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THE INFLUENCE OF NEWS AND INVESTOR SENTIMENT ON EXCHANGE RATE DETERMINATION: NEW EVIDENCE USING PANEL DATA IN THE BANKING SECTOR

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Abstract

Exchange rates behaviour in open economies strongly influences the country's macroeconomic policy as the extent and frequency of exchange rate changes are important indicators of the country's economic stability. Commercial banks are fairly exposed to exchange rate changes and may be directly and heavily affected. The primary goal of this study is to investigate whether exchange rates news plays a significant role in banks' financial performance, and what other channels (factors) potentially affect the banks' profitability. The study collected data on more than 800 US banks over the period of 21 years (1998 to 2020). Following a filtering process, 148 banks were retained, as a significant number of these institutions either declared bankruptcy or underwent mergers with larger organizations, whether in banking or investment sectors. The contribution of this study is twofold. Firstly, the investigation of the association between exchange rates news and banks' profitability, creating a net sentiment index based on the unexpected announcements of domestic currency, US dollar, and then using GMM techniques, and secondly, the examination of this net sentiment index on banks' profitability in combination with other banking or macroeconomic factors. While the determinants of banks' profitability have been studied by many scholars, the relationship between exchange rate news and profitability has not been analyzed by anyone so far.

The analysis relies on public news categorized as favourable and unfavourable exchange rate news based on exchange rate fluctuations for 3 exchange rates. This analysis generates an index that describes the net sentiment of this news based on the characteristics of those announcements. The data of this net sentiment index is obtained from 3 basic exchange rates fluctuations per year, defining the US dollar as the domestic currency. Based on the major changes in exchange rates over time, news is classified as either positive or negative.

Using panel data for 148 US banks during the period 1998-2018 and applying the GMM method, the first goal is to find out if the unexpected exchange rate news has a negative or positive impact on the whole banking system, especially if this news affects Return on Assets (ROA), Return on Equity (ROE) or Net Interest Margin (NIM) which have been defined as measures for the profitability of banks. To do this, empirical econometric tests were performed, finding the best autoregressive model and then applying the Stepwise Forward method selected the most statistically significant variables in each model (p-value < 0.01). The panel unit root, OLS (Fixed Effect) method, and GMM method (GMM single and GMM system) two-step robust estimator, will then be applied for further analysis.

This study showed that banks' profitability is not affected by unexpected exchange rate announcements, which automatically implies that investors underreact immediately to new information. The evidence presented in this article does not justify banking profit or debt management activities if banks react to good or bad information about the appreciation or depreciation of the dollar. Banks appear to underreact to exchange rates news as well as to information conveyed by the event. So, there is no support for the overreaction hypothesis to unexpected exchange rate news in the banking system, suing any technique. Finally, the analysis does not address whether a different explanation of behavior is based on other phenomena. It may be necessary to reinterpret the evidence in this paper. This is left as an area for future research.

Dedication

This thesis is dedicated to my parents, Panagiotis Dimitriadis, Panagiota Mpaltzi, and my brother Theodoros Dimitriadou, whose unwavering support and belief in my abilities have been my greatest source of motivation and inspiration. Their love and encouragement have shaped me into the person I am today, I will always be grateful.

I also dedicate this work to my dog, Cookie. Companionship and unconditional love have been my constant source of comfort and joy throughout this journey. Cookie has been my steadfast friend and true member of my family.

Chapter 1

1. Introduction

1.1 Background of the Study

Banks are regarded as financial intermediaries that transfer and mobilize liquidity. The profitability of banks has a significant impact on the development of the entire economy. Factors both internal (specific to a bank's financial characteristics) and external (macroeconomic factors such as GDP, interest rates, inflation, and others) distinctly influence bank performance across institutions. A bank that is competent and consistently profitable plays a critical intermediary role, allowing for resilience against unfavorable shocks. Such banks bolster the stability of the financial system and spur economic growth, enhancing the flow of funds from savers to borrowers and delivering superior services to clients.

Profitability, as highlighted in empirical literature like Athanasoglou et al (2008), serves as an invaluable barometer for bank performance. However, this metric isn't always a sign of positive tidings for the banking sector. Exceptionally high profitability can raise eyebrows about the potential risk-taking behavior of banks (Mohsni & Mohsni, 2014).

Most of the studies examined the determinants of the banks' profitability and considered the ROA, ROE and NIM the most used profitability measures by country or region. Some of these studies collected data of banks from many EU countries together (Petria, et al., 2015; Goddard, et al., 2004), or individual reports from countries such as Nigeria (Aburime, 2008; Sayedi, 2014), Pakistan (Gul, et al., 2011), Bangladesh (Sufian & Habibullah, 2009; Hossain & Khalid, 2018), Portugal (Garcia & Guerreiro, 2016), Greece (Athanasoglou, et al., 2008), Turkey (Alper & Anbar, 2011)collecting and examining above internal, external, and macroeconomic determinants. As regards the macroeconomic factors, most investigations found that the inflation has significant effect on banks' profitability (positive or negative), while based on the internal of banking sector have been found that liquidity, loans, credit risk, size, and others (Keshtgar, et al., 2020). Although, the exchange rate exposure and GDP seems to have a positive relationship.

In addition, the exchange rate market is probably the largest and most important market in the world due to the presence of differences in the value of currencies. There are several papers which examine the impact of macroeconomic news on exchange rates using multivariate regression models (MLR) and multilayer perceptron (MLP) neural networks (Almeida, et al., 1998; LaakkOnen & Lanne, 2013; Yang, et al., 2015).

Through this literature review, a notable gap emerges concerning the impact of exchange rate news on the global economy and banks' profitability. This led to the study of the evaluation and examination of exchange rates news/announcements for the banks' performance. Several papers have attempted to explain the effect of exchange rates on banks' performance (Priti, 2016).

The overreaction hypothesis offers a compelling lens to interpret these dynamics (Mazouz & Li, 2007; Zarowin, 1990; Chopra, et al., 1992). This theory posits that investors tend to respond excessively to both positive and negative news. This leads to short-lived price movements/shifts that veer away from a commodity or security's intrinsic value. When applied to exchange rate, which are determined by the foreign exchange market, sudden, drastic shifts in exchange rates following the release of significant news or announcements may be viewed as exaggerations. These overreactions may lead to temporary misalignments, which eventually correct themselves.

Banks' share of foreign exchange transactions makes them susceptible to these fluctuations (Fischer & Zurlinden, 1999; Shapiro & Hanouna , 2019). If they or their stakeholders overreact to such news, it could precipitate less than optimal decisions, affecting profitability in the short run. This exaggerated sentiment, sculpted by news, can misguide investment choices and lending decisions in the banking sector.

Incorporating the overreaction hypothesis into the conversation, especially considering macroeconomic news, forms a bridge between human behavior and financial markets. It propels us to consider the cyclical nature of financial corrections post significant news events, further complicating the foreign exchange news for banks (Evans & Lyons, 2008; Chari & Henry, 2004; Burnside, et al., 08/2006; Parveen, et al., 2020; Reddy, et al., 2021; Plastun & Mynhardt, 2013).

In summary, the exploration of news announcements, investor sentiment, and their influence on exchange rate determination, especially in the banking sector, it is imperative to combine traditional economic models with the psychological intricacies of investor behaviour.

1.2 Financial Performance

According to the literature and economic theory, financial performance is an evaluation of the reports of a bank or a company that are made for a given period. According to Murthy (2004), financial performance refers to the ability of banks to leverage and invest in decisions and strategies to achieve financial stability and profitability of a bank. The most common measures of banks' profitability are net interest margin (NIM), return on assets (ROA) and return on equity (ROE) (Murthy, 2004).

ROA is the main percentage-based measure of profitability of banks, which is the net profits expressed as a percentage of total assets. ROA represents the profits earned per assets and gives signal that how effectively the banks or company's assets are being managed by authority to generate revenues. This financial ratio is used to evaluate the operational performance of banks as it examines the profits generated from the assets invested in the bank. So, when a bank/firm/company has high ROA, this indicates more asset efficiency (Aburime, 2008).

Both external and internal factors are also vital to its performance commercial banks (Aburime, 2008; Naceur & Kandil, 2006). Internal factors generally influence the internal decisions made by the board. External factors, on the other hand, involve factors throughout the industry. The banking sector is highly affected by various macroeconomic factors such as interest rates, inflation, exchange rates and economic growth measured by GDP and therefore their financial performance will mostly depend on macroeconomic stability.

1.3 Exchange rates, Unexpected News, and Bank performance

Banking operations have a significant impact on credit to the domestic economy, domestic reserves, mediation in the investment process and ultimately on the economic growth/development of countries. Thus, banks are closely linked to the foreign exchange market as they are considered one of the leading players in it, due to the fact that they are involved in import and export activities using foreign currencies, while they also participate in foreign exchange markets as intermediaries for business organizations operating internationally (such as, smaller businesses, speculators and private investors). It is therefore worthwhile to observe and study the relationship between investors and the value of foreign loans in foreign currency. Investors are closely linked to each bank's borrowing in foreign currency because they are unaware of the extent of the risk, they may face in possible monetary changes through which it could lead to a foreign exchange risk, involving higher borrowing costs.

A bank is also exposed to foreign exchange risk when it attempts to repay foreign currency lending to investors and is likely to have either short or long open positions. When the bank buys more than it sell of a currency, then this bank has a long position, instead it has a short position. Whether a bank is long or short in a currency is expected to take various risks. More specifically, in the long run, the risk arises if the value of the bank's currency is depreciated if the value of the currency falls, making the market value of the bank’s assets lower than the cost price. In the short position, if the value of the currency rises, then the bank will experience a loss. So, both long and short positions can affect the bank’s profit if the currency depreciates or appreciates. Until the bank covers this open position of the dispute, the bank is exposed to adverse changes in exchange rates (depreciation or appreciation). Thus, banks’ performance (which refers to the ability to leverage operational and investment decisions to profitability and financial stability), is affected by exchange rate volatility and they will cause significant gains or losses on the, in turn may cause distorted financial results and give the wrong impression of the financial condition of the institution.

However, in terms of the exchange rate exposure of the banking system, there are few studies that focus on this report and specifically on US and Japanese Banks, creating a big gap in the literature where in this study is going to be covered. Commercial banks are vulnerable to exchange-rate exposure because they are active in foreign currencies by holding assets and liabilities in foreign currencies, with the result that they are constantly exposed to foreign exchange risk. The foreign exchange risk is a major source of risk for the banking sector and various studies have addressed this (Martin & Mauer, 2003; Wet & Gebreselasie, 2004; Papaioannou, 2006; Kasman, et al., 2011; Ryan & Worthington, 2004; Atindéhou & Gueyie, n.d.).

The commercial risk of a commercial bank comes from its commercial and non-commercial services. Banks' foreign exchange trading activities include, firstly, the purchase and sale of foreign currencies so that customers can participate and complete international trade, secondly, the purchase and sale of foreign currencies allows customers (those involved in deposits, loans, investments and currency exchanges) to take positions in foreign real and financial investments (Grammatikos, et al., 1986). In addition, the purchase and sale of foreign currencies for reasons of hedging create risks of trade exposure to customers in any currency.

Finally, the purchase and sale of foreign currencies for speculative purposes should be based on the forecast or expected future changes in exchange rates. Commercial banks, however, are not required to be exposed to foreign exchange risk from their trading activities as mentioned above but may only be exposed to foreign exchange risk to the extent that they have not hedged or covered their position. Therefore, where there is uncertainty that future exchange rates will affect the value of financial instruments, there is a risk of a commercial bank's foreign exchange.

Research on banks and their susceptibility to foreign exchange exposure is an area that has gained considerable attention in academia. Bracker et al (2009), notably examined this theme by pinpointing the fluctuation in the value of the US dollar as a principal risk among six predominant banking hazards. They employed a complex strategy by analyzing the effects of various risk factors on the performance of bank reserves, with exchange rate volatility serving as a key focal point. Their investigation was rigorous, and the results were strong, showing a link between bank ownership of firm equities and the strength of the US dollar. In other words, when the US dollar appreciates, bank ownership stocks typically benefit from it. This conclusion emphasizes how interconnected the world of finance is and how crucial exchange rate stability is to be determining how much bank stocks are worth (Bracker, et al., 2009).

One of the main aims of the thesis is to empirically examine the impact of exchange rate fluctuations via news on the performance of the US banking sector, examining whether these fluctuations affect the economic performance of banks, and through which channels the exchange rate movements are related banks' performance. In this study, a net index sentiment on economic and financial decisions was created, explaining that the news of foreign exchange rates affects the profitability of banks. The basis of this sentiment is the investor's ability to see and study, daily, the conditions prevailing in listening to some public news.

The economy is constantly affected by unexpected news that is integrated into prices through the interaction of demand and supply. If the news is favourable, the investor will buy a currency that raises prices and vice versa. It should be highlighted that there is a significant distribution between forecasting exchange rates and receiving exchange rate news, as well as between what can be viewed as their comparative advantages. A potential change in the exchange rate, whether an appreciation or a depreciation—threatens investors as well as the overall economy, it is a fact. In the global economy, currency depreciation can cause inflation due to rising import prices, rising aggregate demand (AD) and exporters have less incentive to reduce costs because they can rely on depreciation to improve competitiveness. A significant example is the depreciation of sterling at 25% over the financial crises of 2008/2009. This depreciation makes the UK product more competitive, causing inflation and reducing the standard of living of households. Also, most commercial banks report that they suffer from erosion of their profit resulting from their exchange rate exposure, especially when appropriate compensation strategies are not adopted.

Many researchers have tried to predict the foreign exchange market as a means by which many investors will benefit but conclude the difficulty of this approach by referring to market efficiency (Hakkio & Rush, 1989). More specifically, using empirical model deconstruction (EMD) (Premanode & Toumazou, 2013) and other methods, no significant exchange rate prediction has been found to date, except that one random path model is better than others. This implies that investors cannot deal effectively with the nature of the uncertainty and volatility of foreign exchange data. There exist several studies on exchange rates (Cheung, et al., 2015), some of which refer to the influence of exchange rate news and others refer to the search and study of the direction of exchange rate prices (Anderson, et al., 2003; De Broeck & Sløk, 2006; Lubik & Schorfheide, 2007). However, announcements of possible exchange rate changes have played an equally important role throughout the economy (Almeida, et al., 1998; Pearce & Solakoglu, 2007; Evans & Lyons, 2008).

In general, investors are affected by news, let alone unexpected news (good or bad). For example, when a currency appreciation is declared after an exporter borrows money in a foreign currency from a domestic bank, the exporter finds it challenging to repay the loan. This leads to a reduction in the bank's profitability and a foreign exchange risk to the investor since the banking sector's asset base includes credit and investment portfolios and is heavily funded through deposits. When deposits are made in foreign currencies, the financial industry will be upset if there is news of a foreign currency devaluation since investors will rush to transfer their deposits into cash to prevent any losses.

How corporations, banks, and other institutions in the financial and investment sectors respond to unexpected news, particularly news about foreign exchange, is one issue that needs to be addressed in this dissertation. Is the news a significant factor in mitigating risk and losing money? The impact of the news can be minimal or significant, especially if it is negative, and it can be transient or long-lasting. This difference can confuse many investors who cannot manage unexpected news properly. The temporary bad news can be attributed to any small mistake by the management, causing failure that can lead to temporary loss of income and can be described as bad news. However, if the news hasn't changed a company's, bank's, or investment activity's overall outlook, profits might not be significantly impacted and instead might stay the same. Therefore, it is crucial to ascertain if the issue is short-term or long-term.

As for the relationship between exchange rate news and macroeconomic news, one can say that although they differ from each other, they are also connected through intermediate channels. The basic principles assert that changing exchange rates can be caused by the theoretical framework, i.e., that macroeconomic news that is characterized by variables such as gross domestic product, the consumer price, index, the unemployment rate, the trade balance, inflation, interest rates. Experimental tests look at various ways in which changes in macroeconomic variables explain changes in exchange rates. In principle, fluctuations in the value of the domestic currency (causing foreign exchange risk) result from changes in foreign and domestic interest rates caused by differences in inflation. Research has shown that income and money supply are key factors in a monetary model, with real interest rates also playing a role in the presence of price volatility, such as increases in country's real interest rates will cause the domestic currency to appreciate. Therefore, according to macroeconomic theory and related literature, macroeconomic variables can explain exchange rate fluctuations. Particularly the bad unexpected macroeconomic news caught on in this change (Laakkonen, 2004).

The expectation of higher interest rates generated by growth news would normally lead to a currency appreciation, unless expected inflation also rises due to the Phillips curve, in which case a devaluation should occur (Goyenko, et al., 2011). Kim (1999), examines the news in a macroeconomic context in terms of exchange rate fluctuations, collecting five Australian exchange rates. They document that higher-than-expected announcements about the current trade deficit and the unemployment rate devalued the AUD, and an unexpectedly higher increase in GDP appreciated it (Kim, 1999).

The media is not only an important source of financial knowledge for individuals, but it also affects economic behaviour. However, the psychology of investors could be critical to explaining the relationship between news and financial markets, who are informed of the role of unexpected news. The potential role of emotions in economic decision-making has been recognized by both psychologists and economists, which is caused by listening to the news (Al-Horani & Haddad, 2011). Unexpectedly good news can make investors look at an asset as less risky or expect increases in future cash flows. Every reaction leads to an increase in the price of this asset. Unexpectedly bad news can provoke the opposite reaction, and the asset can be considered riskier or its future cash flows may be reduced. In both cases, there will be a reduction in the value of the asset. In an efficient market, only unexpected news or surprises should cause a significant rise or fall in prices. Expected events should not have an impact on asset prices, as investors' expectations will be reflected in the trading standards and the price of the asset (Belke, et al., 2018). A typical example was studied by Belke et al. (2018), who assess the impact of the prospect of hearing Brexit in the British and international financial markets, showing that the uncertainty caused by Brexit will continue to cause instability in key financial markets and has the potential to hurt the real economy both in the UK, as well as in other European countries.

