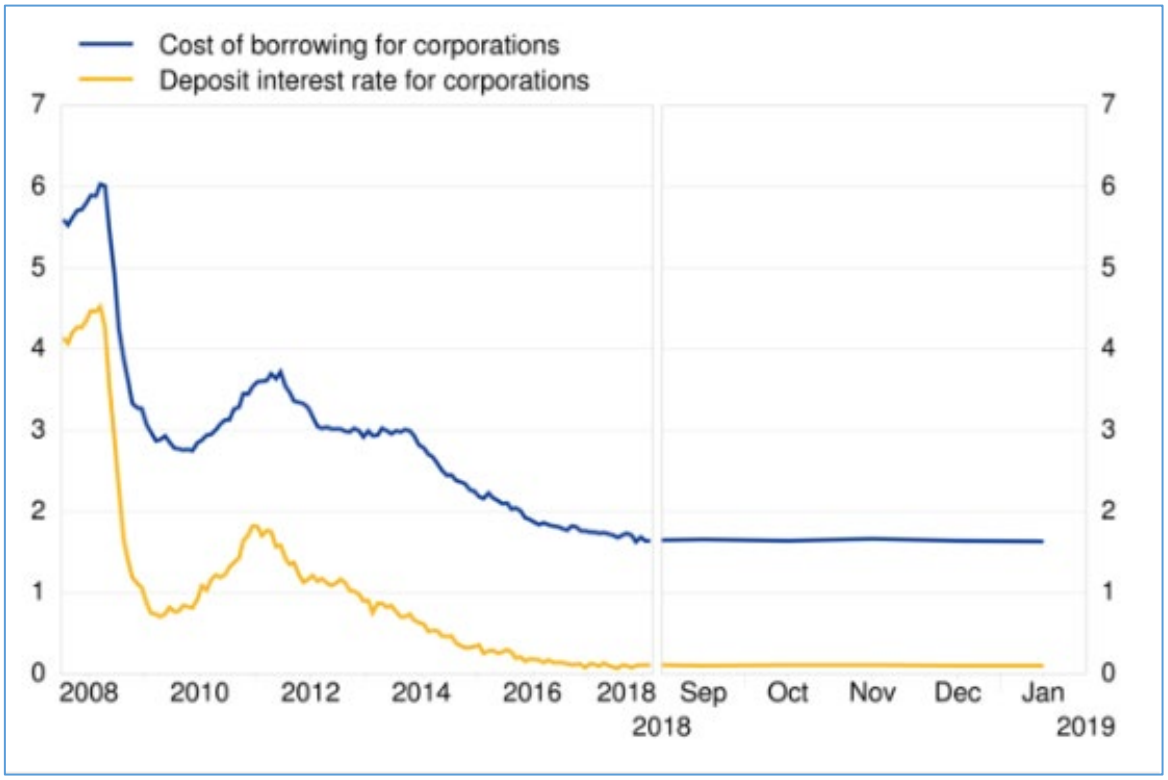

Figure 2. Banks interest rates on loans and deposits (ECB, 2019.)

As figure 2 shows, banks' NIM has declined and according to the ECB (2019), have remained below 2 for a few years. This means for banks that the average interest rates on loans have fallen in relation to the interest rates on deposits.

To summarize, it is now understood how banks' balance sheets affects to the bank returns and the importance of different interest rates in banking. It is understood that banks lend for a long time and take deposits for shorter periods for the duration of. It is also very important to understand the difference between short and long interest rates

for banks from the operational point of view. The following chapter is a closer look at banks' risk management, particularly from the point of view of interest rate risk.

2.4 Risk management

Bank risk management is one of the most important aspects for its profitability, hence stock returns. The main purpose of the risk management is to identify possible risks in advance, analyse them and take preventive measures to deal with risks or minimizing risks' impact. According to Freixas and Rochet (2018), banks' risk management can be divided into three groups; credit risk, interest rate risk and liquidity risk.

As previously stated, banks' interest rate risk is formed of assets and the length of their liabilities. The values of banks' assets, liabilities and off-balance sheet activities are affected by changes in interest rates because the present value of future cash flows will change with general interest rates. When trying to measure and deal with interest rate risk, it is very important to remember that exposure to interest rate risk affects future cash flow and, therefore, be aware of the uncertainty in measuring interest rate risk. Simply put, measuring the interest rate risk from the point of view of banks' risk management, is knowing, recognizing and predicting incoming challenges. (Freixas & Rochet, 2008)

Specher and Pertl (1983: 107-117.) also measure the value of risk management functions to a company. They assume that risk management techniques will prevent losses, and its control can reduce the negative effect of large losses. Risk management measures should also have a positive impact on shareholders. (Specher & Pertl, 1983.) However, because in this thesis we look at the impact of interest rates on bank stock's returns, we only look at the interest rate risk.

2.4.1 Interest rate risk management

Like other business risks, interest rate risk can be anticipated and managed in several different ways. As stated earlier in this thesis, banks' main income generation and operations are based, at least in some way, on interest rates. That is why careful interest rate risk management is central to the business of banking. According to Koch & MacDonald (2015), banks measure their interest rate risk either through the gap-analysis or duration-analysis. (Koch & MacDonald, 2015:56). For example, Shaffer (1991) examines the measurement and management of bank interest rate risk by means of duration and gap analysis. The study shows that differences between banks are due, among other things, to durations, elasticities and gaps. (Shaffer, 1991:17-27.)

2.4.2 Gap-analysis

Gap analysis measures, over a period of time, the difference between interest-bearing assets and liabilities, which is particularly important to be aware of in banking. If there are more interest-bearing assets than interest-bearing liabilities, they go up interest rates increase banks' returns. The traditional gap analysis focuses on the length of interest-bearing assets and liabilities.

(4) $$GAP=RSAs – RSLs$$

(Casu et.al. 2006)

Where:

RSAs= Rate-Sensitive Assets
RSLs= Rate-Sensitive Liabilities

(Casu et.al. 2006)

A bank's assets or liabilities are defined as interest-bearing if the cash flow responds in the same way as an interest rate change. For most banks, the Gap score is higher than zero, meaning that the ratio of assets to liabilities is higher. According to Casu et al. (2006) it is because that banks are lending money for longer period of time than they borrow themselves. In other words, banks lend money to customers with a longer maturity. The author also states in their book, that the relationship between banks' assets and liabilities should be managed in such a way that as interest rates rise, the gap narrows and when interest rates fall, the gap widens. (Casu et al. 2006). At this point it should also be remembered that bank debt is mainly deposits made by customers at very low interest rates, so the loan money is cheaper for the banks.