Once the exchange rate news sentiment for each year is found and the banking and macroeconomic variables are collected in Chapter 3, Chapter 4 will be followed by the methodology, referring an empirical model analysis, panel unit root test (stationary or not stationary test) and Generalized Method of Moments (GMM), defining Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM) as dependent variables and various banking data, macroeconomic data, and the key variable emerge from the news of exchange rates as independent variables. This method is employed because in well-known dynamic panel models the usual fixed effects estimator is unreliable when the time span is smaller than the cross-sectional unit (T<N) (Nickell, 1981). The estimators of this model in Chapter 5, suffer from a weak instrument problem when the dynamic panel autoregressive coefficient (δ) approaches unit (Blundell & Bond, 1998). So, to avoid this problem, the proposed system GMM two-step robust estimator procedure by Arellano and Bover (1995a) and Blundell and Bond (1998a) are employed in this dissertation (Arellano & Bover, 1995; Blundell & Bond, 1998) .

The selected banks were collected based on the data availability on FDIC for the entire period 21-years. To ensure consistency, only banks they operated throughout this period were included, as many banks closed or went bankrupt during this timeframe. This study contributes to existing literature by exploring the effect of exchange rates news on the banking system in the USA. In this study there are several questions to be analyzed and addressed. How will the market react to the announcement of possible changes in the future, and the announcement of exchange rates. Can exchange rate news affect the financial system? What are factors that can affect banks' assets? Given the limited research in this area, the study examined the influence of exchange rates exposure by news in the banking industry by collecting public available information from authorized sources (Bloomberg).

1.4 Overreaction Hypothesis: Bridging Financial Markets and Psychology

Financial landscapes are frequently perceived using quantitative measures and rational decision-making. However, the behavioural dimension of financial markets, which is driven by human psychology, continues to play an important role in shaping market outcomes. The "overreaction hypothesis," a theory emphasizing the major impact of investor psychology on market movements captures one important behavioural occurrence (De Bondt & Thaler, 1985).

At its core, the overreaction hypothesis suggests that investors tend to overemphasize recent information, leading to excessive reactions to both positive and negative news (De Bondt & Thaler, 1985). This causes short-term price misalignments that depart from the intrinsic value of a security or currency. These mispricing's frequently undergo corrections throughout time, resulting in price reversals. The hypothesis, in essence, asserts the presence of cyclical patterns in financial markets, often dictated by human sentiment and psychology.

The theory provides a framework for understanding unexpected and often dramatic variations in exchange rates. News concerning macroeconomic issues, geopolitical movements, or major international events can act as triggers, causing abrupt changes in exchange rates (Frankel & Froot, 1987). Positive news regarding a country's economic growth, for example, may cause its currency to over-appreciate in the near run, only to be corrected once more complete facts or viewpoints emerge.

The implications are significant for banks, particularly those heavily involved in foreign exchange transactions. Because banks are exposed to foreign currencies, these overreactions in the foreign exchange market can have a direct and considerable impact on their profitability. Excessive sensitivity to exchange rate news may lead to inadequate investment or hedging decisions by a bank or its stakeholders. These judgements, affected by temporary news-driven attitudes rather than long-term economic realities, might expose possible weaknesses in profitability and even long-term strategy (Berger, et al., 2000).

Moreover, banks' lending decisions, investment choices, and even day-to-day operational activities can be influenced by the prevailing exchange rate sentiment. If this sentiment is skewed by overreactions, banks might undertake decisions that are misaligned with long-term economic fundamentals, thus placing their profitability at risk. For instance, an over-appreciated currency might make foreign investments seem more lucrative, leading banks to increase their foreign exposure. However, once the overreaction corrects itself, these investments might turn sour, impacting the banks' bottom line (Reinhart & Rogoff, 2004).

Furthermore, to quantify such reactions to news is via Net Sentiment Index (NSI), which provides a quantifiable measure of market sentiment by analyzing the net positive or negative sentiments from exchange rate news. When significant news breaks, it can lead to heightened activity in the foreign exchange market. If the NSI shows a sharp spike (either positive or negative) following significant news, it might be indicative of an overreaction, as posited by the hypothesis.

Exchange rates, sensitive to market sentiment, can experience swift and pronounced fluctuations based on the prevailing NSI. If the NSI is overwhelmingly positive due to positive news, we could see a currency over-appreciating, only to correct itself when the initial euphoria settles. Similarly, a sharply negative NSI might induce a hasty depreciation of a currency, which might self-correct once a broader perspective is considered. For banks, especially those with hefty foreign exchange dealings, these NSI-induced overreactions can have substantial implications. An overvalued currency due to a positive NSI spike could lead banks to perceive foreign investments as undervalued, potentially leading them to amplify their foreign exposures. Conversely, a negative NSI can inflate the domestic value of foreign liabilities. In both scenarios, if banks act on these short-term NSI-driven sentiments without considering the potential of an overreaction, they risk making decisions that could detrimentally impact their profitability.

The Net Sentiment Index, when viewed through the lens of the overreaction hypothesis, can serve as a valuable barometer for banks to gauge market sentiment and its potential overreactions. By understanding and respecting the cyclical nature of these overreactions, banks can strategize more effectively, ensuring that their profitability isn't undermined by the capricious winds of sentiment-driven market movements.

1.5 The difficulties of research based on sentiment analysis of news.

News is the largest source of information for public speaking. Although its exponential growth the first web and mobile communications have dismantled the old guard of general journalism and brought subjectively, more personal views and contributions to the public sphere, journalism and news continue to be its backbone public discussion.

The news also differs from most of the other material in the middle sphere, their own challenge in analyzing emotions. It works on a larger scale media context that is increasingly commercial and increasingly produced by citizens / investors and other producers of information on non-journalistic platforms. News items such as articles, columns and letters to the author usually have one position of the person writing, or in the case of a pension the position of the institution. There are also opinion items in news articles, which are expressed in quotes and quote's view of respondents or other sources. Therefore, when approaching news with sentiment analysis tools, it is important to emphasize that news is not equal to journalism but operates in a larger field of journalism.

Apart from professional liquidity, news articles do not operate in a vacuum, but are usually part of a fairly fluid ongoing public debate in the public sphere. This means that news as texts can be considered as units of a larger dialectical series of public discourse, reaching beyond a single news article or a journalistic institution, referring to the issues or issues available, as well as to other points of view as a whole discussion. At this point it is important to mention that if the news articles are analyzed for emotions, the emotions are most likely found in some parts of the news where the views of the respondents and other sources are present. Balahur *et al.* (2010), argue that the source (who says) and the target (in which issue) is a relatively easy process to map. This helps to build a network of resources, goals and value emotions that will be associated with these offerings.

The nature of news articles, which are made up of different types of sections, creates a rather large research challenge: what is the unit of analysis when analyzing news emotions? A simple approach would be to use a single article as a section describing it as "bad news" or "good news" in some binary form. However, a single news article can contain a lot of different sentiments coming from many different sources, forming a limited set of interactive sentiments in this single article and extensive dialogue in many news articles in many publications and in time and space. Therefore, the ideal analysis of news sentiment should probably work at the level of a single sentiment, whether it is in a sentence, a paragraph or news stories. Feldman, (2013), suggests that it may also be necessary to distinguish between sentence-based and aspect-based sentiments. In this case it means that not all sentences necessarily express sentiment in the same entity.

Given the above difficulties, the study examines this news with a different approach, creating an index for the fluctuation of the exchange rate of the US dollar as the domestic currency against other currencies. More details will be given later in this study.

1.6 Aim and Research Objectives

This study ventures into the intricate dynamics of exchange rate news and its potential repercussions on the profitability of US banks. Specifically, it examines whether announcements related to the appreciation or depreciation of the local currency against other major currencies—such as the euro, the pound sterling, and the yen—have a notable impact on the financial performance of active US banks from 1998 to 2021. Given the behavioral tendencies of market participants, as encapsulated by the "overreaction hypothesis", there is a compelling need to discern if these exchange rate announcements induce exaggerated market responses, leading to transient financial ripples within the banking sector (De Bondt & Thaler, 1985).

The exploration deepens by differentiating between favorable (appreciation) and unfavorable (depreciation) news for the dollar against the currencies. A key aspect of this study is to ascertain whether there is a coherent link between three key indicators of bank profitability, and then to determine how various factors—internal, external, or macroeconomic—affect the banking industry considering these exchange rate announcements.

For those interested in the financial and banking sector, the information gathered will shed light on the interaction between exchange rate news and banks' risk management, especially when viewed through the lens of potential market overreactions. These insights can guide financial institutions towards improved hedging strategies, mitigating their exposure to currency risks. Investors will also benefit, gaining the foresight to bypass the lending risks that arise from these market dynamics. Furthermore, this study creates a fundamental knowledge base for researchers, highlighting gaps and suggesting avenues for further exploration in this multifaceted area of economics, behaviour and economics.

The research objectives are presented below:

- To investigate the relationship between exchange rate news and the financial performance of banks in the US.

- To create a net sentiment index based on unexpected announcements/fluctuations of three major currencies to the US dollar to capture the characteristics of exchange rate news.
- To examine the impact of the net sentiment index on banks' profitability, specifically in terms of the Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM).
- To contribute to the understanding of the factors influencing banks' profitability and the role of exchange rate dynamics in the US banking sector.
- To assess the manifestation of the overreaction hypothesis within the banking sector by examining how unexpected exchange rate news leads to disproportionate financial responses and its subsequent implications on banks' profitability metrics.

Hence, the main research questions of this thesis were:

Is there any relationship between exchange rates news and banks' profitability?

- How does exchange rate news impact the financial performance of banks in the US?
- How can a net sentiment index be developed to represent the unexpected announcements or fluctuations of three major currencies relative to the US dollar?
- What is the relationship between the net sentiment index and the profitability of banks, particularly in terms of Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM)?
- Which factors predominantly influence the profitability of banks in the US, and how significant is the role of exchange rate dynamics in shaping the financial landscape of the US banking sector?
- Is there evidence of the overreaction hypothesis in the US banking sector, particularly in relation to unexpected exchange rate news? And if so, how does this phenomenon influence banks' profitability metrics?

1.7 Significance of the study

In the realm of financial research, understanding the underlying factors that influence key market players and, by extension, the broader economic landscape, is crucial. The intricate relationships between exchange rate news and banking profitability represent one such pivotal dynamic. As this study delved into its core, it is essential to highlight the broader implications and the significance of the findings. This research, in essence, serves as a compass, guiding various stakeholders through the complex maze of financial markets, investor psychology, and macroeconomic indicators.

Banks, which are at the centre of the financial ecosystem and are particularly vulnerable to exchange rate fluctuations, stand to benefit substantially from the findings of this study. Understanding dynamics, especially in the context of unexpected exchange rate news, might be critical to developing better risk management methods. It may enable banks to develop stronger hedging strategies, increasing their resilience to potential overreactions to currency news and assuring their sustained profitability. However, investors, both institutional and individual, can use the findings from the research to make better investing decisions. Knowledge of anticipated banking sector overreactions to unexpected exchange rate news provides a strategic advantage. It enables investors to make proactive portfolio adjustments, potentially capitalizing on momentary market misalignments and better protecting their investments from unnecessary risks.

From an academic standpoint, this research fills a significant gap in the existing body of information. In and of itself, the development of a net sentiment index modified to capture the complexity of exchange rate news is an important advance. The study takes a comprehensive look at the intersection of behavioural finance, macroeconomics, and banking. Such a broad viewpoint can deepen academic debates and lay the groundwork for future study in these fields.

The study's conclusions are also important for policymakers. Informed decisions, particularly in the realms of monetary and fiscal policies, are critical for the financial systems and the larger economy’s stability. A better understanding of how exchange rate news affects the banking sector can help policymakers create an environment that promotes economic growth and stability.

Essentially, this study provides a multidimensional knowledge of the impact of exchange rate movements through news on the performance of the US banking system. The insights gathered from this research are invaluable for banks planning their overseas exposure, investors optimizing their portfolios, and politicians drafting economic directives. Furthermore, by incorporating the overreaction theory, this study provides a deeper understanding of market participants' behavioural patterns and potential exaggerated reactions to exchange rate news. This complete approach emphasizes the complex interplay between exchange rate news, investor behaviour, and banking profitability, laying the groundwork for more informed decision-making across the board.

Chapter 2

2. Literature Review

This chapter provides further discussion and analyzes the results of previous empirical studies on the topic, as well as the existing theoretical framework and literature on the subject. It then identifies the key theories that shape the understanding of the topic and discusses the factors that influence economic performance. After examining the current state of knowledge on the topic, the chapter highlights any gaps or limitations in the existing research and presents the conclusion drawn from the review of the empirical literature. Essentially, this chapter aims to build on previous research and provide a deeper understanding of the topic by considering various perspectives and synthesizing the existing evidence.

2.1 Theoretical Review

Banking operations have a significant impact on credit to the domestic economy, domestic reserves, mediation in the investment process and ultimately on the economic growth/development of countries. Thus, banks are closely linked to the foreign exchange market as they are considered one of the leading players in it, due to the fact that they are involved in import and export activities using foreign currencies, while they also participate in foreign exchange markets as intermediaries for business organizations operating internationally. It is therefore worthwhile to observe and study the relationship between investors and the value of foreign loans in foreign currency. Investors are closely linked to each bank's borrowing in foreign currency, because they are unaware of the extent of the risk, they may face in possible monetary changes through which it could lead to a foreign exchange risk, involving higher borrowing costs. Moreover, the foreign exchange risk is a major source of risk for the banking sector and various studies have addressed this (see among others, De Wet and Gebreselasie, 2004; Papaioannou, 2006).

The theoretical part of this paper investigates the links/channels which directly or indirectly affect the bank’s profitability through exchange rate volatility (Fahrul & Rusliati, 2016). To be more specific, three risk categories can be considered as direct channels for changing the smooth operation of the bank through exchange rates: credit risk, liquidity risk, and market risk. Credit risk is defined as the risk of financial loss due to default, arising from the default of creditors, such as repayment of loans. This risk relates to term-to-maturity loans, provisions for capital claims and the consequences for the capital adequacy ratio. Therefore, every borrower involves credit risk, which can have significant consequences for the development of the credit institution (banks). In the event of a change in the exchange rate, the borrower may not repay the loan within the limited time allotted to him, thus not verifying the credit institution's expectation of repayment of the debt within the defaulted debt (counterparty risk and default risk).

In addition, the exchange rate can affect the liquidity of the bank as much as the insufficient coverage of liabilities (loans) to depositors and borrowers, thus leading to the collapse of the bank, firm or emerging market economy (Ongena, et al., 2012; Mora, et al., 2013). When a bank has financed foreign currency loans in the short term from abroad, it is exposed to the risk of capital outflows. Moreover, the market is also affected by exchange rate fluctuations, in which banks invest most of their capital in products that are volatile in market fluctuations, such as investing in equity securities or financial derivatives.

According to the literature, there is also a significant link between exchange rates, interest rates and inflation. Based on the global economic theory, there is a close relationship between domestic currency and interest rates. This means that they follow the sample directions either positive or negative. More specifically, an appreciation/depreciation of the domestic currency will lead to a higher/lower interest rate. Reducing interest rates can make exporters more competitive and lending more expensive. So, there are many ways in which changes in exchange rates can have both negative and positive effects on banks' assets (assets and liabilities), such as lending to companies with import and export activities and the risk of transfer caused by the bank's default on loan repayment. Therefore, it is very imperative to understand how the performance of the banking sector is affected by the unexpected news of a possible exchange rate change.

The first research on foreign exchange exposure is that of Alder and Dumas (1998), who defined foreign exchange exposure as the effect of unexpected changes in foreign exchange rates on cash flows of financial institutions (Adler & Dumas, 1998). Some researchers have focused that the exchange rate fluctuations of the domestic currency should affect the value of companies via foreign sales and foreign assets (Bodnar & Gentry, 1993). Others, however, are more consistent with financial theory and find that exchange rate movements are an important factor in determining a financial institution’s value.

2.1.1 The Impact of Exchange Rate Movements on Banking Risk and Profitability

The intricate relationship between currency movements and banking risk is underpinned by how exchange rate fluctuations directly related with banking risk exposure. Banks with a significant imbalance between their foreign currency obligations and holdings stand to lose in the event of a domestic currency depreciation (Niepmann & Schmidt-Eisenlohr, 2022). According to the literature review, most studies have focused on the exchange rate exposure of major global economies, with fewer studies delving into smaller economies such as Finland, which are intrinsically linked to foreign currencies.

Exchange rate exposure is traditionally classified into transaction and economic exposure. Transaction exposure incorporates the risk exposed by banks because of anticipated long-term swings in exchange rates from the time a foreign currency transaction is initiated to the time it is settled. On the other hand, economic exposure concerns the risk arising from exchange rate fluctuations affecting short-to-long term future cash flows and overall valuations of companies and banks. This latter exposure type has remained largely underexplored in empirical studies, despite its significance.

There are nuanced divisions within these exposures: direct long-term exposures, which encompass bank lending, leasing portfolios, held-to-maturity assets, and off-balance items. These exposures are challenging to quantify as they're contingent on the financial dynamics of a bank's clientele, competitors, and capital providers. Conversely, short-term exposures, influenced by the economic environment of these same entities, impact a bank's cash flows. This category extends to sectors like business operations, mark-to-market investments, and short-term off-balance liabilities, originating from transactional services and loan provisions.

The central focus of this section is to quantify the exposure of US banks to shifts in the dollar's value. Notably, many banks, anticipating potential exchange rate exposures, have proactively adopted financial instruments such as forwards, futures, swaps, and options as risk-mitigation strategies.

Based on economic theory, currencies are considered by many scholars as distinct asset categories necessitating specific management strategies, primarily due to their inherent transaction risk. Some argue that international investors are managing foreign exchange risk from the perspective of assets and liabilities (Allen & Gale, 2004). Floating exchange rate has caused a sharp volatility, adding a new dimension to the banks' balance sheet risk profile. The escalating funds flow across open economies, coupled with exchange rate volatility, has heightened the vulnerability of bank balance sheets.