The gap analysis above does not take the passage of time into account because it is only measured over a specific time period. That is why the analysis may be unreliable in measuring the interest rate sensitivity of assets and liabilities. For example, it does not take credit losses or early loan repayments into consideration, which might change the gap significantly. That's why a maturity bucket has been developed based on traditional gap analysis. A maturity bucket analysis is an approach whereby banks' assets and liabilities are categorized according to their maturity. In this case, each category is computed separately, as well as the combined income of the various categories, whereby the combined profit - loss for each category must be zero. The Maturity bucket formula allows to illustrate better, how many different maturity assets and liabilities the bank has. (Casu et al. 2006)

Weighted Maturity Gap-analysis:

(5) $$M\ Gap = W_A RSA - W_L RSL$$

where:

$W_A RSA = \text{weighted average of interest} - \text{sensitive assets}$
$W_L RSL = \text{weighted average of interest} - \text{sensitive liabilities}$

The maturity gap model takes greater account of economic realities. It assumes that the assets and liabilities of the bank are liquidated at the settlement date price. If the maturity of assets is higher than the maturity of liabilities, the rise in interest rates will cause a larger drop in assets. (Casu et al. 2006)

Gap analysis is one of the first tools banks have adopted to measure interest rate risk and is still regularly used. Although gap analysis has been widely used, it has also received a lot of criticism, because the gap analysis doesn't take into consideration possible restructuring periods in the payment of interest or principal of the loans. The gap analysis also ignores the so-called basis risk, which means that interest and debts are fixed at different rates of interest. Casu et al. (2006) states in their book that the gap-analysis may over-simplify banks' risk management, which can easily lead them to erroneous assessments.

Although the gap analysis is not a perfect model for bank risk management, it is still used in many studies. For example, Reeta (2016) find out, that the gap analysis has produced reliable results from Indian private and public banks. As a result, the author states that "all the banks have done their assets-liability management very well and they have positive value of gap throughout the research period". This positive value of gap also means that banks are able to benefit from interest rate changes, when their rate sensitive assets are larger than rate sensitive liabilities. (Reeta, 2016)

2.4.3 Duration analysis in banks' risk management

Duration, or effective maturity, refers to the price sensitivity of a debt instrument to its ratio changes in interest rates. Duration can be used to quickly estimate changes in

present value with a sufficient degree of accuracy in situations where it is not desired to discount all cash flows of a bond by calculating the exact change in present value. When talking about duration, it is usually referred to as Macaulay's duration. The aim is to develop a formula for the change in the present value of a fixed rate bond, which would be a more informative method than maturity. (Tuhkanen, 2006)

In banks, the duration differs from the maturity, for example the repayment schedule of loans granted by banks includes interest and principal. The maturity and duration are only then the same when loan is paid all at once back. For example, the duration of a ten-year coupon bond might be eight and a half years, because part of the investment will be repaid in coupon rates since the first year. The larger the duration is, the greater the impact of interest rate changes are on the economic value. (Casu et al. 2006)

Duration analysis of banks simulates Macauley's duration. It calculates the duration of the bank's total assets and liabilities instead of bonds.

(6) $$D_1 = 1 * \frac{C_1/(1+Y)^1}{V} + 2 * \frac{C_2/(1+Y)^2}{V} + \cdots + n * \frac{C_n+P_n/(1+Y)^n}{V}$$

Y = bonds yield
C = coupon rate per year
P = principal payment
n = maturity of the bond (years)
V = the present value of the bond
(Casu et al. 2006)

As it can be seen from formula 6, it takes into consideration more closely the market value of cash flows. Gap analysis focuses more on the book value of assets and liabilities. To find out the difference between the duration of a bank's assets and its liabilities, it

must be used a combine formula from duration analysis and gap analysis. According to Casu et al. (2006) it is called duration gap analysis:

(7) $$DG = (D_A - \frac{L}{A} D_L)$$

Where:

A = market value of assets
L = market value of liabilities
D_A = duration of assets
D_L = duration of liabilities
L/A = gearing ratio
(Casu et al. 2006: 194.)

Now it is known the difference between the duration of assets and liabilities, however it is still needed interest rate factor to see its impact on the bank's value of the capital. It can be calculated:

(9) $$\Delta E = -DG\left(\frac{\Delta r}{(1+r)}\right) A$$

Where:

ΔE = bank's equity change
DG = duration gap
Δr = interest rate change
A= market value of assets
(Casu et al. 2006)

Thus, the duration gap analysis allows banks to manage the interest rate risk on assets and liabilities. According to Ghosh (2015), banks should strive to minimize the gap

between interest-bearing assets and liabilities. However, he states that in practise it is impossible to get the zero-difference in gap. In contrast, banks should seek to minimize either negative or positive gaps by using different tools, such as forward rate agreements, derivatives or interest rate swaps. This also means, that banks should invest in more shorter products, which carry less risk than long ones. (Ghosh, 2015)

Example of duration gap:

- 400 mil. € assets
- 300 mil. € liabilities
- 80 mil. € equity
- the maturity of assets is 4 years
- the maturity of liabilities is 3 years
- interest rate increases from 4,2 to 4,4 per cent

DG = [4-(300/400)3] = 1.75, which means that the gap between interest sensitive assets and liabilities is 1.75 million euros.

ΔE = -1.75[0.20/ (1+0.042)] * 400 = -1.34 million euros

This example shows, that if interest rate increases by 0,2 percent, the bank's value of equity decreases by 1,34 million. This proves that even a small change in interest rates will cause quite a big change in the bank's value of equity and interest rates should be effectively hedged. The following section will look more closely at interest and its definition in order to get better understanding about its role in banking.

3 Interest rate

This section describes what interest rate means and how different interest rates are formed. In addition, it is looked at how interest rates affect the bank's operations and the value of bank stocks. At first, it is shown the interest rate function and the definition at a general level.