Exchange rate fluctuations can cause significant changes in the financial statements of both companies and banks, if assets or liabilities are denominated in a currency other than the balance sheet, may affect the overall income statement (mainly revenue or expenditure). Exchange rate risk is trifurcated into translation, transaction, and economic risks (Shapiro & Hanouna , 2019). Transaction risk refers as the difference between the exchange rate at which the receivables are collected and payable debts and the exchange rate at which they are recorded and reported on the bank's financial statements (Kamau, et al., 2015). However, other researchers argue that the risk of a transaction is related to the number of damages that are related to the unexpected depreciation of a foreign currency (Carrada-Bravo, et al., 2006). More specifically, it is a form of cash flow risks and deals with the effect of exchange rate changes on opening a transaction account related to receivables, liabilities, or repayments of dividends. In addition, the economic risk is the unexpected effect fluctuations in exchange rates to the present value of the bank's future operating performance and cash flows when expressed in the reference currency (Kamau, et al., 2015). Therefore, it is directly related to the profitability of banks and can have significant implications.

2.1.2 Channels Affecting Bank Profitability through Exchange Rate Volatility

Banks are critical to a country's economic development, acting as essential participants in both domestic and global financial markets. Their importance extends to a various functions, such as lending money to support the domestic economy, maintaining domestic reserves, managing the investment process, and supporting economic growth and development (Hakenes, et al., 2015) Banks are closely linked to the foreign currency market due to their involvement in import and export transactions involving foreign currencies, as well as their participation as intermediaries in foreign exchange markets for multinational enterprises. This close relationship to the foreign exchange market highlights the significant influence that exchange rate movements have on bank’s financial performance, including their capacity to maximize operational and investment choices in order to attain financial stability and profitability (Abbas Elhussein & Elfaki Osman, 2019).

Their operations, however, are not without risk. Exchange rate fluctuation can have a major impact on their profitability, particularly through three main channels: Credit risk is defined as the risk of financial loss due to default, arising from the default of creditors. This risk relates to term-to-maturity loans, provisions for capital claims and the consequences for the capital adequacy ratio. Therefore, every borrower involves credit risk, which can have significant consequences for the development of the credit institution (banks). Exchange rate fluctuations can drastically alter a borrower's ability to service their loans, introducing counterparty and default risks.

Additionally, the exchange rate profoundly impacts a bank's liquidity, potentially affecting its solvency. Banks securing short-term foreign currency loans expose themselves to the risk of capital outflows, as foreign lenders may decide against transferring deposits upon arrival. Concurrently, domestic borrowers engaged in long-term foreign currency commitments might struggle with immediate loan repayments due to currency fluctuations. In attempting to counter credit challenges, banks may face difficulties attracting foreign currency deposits, reporting to offering high interest rates, thereby unintentionally increasing default risk. Significant exchange rate depreciations have traditionally related to banking crises in emerging nations, according to Jeanne and Rancière, (2011), emphasizing the critical relationship between exchange rate volatility and liquidity risk. This complex link demonstrates how sensitive banks are to changes in exchange rates, especially when it comes to handling credit risks and liquidity. The complexity is further shown by Keshtgar's (2020) findings, which show how exchange rate volatility increases the loan to total bank deposit ratio, raising credit risk. This understanding clarifies the complex processes by which fluctuations in exchange rates affects banks' capacity to maintain their financial stability and emphasizes how important it is to implement efficient risk management techniques to reduce unfavorable outcomes.

Furthermore, appreciations in the foreign currency can have substantial implications for a bank's capital adequacy ratios. If the foreign currency appreciates against the local currency and the value of assets and liabilities is fully offset, the overall value will witness a proportionate increase. As the value of assets in foreign currency increases, the capital adequacy ratio (approximate terms, equity divided by assets) will decrease. In scenarios where a bank's foreign loan exposure is significant and the domestic currency experiences a pronounced devaluation, the bank's capital adequacy might plummet, potentially breaching the regulatory threshold.

Banks' investment decisions are influenced by exchange rate fluctuations particularly in volatile assets such as equity securities and financial ratios. Due to the process of financial market liberalization, the majority of banks now operate primarily in foreign nations, exposing them to interest rate risk as a result of the recent volatility of the financial market. Thus, fluctuations in interest rates and currency rates may have a negative influence on banks' ability to remain solvent because risk management strategies cannot completely mitigate these effects (Gilkeson & Smith, 1992).

Moreover, understanding the relationship between exchange rates, interest rates and inflation becomes paramount. An appreciation of the domestic currency will lead to a higher interest rate, whereas a devaluation of the domestic currency will reduce the interest rate, impacting the domestic currency, making exporters more competitive and borrowing more expensive. This underscores the profound influence of currency movements on the broader economic landscape. Notably, when interest rates change, commercial banks are exposed to market value risk in addition to borrowing and reinvestment risk. This happens when rising interest rates drive the market value of banks' assets to decline, creating direct threats to the banks' owners' equity or net worth. Such interest rate shocks have a major impact on the financial stability of banks since debt holders usually have senior claims over equity holders over a firm's assets (Saunders & Cornett , 2003).

Moreover, there is historical evidence that excessive exchange rate volatility has preceded stock market disasters, underscoring the connection between exchange rate fluctuations and broader market risks (Eichengreen, et al., 1996). Although, changes in exchange rates can affect banks' assets and liabilities in both negative and positive, such as lending to companies with import and export activities and the risk of transfer caused by the bank's default on loan repayment, it is crucial to understand how the banking industry reacts when news of possible exchange rate changes is unexpected (Abbas Elhussein & Elfaki Osman, 2019). In order for banks to effectively navigate the complexities of the financial landscape, strong risk management methods are essential. This is because exchange rate dynamics and market risks are mutually reinforcing.

Policymakers, regulators, and industry stakeholders must critically assess the intricate interactions of foreign exchange rates, banking operations, and financial market dynamics to ensure the banking sector remains strong in the face of volatile economic circumstances.

2.1.3 The Overreaction Hypothesis and its Implications in Finance

In the realm of financial markets, behavioral finance emerged as a novel and innovative field that integrated elements of sociology, psychology, anthropology, and finance (Ricciardi & Simon, 2000). Its primary objective is to examine human conduct and how it influences capital markets. This is a fast-growing branch and holds that people make irrational judgments based on their actions (Statman, 2014). Their decision actions have an impact on the timing of asset purchases and sales, portfolio selection and investment strategies (Thaler, 2015; Baker, et al., 2017).

The Overreaction Hypothesis, rooted in behavioral finance, assumes that investors tend to overreact to new information such as historical performance, company reputation, and market sentiment, leading to significant mispricing in financial markets. This theory challenges the traditional efficient market (EMH) hypothesis, which assumes that market prices fully reflect all available information and that investors make rational decisions based on that information. Instead, the overreaction Hypothesis suggests that psychological biases and cognitive errors lead to investors to make irrational decisions, resulting in anomalies. The Overreaction Hypothesis basically contradicts the Efficient Market Hypothesis and rationality by claiming that market anomalies such as stock price bubbles and collapses are caused by investors' psychological biases, technical reasons, or fundamentals of nature (Guo, et al., 2017; Baker, et al., 2017).

Subsequent research has expanded upon the findings of De Bondt and Thaler (1985) to investigate the mechanisms underlying investor overreaction and its effects on financial markets. Cognitive bias is a common phenomenon among investors who think that past achievements can predict future outcomes (Silva, et al., 2023). When a stock has recently done well, people tend to believe that this trend will last forever. As a result, investments are attracted to assets with impressive recent returns. They are drawn to these assets by the promise of continuing prosperity, which amplifies price fluctuations. Several cognitive biases, such as anchoring, overconfidence, confirmation bias, and herding behavior, have been linked by behavioral economists to overreaction (Cao, et al., 2021; Friesen & Weller, 2006). These lead investors to follow the herd, disregard contradicting facts, and give an excessive value to recent information.

The literature has made the argument about whether investor behavior in stock price is rational a main topic and has generated a great deal of disagreement. The main issue in this discussion is whether investors regularly make logical choices or if they frequently overreact to information released by the market, which causes stock prices to diverge from their fundamental values (Dreman & Lufkin, 2000).

Berberis et al. (1998), introduced the idea of overreaction, arguing that investors misunderstand the erratic nature of earnings fluctuations. Rather, they follow patterns and wait for negative surprises after good earnings news, which results in less-than-ideal investing choices. On the other hand, De Bondt and Thaler's key study in 1985, gave empirical evidence that stocks that performed well in the past (winners) underperformed in the future, while those that did poorly (losers) outperformed. This suggests that investors overreact to both good and bad news, causing stock prices to vary from their genuine values (De Bondt and Thaler, 1985).

Furthermore, the Overreaction Hypothesis has been used to analyze different types of assets as well, such as commodities and foreign exchange (FX) markets, in addition to equities markets. Studies have indicated that the sentiment of investors and their tendency to overreact are important factors influencing the volatility of commodities and currency values (Parveen, et al., 2020; Larson & Madura, 2001; Saleh, 2007). For instance, overreaction by currency traders to geopolitical or macroeconomic news can cause short-term fluctuations in exchange prices that are not consistent with underlying values. According to Frankel and Froot (1990), fluctuation in exchange rates is mostly driven by speculative bubbles, with traders frequently depending on their opinions rather than underlying values. Such behaviour can result in currencies that are overvalued or devalued which finally revert to their underlying values over time.

Moreover, banks, as important participants in the FOREX markets, are usually influenced by the Overreaction Hypothesis. Banks' foreign exchange exposure can be influenced by overreaction to exchange rate news, affecting their balance sheets and profitability. Overreactions by investors to news about banks' international activities, particularly in countries with fluctuating currencies, can result in severe mispricing of bank stocks. A quick depreciation in a foreign currency, for example, can inflate a bank's foreign obligations, leading to negative emotions and possibly stock undervaluation.

Furthermore, the Overreaction Hypothesis provides light on investor behavior. Overconfidence and representativeness are two cognitive biases that frequently induce investors' behavior in behavioral finance. When making investment decisions, overconfident investors frequently overestimate their skills, expertise, and knowledge and place heavy emphasis on recent information, believing that they can influence decision outcomes based on superior attributes compared to the average investor (Ricciardi 2008b). The Overreaction Hypothesis in financial markets is influenced by this tendency as well as the representativeness heuristic, which causes investors to place undue weight on recent information (Adel & Mariem, 2013; Haixia, 2018; Odean, 1998). The representational heuristic frequently causes investors to ignore other crucial factors in favor of making decisions based on past performance or patterns.

Understanding these psychological biases is critical for banks and financial organizations, particularly those involved in FX markets, because it can help with risk management and strategic decision-making (Daniel, et al., 1998; Park, et al., 2010; Haixia, 2018; Parveen, et al., 2020). Although, it's crucial to evaluate these biases. In the short run, they might cause overreactions, but they might also create possibilities for profit and inefficiencies in the market. Al-Horani and Haddad (2011) also emphasized the complexity of market dynamics and the necessity for a nuanced knowledge of investor behavior and its psychological determinants.

Numerous studies have employed the Overreaction Hypothesis as a framework to examine investor behavior in a variety of stock market environments, including both developed and developing countries. Significant research has repeatedly demonstrated strong overreactions in a variety of markets, providing insight into the complex dynamics of investor decision-making and investment strategies. Particularly, empirical studies conducted in recognized stock markets like the Chinese market (Reddy, et al., 2021), German stock market (Glaser & Weber, 2007), UK market (Mazouz & Li, 2007), Saudi stock market (Alsabban & Alarfaj, 2020), and Ukraine stock market (Plastun & Mynhardt, 2013), among others, have highlighted a recognizable pattern of investor overreaction. Moreover, using NYSE data from 1988 to 1998, Larson and Madura (2001) further demonstrate the existence of overreactions. Clements et al. (2009) state that during the 1990s, the overreaction phenomenon has not only continued but gotten worse. Theoretical understanding of market inefficiency and investment strategies is enhanced by these findings, which highlight the significant influence of cognitive biases and market dynamics on investor behavior and investment outcomes.

Contrary to the overreaction hypothesis which contends that investors may respond excessively to certain events, leading to long-term contrarian movements, the underreaction hypothesis offers an alternative explanation for investor behavior. According to the underreaction hypothesis, market participants tend to underreact to new information or events, causing asset prices to adjust more slowly to fully reflect the significance of the information. This implies that new economic data releases, central bank policy statements, and geopolitical events may not instantly reflect their impact on currency prices in the context of the foreign exchange (FX) market. Alternatively, it might take some time for market participants to completely incorporate and respond to the new information, which could result in a later than anticipated change in currency values.

Moreover, the underreaction theory sheds doubts on the effectiveness of the currency market while highlighting the possibility of delayed market adjustments. Market participants may indicate inefficiencies in price discovery and possibilities for profit by taking advantage of these delayed adjustments if they persistently underreact to new information. Underreaction may also cast doubt on the Efficient Market Hypothesis (EMH), which holds that asset prices accurately reflect all available information. Because of this, it's critical to take into account the actual data proving these theories as well as their applicability to traders and investors (see Section 2.2.3). Research on how the market responds to new information and developments can shed light on the degree of underreaction and how it affects trading strategies (Jegadeesh & Titman, 1993; Hvidkjaer, 2001; Shleifer, 2000; Alrabadi, 2012).

A study by Larson and Madura (2001), sought to identify whether the FX market in industrialized and emerging economies exhibits both overreaction and underreaction phenomena (Larson & Madura, 2001). The results showed evidence of overreaction for at least one emerging currency and underreaction for at least one industrial currency after large price changes in a single day. This highlights the intricate dynamics of investor behaviour in currency markets, where market results are influenced by theories of both overreaction and underreaction. Furthermore, based on the type and duration of news events, investors may have a tendency toward both overreaction and underreaction, according to Berberis et al. (1998)

results. Thus, it is crucial to comprehend these behavioural dynamics in order to make wise investing decisions and accurately forecast market moves.

Furthermore, Jegadeesh and Titman (1993) offer direct evidence that stocks that have historically outperformed do so again in the future, and vice versa, highlighting the underreaction theory. Investors may build their expectations or views on existing knowledge, and when new information contradicts these assumptions, there may be uncertainty or a delay (lag) in adjusting to the new information (Jegadeesh & Titman, 1993). Shleifer (2000, p. 427) suggests that underreactions may stem from investors' tendency to perceive earnings as more stable than they actually are.

Finally, the Overreaction Hypothesis provides a complete lens through which to examine the strange phenomena that are frequently noticed in financial markets. Banks and financial institutions can better negotiate the challenges presented by market volatility and maintain sustainable growth by recognizing the underlying biases that lead to overreactions. As a result, overreaction in the marketplace can have a significant impact on theory and investing decision-making.

2.1.4 Anticipated vs. Unanticipated News: Differential Impacts on Foreign Exchange Dynamics.

Market movements in the field of foreign currency are frequently influenced by news announcements, both expected and unexpected. These public announcements may include actions undertaken by the central bank, the release of economic data, or geopolitical developments. Unanticipated news includes sudden, unexpected developments that can cause major market volatility, as opposed to anticipated news, which refers to events that traders and investors anticipate, such as scheduled economic data releases or central bank meetings. Both academic scholars and financial experts are very interested in the distinct effects of these two types of news on currency valuations. The complex nature of expected and unexpected news is explored in this part, along with their differential impacts on foreign exchange dynamics and the underlying mechanisms that explain currency movements in response to various news types (Paramanik & Singhal, 2020).

In the content of the Overreaction Hypothesis, it is crucial to understand the dynamics of investor behavior in response to anticipated news. Anticipated news refers to data releases or events that market players have anticipated, including expected economic events like GDP figures, employment statistics, or central bank decisions. According to the Overreaction Hypothesis, investors tend to overreact to both positive and negative news, leading to exaggerated price movements in financial markets (De Bondt & Thaler, 1985). Investors could nevertheless behave excessively even if they are informed of the impending news. For instance, investors can have already modified their investment decisions if positive economic data is anticipated. However, short-term fluctuations in prices can occur when investors overreact to the actual news release, buying or selling assets more aggressively than warranted by the new information. This behavior can lead to exaggerated price movements in the market, amplifying the impact of news on asset prices (De Grauwe & Grimaldi, 2006).

In understanding investor behavior in response to news, attention plays a crucial role. Investors tend to pay attention to news that directly affects their portfolio or investment strategy. When news mentions specific stocks experiencing extreme positive or negative results, or when stocks are highly traded, it indicates that behavioral attention of investor. This attention behavior is often driven by the herding effect and availability bias, where investors quickly respond to news information and are more likely to select stocks that are frequently promoted in the media (Barber & Odean, 2008).

According to the Efficient Market Hypothesis (EMH), current exchange rates are thought to reflect all information that is currently available, including predictions for the future (Fama, 1970). This suggests that if expected news (anticipated news) meets market expectations, its release may not have a major effect on currency volatility. In these situations, share prices react quickly to new information, which may reduce the probability that investors would benefit from it. However, Fama's hypothesis states that the degree of efficiency and how accessible the foreign exchange market is to news might alter depending on the situation. In the context of Pakistan’s foreign exchange market, Bagh (2020) investigated this. Their research found that news sentiment significantly influences exchange rates in Pakistan. The effect of news sentiment on currency fluctuations shows that the market may be gradually becoming more efficient.

This research suggests a more complex view of market dynamics, in which determinants still exist that can affect market behavior even though the EMH may be somewhat accurate. Exchange rate fluctuations are influenced by news sentiment, which highlights the complex structure of market dynamics and the diverse range of informational inputs that influence currency prices.

Moreover, El Ouadghiri and Uctum (2016) investigated whether the EMH might be applied to the stock market, with a particular emphasis on expected macroeconomic news that were anticipated and unexpected events. Their research showed that shocks from these kinds of events have a significant effect on foreign exchange rate returns, with negative shocks having a bigger effect on volatility than positive shocks of the same size. These results cast doubt on the idea of market efficiency and raise the possibility that the EMH may not fully guide the behavior of the main foreign exchange markets.