3.1 Definition of the interest rate

Simply put, interest is the price or time value of money. It is a kind of compensation that the borrower pays to the lender for its maturity. The interest rate has usually expressed as a percentage over a given period, which is typically one year (360 days). Market interest rates are affected by the length of the loan period (maturity), lender's creditworthiness, market liquidity, and from which point are looked at interest rates. (Schmidt, 2017)

The main function of the interest rate is to create an incentive to borrow money. This leads to the allocation of surplus sector funds to the deficit sector and it will bring the market to the most efficient use where everyone can win. For example, large investments and development would not happen without efficient allocation of funds. Financial market products are also priced through interest rates, such as Libor and Euribor. (Schmidt, 2017)

Interest rate can also be seen as a significant part of investment activity. When an investor invests in a company, he demands a return on it. Thus, this is a premium (interest) to the investor on risk taking when owning shares of the company. Optional interest rate is also used to calculate the present value of future cash flows. In this case, the interest rate is the discount on cash flows.

3.2 Nominal interest rate and real interest rate

The definition of interest is almost 100 years old, but it is still valid to be used. According to Fischer (1930), the interest rate is divided between the nominal interest rate and the real interest rate. Nominal interest rate is the interest that is entered in a loan or deposit agreement and is paid by the mortgagee to the bank for his mortgage or received by the depositor from the bank for his savings. However, it is also important for borrowers and investors how much goods, services or other consideration they receive for their money. It is called the purchasing power of the money. Purchasing power tends to decrease over time due to inflation, or rising consumer prices. (Fischer, 1930:14). Because of these factors, it is not always sensible to talk about the nominal rate, because it does not tell the whole truth about the price of money. By deducting purchasing power (inflation) from the nominal interest rate, the real interest rate can be calculated:

(6) $$r = \frac{1+i}{1+p} - 1$$

(Fischer, 1930:34, the real interest rate)

Where *i* is the nominal interest rate and *p* is the inflation rate. The real interest rate can also be roughly calculated:

(7) $$r = Nominal\ interest\ rate\ (i) - inflation\ rate\ (p)$$

(Fischer, 1930)

3.3 Risk free interest rate

According to another definition, the risk-free interest rate is the rate at where the investor can expect to get his investment in a long-term government bond. In the definition

of Emott (2011), he assumes that a long-term government bond has a decent credit rating and financial standing. For example, the US long-term bond is expected to be that way. (Emott, 2011)

While the designation of risk-free interest implicates something else, it is not completely risk-free. In reality, risk-free interest rate reflects a level of market risk that cannot be diversified by any means. This is called systemic risk. Therefore, systemic risk is the smallest possible risk prevailing in the market at the certain time. In practice, systemic risk is linked to the state; the functioning of society, infrastructure, the legal system and the functioning of financial markets. Anyone active in the investment market must be located in a state where the investor is exposed to systemic risk. Any other investment risk taken, and thus the required return, comes on top of this risk-free rate, which is the premium on the risk-free rate. This is an essential aspect of financial theoretical pricing such as the CAPM model or option pricing. (Pratt, Grabowski & Brealey, 2014)

Pratt et al. (2014) also state in their book, that the change in inflation levels has no effect on the real interest rate, because it is the nominal interest rate minus impact of inflation. The inflation and risk-free interest rate ratio are directly proportional. With inflation expectations rising, investment's yield requirements of the companies are increasing. That means that the risk-free interest rate level also increases. Similarly, as the inflation expectations fall, investors' return expectations fall, meaning that the risk-free interest rates will fall. (Pratt et al. 2014)

3.4 Interest rate and risk premium

As stated earlier, interest rates vary according to different factors. In this paragraph, it is focused more on the factors that make up different interest rates. In practice, this means that the riskier the benefit, the higher the interest rate (premium) required. In their book, Pratt et al. (2014) define how interest rates are structured. The market interest rate consists of a risk-free interest rate plus a market risk premium. The risk-free interest rate

consists of the sum of three components: inflation, real interest rate and maturity. As stated before, a risk-free interest rate does not mean that the investment is completely risk-free, but that it represents the lowest risk return. The risk-free interest rate reflects the level of market risk that cannot be diversified in way. Generally, the yield on a government bond with a maximum term of 10 years has served as a benchmark for risk-free interest. The shorter the maturity, the less risky it is thought to be, because there is almost no chance that a solvent state, for example, would go insolvent in a few months. (Pratt et al. 2014). For example, even if the bonds have the same level of risk, liquidity and tax treatment, their return expectations will vary. This is because, over time, bond yield requirements vary by maturity. (Eakins & Mishkin 2000). Theoretically, as maturity extends, yield requirements as interest rates are rising.

Why longer bonds are required for higher yields? Generally, it can be seen that a higher yield requirement is based on a higher yield risk. This higher risk is partly due to inflation because the real return on purchasing power is below the nominal return. In this way, income expectations need to be raised to offset the negative effects of inflation. If inflation expectations are rising in the future, then this raises yield requirements for long-term debt, whereas the opposite is true for lowering inflation expectations. (Musgrave & Musgrave 1985)

3.4.1 Risk of maturity

Maturity risk means compensation that we do not know about future prices and changes. In addition to the loan repayment assurance associated risks increase with longer maturities due to price and economic fluctuations cannot be known in advance. (Fabozzi, 2000). Therefore, the longer the maturity of the loan is, the higher the premium the lender usually wants to have. As the maturity of the loan increases, the interest rate will normally increase. For example, the interest of the 12-month government bond is usually higher than the 1-month bond. The figure below shows the yields on US bonds with different maturities. It illustrates the maturity and required return.