However, sentiment analysis offers a way to examine additional information sources that might not be completely accounted for in market prices, such as social media sentiment. Beyond what the Efficient Market Hypothesis (EMH) and Overreaction Hypothesis suggest, traders and investors may be able to forecast currency market movements more accurately by integrating sentiment analysis into their decision-making process.

In the realm of finance, sentiment is frequently defined as a person's attitude or feelings that have the potential to affect capital market, suggesting that underlying shifts in the economy or in specific securities should not be entirely attributed to asset pricing. According to Kaplanski and Levy (2008), sentiment is a more inclusive term that includes any misconception that might result in asset mispricing. Specifically, these two factors – mood and fear- show how irrational investor behaviour can cause changes in market sentiment. In this paper, the term "sentiment" has been utilized to denote a technical indicator derived from fluctuations in exchange rates.

Sentiment analysis has serves as a valuable tool for understanding better how market participants/investors perceive and react to the new information and event (Kaplanski & Levy, 2008). Empirical research has shown the significance of sentiment analysis in predicting or obtaining news (See section 2.2.4). For example, Kokoy (2016) explored correlations between public sentiment, particularly on platforms like Twitter, and exchange market trends. Kokoy (2016), implies that EMH is semi-strong Efficient Market Hypothesis, and that public information provide by Twitter sentiment correlate with changes in the exchange market trends. A different approach was employed by Haritha and Rishad (2020), to examine investor sentiment and stock market volatility. Developing the aggregate sentiment index (ASI) from market-oriented sentimental factors and applying the GARCH framework, their study clarified how investors saw the market as weak-efficient, casting doubt on the EMH's ability to adequately explain market behaviour, particularly in developing nations like India.

However, it is important to mention the effectiveness of sentiment analysis in informing investment decisions. While sentiment analysis can provide valuable insights, its reliability and predictive power can vary depending on a number of factors, including data quality, the sentiment analysis model used, and the context in which the analysis is conducted. For instance, regardless of whether investor sentiment is bullish or bearish, Xu et al.'s (2020) study discovered that stock prices respond considerably to rumors both before and after they become public. This implies that investors may profit from making judgments about investments based on rumors before and after they are published.

According to Evans and Lyons (2008), traders and investors may modify their investments before an anticipated occurrence. Exchange rates may fluctuate because of this proactive behaviour even before the data is released (Evans & Lyons, 2008). Central banks are also quite important in this dynamic. Markets may react in advance based on anticipated news when they provide an idea of future intentions, such as a likely interest rate adjustment, which might affect the value of currencies before the official announcement (Woodford, 2005).

Unanticipated events or data, in contrast, include matters like unexpected geopolitical developments, unexpected election results, or unanticipated economic downturns. Such news items are frequently regarded as "shocks" in the market. These shocks can cause significant short-term volatility in the foreign exchange market when traders and investors adjust their strategies in reaction to the fresh information (Anderson, et al., 2003). Unexpected news may also have an impact on market liquidity (Melvin & Taylor, 2009). For instance, a sudden geopolitical occurrence may cause traders to become less willing to engage, reducing liquidity and causing sharp volatility in currency prices. Another aspect is highlighted by the behavioural finance perspective, which contends that traders may overreact to unexpected news. This heightened reaction may be due to cognitive biases such herd behaviour, in which market players sell or buy a currency in bulk (De Grauwe & Grimaldi, 2006). Additionally, such news may cause investors to rebalance their portfolios, which may influence the currency of the relevant country (Hau & Rey, 2006).

2.1.5 Mechanism of Impact on Foreign Exchange through News

Foreign exchange is characterized by complex dynamics that are extremely sensitive to information flow. Whether expected or unexpected, news serves as a catalyst, affecting traders' attitudes, views on risk, and subsequent trading decisions. The introduction of news tends to change the cognitive harmony of traders since their psychology is a complex stage. Traders' behavioral biases can influence decision making (Shefrin, 2002). Given the element of surprise, unexpected news can cause a strong cognitive response. The sudden influx of information frequently causes a rise in short-term volatility as traders try to modify their positions out of urgency and perhaps overconfidence. The rapid liquidation or establishment of new trading positions can be attributed to the 'recency bias,' where traders give disproportionate weight to the most recent information, they receive (Barberis, et al., 1998).

On the other hand, anticipated news operates under a different mechanism. Given that such news is anticipated, traders frequently proactively modify investments prior to the event. According to Menkhoff et al. (2012), this phenomenon might result in a "buy the rumour, sell the fact" behaviour, where price fluctuations take place in anticipation of the news and then reverse or stabilise once the actual news is released. In essence, the market adjusts reconcile projections with reality by the time the news is made public because its effects have already been "priced in." (Menkhoff, et al., 2012).

2.2 Empirical Review

2.2.1 The determinants of banks' profitability

In the literature, bank profitability is not mentioned in the internal factors of banks, but in the external which they mainly refer to the operation of financial institutions. On the one hand, there are certain researchers who claim that banks' profitability is affected by their internal characteristics, as well as changes in the overall banking environment. In the literature review, internal determinants, as liquidity level, provisioning policy, capital adequacy, expense management and bank size, were used to find the relationship between the profitability and bank internal management. On the other hand, external determinants represent both the economic and various macroeconomic variables (Athanasoglou, et al., 2006). According to Athanasoglou et al. (2006), they found that all the determinants play an important role in banks' profitability except for one internal factor, liquidity. To do this, they used an unbalanced dataset containing the credit institutions of Southeast Europe between 1998 and 2002.

In most studies, the determinants of banks' profitability are divided as internal variables and external determinants. Relevant to the factors which affect the Greek bank's profitability, studied by (Athanasoglou, et al., 2008), using an empirical econometric model from 1958 to 2001. They concluded that capital and employee productivity play an important role in banks' profitability while increasing credit risk reduces bank profits. Seiford and Zhu (1999), Moreover, other researchers studied the profitability and marketability of 55 US commercial banks, finding that larger banks show better profitability performance, while smaller banks document better marketability (Seiford & Zhu, 1999).

According to the literature review, many studies used dynamic GMM techniques proposed by Arellano and Bover (1995). One of these studies was by Dietrich and Wanzenried (2011), who used GMM technique proposed by Arellano and Bover (1995) and analyzed the profitability of 372 commercial banks in Switzerland between the period pre crisis and during economic crises, 1999 to 2009, dividing the period as two sample, pre-crisis period 1999-2006 and crisis from 2007 to 2009. The results of the research showed that the profitability of banks is mainly due to three factors, operating efficiency, the increase in total loans and financial costs (Dietrich & Wanzenried, 2011).

Many studies set as dependent variables the ROA, ROE and NIM for the search banks' profitability using a pooled regression estimation method (Rahman, et al., 2015). Rahman et al. (2015), aimed to examine whether 9 different factors (capital strength, credit risk, ownership structure, bank size, non-interest income, cost efficiency, off-balance sheet activities, liquidity) are considered important to banks' profitability as other macroeconomic factors (growth of gross domestic product and inflation). To this end, they focused on 25 commercial banks from Bangladesh during the period 2006 to 2013. Findings of this study showed that capital strength and loan intensity positively affect the bank profitability. In addition, a positive influence is created by non-interest income, credit risk and GDP growth on Net Interest Margin (NIM), as a measure of banks' performance. The size can cause a significant positive change on Return on Assets, as a measure of banks' performance. However, those variables that negatively affect the bank's profitability were cost-effectiveness and balance sheet.

Regarding studies from the Middle East, some of them have found positive evidence between the banks' assets and net income (Khrawish, 2011; Demirguc-Kunt & Huizinga, 1999). Khrawish, (2011) , studied those factors who affect the Jordan commercial banks' performance during the period 2000 to 2010. This study is an extension of Demirguc-Kunt and Huizinga (1999), and others based on the Multiple Linear Regression Model, collecting 100 observations of 10 banks from 2001 to 2010, dividing the data to two categories, internal and external factors. The results of this study showed that there was a positive relationship between the Return on Assets (ROA) and cash flow framework and a negative relationship between ROA and the annual growth rate of gross domestic product and the inflation rate. Finally, they found that there is a significant and positive relationship between ROA and Exchange rate.

While many studies used and applied panel data to train models in setting of a single nation, Flamini et al. (2009), adopted a broader geographical scope. They collected data from 389 banks across 42 countries in Sub-Sahara African during the period 1999-2006. In their methodological approach, they did not limit themselves to internal bank metrics like assets, deposit growth, capital sufficiency, operational efficiency, and liquidity ratios. Instead, they added external macroeconomic factors to this, namely GDP and inflation. It is especially interesting that they used the panel random effects model as their statistical framework. It's interesting that their findings highlight how macroeconomic forces at large interact with bank-specific factors to affect bank profitability. This serves as a crucial reminder of the complex factors that influence the banking industry's profitability (Flamini, et al., 2009).

Additionally, Miller and Noulas, (1997), the portfolio composition and profitability of the US market for large banks. Using a cross-sectional and pooled time-series sample of 1206 observations (201 banks over 6 years), they also sought to identify key determining factors that may have an impact on the profitability of the USA Bank system and primarily the assets. The estimation results indicate that there is an unfavourable connection between credit risk and profitability. Additionally, the poor quality of loans has made it difficult for American banks to maximize their profits (Miller & Noulas, 1997).

Some authors have studied the liquidity risk in relation to bank profitability, which they considered one of the most important factors. The liquidity risk that results when the investor cannot meet the short-term sustained financial requirements, that is, the lack of marketability of an investment that cannot be bought or sold in a short period of time and minimizes this loss (Brouke, 1989). Bourke (1989), studied the performance of banks in 12 different countries, collecting data from 90 banks between 1972 and 1981. In this comparison, he adds the concept of value-added and concluded that there was a positive relationship between bank liquidity and profitability. In addition, credit risk is considered as another factor that can cause changes in the bank's loan portfolio and consequently in bank performance (Cooper, et al., 2003).

However, the size of a bank is used by many researchers as an important cause for various economic reasons for the banking system and many believe that there is a higher positive relationship between variable size and bank profitability if there are significant economies of scale. Goddard et al (2004), set up dynamic panel and cross-sectional data to assess the growth and profit of banks from 5 EU countries. They found that a saving, and corporate bank has better retention of profits than the commercial banks. However, these banks have high capital assets and this leads in low profitability. On the other hand, the size of a bank can control the differentiation of the risk of each industry individually. This can have a negative impact, because increased diversification in a bank or a company leads to lower credit risk and therefore lower returns.

High economic growth is considered to give both the country and the banks the opportunity to borrow and then change their higher profit margins and improve their assets. (Claessens, et al., 2001), attempted to find this external link that may affect domestic banking markets on net margins, overhead, taxes paid and bank profitability. Claessens et al (2001), collected 7900 observations from 80 different countries in the world, between 1988 and 1995. The results of this study were that the high presence of these foreign countries is closely linked to the decline in profitability and domestic banks.

As regards external determinants, several factors have been proposed affecting the profitability of banks who can distinguish them variables describing the macroeconomic environment, such as inflation, as well as variables representing market characteristics.

Many studies are dominated by a macroeconomic variable related to the banking environment and can positively or negatively affect the Bank's profitability. This variable is inflation. Many of them are concentrated in developed countries. As for Central and Eastern Europe, there are much fewer pieces of evidence. Athanasoglou et al (2006), explore banks from the SEE region during the period 1998 to 2002. It is found that the concentration has been positively correlated with banks' profitability and that inflation has had a strong impact on profitability, while bank profits are not significantly affected by real GDP per capita fluctuations.

In addition to researchers who studied and studied one of the two categories of factors (external and internal). Petria et al. (2015) investigated both to identify the elements that influence bank profitability based on ROAE and ROAA. According to the study results, credit risk, liquidity risk, managerial efficiency and diversification, market competitiveness, and economic growth are all elements that can have a good or negative impact on profitability. In addition, in the same year, Petria et al. (2015), collected data on five CEE countries between 2004 and 2011. The sample consists of 143 commercial banks based on three economic variables, average return on assets (ROAA), the return on average equity (ROAE) and net interest margin (NIM). They conclude from their research that two key factors influence banks' performance, management efficiency and capital adequacy. However, credit risk and inflation only determine ROAA and ROAE.

After one year, Garcia and Guerreiro (2016), studied both categories of 27 total banks in Portugal between 2002 and 2011. They used three keys as dependent variables, Return on Average Equity (ROAE), Return on Average Assets (ROAA), and Net Interest Margin and many macroeconomic and industrial factors as independent variables, using the ordinary least squares estimations with fixed effects model. This research concludes that two factors have a positive impact on banks' profitability, the cost income ratio and GDP, and two equally negative factors, the difference between bank and market growth of total loans, and the annual growth of household disposable income.

A study based both on internal and external factors was by Gul et al (2011). The author wanted to find these factors where affect the bank profitability, collecting data from 15 Pakistan Banks, from 2005 to 2009. Using the pooled ordinary least square estimation method to determine the impact of macroeconomic and other factors on banks' profitability (i.e., assets, loans, ROA, ROE), he concluded that both internal and external factors can affect profitability. In the same year, a study with the same goals but in a different country, Turkey, was achieved by Alper and Anbar (2011). These ranged from 2002 to 2010 with the dependent variables being bank profitability indicators, ROA and ROE. They studied using a balanced dataset and found that the size of earnings and non-interest inks can bring about positive changes in banks' profitability, but the size of the credit portfolio and debt has the opposite effect on bank performance. Regarding the macroeconomic factors tested in this model, they found that the only one variable could affect the bank's performance, the real interest rate.

Sufian and Habibullah (2009), focus their research mainly on 37 commercial banks in Bangladesh from 1997 to 2004 to find the factors that determine the banks' profitability. Their goal was to identify the factors that affect banks' profitability. Their analysis revealed a complex relationship between banking features, including loan intensity, credit risk, cost, and bank performance. Moreover, the size of the bank in terms of ROAA and net interest margin (NIM) has also a positive impact. Yet, it's crucial to understand the contradictions that exist. Return on Equity (ROE) may be harmed by the bank's size, and non-interest revenue may have an adverse effect on profitability. When they turned their attention to macroeconomic factors, they noticed that inflation stood out as a distinct factor affecting profitability, a sign of its potential effects on the banking industry.

The banking sector, and in particular bank profitability, is inherently sensitive to macroeconomic variables. Various empirical studies underscore this relationship (Messai, et al., 2015). Based on their empirical investigation, they concluded that GDP growth had a favourable impact on bank profitability, with Net Interest Margin (NIM) serving as their key performance indicator. However, the landscape isn't without its shadows. Profitability is negatively impacted by inflation, which is frequently used as a gauge of economic health. Naceur and Kandil (2006), argued that rising inflation rates generate uncertainty and restrict credit demand, share this viewpoint.

In the literature, bank profitability is not mentioned in the internal factors of banks, but in the external which they mainly refer to the operation of financial institutions. On the one hand, there are certain researchers who claim that banks' profitability is affected by their internal characteristics, as well as changes in the overall banking environment. In the literature review, internal determinants, as liquidity level, provisioning policy, capital adequacy, expense management and bank size, were used to find the relationship between the profitability and bank internal management. On the other hand, external determinants represent both the economic and various macroeconomic variables. According to Athanasoglou et al (2006), analyze the southern European banking sector profitability between the period 1998 and 2002. They found that all the determinants play an important role in banks' profitability except for one internal factor, liquidity. The authors also apply a dynamic panel data model to study the performance of Greek banks over the period 1985 to 2001, finding some benefit of persistence, a result which indicates that the market structure is not perfectly competitive. They also found that the profitability of Greek banks is explained by banking variables and macroeconomic variables.

2.2.2 The counterparty risk and bank lending

Theoretically, commercial banks play a dominant role in commercial lending (Allen & Gale, 2004). Bank deposits regularly carry out investment banking activities in many countries by providing new debt to their customers (Gande, 2008).

While some studies in the literature show that the credit risk has a positive effect on banks' economic performance, most studies have concluded that there is a negative relationship between credit risk and financial performance (Kargi, 2014; Muriithi, et al., 2016; Ekinci & Poyraz, 2019). Kargi (2014), studies the effect of risk withdrawal on the profitability of

Nigerian banks. Financial indicators were collected as measurements of bank performance and credit risk during the period 2004-2008. The findings revealed that credit risk management has a significant impact on profitability of banks. Bank profitability is also inversely affected by levels loans and advances, non-performing loans and deposits thus putting them at great risk.

Muriithi et al (2016), measure the credit risk based on by capital to risk weighted assets, asset quality, loan loss provision, loan and advance ratios and financial performance by return on equity (ROE) from 43 commercial banks in Kenya, collecting data between 2005 and 2014. The conclusion of this study was that credit risk has a negative but significant relationship with the profitability of banks while poor quality assets or high non-performing loans with total assets are associated with poor banking performance.

Ekinci and Poyraz (2019), obtain data from 26 commercial banks in Turkish during the period 2005 and 2017. As financial performance indicators used the ROA and ROE, while the Non-Performing Loans (NPLs) are used as indicators of credit risk. They found a negative relationship between credit risk and ROA and ROE respectively.

2.2.3 Exchange rates and Banks' Performance

Several papers have attempted to explain the effect of exchange rates on banks' performance. There are many different views on this using various of empirical methods. Nigeria (2014), followed a relevant study to finding and recognizing the effects of credit risks on the market and exchange rate for banks' profitability. For this study, 15 annual cash deposits were collected during 2006 and 2011 in the Nigerian Stock Exchange (NSE). He found that fixed exchange rates added value to the profitability of Nigerian banks. Atindéhou and Gueyie,(2001), tried to interpret the exchange risk of the banks collecting various assets from the market, interest rates and exchange rates over the period 1988 to 1995. The results showed that the banks' yields were exposed to currency risks mainly with the US dollar relative to the Canadian dollar exchange rate.