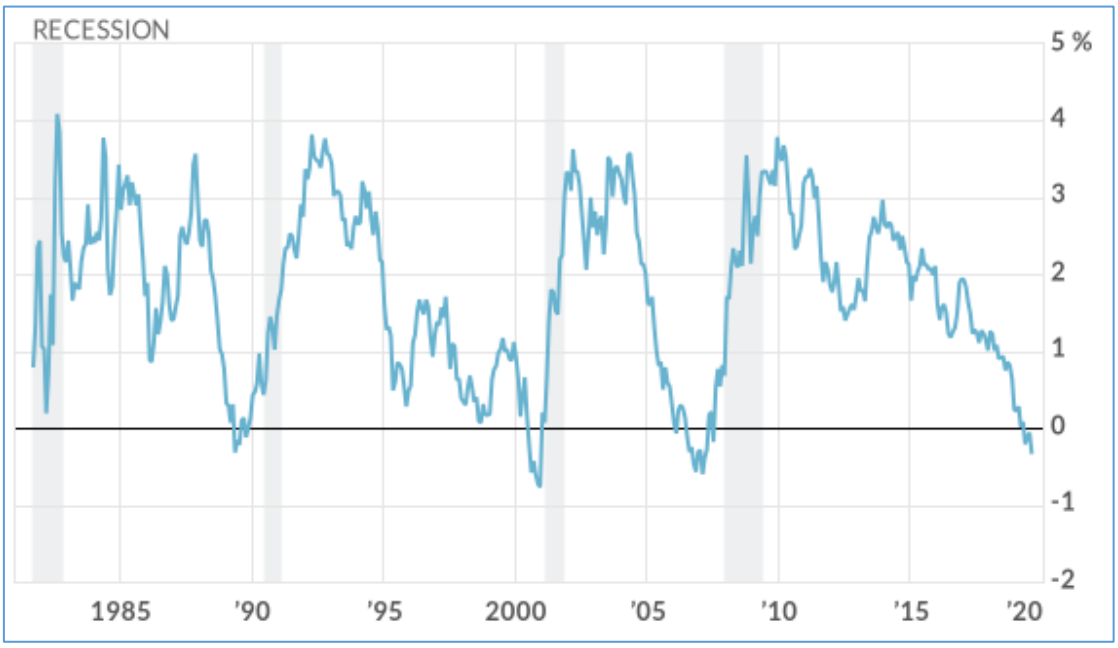

Figure 3. 10-year yield minus 3-month yield (CNBC, 2020)

As the yield curve shows above, the spread between 10-year and 3-month interest rates is mainly positive. As early mentioned, this is due to the maturity risk. We can also see from the chart that at relatively even intervals, the spread between long- and short-term bonds has decreased negative. In history, moments in which short-term interest rates have outstripped long-term interest rates have often led to an economic downturn. The interest rate differential is an important predictor of future economic growth, as the flattening of the interest rate curve and the reversal of interest rates has preceded every US recession since the Second World War. (Estrella & Miskin, 2006.)

In this thesis, interest rate differentials have a great importance for bank equity returns. When considering banks' balance sheet structure in banking theory section, the difference between long and short interest rates should affect banks' returns. Thus, it has now been found that interest rates affect banks in many ways. Balance sheet structure, income generation and risk management are at the core of the banks in terms of interest rates. The following section explores the valuation of a share and the impact of interest rates on share performance.

4 Stock valuation

This chapter discusses how to determine the value of a share to help you understand how a bank's share price is formed. The main objective is to determine the theoretical value of the company (share), as it may differ a lot from the market value. Bank stocks are commonly valuated in the same than any other stocks.

Value theories are used to describe various financial characteristics of a company factors as factors affecting the course. The content of these factors has been discussed extensively, as the effect of dividends on the market value of a share has been made studies with varying results. The starting point for valuation theories is business maximizing market value. It is also assumed that the company's market value maximization also maximizes shareholder wealth. (Peelo, 2019.) On the other hand, the purpose of valuation models is to provide regardless share value which is not affected by random fluctuations. Valuation model abusers are both corporate management and potential shareholders. Value models can be used to study the impact of different information per share value. (Copeland-Weston, 1988:360-363.)

As a rule, the time value of money is considered in the stock valuation. Time value refers to the price of future cash flows today, which is normally lower now than in the future. It is influenced in many ways, for example by inflation, uncertainty and liquidity factors. The most important valuation models based on time factor are dividend models, profit based models and cash-based models. (Auerbach, 1979)

4.1 Dividend based model

The dividend-based model is a traditional stock valuation model. Based on that, free cash flow and value models are also being formed. This valuation is based on the fact, that the value of the share equals the future share value of dividends. Since there is no time limit for the equity investment, it is formed the value of the share from the perpetual

dividend flow. Equity investors' return requirement is used as an interest rate to discount current dividends in the coming years.

Based on dividends, it is developed a formula for stock valuation:

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \cdots + \frac{D_t}{(1+r)^t} + \frac{D_t(1+g)}{r-g} \quad (8)$$

Where:

P_0= Share value today

D= dividends in year = 1, 2, 3… n

r = stock's yield requirement

g = dividend growth rate

(Kallunki & Niemelä, 2007)

If the dividends grow at a steady rate each year, the formula becomes simpler:

$$P_0 = \frac{D_1}{r-g} \quad (9)$$

Where:

D_1= dividend in year one

r = stock's yield requirement

g = dividend growth rate

(Kallunki & Niemelä, 2007)

According to formula 9, the current value of the company is the dividend payable this year divided by the difference between the yield requirement and the dividend growth rate. The formula can be seen that the closer are the interest rate r and growth factor g estimates, the higher the stock value. It means that the growth factor value cannot be greater than, or even equal to, the interest rate factor because then the value of the share would be infinite. According to Penman (2010), the advantage of the dividend-based model is that the dividends are the practical benefits which the shareholders get, so using them for stock valuation justified in this case. Dividends are usually stable in the short term, so short term dividends are also easy to predict. On the other hand, Penman also states that short-term dividends have no great impact to the value of the company, so longer-term forecasts will be needed. (Penman, 2010)

Although this model is very commonly used, there are still problems with it. For example, dividend-based model can give distorted results for company value, when a corporate share only part of the dividend of the earnings. Dividend policy also varies greatly between companies and may change rapidly from year to year. The predictability of dividends also poses a problem, because dividend forecasts are only available for one or two years while the availability of earnings forecasts is clearly better. When determining the value in formula 9 in line with the dividend growth pattern, the dividend must be assumed to be flat growth. However, in practice the dividend flow is rarely so steady. (Levy 2002)

4.2 Capital Asset Pricing model

When looking at the bank stock yield requirement, it is valid to use the Capital Asset Pricing model (CAP) developed by Sharpe (1964). The CAP model is a stock pricing model used for a single stock or to calculate the expected return on a portfolio. The model is based on the idea that higher expected returns can only be achieved by increasing risk. The model can be used to estimate how large the return on an investment with a particular risk should be. (Sharpe, 1964)

According to Sharpe (1964), the model starts with some restrictive assumptions. It is easy to see that not all assumptions are fulfilled in practice. The CAP model is also simple, making it easy to question its functionality. However, the model provides a reasonably good description of stock market returns and help to understand stock market behaviour.

1. There are no trading cost and shares can be bought and sold without transaction costs.
2. An investor can invest as much as he wants in each share.
3. There are no taxes. In this case, the investor is not interested in whether there will be a return on the share in the form of dividends or price increases.
4. Investors cannot influence the prices of investment objects through purchase and sale orders. Investors are price takers, so there is full competition in the market.
5. Investors make investment decisions based on the expected return on the portfolio and standard deviation.
6. Short selling is allowed without restrictions. The investor will then have the opportunity to take a negative weight on the investment
7. An investor can invest risk-free and get unlimited loans at the same interest rate.
8. Investors have similar expectations regarding the return and risk of the investment. Everyone invests for the same period based on expected return and standard deviation.
9. All capital goods are available for sale and purchase, including human capital.

Sharpe himself states that the assumptions above are unrealistic, but the validity of the theory does not depend on assumptions but on accepting the implication of it.

The CAP model formula:

(10) $$E(R_i) = R_f + \beta[E(R_m) - R_f]$$

where:

E (r_i) = expected return on stock *i*

r_f = risk free rate

β_i = beta of the stock

E_{Rm}= expected return of the market portfolio

(Sharpe, 1964.)

The Cap model is able to outline where banks' yield requirement arises. For banks, the discount rate used in valuation models is also risk-free rate plus market risk. Banks' beta factor is used to determine how sensitive a bank's stock is to the market. Beta reflects systematic risk, that is, how exposed a security is to market fluctuations. A beta value of 1 means that the yield on the security fluctuates completely with the market. If it is less than 1, the return fluctuates less than the market return. If a beta is more than 1, the yield on a security fluctuates more than the market and now the yield requirement is higher than the market risk premium. When the beta is zero, this means according to the CAP model, that the yield requirement corresponds to the risk-free rate of return. (Fama & French 2004)

The CAP model also has its problems. When the model is tested in practice, a variety of issues are encountered. First of all, stock returns have a large variance which undermines the reliability of the tests. For example, when estimating beta, high volatility results might give misleading estimates. Those stock market indices are bad substitutes for the market portfolio because market portfolio cannot be detected in practice, which makes CAP model testing impossible as well. This is known as Roll's Critique (1977). There is also a problem with the actual returns used in tests because the CAP model has expected returns. (Bodie, Kane & Marcus, 2005)

However, despite its grievances, the cap model is a commonly used tool for estimating relation between company's risk and returns and the CAP model continues to provide good investor information, and at least in theory, these often still work well. However, the problems of modern financial theory should be acknowledged and developed with an understanding of the functioning of markets, investor behaviour and phenomena that modern theory cannot explain.

Now, when considering the banks' profit function, it is known that banks' profits are affected by the difference between long and short interest rates relative to the balance sheet structure of banks. Based on the theory above, formula 9 suggests how increasing the difference between long and short interest rates should have a positive effect on bank returns, since it is known from the theory of banks that banks' assets are tied longer than bank's debt. At the same time, increasing profits should also increase the dividend return. Based on the theory, it is possible to say how a widening interest rate differential should be very positive for bank shareholders and earnings.

5 Literature review

This chapter examines how different interest rates and their fluctuations have affected on bank equity returns. At first, it is reviewed how equity market changes have affected on the stock market in general to get a better understanding of its impact. After that will be considered the impact of interest rates on banking stocks, which gives us information if the reactions of other industries differ from banking stocks.

5.1 Impact of interest rates on stock market

The general investment environment has changed over the last 10 years compared to the past. As a result of financial crisis 2008, global interest rates fell to a very low level. Federal Reserve System (FED) raised its key interest rate for the first time in eight years, which reflected the widespread market disruption caused by the financial crisis. Since then, the Fed has steadily raised its key rate until June 2019, after which interest rates have again fallen to near zero. It is also noteworthy that, at that time, the key interest rate rose to only 2%, which is well below what we are used to. The European Central Bank is also in line with the Fed. It has never raised interest rates since 2011, and since 2016 the policy rate has been 0 percent. (ECB, 2019). At the same time, the new low interest rate has changed the investment environment, when the return on fixed income investments is no longer the same as in the past and as a result investors' assets have applied for shares.

Kurov and Raluca (2018) state in their article, that understanding monetary policy and interest rates is important for the investor as it helps to anticipate market reactions, for example caused by news coverage. Positive financial news also signals a stable economy, which is directly reflected in the profits of the companies and thus in the individual stocks and stock markets. This also has an indirect effect on the general interest rate level, which should increase during good economic development and tightening of the equity risk premium as a result of monetary policy. Because current interest rate

environment can be considered as a condition of high monetary uncertainty, the risk level and equity risk premiums are sensitive for bad financial news. That is why it can be assumed that stocks are also vulnerable to bad financial news and thus interest rate increases. (Kurov & Raluca, 2017)

Especially in the US, the impact of interest rate changes on the stock markets has been extensively studied. The aim of these studies is to understand how stocks respond to interest rate increases and decreases and can the stock market be predicted based on past interest rate changes. In the current low interest rate environment, attention should be paid to future interest rate peaks.

Kontonikas, MacDonald and Saggun (2013) study those impacts widely. Their study examines the reactions of US stocks to the FED interest rate changes between 1989 and 2012. According to Kontonikas et al. (2013), stock prices rose as the FED lowered its policy rate. On the other hand, during the financial crisis, stock prices did not respond positively to interest rate cuts. According to the study, this unusual reaction is due to the fact that after the crisis, loose monetary policy was indicative of weak economic conditions. During the financial crisis, it was not known how investors in the stock market will react to the interest rate cut as the macroeconomic situation overheated and zero interest rates approaching. For example, in 2009, the US stock market plummeted at the same time as the FED lowered its interest rates, which didn’t match the theory about the impact of a fall in interest rates on the stock market. The study shows that during the period outside the financial crisis, a one percentage point decline in the Federal Reserve's interest rate raised the S&P 500 index by almost 4%. (Kontonikas et al. 2013)

Jensen, Johnson & Bauman (1997) also investigate the impact of interest rates on stock markets. Their study includes sixteen different industry indices between years 1968 and 1991. They find out, that changes in interest rates has an impact on stock returns. The authors also assume, that there is no significant difference between short-and long-term interest changes. Especially when interest rates were downgraded, stock markets

reacted strongly. (Jensen et al.1997). In turn Jareno, Ferrer and Miroslavova (2016) explain that there are differences in impacts between different industrial sectors. Consumer staples, financials and utilities sectors would appear to be more sensitive to interest rate fluctuations in US and the sensitivity is higher within extreme financial situations, for example during recession. (Jareno et al. 2016.)