Even though many theoretical studies are trying to explain the relationship between the exchange rate and banks' profitability, some of the researchers have used different modelling approaches. For example, using OLS and GARGE estimation models, Kasman et al (2011), studied the impact of interest rate and exchange rate changes on the yields of Turkish banks during the period of 1999 and 2009. The volatility of these factors negatively affected the return on equity of banks. In addition, Ryan and Worthington (2004), used an econometric model to study the exposure of Australian banks' stocks to market risks, interest rates and exchange rates for the period 1996-2001. Their research showed that the long terms interest rates and the exchange rate did not significantly affect Australian banks, but the market risk brought many responsibilities.

Priti (2016), examine the volatility of short-term and long-term exchange rates and interest rates in three bank portfolios, Money Center (MC), Large (LG) and medium-sized banks (MED). He collects a total of 1.508 daily observations from 70 commercial bank stocks traded on the New York American Stock Exchange or the American Stock Exchange. To this end, he used an Exponential Generalized Autoregressive Conditionally Heteroscedastic (EGARCH), model. The results of this study show the presence of asymmetries in both the short- and long-run exchange and interest rates in terms of MC, LG, MED

2.2.4 The Overreaction Hypothesis and its Implications in Finance

In the financial world, the study of investor behavior has become significantly important, especially since behavior finance has emerged. This field suggests that investors frequently act irrationally, driven by multiple psychological biases, challenging the conventional notion of rational decision making (Baker, et al., 2017; Thaler, 2015; Statman, 2014).

Through investigation of the Overreaction Hypothesis (ORH) and its consequences for financial markets, we illuminated investor behavioral patterns and the ensuing effects on asset pricing and volatility (De Bondt and Thaler, 1985). As discussed earlier, the Overreaction Hypothesis (ORH)posits that investors' reactions to news, whether positive or negative, are excessively strong, resulting in significant price movements that vary from an asset's intrinsic worth. These price variances fix themselves over time, generating a reversal in returns. Understanding the ORH is critical in the banking sector, given the sensitivity to news and macroeconomic factors, which can significantly influence market sentiment and investor behavior (Statman, 2014; Thaler & Ganser, 2015). This review of the literature looks at empirical research that has investigated the Overreaction Hypothesis (ORH).

The Overreaction Hypothesis phenomenon has been observers in various studies, including the seminal work by De Bondt and Thaler, (1985), indicating that stocks with low previous returns generate better future returns than stocks with exceptional past results. Their findings point to investors' habitual overreaction to previous data. There are two primary theories explaining this observation. Firstly, it is believed that this overreaction is a reflection of the size effect. This means that underperforming stocks are typically from smaller firms, and historically, small firms tend to perform better than larger ones. Zarowin, (1990) and Chopra et al. (1992), delved into the influence of the size effect within the Overreaction Hypothesis using US datasets. Their findings suggested that when accounting for size, the additional returns from underperforming stocks were reduced. While accepting this viewpoint, DeBondt and Thaler (1985) did not conduct an exhaustive examination to back up their argument. The second theory suggests that the reversal in returns mirrors alterations in the necessary equilibrium returns, which were not factored into DeBondt and Thaler's (1985) initial study. According to Ball and Kothari (1989), the betas of significant underperformers outperformed the betas of large outperformers by 0.76 following the creation of portfolios. Beta inequalities, when supplemented with historical understanding of risk premiums, can explain the large variances in actualized returns. Moreover, they suggested that using annual rather than monthly return data weakens evidence for the Overreaction Hypothesis (Ball & Kothari, 1989).

However, recent research has delved into the evidence of overreactions using daily data. Plastun and Mynhardt (2013) are notable examples. Analyzing daily data from 2008 to 2012, they explored short-term price reactions following one-day abnormal price shifts in the Ukraine stock market. Their research indicates that after unusual price movements, the magnitude of contrarian price shifts is typically greater than after standard daily fluctuations. Furthermore, in a comprehensive study spanning 30 years, Mazouz and Li (2007), examined the overreaction hypothesis within the UK market. Their findings were in line with the overreaction hypothesis, and interestingly, they could not pinpoint any discernible seasonal trends. Another research by Ali et al. (2011) analyzed weekly data from 2000 to October 2010. They observed that portfolios with 'winner' stocks typically yielded negative returns, while those with 'loser' stocks demonstrated positive returns across various holding periods ranging from 1 to 52 weeks. Significantly, the overall findings indicated that a portfolio comprising 'losers' over 'winners' consistently generated substantial returns (Ali, et al., 2011). When examining overreaction based on trading volumes - low, medium, and high - it was evident that stocks with low trading volumes were more susceptible to consistent and pronounced performance reversals. Consequently, there's an inverse relationship between trading volume and overreaction. Furthermore, their findings suggest that investors could potentially realize significant gains by adopting a short-term contrarian strategy, particularly focusing on low-volume stocks.

The exploration of overreaction effect in the Chinese stock market have been done recently by Reddy et al. (2021), specifically in the Shanghai Stock Exchange (SSE) Composite 50 index, post the 2007 Global Financial Crisis. Using a time series analysis of average cumulative abnormal return from January 2009 to December 2015, the researchers applied a contrarian strategy to develop an arbitrage portfolio based on both intermediate and short-term analysis periods. The findings indicated a significant overreaction in the SSE, with the arbitrage portfolio yielding positive excess returns, especially for loser portfolios. Notably, losers rebounded and outperformed the market rapidly, highlighting the potential gains from a contrarian investment strategy and underscoring the volatile behavior of the SSE during the study period.

However, it’s important to note that the dynamics of overreaction are not uniform across all stock exchanges. Research on the Amman Stock Exchange (ASE), for example, presents a more complex picture. Saleh (2007) concluded that in the short and medium term, the underreaction hypothesis is more likely to be accurate, while in the long run, the overreaction theory holds true for the ASE over the period 1980 to 2002. Additionally, this idea is further supported by Jegadeesh and Titman's (1993) analysis of the underreaction theory, which shows positive autocorrelation in stock returns over a six-month period, resulting in momentum effects in following months. In a similar vein, Alrabadi (2012) found evidence of underreaction on the ASE, especially in the stock market's immediate response to shocks. According to Alrabadi's findings, there was a notable continuation of return (momentum) in the short term after a price shock that was not explained by risk, liquidity, or size factors.

Furthermore, psychological aspects are very important in determining the dynamics of the market and investor behavior. Five major psychological elements were found by Al-Horani and Haddad (2011) during their investigation of the elements influencing investors' behavior on the ASE: overconfidence, opportunistic behavior, mimicking attitude, sensitivity to rumors, and self-attribution. The contradictory findings on conservatism bias, however, emphasizes the complexity of investor decision-making processes.

Market overreaction, investor behavior, and investment decisions are all linked phenomena that play critical roles in stock market dynamics, particularly in emerging economies. The delicate interplay of these elements frequently influences stock market direction, influencing both micro and macroeconomic indices.

By definition, emerging stock markets are more volatile and sensitive to rapid fluctuations than established ones. This volatility is frequently compounded by investor moods, which, when influenced by a variety of internal and external events, can lead to market overreactions. In simple terms, overreaction refers to the exaggerated and often unjustified reaction of stock prices to information, whether favourable or unfavourable. When exacerbated by investor behavior, this overreaction can result in large stock price fluctuations. In turn, these biases influence investing decisions, with investors flocking to acquire stocks in the expectation of profiting or selling them to offset losses. These decisions, which are frequently influenced by emotion rather than rational thought, might exacerbate the cycle of overreaction.

As already discussed in the previous section (see Section 2.1.3), cognitive biases, in particular overconfidence—the tendency of investors to overestimate their own signal precision or trading abilities—have a substantial impact on investor behavior in the financial markets. Throughout the empirical review of the studies, it is important to recognize how cognitive biases, such as representativeness and overconfidence, influence investor decisions. Several studies offer important insights into the effects of overconfidence on several facets of financial markets (Odean, 1998; Scheinkman & Xiong, 2003; Park, et al., 2010; Ul Abdin, et al., 2022; Michailova, et al., 2017).

The impact of overconfidence on investors' decisions was examined also by Adel and Mariem (2013). Data from 27 companies listed on the Tunis stock exchange between 2002 and 2010 was examined. They discovered that overconfident investors trade more frequently, which raises trading volume, using a model known as ARMA-EGARCH. They also found that increased market volatility is a direct result of increased investor confidence. They proposed the MA-EGARCH model as a way to better comprehend this connection. Overall, their research indicates that a significant contributor to market volatility is overconfidence.

Park et al. (2010) proposed a model suggesting that investors with stronger confirmation bias exhibit higher levels of overconfidence, leading to more frequent trading but lower realized returns. This highlights the intricate relationship between cognitive biases and investment behavior. Similarly, studies by Iqbal et al. (2015) and Haixia (2018) further support the idea of overconfidence bias influencing investment behavior, enriching this study for understanding investor decision-making.

Especially, Parveen et al. (2020), delved deeper into this complex relationship within the context of the Pakistan Stock Exchange (PSX). Their findings highlighted the essential part that cognitive biases, notably overconfidence and representational heuristic, play in influencing investor decisions. The study indicated that overconfident investors rely largely on the representative heuristic, causing them to overreact to new market information. This overreaction, which was affected by cognitive biases, was discovered to have a major impact on investment decisions and trading volumes.

Additionally, Ul Abdin et al. (2022) studied how risk trends influence the factors that contribute to excessive confidence bias and how it affects investment results. Using a questionnaire and pilot testing, their study found that risk propensity—a measure of an investor's propensity for taking risks—is significantly impacted by cognitive biases. Interestingly, the best predictor of risk propensity and investing performance was shown to be the illusion of control. The results of Glaser and Weber's (2007) study add to the knowledge gained from earlier research on this topic by highlighting specific routes via which cognitive biases, such overconfidence, appear in investor behavior. Especially, investigating the effect of stock returns on individual investors in the German stock market between 1997 and 2001, they found that both past market and portfolio returns increase investors' overconfidence, leading to more trading activity and higher risk management strategies.

By developing a novel methodology, Michailova et al. (2017) made a substantial contribution to the investigation of overconfidence. They created a risk aversion measure and an overconfidence measure, called the "bias score". Their results showed a negative association between the two variables, pointing to an intriguing relationship between overconfidence and errors in future price predictions. They did note, however, that risk aversion did not correlate with overconfidence and did not appear to affect the experimental results. The complexity of overconfidence and how it affects decision-making in financial circumstances are clarified by this study.

Furthermore, a more recent study conducted by Alsabban and Alarfaj (2019) on rational decision making in Saudi stock market, Tadawul investors from 2007 to 2018. Based on the analysis of the monthly data using a Vector Autoregression model, their conclusions point to a propensity for overreaction on the part of investors in this market, emphasizing the pervasive influence of cognitive biases on investor behavior.

Moreover, the overreaction phenomenon, commonly observed in equity markets, is also evident in the foreign exchange (FX) market. Overreaction in the FX market refers to the excessive and prolonged reaction of exchange rates to various macroeconomic news or policy decisions, leading to subsequent price reversals. This behavior is primarily attributed to traders' cognitive biases, where they tend to place too much weight on recent information, leading to sharp exchange rate movements that deviate from the fundamental values (Menkhoff, et al., 2012). The FX market's tendency to overreact has consequences for both market participants and policymakers, as it can lead to mispriced currencies, greater volatility, and the possibility of speculative bubbles.

Several researchers have delved into this phenomenon in the FX market by investigating the macroeconomics news (Evans & Lyons, 2008; El Ouadghiri & Uctum, 2016). For instance, Evans and Lyons (2008), examined the microstructure of the FX market and found evidence of overreaction to macroeconomic news. Similarly, Chari and Henry (2004), investigated the currency crises in emerging markets and found that overreactions were frequent, leading to significant exchange rate misalignments. Another study by Burnside et al. (2006), provided evidence on the profitability of currency trades that exploited the overreaction in the FX market. These studies provide important insights into the fundamental behavioral biases that impact market dynamics, which has major implications that extend beyond academic discussion.

2.2.5 Models for Sentiment Analysis in Finance

In the realm of finance, traders, portfolio managers, and investors must quickly identify favorable or unfavorable attitudes from financial and economic news in order to make well-informed investment decisions (Mishev, et al., 2020). Models for sentiment analysis provide a productive way to extract relevant signals from news sources. Sentiment analysis can shed light on the psychological factors influencing how investors respond to current events. Traders and investors can evaluate the level of market feelings and potential overreaction or underreaction by examining sentiment movements prior to and following news announcements. This enables them to make better informed trading decisions.

A model for investor sentiment based on psychological factors was developed by Berberis et al. (1998), who looked at whether investors overreacted or underreacted to the stock market. In order to determine if the average return after a protracted run of positive earnings shocks is less than the average return after an equivalently long run of negative shocks, their study examined overreactions to news. They observed that stock prices tended to underreact to earnings announcements, while overreacting to consistent patterns of good or bad news. Interestingly, they found contradictory results: while the average return following a positive earning shock was greater than the average return following a negative shock, indicating underreaction, they also found that stock prices tended to underreact to similar events.

Meanwhile, many researchers have employed the Consumer Confidence Index (CCI) as a proxy for investor sentiment (Lemmon & Portniaguina, 2006; Fernandes, et al., 2013; Banchit, et al., 2020). Notably, Schmeling (2009) discovered that, on average, strong sentiment levels negatively predict overall stock market outcomes across national boundaries. In particular, future stock returns are generally lower when sentiment is strong and vice versa. This shows how important it is to comprehend market dynamics and implies that investor sentiment, as gauged by the CCI, might be a useful forecast of future market moves.

The science and art of sentiment extraction from textual sources has seen a rise in study interest in the field of financial analysis. This research' techniques and areas of focus, however, are very diverse, offering an extensive collection of data but also raising concerns about the best strategies (Bollen, et al., 2011; Tetlock, 2007).

Researchers have long been fascinated by how emotions and financial market dynamics interact. The relevance of sentiment in financial markets was highlighted Bollen et al. (2011), showing that Twitter sentiment could forecast stock market fluctuations. Similar to this, Tetlock (2007), demonstrated how media-based investor sentiment may be used to predict changes in stock prices. These studies provide a basis, but there is still little research done in the particular field of exchange rate news. This study is focused on Bollen et al (2011) investigation by creating a dictionary-based approach where words in the text are matched against predefined lists of words associated with positive or negative sentiments. Turning attention to Tetlock's (2007) research, the study provided valuable insights into how the sentiment in financial news columns could influence stock market prices. Focusing on the Wall Street Journal's "Abreast of the Market" column, Tetlock undertook a comprehensive content analysis.

Similar to the previous study, Li et al. (2014) collected historical Hong Kong Stock Exchange prices and news articles to examine the impact of news sentiment. This study also relied on the dictionary-based technique used Harvard psychological dictionary (Harvard IV-4 sentiment dictionary- HVD) and Loughran–McDonald financial sentiment dictionary. Using techniques like bag-of-words (BoW) and SenticNet 3.0-beta (SN), they evaluated the prediction accuracy of sentiment-based methods versus non-sentiment approaches. Interestingly, their results cast doubt on the effectiveness of sentiment-based techniques in financial prediction, indicating that models integrating sentiment polarity did not significantly enhance prediction accuracy. Expanding on this line of inquiry, Li et al (2020), developed a more advanced method to further explore this area of study by utilizing deep learning techniques to assess market sentiment. Their research combined news sentiment and technical data to create a multi-layered deep learning model for predicting stocks on the Hong Kong Stock Exchange. They investigated the effectiveness of combining sentiment analysis with traditional indicators using four distinct sentiment dictionaries. Remarkably, their findings demonstrated the potential of sentiment analysis in conjunction with pricing information. At the individual stock and sector levels, models that included prices and news sentiments performed better than those that just used technical indicators or news sentiments. This implies that while sentiment analysis by itself might not have much predictive ability, combining it with additional variables can improve forecasting accuracy.

Nonetheless, Friesen and Weller (2006) suggested and developed two models- the rational model and the cognitive bias model- to clarify the nuances of analyst earnings estimates. These models attempt to distinguish between behaviors driven by cognitive biases like loss aversion, overconfidence, and conservatism and behaviors which are rational. Their findings provide insight into how these biases affect how investors perceive and process information. They found strong evidence, which is noteworthy, that analysts are prone to cognitive dissonance bias and overestimate the accuracy of their own information. They also show, nevertheless, that analysts are able to reduce bias when evaluating other people's estimates.Expanding on the previous conversation, some researchers have studied behavioral models designed to forecast stock market behavior. Specifically, they believe that financial behavior is intricately linked to investment decisions and their results. For instance, Cao et al (2020), examined at how behavioral factors affected the choices made by individual investors and the performance of their investments in the stock market in Vietnam. The researchers polled 250 investors using techniques like exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modeling (SEM). According to their research, heuristic, prospect, market, and herding elements all have a direct, favorable impact on how investors make decisions. This emphasizes how important behavioral aspects are in influencing the decisions and results of investments.

Loughran and Mcdonald (2011) offered a pioneering perspective by introducing financial dictionaries tailored specifically to analyze financial texts. These dictionaries are categorically structured, identifying words as negative, positive, uncertainty-driven, litigious, among other classifications. Their application to 10-K reports, annual summaries of company performance submitted to the U.S. Securities and Exchange Commission, underscored the paramount importance of context. Generic sentiment analysis tools might falter in financial contexts due to industry-specific jargon and the nuanced meanings words might carry in a fiscal backdrop. Their study illuminated how custom-tailored tools can yield more accurate and actionable insights when analyzing financial texts (Loughran & Mcdonald, 2011).