The impact of US monetary policy (interest rate change) has also been widely studied worldwide. In their study, Bernanke & Kuttner (2005) find out that a 0.25% decline in the Fed's interest rate mean a 1% increase in the US stock index. Chen & Gao (2013) also discover in their study, that US monetary policy and stock markets correlate positively with each other in the long run. They also mention that the FED has generally raised its interest rates in times of strong economic growth and, on the other hand, lowered interest rates in downturns. However, it is also important to know that interest rate changes affect the stock market with a lag, as changes are usually the result of market events. This means that stock markets will grow approximately 2 years after the interest rate decline. (Chen & Gao, 2013)

5.2 Impact of the interest rate on banking stocks

As mentioned earlier, interest rate changes have a massive impact on stock market and on economy generally. It has also been shown that different industries and companies respond differently to changes in interest rates.

Among others, English, Van Den Heuvel & Zakrajsek (2018) study the interest rate risk on bank stock returns. They argue, that there are many different ways how interest rate changes affected on banks' operations and returns. First thing that English et al. (2018) figured out was that the higher the bank's maturity gap, the more sensitive the change in the interest rate is to the bank's stock price. According to the authors, this means that banks with a small GAP are somehow hedged against interest rate risk, for example through derivatives. (English et al. 2018.)

The other thing that English et al. (2018) studied is banks' balance sheet structure aspect. If the bank's balance sheet has a significant amount of debt and is financed by customer bank deposits, then the stock is also more vulnerable to interest rate changes negatively. That's because bank deposits are more sensitive on interest rate changes and the money will be more expensive for banks to hold on. There is also a third factor that English et al. (2018) found out. They assume that if bank has significantly more assets than average, they are also more sensitive on surprising interest rate changes. For example, if bank has 500 billion in their real assets and other factors are in median level, 0.25 percent rising in interest rates will decline its stock by 3,8 percent. On the other hand, if bank has median assets, the change will only effect by 1.8 percent decline on bank stock value. (English et al. 2018)

Also, Ying, Yang and Handorf (2010) research how FED's interest rate changes are affected on bank stock returns in US between 1988-2007. In their study, the authors perform that banking stocks will react much more strongly when interest rate changes were unexpected or unpredictable. When the change was known in advance, the earnings and prices of bank shares did not differ significantly from other shares. (Ying et al. 2010.)

Priti (2016) investigates about the impact of interest rate changes on bank stocks in the U.S. markets. As mentioned earlier, the author states that bank stocks are commonly more sensitive to interest rates changes than other industries. According to the author, the size of the bank has no significant bearing on the sensitivity. In the study, the author states that banking stocks are more sensitive to bad news rather that good news regarding interest rate change. Also, for the duration of the interest rate (3 months or 10 years) is not relevant to the sensitivity of the reaction. This clearly supports the fact that banks should carefully hedge against changes in interest rates, for example by assessing capital adequacy and following the regulations. (Priti, 2016). As well as Priti, Ying et al. (2010) find that the size of the financial institution has no significant meaning when looking at

the impact of interest rate changes. From this fact it can be concluded that banks' balance sheet structure and income generation are similar regardless of their size.
To gain more evidence from the impact of interest rate changes on bank stocks, it is valid to view other than the U.S. markets. Borio, Cambacorta and Hofmann (2015) study the impact of interest rate changes on bank stock returns worldwide, between years 1995-2012. They also find out that interest rate changes have wide impact on bank stocks in many ways. They argue that higher rates and a steeper yield curve will increase banks' returns, but the study also showed negative aspects. If short-term interest rates are increasing and yield curve gets steeper, it will give rise to banks assets. That is why, because those changes will increase banks' net interest income, as they raise bank interest margins and returns from maturity transformation. On the other hand, Borio et al. (2015) mention, that higher interest rates might cause credit losses and decrease interest free incomes. As mentioned earlier, increasing in interest rates also transfers money from stocks to bonds, which directly affected on stock prices. (Borio et al. 2015.)

Positive dependence of the interest rate and bank stock returns was also supported by the study of Vaz, Ariff and Brooks from 2008. They study the impact of publicly announced changes in official interest rates on Australian bank stock returns. Unlike in Europe or the U.S., they state that the rise in interest rates even had a positive effect on bank stock returns. Vaz et al. (2008) assume, that this may be due to Australia 's relatively independent economy and less competition between banks. (Vaz et al. 2008.)

As several authors have shown above, changes in interest rates have implications for both banking stocks and the stock market in general and the length of the interest rate does not seem to matter to the sensitivity. Thus, according to studies above, the size of the bank and its balance sheet structure are most sensitive to changes in interest rates, which in turn have a direct impact on the share price. As Priti (2016) states in the article, banks need to be prepared for interest rate changes in advance, which is also a significant factor in their risk management and returns. (Priti, 2016)

6 Data and methodology

The following section discusses the type of data used to study the effects of interest rate changes on bank stocks in the United States and describes the methodology used in the study.

6.1 Data

The study period is 2012–2021, and monthly data are available for this period both the interest rates and the banks listed in NASDAQ, NYSE and AMEX. All data is extracted using a data stream to maintain integrity. The time interval used is large enough interest rate fluctuations to give us evidence of what the real impact of interest rate changes has been on bank stock returns. This period has been chosen as the data because it excludes the effect of the 2008 financial crisis, but on the other hand, it is examined how changes in low interest rates have affected bank stock returns.

The U.S. 10-year Treasury bill rate is used as interest rate in the empirical section. Three different portfolios of banks listed on the NASDAQ, NYSE and AMEX in the United States are used as an explanatory factor. I have divided these banks to Small, Midsize and Large asset portfolios according to the banks' balance sheet assets. The assets of small banks are less than 8 billion dollars, the assets of medium-sized banks are 8-60 billion dollars, and the assets of large banks are more than 60 billion dollars. In order to make the data comprehensive and relevant, it has been adjusted, for example, stock splits and de-listings, as well as observations that differ greatly from other data. Additionally, there were so many small banks that they are limited to 200 per month to ensure uniformity.

S&P500 general index is used as a market factor, because it is a market value weighted index compiled from the prices of the 500 largest stocks in the U.S. market, and describes well the stock market trend in the U.S.

All returns per share have been calculated on a monthly basis as follows:

(11) $$R_t = \frac{(P_t - P_{t-1})}{P_{t-1}}$$

Where:

R_t= Return of the stock at time t.

P = The value of the stock at time t.

6.2 Methodology

In this study, an ordinary least squares (OLS) regression model is constructed to find out how changes in interest rates have affected the returns of banking stocks in the U.S., also taking into account the size of the bank as measured by balance sheet assets. This study hypothesizes the model between U.S. banking stocks, S&P500 Index and the U.S 10-year Treasury bill rate.

Three different regressions are formed from this function that answer the questions of whether interest rates changes affect bank stock returns in the United States:

(13) $$USB_S = \beta_0 + \beta_1 MKT + \beta_2 TBR_{10-year} + \varepsilon$$

(14) $$USB_M = \beta_0 + \beta_1 MKT + \beta_2 TBR_{10-year} + \varepsilon$$

(15) $$USB_L = \beta_0 + \beta_1 MKT + \beta_2 TBR_{10-year} + \varepsilon$$

Where:

USB_S = U.S. small banks portfolio return.

USB_M = U.S. midsize banks portfolio return.

USB_L = U.S. large banks portfolio return.

$TBR_{10-year}$ = Change in U.S. 10- year Treasury Bill rate.

MKT = Market factor (S&P 500)

β_0 = Constant

$\beta_1 \; and \; \beta_2$ = Sensitivity of the variables.

ε = Stationary error correction term.

Based on the theoretical part of the study, four hypotheses are formed as follows:

H1: The change in the interest rate can explain the returns of the U.S. bank stocks.

H2: There is a negative relationship between returns of U.S. Bank stocks and U.S. 10-year Treasury bill rate.

7 Results

This chapter reviews the results of empirical study. First the variables used in the tests are reviewed, after which the regressions made from different portfolios are examined in more detail and examined results obtained. In addition, the returns of the formed three bank portfolios presented and compared to each other, as well as to the S&P 500 index, which acted as a market factor in this empirical study.

7.1 Descriptive statistics

Table 1 shows the features of the variables used in the regressions. The first three variables are the explanatory factors (Small, Midsize and Large banks) in the table describing the portfolios used in the regressions. There are a total of 120 observations for all factors, which means 120 months of returns in portfolios and the S&P 500 index. Regarding the 3-month T-bill and 10-year T-bill, there are 120 observations on the interest rate fluctuations in question. Descriptive statistics table also shows the mean, median, standard deviation and other statistics to support the empirical study.

Table 3. Descriptive statistics.

Variable	*Small*	*Midsize*	*Large*	*S&P500*	*Δ 10 year T-Bill*
Mean	0.0125	0.0086	0.0079	0.0119	0.0047
Median	0.0156	0.0147	0.0126	0.0179	0.0113
Minimum	-0.2404	-0.2935	-0.3206	-0.1251	-0.3805
Maximum	0.1448	0.1638	0.2193	0.1268	0.3091
Standard Deviation	0.0468	0.0627	0.0631	0.0377	0.1134
No. Of observations	120	120	120	120	120

Sample period 1.1.2012 - 31.12.2021

The table (3) above shows the features of the variables used in the regressions. The first three variables are the explanatory factors (Small, Mid and Large banks) in the table describing the portfolios used in the regressions. It is interesting to see how the portfolios used in the study have behaved during the analysed period. Small banks portfolio has

returned during the period under review, an average of 1.25% per month, while the medium-sized portfolio has returned 0.86% and the large bank's portfolio 0.79% per month. This shows how small banks have created more returns the period under review than medium-sized or large banks on average. The market, in turn, has returned the period under review an average of 1.12% monthly, so the average market returns ended up between small banks and medium and large banks. However, in relation to portfolios, it should be taken into account, that the returns have varied largely on a monthly basis, especially when it comes to small bank portfolio. Between 2012-2021, the largest positive monthly return was 14.5% and the largest negative return was -24.04% in small cap portfolio, excluding the collapse caused by Covid19 in March 2020.

Throughout the period under review, the largest fluctuations occurred in March 2020, when Covid19 started to spread around the world, causing the biggest drop in the stock market since the 2008 financial crisis. As at March 2020 the small banks portfolio returned -24.04%, the midsize banks -29.35% and the large banks -32.06%. According to the size anomaly (Banz, 1981), the risk-adjusted return on shares of small companies is better than on shares of medium-sized or large companies. An attempt has been made to explain the higher returns of the shares of small companies by the fact that there is less news about them, i.e. there is not enough information available for price formation. In addition, the risk inherent in small companies is greater and the liquidity of the shares is weaker. Over the years, the company size anomaly has weakened despite the fact that the risks of small companies have not decreased but even increased, if the risk associated with these companies is measured by volatility or market risk.

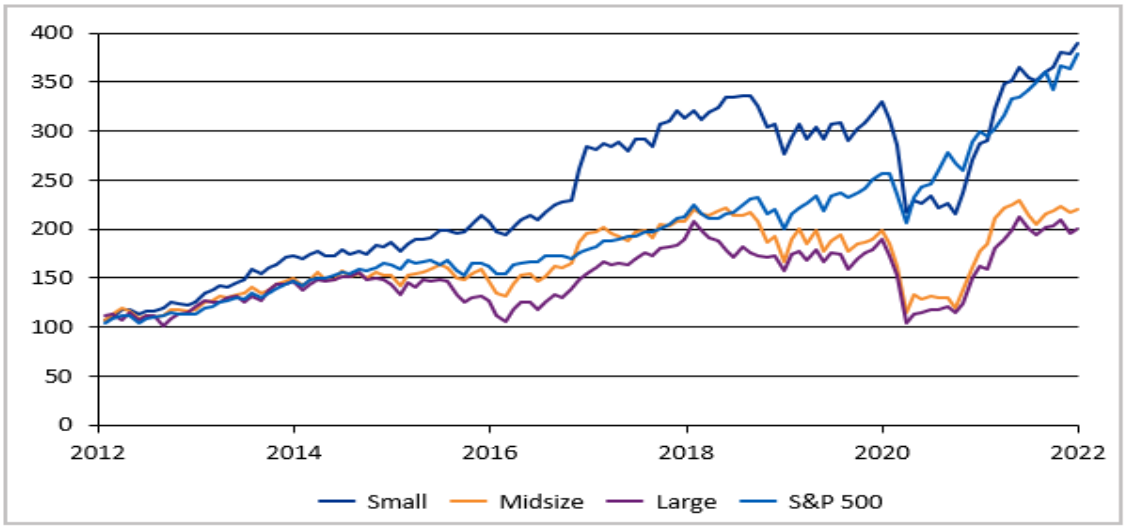

Figure 4: Cumulative monthly returns of Small, Midsize, Large and the market index used (S&P 500).