In order to predict the price of stocks, Jin et al. (2021) created a hybrid model that combines sentiment analysis with deep learning. They employed a Long Short-Term Memory (LSTM) Neural Network technique to categorize unknown sentiments of investors that were taken from a significant stock forum. Six different industries were covered by the forum data from the Shanghai Stock Exchange (SSE). To evaluate the performance of the prediction model they used the mean absolute percentage error (MAPE). Additionally, they also trained and tested their sentiment analysis model using the 3,000 positive and negative textual data samples included in the ChnSentiCorp Chinese sentiment corpus. This method provides a more sophisticated view of investor mood in the financial sector.Smales (2014), on the other hand, incorporates sentiment analysis within the larger context of market dynamics. He bridges the gap between qualitative news mood and measurable market volatility by connecting the VIX index—often referred to as the "investor fear gauge"—with the sentiment obtained from financial news. The VIX, which measures expected market volatility over a coming 30-day window, is affected by several variables, with news sentiment being one of the most important, as identified by Smales (Smales, 2014).

Another sentiment analysis has been investigated by studying the relationship between twitter sentiment (or mood) and the stock market, specifically the Dow Jones Industrial Average (DJIA). Bollen et al (2011) collected a substantial amount of Twitter data (tweets) over a specific time frame. They analyzed approximately 9.8 million tweets from 2.7 million Twitter users. They didn't merely measure positive versus negative sentiment. Instead, they used a more complex tool, OpinionFinder, which gauges positive or negative sentiment. They also used the Google-Profile of Mood States (GPOMS) which gauges mood in terms of six different dimensions: Calm, Alert, Sure, Vital, Kind, and Happy. By examining the mood data and comparing it to stock market changes, the researchers attempted to determine if collective societal mood can predict up or down movements in the stock market by testing Granger causality between sentiment and financial time series. Their findings showed that the mood measured from Twitter could be used to predict the direction of DJIA changes three to four days in advance with an accuracy of 87.6%.

Similarly, Atkins et al. (2018) recommended using Google Trends and Stock Twits to further predict volatility in financial indices and capture market sentiment.by constructing machine learning models of Latent Dirichlet Allocation to represent data from news feeds, and basic naïve Bayes classifiers to predict movement direction. Their empirical results showed that the average directional prediction accuracy for volatility, upon the introduction of new information is 56%, although the asset close price's accuracy is 49%, which is as good as random.

Various researchers examined and created an index of sentiments in relation to macroeconomic and currency news, seeking to unravel their impact on financial markets. (Anderson, et al., 2003; Evans & Lyons, 2008; Égert & Kočenda, 2014). Anderson et al. (2003), attempted to understand how U.S. and German macroeconomic announcements affect the foreign currency market in real-time employing the International Money Market Services (MMS) real-time data and utilized an ARMA model for their analysis. Égert & Kočenda (2014) also investigated how central bank communication and macroeconomic news affected the exchange rates of CEE (Central and Eastern European) currencies relative to the euro. They studied the effects of news and communication on exchange rate movements by using a high-frequency GARCH model and a monetary model to predict the nominal equilibrium exchange rate. Their research showed that the currencies of Central and Eastern Europe react to news about the macroeconomy.

On the other hand, Evans and Speight (2010) explored the responsiveness of high-frequency Euro exchange rates to macroeconomic news announcements, particularly focusing on the volatility response pattern. They empirical investigation involved assessing the immediate price response to these announcements using high-frequency data (which captures market movements at minute-by-minute intervals or even smaller intervals).

In a contemporary context, Rajendra and Vatsal (2020) employed novel techniques for sentiment analysis in a modern setting, drawing on textual information taken from pertinent news stories on the financial markets and the economy. By including the previously mentioned market sentiments, their study attempted to present an improved version of the asymmetric GARCH model of conditional volatility for the Indian stock exchange, Sensex, covering the period from April 19, 2007, to January 10, 2020. Their findings provide insight into the dominant role that negative sentiment plays in the market compared to good sentiment. Additionally, their investigation turned up evidence of noise trading in the underdeveloped Indian stock market, highlighting the intricacies of sentiment-driven market dynamics.

2.3 Conclusion

Despite extensive research exploring the determinants of banks' profitability and the impact of exchange rate volatility on the stock market, surprisingly there is a gap in the literature review of how creating a news sentiment index based on exchange rate fluctuations could affect banks. This gap in the literature highlights the need for a more thorough comprehension of the interactions among exchange rates, news sentiment, and bank profitability. Thus, while the literature review has provided insight into a number of factors that impact bank's profitability, investigating internal and external banking variables and measures (Athanasoglou, et al., 2006), transaction risks (Kamau, et al., 2015; Carrada-Bravo, et al., 2006), the relationship of currency movements and banking exposure (Niepmann & Schmidt-Eisenlohr, 2022), the relationship among news sentiment, exchange rates and the banks' profitability have not been well studied.

After reviewing the empirical literature review on sentiment measures for obtaining textual news information, it's clear that there are not many well-established techniques accessible and that researchers are always coming up with news strategies by combining preexisting models and creating their own, as followed in this study. Consequently, the goal of this work is to create an index, called as news sentiment index, that captures the overall news releases by analysing their attributes, thereby bridging the gap between the Overreaction theory and news sentiment analysis. The rationale behind of this connection is to gain a deeper understanding and predictive insight into whether banks' profitability is positively or negatively influenced by this sentiment index, as established in Chapter 3. By evaluating this relationship, or lack thereof, with this predictor (new sentiment index), the study's findings will be able to conclude whether investors may be prone to over- or underreaction to new information about exchange rates.

It is important to note that this study does not delve into investigating the sociology, psychology, anthropology, and finance factors described in behavior theory (Ricciardi & Simon, 2000) or the implications of the Efficient Market Hypothesis, as where most scholars looked at behaviour and excessive confidence bias in investor decision-making in the stock market. However, while many scholars have attempted to create different tools for news sentiment analysis using different models (Li, et al., 2020; Paramanik & Singhal, 2020; Evans & Lyons, 2008; Komariah, et al., 2016), none have particularly addressed the effect of exchange rates on bank profitability.

Chapter 3

3 Methodology.

3.1 Introduction

Several current US banks and financial entities are covered within this study. Over a substantial time, frame, a total of 800 banks were chosen for investigation. However, after undergoing a rigorous filtering process for the models the sample size was reduced to 148. The information was obtained from the annual financial reports published by the FDIC and Bloomberg for the years 1998 to 2018. With the collection of both internal (assets and liabilities) and external (macroeconomic) variables, the effect of unexpected exchange rate news on the banking industry is exogenous, which may be appropriately retrieved using the OLS Fixed Effect model. However, given the cross-section and usage of lagged differences, the GMM model can more effectively capture components of the model's endogenousity, making it a strong choice of approach for recording the endogenousity involved in the simultaneous determination of variables in models.

Panel estimations use the OLS fixed effects model, the Least Squares Dummy Variable (LSDV) model, and the Instrumental Variable estimator. he GMM estimator of the system is also used to fully calculate the heterogeneity of the data. To address potential endogeneity of the explanatory factors in the panel, Arellano and Bond's (1991) GMM estimators include lagged instruments of the endogenous variables for each time period. The GMM panel estimators' equation is as follows:

$$ROA_{it} = \alpha_{it}\ \beta_t + X_{it} + e_{it} \qquad (4.1)$$

$$ROE_{it} = \alpha_{it}\ \beta_t + X_{it} + e_{it} \qquad (4.2)$$

$$NIM_{it} = \alpha_{it}\ \beta_t + X_{it} + e_{it} \qquad (4.3)$$

Where ROA, ROE and NIM are the dependent variables for each bank i at the time period t, α_{it} is the time-invariant unobserved bank-specific fixed effect, β_t captures the unobservable individual-invariant time effect (e.g. total assets are common to all these banks), X_{it} is a vector of the explanatory variables (independent variables) and e_{it} is the error for bank i at the time period t. If E $(e_{it}\ e_{iz})$=0 hold for z≠t across all banks, then it represents the following moment conditions:

$$\text{E}\ (ROA_{i,t-z}\Delta_{e_{it}}) = 0 \text{ for } z \geq 3;\ t = 1, \ldots\ldots, T$$

Where $\Delta_{e_{it}} = e_{it} - e_{i,t-1}$

If X_{it} are weakly exogenous then we also have the following additional moment conditions:

$$E\ (X_{i,t-z}\Delta_{e_{it}}) = 0 \text{ for } z \geq 3;\ t = 1, \ldots\ldots, T$$

The single equations GMM panel estimator generally specifies a dynamic panel model in first differences and exploits the above moment conditions[1]. Therefore, to deal with endogeneity, were used and applied lagged levels of endogenous variables (independent variables), which are considered appropriate instruments.

One problem that needs to be addressed is the possible small time series dimension of the table, so the estimation of the single equation suffers from the problem of weak instruments. To solve this problem, we apply a panel GMM system[2] estimator by Arellano and Bover (1995b) and Blundell and Bond (1998b), reducing the inaccuracy associated with the single equation estimator. The system GMM estimator estimates a system of equations in first differences and level by stacking the data. In the first transformed equation, the lagged levels were used as instruments. For the level equation, the lagged first differences were used as instruments.

$$E[(\alpha_{it} + e_{it})\ \Delta ROA_{i,t-z}] = 0 \quad \text{for} \quad z=1$$

$$E[(\alpha_{it} + e_{it})\ \Delta X_{i,t-z}] = 0 \quad \text{for} \quad z=1$$

According to Bond et al. (2001), the system GMM estimator outperforms a variety of different methods of moment type estimators. To make a comparison between the simple GMM equation and the GMM system estimators, the Hausman test was chosen, adding delayed first differences to the set of instruments (additional instruments used in GMM system estimates). Based on the Hausman test, the GMM system estimator differs considerably from the GMM single equation estimator if the test rejects the null hypothesis that they are not significantly different.

The consistency of GMM estimators depends crucially on whether the delayed values of the explanatory variables have a valid set of instruments and whether e_{it} they are not serially related. To verify the validity of the set of instruments, we undertake Sargan's instrument validity test. Subsequently, to test the serial correlation the Arellano-Bond test was used, which

[1] The model has transformed into first differences.
[2] The system GMM estimator, based on moment conditions

claims that there is no serial correlation, the null hypothesis is that the errors in the regression of the first difference do not show a second order serial correlation.

3.2 Hausman test

The Hausman tests (Hausman 1978) compare two distinct estimators of the model parameters in order to detect misspecification in econometric models. Under the null hypothesis of the correct model specification, both comparative estimators should be consistent with the "actual parameters" of the model (those corresponding to the data generation process), while under the alternative hypothesis, the estimators should have different probability limits. The first property guarantees asymptotically controllable test size, and the last property confers the test's robustness. Theoretically, the fundamental tenet is that when the model is set correctly, the benchmarks will be close to each other, but when the model is not set correctly, the benchmarks will be far apart. In order to run a Hausman test, the Hausman statistic is compared to a critical value derived from the sample distribution, and if the Hausman statistic exceeds the critical value, the null hypothesis of the proper specification is rejected.

The Hausman test finds also endogenous regressors in an OLS model. The values of Endogenous variables are determined by other variables in the system. OLS will not work in a model with endogenous regressors if there is no correlation between the variable prediction and the error term. Instrumental variables estimators can be utilized as an alternative in this situation. So, the Hausman test is employed to determine whether the predictor variables are endogenous.

In panel data analysis, a Hausman test serves as a valuable tool for determining the most suitable models, between Fixed Effect Model and Random Effect Model. The correlation between unobserved results and regressions are those criteria that must be decided for which method will be chosen between the fixed or random specification. In this way, the following hypotheses are developed:

H_0: $\mathrm{Cov}(X'_{it}, c_i) = 0$

H_A: $\mathrm{Cov}(X'_{it}, c_i) \neq 0$

The null hypothesis refers to the Random Effect model, specifically if the result of the test is insignificant (p-value > 0.01) then the NH is accepted. It should also be noticed that in the null hypothesis there is no correlation between unique errors and the regressors in the model. The opposite interpretation is specific to the alternative hypothesis suggesting using the Fixed

Effect model if null hypothesis is rejected. The following table presents the characteristics of the models.

Table 1: Hausman test specifications

Hausman test	H_0	H_A
Fixed Effect Model	consistent + inefficient	consistent + efficient
Random Effect Model	consistent + efficient	inconsistent

As shown in Table 1, the Hausman test specifications, under the null hypothesis (H_0)**,** the best model between Fixed Effect and Random Effect is the second, the Random Effect model due to the fact that it is characterized by the consistency and efficiency of the evaluator over the FE evaluator which is only consistent and not efficient. On the contrary, the Fixed Effect model is suitable in the alternative hypothesis (H_A), characterized by both consistency and efficiency while the Random Effect model does not include any of them.

Ordinary least squares (OLS) estimation is most frequently used to describe endogeneity, which is when an independent variable correlates with the structural error term. (Kennedy, 2008; Christopeit, 2003). In this situation, the error term is not random, and the estimation is inconsistent, which means that the coefficient estimate of the independent variable does not converge to the real value of the coefficient in the population as sample size increases. When an independent variable correlates with the error term, the coefficient estimate includes the effect of the respective independent variable on the dependent variable as well as the effects of all unobserved factors that correlate with the independent variable and explain the dependent variable, thus rendering its interpretation problematic. If this correlation is ignored, the estimated effect of the observed variable is likely to be biased. This bias is referred to as the endogeneity bias.

3.3 Sources of Endogeneity

According to the relevant literature it highlights three primary cases where the state of exogenousness is violated and therefore endogeneity occurs omission of variables, error-variables and simultaneous causality (Christopeit, 2003). The following sections describe briefly the problems associated with each of these endogenous sources.

3.3.1 Omission of Variables

The exclusion of variables from a model is the primary cause of endogeneity. A variable omission is typically caused by a lack of data, and it may result in the exogenous hypothesis being violated if the omitted variable connected with the dependent variable was also correlated with any of the independent variables being investigated (Christopeit, 2003; Muriithi, et al., 2016). In this case, the independent variable's coefficient estimator will be biased, and the error term will be correlated. Missing data, however, can be viewed as a measurement error.

3.3.2 Errors in Variables

Errors in variables, also known as issues, that develop when variables are wrongly measured and their true values are not observed, are the second source of endogeneity (Christopeit, 2003). Measurement errors result from the use of inadequate measurement instruments to capture concepts of interest, or non-comprehensiveness of the data collection method (Kennedy, 2008). According to Christopeit (2003), error in variables is an important issue when the variables on which data can be collected differ from the variables that influence the decisions of the relevant factors. The measurement error in the dependent variable can cause bias if it is systematically associated with one or more independent variables of a model. However, if it is connected to the independent variables, it will have a modest impact. The features of the OLS estimations depend on certain assumptions about the measurement error, according to Christopeit (2003), who also considers that measurement mistakes are essential. The measurement error and observed independent variable are first assumed to be uncorrelated, as well as the error term of the model and actual (unobserved) and observed independent variables. In this instance, the estimate produces reliable coefficients. The "classical mistake in variables assumption" is the name given to the second supposition. This indicates that neither the measurement error nor the error term has any relationship to the independent variables that are not observed. Because the measured independent variable and measurement error are correlated in this situation, the estimation produces inconsistent coefficient estimates: the coefficient estimate will be biased towards zero, and the magnitude of this bias depends on how much the unobserved independent variable's variance differs from the measurement error's variance.

3.3.3 Simultaneous Causality

Simultaneous causality, which happens when one or more independent variables are determined along with the dependent variable, is the third and last potential source of endogeneity (Christopeit, 2003). One example of simultaneous causality involving bank profitability might involve the relationship between a bank's lending practices and its profitability. It is possible that a bank that is more profitable may be more willing to lend money to borrowers, because it has a larger reserve of capital that it can use to fund new loans. At the same time, the act of lending money can also contribute to a bank's profitability, as it generates income through interest payments on the loans.

This creates a circular relationship between lending and profitability: a bank that is more profitable may be more willing to lend, which in turn can lead to even greater profitability. On the other hand, a bank that is less profitable may be more cautious about lending, which can lead to a decline in profitability. This simultaneous causality makes it difficult to determine the exact cause and effect relationship between lending and profitability.

Because all the unobserved variables that affect the dependent variable are included in the model's error term and because the dependent variable influences the independent variable when simultaneity exists, the error term is correlated with the independent variable, which creates endogeneity issues.

As the preceding discussion reveals, sources of endogeneity are manifold and have several dimensions. Regarding previous studies, especially in the econometrics literature, there is a wide range technique that allow researchers to address endogenous problems such as instrumental variables techniques, techniques for Panel Data, instruments free approaches, matching method, Heckman Two-Step Procedure, Lagging Independent Variable

3.4 Testing for stochastic trend or Unit Root Test

One of the most popular and used procedures in literature for a stationary or non-stationary test is the unit roots test. The starting point is the (stochastic) Unit roots process with the following function:

$$Y_t = \rho Y_{t-1} + u_t, \qquad -1 \leq \rho \leq 1 \qquad (3.4.1)$$

Where u_t a white noise error term.

If p = 1, in the case of the unit root, the following equation becomes a random walk model without wandering, which is a non-stationary stochastic process. The unit root test of stationary is based on the regression of Y_t with its value with a time lag, Y_{t-1}, and it is found that the estimated p is statistically equal to 1.

However, we cannot estimate the above equation using OLS and test the hypothesis that ρ = 1 with the t, because this presents a serious impartiality in the case of a unit root. Subtracting Y_{t-1} from both sides of the above equation, it becomes:

$$Y_t - Y_{t-1} = \rho Y_{t-1} - Y_{t-1} + u_t$$

$$= (p - 1)\, Y_{t-1} + u_t \qquad (3.4.2)$$

Or

$$\Delta Y_t = \delta Y_{t-1} + u_t \qquad (3.4.3)$$

Where δ = (ρ - 1) and Δ is the first difference of Y_t. However, calculated the second function and texted the null hypothesis that δ=0, and the alternative hypothesis is δ < 0. If δ=0, then ρ=1, thus there is unit root, this means that the time series under consideration is non-stationary.

Therefore, if δ = 0, the equation 3.4.3 becomes,

$$\Delta Y_t = (Y_t - Y_{t-1}) = u_t \qquad (3.4.4)$$

Since u_t is stationary, then even the first differences of a random walk time series are stationary.