7.2 Results of the regressions

In this section, it is presented the results obtained from linear regression (OLS). The purpose of the regression was therefore to find out how much the fluctuations of the U.S. 10-year T-bill have affected the returns of banks of different sizes. As stated in the theory section, a rise in interest rates should lower stock prices, and a fall in interest rates, on the contrary, will raise stock prices. In the period 2012-2021, the general interest rate, especially in the United States and Europe, has been extremely low during that period, so this study aims to find out whether interest rate increases or decreases affect bank stocks as expected, even though interest rates remained low in general.

Regression analysis of the impact of interest rate changes on bank stocks in US stock markets

Sample period 1.1.2012-31.12.2021 (Up and down market days)

	Small banks	Midsize banks	Large banks
Intercept	0.41 % (1.907)*	-0.42 % (-1.275)	-0.51 % (-1.354)
MKT (S&P500)	0.633 (8.794)***	0.982 (11.266)***	1.017 (10.140)***
Δ 10 year T-Bill	0.198 (8.281)***	0.246 (8.497)***	0.192 (5.759)***
Sample size	120	120	120
R Square	0.640	0.706	0.616
Adj. R Square	0.634	0.701	0.609

*** Significant at the 0.01 level
** Significant at the 0.05 level
* Significant at the 0.10 level

Table 4. Regression results.

The table (4) above shows the results of the regression analysis for all formed bank portfolios, of which the results of small bank portfolio are examined first. When interpreting the regression results, it is important to first look at the model's adjusted R Square, which practically means how much the regression model can explain the returns of the formed portfolio. It can be noticed that the adjusted R Squares of the regressions are 60.9% for large bank portfolio, 63.4% for small bank portfolio and 70.1% for midsize bank portfolio. The obtained results of the adjusted R Squares are quite good, but it can be concluded from them that some of the returns of bank portfolios can also be explained by factors other than the market and the interest rate, which will be considered later in this results section.

Regarding to the intercept variable, it can be seen, that formed regression models do not generate alpha a lot. Only for small banks, intercept is positive (0.41%) and statistically significant with 10% accuracy, with a t-value of 1.907. For midsize and large banks, intercepts are between -0.42%-0.51%, but they are not statistically significant.

When interpreting the coefficient obtained for the market factor, it can be noted that it is approximately 1 for midsize and large banks, and 0.633 for small banks, and for all portfolios the results are significant at the 1% significance level. This means that the banks in question follow the market index, for example the S&P 500 index, very closely. In other words, between 2012 and 2021, midsized and large banks have been significantly dependent on the direction of the market. However, the result is different for small banks, for which the coefficient is only 0.633. This means that when the market changes by 1 percent, small banks change by 0.633% in the same direction, so they have not been as dependent on the general direction of the market and, thus, the returns should be explained by other factors. Reasons for this may be, for example, that the riskiness of small banks is usually higher, and they may be in the growth phase or have just been listed on the stock exchange. In this case, for example, the company's profit-making ability and growth prospects can be affected relatively more than in the case of midsize and large banks.

When looking at a very important factor for the thesis, the effect of the interest rate change on the returns of small, midsized and large banks, it can be seen that the coefficients are positive for all portfolios, 0.192 for large banks, 0.198 for small banks and 0.246 for midsize banks. Hence, the obtained results mean that the rise in interest rates has had a positive effect on bank stock returns. The obtained results are also confirmed by the fact that they are statistically significant at the 1% significance level for all three portfolios. The results of the effect of the interest rate factor related to banking stocks' returns therefore provide different evidence than predicted in the theory section, as according to theory, an increase in the interest rate should have a negative effect on the returns of banking stocks. Reasons for the obtained regressions results will be discussed in more detail in the conclusion chapter.

8 Summary and conclusions

This chapter summarizes the results of the empirical study and compares them with previous studies. In addition, the chapter considers what the obtained research results are due to and what kind of research it would be important to do in the future in order to strengthen the evidence obtained.

The main purpose of this study was to find out how the changes in the interest rate have affected the returns of bank stocks in the environment of low interest rates. In other words, how the rise or fall of the interest rate can explain the returns on bank shares. In my study, I also compare how interest rate changes have affected the returns of bank stocks of different asset sizes. The topic in question is interesting because according to several previous studies, an increase in interest rates has a negative effect on the returns of bank stocks, even though banks' main source of income is interest on loans, in which case it would be assumed that an increase in the interest rate would be a favorable thing, at least in terms of banks' profitability. It is a different matter, of course, how banks' profitability and stock returns correlate with each other. The importance of this study is also increased by the fact that the general interest rate level has never been as low as during the studied period, so slightly different results can be expected.

The results of the regressions provide evidence that interest rate fluctuations have been able to explain the returns of bank stocks in all three different asset size categories, in small, midsized and large bank portfolios, and the effect of the interest rate change is positive to bank stock returns. When comparing to previous studies, for example, English et al. (2018) state that the rise in interest rates has had a negative impact on the returns of bank stocks, while in this study the results are opposite. Correspondingly, Saunders and Yourougou (1990), Wetmore and Brick (1994), and Choi et al. (1992) state that the effect of interest on bank stocks' returns varies over time, giving support to the results of this thesis.

However, as stated in the regression results section, during the studied period bank stock returns followed strongly the direction of the market, which also partially explains the different results as expected. As can be seen in the figure 5, the U.S stock market has been strongly in a bull direction during the entire studied period, excluding the dip caused by Covid-19 in early 2020. Correspondingly, in previous studies, the period has often covered, for example, the financial crisis, which resulted in a several-year bear trend in the market, when bank stocks have behaved differently in relation to changes in interest rates. The prevailing low interest rate in the market reduces the interest margin of the banks, causing the income of basic banking to fall even to an unprofitable level, which could be one of the reasons why banks react positively to rising interest rates.

To summarize this thesis, it can be stated that the rise in interest rates has had a positive effect on the returns of bank stocks between 2012 and 2021. However, it should be considered that in this study bank stocks mainly followed the market, and the effect of the interest rate as an explanatory factor of returns remained rather small. Based on previous studies and this study, it can be concluded that the effect of the interest rate varies based on the studied period and market direction. In order for the research to get more evidence in the future, it would be important to have more length in the period after the financial crisis, especially now that interest rates have clearly risen during 2022. Furthermore, now that the era of low interest rates seems to have come to an end, it would also be interesting to study the Ying et. al. (2010) approach, how a change in the interest rate affects bank stock returns when it is expected or unexpected. Additionally, this research would be supported if it was done for the same period, for example, from European banks.

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