Focusing on the estimation of equation 3, the first differences of Y_t are calculated and regressed by Y_{t-1} to determine whether the estimated slope coefficient in this regression (= δ) is zero or not. If this is zero, Y_t is non-stationary but if this is negative number, then Y_t is stationary[3].

In testing for stochastic trends (unit root), It will used one testing procedures the augmented Dickey-Fuller test as an attempt to deal with the fact some of the series may not be very informative about the existence or not of a unit root. The ADF tests are conducted using the following regression:

$$\Delta Y_t = \text{a} + \beta\text{t} + \delta Y_{t-1} + \sum_{i=1}^{m} a_i\, \Delta Y_{t-i} + \varepsilon_t \qquad (3.4.5)$$

[3] Since δ = (ρ-1), for stationarity, ρ must be less than 1. For this to happen the coefficient δ must be negative.

where a is a constant, β is the coefficient on a time trend and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$. The null hypothesis of a unit root is rejected if δ is negative and significantly different than zero. The critical values are not the usual t-statistics but are those given by Fuller (1976). The problem with this testing is that the order of the autoregression is not known. To solve this, use some information criterion to select the best model.

The Phillips-Peron test procedure, which uses non-parametric correction, is an alternative for using augment lags to correct for serial correlation. The PP test Is based on the above question on ADF with m=0 and then the statistics are transformed to correct for serial correlation in their asymptotic distribution (Phillips-Peron, 1988). The critical value for the test is the same as in the Dickey-Fuller tests.

3.4.1 The basic model of panel unit root test

Assume that time series {yi0, ..., yiT} on the cross-section units i = 1, 2, ..., N are generated for each i by a simple first-order autoregressive, AR (1), process

$$y_{it} = (1 - \alpha_i)\,\mu_i + \alpha_i y_{it-1} + \varepsilon_{it}, \qquad (3.4.6)$$

where y_{i0} is the initial values, and e_{it} is the errors which is identically, independently distributed across i and t with E (ε_{it}) = 0, $E(\varepsilon_{it}^2) = \sigma_i^2 < \infty$ and $E(\varepsilon_{it}^4) < \infty$. These processes can also be written equivalently as simple Dickey–Fuller (DF) regressions.

$$\Delta y_{it} = -\varphi_i \mu_i + \varphi_i \mu_{i,t-1} + \varepsilon_{it}\ , \qquad (3.4.7)$$

where $\Delta y_{it} = y_{it} - \Delta y_{i,t-1}$, $\varphi_i = \alpha_i - 1$.

In further developments of the model it is also helpful to write (3.3.1) or (3.3.2) in mean-deviations forms $\tilde{y}_{it} = \alpha_i \tilde{y}_{it-1} + \varepsilon_{it}$,, where $\tilde{y}_{it} = y_{it} - \mu_i$. The corresponding DF regression in $\tilde{y}_{it}$ is given by,

$$\Delta y_{it} = \varphi_i \tilde{y}_{i,t-1} + \varepsilon_{it}. \quad (3.4.8)$$

Most panel unit root tests are designed to test the null hypothesis of a unit root for each individual series in a panel. Accordingly, the null hypothesis of interest is,

$$H_0 : \varphi_1 = \varphi_2 = \cdots = \varphi_N = 0, \qquad (3.4.9)$$

that is, all-time series are independent random walks (non-stationary). The formulation of the alternative hypothesis is rather a controversial issue that depends on one's assumptions about the nature of the homogeneity / heterogeneity of the panel. Assuming the autoregressive parameter is the same for all cross-sectional units, we can consider.

$$H_1^a : \varphi_1 = \varphi_2 = \cdots = \varphi_N = \varphi \text{ and } \varphi < 0. \qquad (3.4.10)$$

$$H_1^b : \varphi_i < 0, \quad \varphi_{N0} < 0, \qquad N_0 \leq \text{N}, \qquad \text{for one or more i.}$$

The panel unit root statistics motivated by H_1^a pools the observations across the different cross section units before forming the 'pooled' statistic (Levin, Lin, and Chu (2002)). This is referred to as a homogeneous alternative. Tests based on such alternatives have the drawback of frequently remaining valid even when part of the units are immovable. The fact that the null hypothesis, H_0, was rejected, however, does not demonstrate that a sizable portion of the series is indeed stationary. The alternative hypothesis H_1^a has the additional drawback of being very restrictive, particularly for cross-country research including various short-term dynamics (such as the PPP Hypothesis, where y_{it} it is referred to the real exchange rate). As for the second alternative hypothesis H_1^b, it states that at least one of the series in the panel is created by a stationary process, assumes that N_0 of the N (0 < N_0 < N). This is referred to as heterogeneous alternative. Observing equations 4 and 5, the alternative hypothesis H_1^b is suitable only when N is finite, i.e. within multi-variant model with a fixed number of variables. On the contrary, in the case of large time dimension (T) and the cross-section dimension (N), panel unit root test will lack power if the second alternative hypothesis is adopted, H_1^b. In this case of large Panels N and T it makes sense to create alternatives that are somewhere between the two ends of H_1^a and H_1^b. Thus, a more suitable alternative is given by the **heterogeneous alternative**.

$$H_1^c : \varphi_i < 0, \text{I} = 1, 2, \ldots, N_1, \varphi_i = 0,$$

$$\text{i} = N_1 + 1, N_1 + 2, \ldots, \text{N},$$

such that

$$\lim_{N\to\infty} \frac{N_1}{N} = \delta, \qquad 0 < \delta \leq$$

Based on the above, the null hypothesis is H_0: δ = 0, while H_1^c can be written as

$$H_1^c : \delta > 0.$$

The tests developed against the above heterogeneous alternatives, H_1^c, operate directly on the test statistics for the individual cross-section units using simple averages of the underlying individual statistics or their suitable transformations such as rejection probabilities (Choi, 2001; Im, et al., 2003; Pesaran, 2004).

3.5 Autoregressive Panel Model specification

Forecasts of inflation are used by economists at central banks, including the US Federal Reserve, to formulate monetary policy. Therefore, the main goal is to examine predictions made using autoregression, a regression model that links a time series to previous values (lags) of the dependent variable.

$$y_{it} = \mu + a_1 y_{i,t-1} + a_2 y_{i,t-2} + a_3 y_{i,t-3} + \ldots + a_m y_{i,t-m}$$

$$y_{it} = \mu + \sum_{i=1}^{m} a_i y_{i,t-i} + v_{in} \quad (3.4.11)$$

Where y_t is the log of the series in question, y_{t-i} is the last observations and white noise v_n is referred to as an autoregressive model (AR model). In this case, we assume that v_n is white noise that follows a normal distribution with a mean value of 0 and a variance σ^2 and is independent of the previous time series y_{t-1}.To select the number of AR lags for each series, it estimate using m=1 and progressively increase the number of autoregressive lags until ε_t is not serially correlated. For the testing for autocorrelation in the residuals, it can be used the Ljung-Box Q-statistic. Also, there are two models that can be used choosing the number of the lags each model, such as Akaike (AIC) and Schwartz (SIC). To this study, the Schwartz Information Criterion was used as presented below.

The Schwartz (SIC) model is below,

$$\text{SIC} = n^{k/n} \frac{\sum \widehat{u_i^2}}{n} = n^{k/n} \frac{RSS}{n} \quad (3.4.12)$$

Or

$$\text{lnSIC} = \left(\frac{k}{n}\right)\text{lnn} + \ln\left(\frac{RSS}{n}\right)$$

where [k/n ln n] is the penalty factor. As before with the SIC criterion, when comparing two or more models, the model with the lowest AIC value is preferred.

3.6 Construction of Net Exchange Rate Sentiment Index

The primary goal of this study is to determine if US bank profitability overreacts or underreacts to changes in exchange rates. The establishment of the Net Sentiment Index through the exchange rate news is a critical component of this work. This indicator is designed to capture market sentiment based on key exchange rate news and acts as a tool for providing insight into the previously described relationship between bank profitability and exchange news emotion.

The robustness approach to developing and applying the Net Sentiment Index was significantly conducted by the research of Apergis and Pragidis (2019). They embarked on an examination of the link between shifts in sentiment tone concerning the European Central Bank’s (ECB) announcements and stock returns. Their methodology entailed the construction of a unique sentiment index that captured the sentiment tone derived from these ECB announcements, spanning from January 2002 to June 2016 (Apergis & Pragidis, 2019).

In this study, to solidify the methodology, a meticulous process was employed to discern the most significant absolute fluctuations annually for the dollar exchange rate. The identified fluctuations, whether positive or negative, were then juxtaposed against the formula to ascertain the sentiment. The formula's output was rigorously cross-checked with the news from Bloomberg, specifically focusing on narratives surrounding the domestic dollar against the three identified currencies. Bloomberg's vast database ensures that the news articles sourced are credible and impactful. The time frame for the data collection spans from 1998 to 2020. This comprehensive approach not only reaffirmed the authenticity of the technique but also validated its alignment with Bloomberg's comprehensive news repository.

A pivotal finding was the correspondence between the Net Sentiment Index's output and the predominant sentiment in the news. Specifically, a negative ratio from the index signified a predominance of negative news, while a positive ratio indicated the contrary.

To elucidate further, negative news typically alludes to narratives of the dollar's depreciation against other major currencies. Such depreciation narratives could be spurred by various macroeconomic factors, including trade deficits, burgeoning national debt, or economic policies perceived as unfavourable by the market. On the contrary, positive news encapsulates the dollar's appreciation narratives, often spurred by robust economic indicators, favorable trade balances, or policies that bolster investor confidence in the U.S. economy.

To do this, the methodology for determining the Net Sentiment Index for exchange rate news involves a systematic and multi-step approach:

- Identification of Key Exchange Rate Fluctuations: Initially, news was categorized based on the most significant fluctuations each year for the three major exchange rates:

USDJPY, USDEUR, and USDGBP. This step is crucial as these major exchange rates often set the tone for global financial sentiments.

- Defining the Nature of Fluctuations: The first differences of these exchange rates were calculated to identify the direction of the fluctuation, whether positive (indicating appreciation) or negative (indicating depreciation). This step helps in quantifying and qualifying the nature of each fluctuation.
- Sampling of Fluctuations: From the plethora of fluctuations available, the three most notable fluctuations for each exchange rate were chosen annually. This distilled approach led to the selection of 189 significant exchange rate fluctuations, forming the backbone of this study's sample.
- Application of the Sentiment Index Formula: A specifically tailored formula was employed to compute the Net Sentiment Index for each year. The index is computed by taking the difference between the number of positive and negative news articles and then dividing them by the total number of words in the article. Mathematically, the index is represented as

Net Sentiment Index = (*number of positive fluctuations – number of negative fluctuations)/ total exchange rate fluctuations per year*

- Illustration through Examples: For a clearer understanding, two specific years were cited:

Net Sentiment Index of 1998= (number of positive fluctuations – number of negative fluctuations)/ total exchange rate fluctuations per year = (2-7)/9 = -0.55556 or -56% (NEGATIVE)

Net Sentiment Index of 1999: (number of positive fluctuations – number of negative fluctuations)/ total exchange rate fluctuations per year = (7-2)/9 = 0.55556 or 56% (POSITIVE)

- Validation of Results: To ensure the credibility and robustness of the methodology, the computed index values were cross verified with Bloomberg's news narratives. This validation process focused on stories surrounding the domestic dollar vis-à-vis the three exchange rates. This validation not only underscored the accuracy of the methodology but also cemented its congruence with Bloomberg's comprehensive data.

Sentiment analysis, especially in financial contexts, has gained significant traction in academic literature (Khadjeh Nassirtoussi, et al., 2014). The underlying premise is the exploration of how human emotional interpretations of news articles can offer predictive insights into financial market movements. Studies such as Khadjeh Nassirtoussi et al. (2014), have delved into the potential financial gains from sentiment analysis, especially concerning financial news. This thesis expands upon this burgeoning field of study by tailoring a sentiment analysis specifically for the exchange rate market, with a particular focus on understanding its implications on banks' profitability.

3.7 Conclusion

In conclusion, the approaches we've selected, particularly OLS, GMM, and the Hausman test, combine contemporary advances in financial research with both traditional econometric techniques (Martin , 2015; Hausman & Taylor, 1281; Baltagi & Khanti-Akom, 1990). Studies like those by Martin (2015) and Baltagi and Khanti-Akom (1990), have shown the importance and effectiveness of these strategies. The application of these techniques demonstrates the dedication to accuracy, sturdiness, and academic rigour.

Adopting approaches that fully capture the complexity and intricate details present in the data is essential when conducting research on the banking sector applying panel data. Panel data's ability to combine cross-sectional and time-series features was a key factor in the integration of the OLS Fixed Effect and GMM models. Due to the different structure, a solution that simultaneously considers time-series effects that are common to all entities and fixed effects that are specific to each bank is required. Using lagged values of variables as instruments, GMM, in particular, offers a comprehensive strategy to address potential endogeneity, giving a more accurate picture of the underlying relationships. Panel estimation techniques were chosen because of their specificity to panel data structures (Wooldridge, 2011). These techniques are suitable for investigations involving many financial institutions over a period of years since they tend to be successful at capturing differences between entities and over time. On the other hand, the System GMM estimator provides a sophisticated response to endogeneity issues. It not only extracts the most information possible but also improves the effectiveness of the research by completely accounting for the data's heterogeneity and using various lags as instruments (Arellano & Bond, 1991).

To choose between fixed effects and random effects models for panel data, it was necessary to consider the Hausman test (Hausman, 1978). By comparing these models, this test verifies that the chosen model produces reliable and effective estimators, protecting the study's findings from any biases.

The existence or lack of stationarity in the series can have a major impact on the outcomes given the time-series component of the panel data. Non-stationary series could produce false regression results (Dickey and Fuller, 1979). The Augmented Dickey-Fuller (ADF) and Phillips-Peron tests, both well known for their effectiveness, were used to check for stationarity to reduce this risk.

Moreover, bank profitability, like other financial indicators, does not work in isolation. It is constantly inspired by a variety of previous events and trends. When looking at how the banks' profitability reacts or underreact or react to the various features and to the net sentiment analysis for the exchange rate news, it is reasonable to believe that both profitability and the features of previous days/months/years could still resonate and influence current banks profitability. News typically has long-lasting consequences, particularly when it concerns economic indicators like currency rates. An increase in investments, trading, or even speculative activities may follow a large piece of favourable news regarding currency rates and may last several days or longer. This delayed effect suggests that the perception of earlier news stories may have an impact on present and future bank profitability. Thus, in this study, the complexity has been recognized and ensured that the model respects market memory by applying auto-regression to panel data, particularly in the way that previous exchange rate news may still influence present profit possibilities.

Chapter 4

4 Data and Sample Creation

4.1 Introduction

This chapter begins by introducing the data source and the rationale behind its selection, and then goes on to describe the variables of interest and how they were chosen. In order to ensure that the data used in the study is reliable and accurately represents the research questions being addressed, the chapter should provide a detailed account of the data collection and variable selection process, as well as any measures taken to ensure the quality and integrity of the data. This includes outlining the steps taken to clean and prepare the data for analysis, including any necessary transformations or manipulations. It is important to ensure the reliability of the data in order to make reliable findings. Therefore, this chapter describes the extensive purification and testing procedures that were performed to complete the study. Overall, the chapter plays a crucial role in establishing the foundation for the research and should be presented in a clear and rigorous manner.

4.2 Choice of data source

There are a variety of sources available for both the collection of internal and external factors, but also for macroeconomic variables. In terms of internal and external factors, it is usually collected from the bank's annual report. This data is now regularly uploaded to large databases for analysis by investors and other stakeholders party and is available on the internet on financial sites, such as FDIC and similar.

4.2.1 Choice of Federal Deposit Insurance Corporation (FDIC)

Given the scope of the study, to look at a wide range of US banks for several years (from 1998 to 2018), only a privately owned database could provide such a complete range of data. The FDIC presents accurate and up-to-date data, trusted by readers and researchers. However, FDIC makes no express warranties about the data and expressly disclaims any legal liability or liability to persons who access this website.

Because of the wide range of financial institutions and why we look at the determinants of US banks' profitability over 21 years, we have received 148 US banks as presented in the FDIC and listed most of the variables (internal and external factors).

4.2.2 Choice of the Bloomberg database

Access to proprietary databases, such as Bloomberg Professional at the researcher's university institution, also influenced the choice of data source (Bloomberg, 2018b). By far, Bloomberg has the greatest market share of the expenditure on global market data and analysis (33.22% in 2017), followed by Thomson Reuters (22.50%). With over 300 institutions employing their Professional Service (Bloomberg, 2018b) as part of simulated trading floor environments, it is also being employed more and more in academic contexts within university economics departments.

Given that it was recently made available to researchers at their academic institutions, Bloomberg has not been commonly used in academic research, despite its popularity in the financial world. Additionally, Bloomberg has historically concentrated on the financial data of companies, financial institutions, and banks and has a very thorough coverage of international companies over a number of years (rather than just US-focused companies), making it a valuable resource for international comparative studies. However, it is acknowledged that if the researcher used a different database for the study, the outcomes might vary.

Some of the macroeconomic variables have been collected by Bloomberg Professional Database.

4.3 Choice of Variables

In this study, a variety of variables representing bank size and bank profitability in the US for several years have been collected and analyzed, and mainly some of the external and internal factors which affect the profitability. The choice of data collection in this study, was by the field of financial and macroeconomic studies in the literature. Most of the data was collected from Federal Deposit Insurance Corporation (FDIC) during the period December 1998 to December 2018. Data was collected on an annual basis. Macroeconomic data are also collected by the Federal Reserve Bank of St. Louis (FRED), all monetary values were in US dollars, and all indicators represent as a percentage (most of them come from the FDIC).

The initial stage of this study was data filtering, choosing a smaller part of the data set and using that subset for viewing or analysis. First, we dropped missing data for key variables in the model and then we also dropped banks with negative and zero total assets, deposits, and loans. On this study, 800 banks were collected of which only 148 were kept, including large and small banks, saving banks and bank institute, after filtering data with total assets starting in the trillions and reaching trillions of dollars. Because of the long term we used to run and analyze this survey, many of the banks had closed and others had merged with larger ones. As a result, only the balanced panel was assembled, keeping the banks that existed for all periods, leading in balanced panel data of 148 parent active banks for 21 years (1998-2018), yielding 3108 annual observations over the whole sample period. Table1 presents the USA banks have been selected after the filtering method. According to the table, the largest banks appear first in terms of total assets, followed by the immediately smaller ones for the year 2018. The bank chapter class is a classification code assigned by the FDIC based on the institution's charter type, charter agent, Federal Reserve membership status and its primary federal regulator. These codes are presented below,

- N = commercial bank, national charter, and Fed member
- SM = commercial or savings bank, state charter and Fed member
- NM = commercial bank, state charter and Fed nonmember

- SB = savings banks, state charter
- SA = saving associations, state or federally chartered.

Table 2: USA Banks Collection

Rank	USA Banks	Total Assets	Bank Charter Class
1	JPMorgan Chase Bank, National Association	2,218,960,000	N
2	Bank of America, National Association	1,782,639,000	N
3	Citibank, National Association	1,406,745,000	N
4	PNC Bank, National Association	370,500,928	N
5	Capital One, National Association	304,657,685	N
6	TD Bank, National Association	302,668,929	N
7	THE BANK OF NEW YORK MELLON	286,411,000	NM
8	Branch Banking and Trust Company	219,071,000	N
9	Fifth Third Bank, National Association	144,453,358	SM
10	The Northern Trust Company	131,695,551	SM
11	Regions Bank	124,716,588	SM
12	Manufacturers and Traders Trust Company	119,636,147	SA
13	USAA Federal Savings Bank	81,602,818	SB
14	New York Community Bank	51,874,621	SA
15	Flagstar Bank, FSB	18,466,868	SA
16	MidFirst Bank	17,230,779	SB

17	Apple Bank for Savings	14,307,238	SA
18	Third Federal Savings and Loan Association of Cleveland	14,205,430	SB
19	Northwest Bank	9,701,569	SA
20	Wilmington Savings Fund Society, FSB	7,183,022	SA
21	Columbia Bank	6,680,371	NM
22	Dime Community Bank	6,392,762	SB
23	Ridgewood Savings Bank	5,534,383	SB
24	Liberty Bank	5,093,375	SB
25	Salem Five Cents Savings Bank	5,010,771	SA
26	TRUSTCO BANK	4,959,305	SB
27	Middlesex Savings Bank	4,954,135	SB
28	Bangor Savings Bank	4,410,311	SB
29	Cambridge Savings Bank	3,881,689	SB
30	Institution for Savings in Newburyport and Its Vicinity	3,470,490	SB
31	Firstrust Savings Bank	3,458,196	SB
32	The Cape Cod Five Cents Savings Bank	3,425,994	SA
33	Sterling Bank and Trust, FSB	3,198,235	SA
34	Spencer Savings Bank, SLA	2,947,705	SB
35	PeoplesBank	2,867,537	SA
36	Gate City Bank	2,231,157	SA
37	North American Savings Bank, F.S.B.	2,185,032	SA
38	El Dorado Savings Bank, F.S.B.	2,184,373	SB
39	Beal Bank, SSB	2,182,999	
40	Penn Community Bank	2,158,804	SA

41	Westfield Bank	2,116,384	SA
42	North Shore Bank, FSB	2,031,675	SB
43	WaterStone Bank, SSB	1,911,865	SB
44	ESSA Bank & Trust	1,858,718	SA
45	Colorado Federal Savings Bank	1,847,790	SA
46	First Federal Bank of Florida	1,811,622	SB
47	Union County Savings Bank	1,759,208	SB
48	Boiling Springs Savings Bank	1,693,206	SB
49	First County Bank	1,674,924	SM
50	BankNewport	1,665,373	SB
51	Country Bank for Savings	1,625,625	SB
52	Dedham Institution for Savings	1,559,833	SB
53	Machias Savings Bank	1,498,661	SB
54	Fairfield County Bank	1,486,214	SM
55	Easthampton Savings Bank	1,370,984	SM
56	Bank of Bennington	1,370,984	SB
57	Florence Bank	1,347,893	SB
58	Manasquan Bank	1,339,140	SB
59	Newtown Savings Bank	1,318,237	SB
60	Pioneer Savings Bank	1,286,967	SB
61	First Federal Savings and Loan Association of Port Angeles	1,242,429	SB
62	Gorham Savings Bank	1,193,697	NM
63	Riverview Community Bank	1,150,040	SA
64	Cenlar FSB	1,135,456	SB
65	Chelsea Groton Bank	1,116,897	NM
66	Peoples Bank SB	1,093,760	SB

67	SAVINGS BANK OF DANBURY	1,079,812	SM
68	East Cambridge Savings Bank	1,077,667	SB
69	Thomaston Savings Bank	1,045,969	SB
70	Haven Savings Bank	1,016,527	SA
71	Colonial Savings, F.A.	1,011,136	SB
72	Meredith Village Savings Bank	975,332	SB
73	Provident Bank	973,897	SB
74	Merrimack County Savings Bank	895,849	SB
75	Sturdy Savings Bank	840,781	SB
76	Great Midwest Bank, S.S.B.	789,322	SB
77	The Guilford Savings Bank	787,149	NM
78	Berkshire Bank	720,038	SA
79	Iroquois Federal Savings and Loan Association	664,274	SB
80	East Boston Savings Bank	653,386	SA
81	First Federal Savings Bank of Twin Falls	648,447	SB
82	Magyar Bank	643,579	SB
83	The Bank of Canton	627,483	SB
84	The Savings Bank	603,861	SB
85	Stoneham Bank, A Co-operative Bank	600,693	SB
86	Skowhegan Savings Bank	593,199	SB
87	Sanford Institution for Savings	580,618	SB
88	Savers Co-operative Bank	570,232	SB
89	Norwood Co-operative Bank	536,259	SB
90	Reliance Savings Bank	531,516	SA

91	Windsor Federal Savings and Loan Association	514,545	SB
92	Hoyne Savings Bank	447,137	SB
93	The Milford Bank	441,881	SB
94	Mt. McKinley Bank	431,138	SB
95	Claremont Savings Bank	417,193	SA
96	Broadway Federal Bank, f.s.b.	407,170	SB
97	Royal Savings Bank	406,773	SB
98	Essex Savings Bank	394,564	SB
99	Washington Savings Bank	365,470	NM
100	Citizens First State Bank	318,345	SA
101	Ottawa Savings Bank	292,679	NM
102	American Bank of Oklahoma	286,729	NM
103	Northeast Security Bank	275,549	SA
104	Midwest Heritage Bank, FSB	272,118	SN
105	International City Bank Federal Savings Bank	270,601	NM
106	FirstBank of Nebraska	269,734	N
107	The Dolores State Bank	262,103	SM
108	The Hondo National Bank	257,425	NM
109	First State Bank of DeQueen	245,244	NM
110	Peoples Trust and Savings Bank	189,116	SM
111	First State Bank of DeKalb County	187,971	NM
112	Glenwood State Bank	177,134	NM
113	Sandhills Bank	173,221	NM
114	Wray State Bank	165,765	N
115	American Bank & Trust Company	164,745	NM

116	The First National Bank of Hugo	116,745	NM
117	LNB Community Bank	115,786	NM
118	First State Bank of Bloomington	114,934	NM
119	Elk State Bank	97,605	NM
120	Philo Exchange Bank	96,707	NM
121	Greenleaf Wayside Bank	94,767	NM
122	Citizens State Bank of Hayfield	94,730	NM
123	Farmers State Bank & Trust Co.	91,743	N
124	Merchants and Planters Bank	91,421	NM
125	The First National Bank	90,406	NM
126	The Riley State Bank of Riley, Kansas	87,053	NM
127	The Stockgrowers State Bank	85,407	NM
128	THE FIRST NATIONAL BANK OF SULLIVAN	85,325	SM
129	Commodore Bank	82,223	SM
130	The Tilden Bank	82,074	NM
131	The Elberfeld State Bank	81,006	NM
132	Farmers State Bank of Munith	79,750	NM
133	The First State Bank of Red Wing	79,508	N
134	CENTREBANK	77,002	NM
135	Summit National Bank	76,193	NM
136	Farmers and Merchants Bank of Kendall	75,269	NM
137	Concordia Bank of Concordia, Missouri	74,151	NM

138	Independence State Bank	70,150	NM
139	The Lyndon State Bank	69,632	NM
140	Triumph State Bank	66,350	NM
141	United Security Bank	63,468	KS
142	The First Security Bank	61,269	NM
143	First National Bank of Kansas	58,754	NM
144	United Bank of Philadelphia	50,322	NM
145	The Citizens State Bank and Trust Company	48,061	NM
146	Brighton Bank	41,531	NM
147	North Adams State Bank	37,579	NM
148	Hometown Community Bank	32,415	SM

Three different measures of profitability namely return on assets (ROA), net interest margin (NIM) and return on equity (ROE) are used in the study as dependent variables, creating 3 different models. The data for the dependent variables are collected from the balance sheet and the income statement (published annual reports) as well as from an individual bank website (FDIC). ROA is the net profit expressed as a percentage of total assets that reflects the earnings earned per item. This measure is used to assess the capacity and operating efficiency of banks as it examines the profits generated by the assets invested by the bank. As alternative measures of the profitability are Return on Equity (ROE), which is defined as the ratio between net profits and equity capital expressed as a percentage and Net Interest Margin (NIM), which is a measurement comparing the net interest income a bank/firm/company generates from credit products like loans and mortgages and expressed as a percentage.

In this study, the researchers identified 30 independent variables that are commonly used to study and determine the profitability of banks. These variables were selected based on a review of the existing literature on the topic, which identified the variables that have been most commonly used in previous studies. The 30 variables included 24 variables related to the assets, liabilities, income, and expenses of the banks, as well as 5 macroeconomic variables. The researchers also included the exchange rate news as a significant variable in the study.

The independent variables are factors that are believed to potentially influence the dependent variable, which in this case is the profitability of the banks. By including a range of different variables in the study, the researchers are attempting to capture the various factors that may be contributing to the profitability of the banks. The selection of the specific variables was based on the findings of the literature review, which identified the variables that are most commonly used to study and determine bank profitability. Table 2 presents the variables list some of which are listed in the FDIC, and an accurate explanation of how each variable is calculated. The following is a more detailed explanation of the variables along with the abbreviated reference name used for each of the variables in parenthesis. The other variables were obtained taken from yahoo finance. Also, in this study, a dummy variable (binary: 0 or 1) expressing the years of the global financial crises was used.

Table 3: Data Collection for each Bank

Banking Variables			**Other Variables**
Assets & Liabilities	**Performance &Conditions Ratios**	**Income & Expense**	**Macroeconomic Variables**
Total Assets	Net Operating income to assets	Total interest income	3-Month London Interbank Offered Rate (LIBOR)
Loan & Leases Loss Allowance/Total Assets	Efficiency ratio	Additional noninterest income/Total interest income	5-Year Treasury Constant Maturity Rate
Total Deposits/ Total Assets	Yield on earnings assets	Salaries and employee benefits/Total interest income	Real Effective Exchange rates for USA
Interest-being deposits/ Total Assets	Net loans and leases to Total Assets	Pre-tax net operating income/ Total interest income	GDP CQOQ Index

Tier one (core) capital/ Total Assets	Net loans and leases to deposits	Net income/ Total interest income	U-3 US Unemployment Rate Total in Labor
Tier 2 Risk-based capital/ Total Assets	Total domestic deposits to Total Assets	Total noninterest expense/ Total interest income	Sentiment index, Exchange rate news
	Leverage (core capital) ratio		
	Total risk-based capital ratio		
	Equity capital to assets		
	Tier 1 risk-based capital ratio		

4.3.1 Variable Specification: Dependent Variables

The main purpose of the study is to investigate the factors of banks' profitability and especially whether exchange rate news can affect the profitability of American banks.

The dependent variable in the model specifies is some measure of commercial bank profitability. In the literature review, (chapter 2), the most studies use more approaches to bank performance, from profitability ratios to most complex composite indexes. The most used performance for banks is: Return on Assets (ROA), Return on Equity (ROE) and Net Interest Income (NIM).

- According to the finance literature review and the banking system, ROA is the main percentage-based measure of profitability of banks, which is the net profits expressed as a percentage of total assets. ROA represents the profits earned per assets and gives signal that how effectively the bank’s assets are being managed by authority to generate revenues. According to Jahan 2012, this financial ratio is used to evaluate operational performance of banks as it examined the profits generated from the assets invested be the bank. So, when a bank or firm has high ROA, this indicates more asset efficiency.

$$\text{ROA} = \frac{Net\ Income}{Total\ Assets}$$

- The second dependent variable is the Return on Equity (ROE), which is defined as the ratio between net profits and equity capital expressed as a percentage. ROE is considered the return on net assets and shows how effectively management is using a bank's assets to create profits and the measured of this calculated also in percentage. According to Dietrich and Wanzenried (2011), this ration is not considered the best measure of bank profitability.

$$\text{ROE} = \frac{Net\ Income}{Average\ Shareholders'\ Equity}$$

- The third dependent variable is Net Interest Margin (NIM), which is a measurement comparing the net interest income a bank/firm/company generates from credit products like loans and mortgages and expressed as a percentage. When a bank has a positive net interest margin suggests that an entity operates profitably, while when the bank has a negative figure implies investments inefficiency.

$$\text{ROE} = \frac{IR - IE}{Average\ Earning\ Assets}$$

IR= Investment Returns

IE= Interest Expenses

4.3.2 Variable Specification: Independent Variables

These are variables which could explain the outcomes of the dependent variables. As a start point, all variables in the list above were deemed potential explanatory variables, although prior to constructing a model, collinearity tests were carried out to assess excess correlation between the variables and which could affect the outcome of the model.

Variables of each Bank[4]

- Total Assets: The sum of all assets owned by the institution, including cash and cash equivalents, investments in securities, loans and advances to customers, and property, plant, and equipment. Also are included intangible assets, such as trademarks and copyrights, as well as any other assets that the bank owns. This does not include off-balance-sheet accounts. Bank total assets are important in the context

[4] All variables of each bank are obtained by FDIC

of exchange rates because they show a bank's financial strength and influence in the foreign currency market. Larger banks, with more assets, keep more foreign currency, making them more vulnerable to exchange rate volatility. Their engagement in international lending, borrowing, and hedging activities can have a direct impact on the dynamics of the foreign currency market.

To calculate total assets, you would use the following formula:

Total Assets = Cash and Cash Equivalents + Investments in Securities + Loans and Advances to Customers + Property, Plant, and Equipment + Intangible Assets + Other Assets

- Loan and leases loss allowance: Each bank must maintain an allowance (reserve) for loan and lease losses that is sufficient to absorb the estimated credit losses associated with its loan and lease portfolio (which also includes off-balance-sheet credit instruments). Significant changes in the loan and leases loss allowance can influence international perceptions of a country's banking sector stability. A higher loan loss allowance may suggest that a bank perceives increasing credit risk in its portfolio. If foreign organizations regard local banks to be unsafe due to substantial loan loss provisions, this might inhibit foreign investment, resulting in lower demand for the domestic currency and, as a result, a negative impact on the exchange rate.

- Total deposits: The sum of all deposits, including demand deposits, money market deposits, other savings deposits, time deposits and foreign currency deposits. Total deposits can be considered a measure of confidence in the banking system. An abrupt withdrawal or decrease in deposits may signal a loss of confidence in the currency, which might affect the exchange rate. Moreover, banks use deposits to lend and invest. An increase in total deposits may result in increased lending and investment, influencing the money supply.

- Interest-bearing deposits: Interest-bearing deposits (includes interest-bearing deposits in foreign offices). Represents any deposit in domestic and foreign offices on which the banks pay or accrues interest. Fluctuations in exchange rates can impact on the inflow and outflow of foreign currency deposits, influencing a bank's liquidity position and its ability to lend.

- Average total assets: Average year-to-date of the total assets represented in the balance sheet. Used as the denominator for year-to-date income as a percentage of average assets. The number of quarterly values used in the calculation depends on the date of the data.

- Tier one (core) capital: common equity plus noncumulative perpetual preferred stock plus minority interests in consolidated subsidiaries less goodwill and other ineligible intangible assets. The number of eligible intangibles (including mortgage servicing rights) included in core capital is limited in accordance with supervisory capital regulations. Tier one capital is considered to be a key indicator of a bank's financial strength, as it represents the portion of the bank's capital that is available to absorb losses in times of financial stress. Regulators often set minimum tier one capital requirements for banks to ensure that they have sufficient capital to support their operations and protect depositors. Tier one capital serves as the principal insurance against unexpected financial losses. Banks with extensive overseas exposure may see significant valuation adjustments in their foreign assets and liabilities when exchange rates shift. Tier one capital ensures that banks can sustain such losses without going bankrupt.

- Tier 2 Risk-based capital: is a measure of a bank's financial strength that takes into account the risks associated with the bank's assets and off-balance sheet activities. It is defined as the sum of a bank's tier 2 capital and its supplementary capital. Tier 2 capital includes forms of capital that are not considered to be as high quality as tier 1 capital, but which can still be used to absorb losses in times of financial stress (undisclosed reserves, general loss reserves, and subordinated debt). To calculate a bank's tier 2 risk-based capital, you would use the following formula: Tier 2 Risk-based Capital = Tier 2 Capital + Supplementary Capital

- Total interest income: Total income from loans and leases, plus investment income, interest on bank balances interest, interest on federal funds sold and interest on trading account assets earned by the institution. Changes in currency rates can cause fluctuates in interest income for banks with overseas assets and liabilities. If a bank gets interest revenue from loans in a foreign currency, changes in that currency's value can affect the translated value of that income.

- Total interest expense: It represents interest payable on any borrowings – bonds, loans, convertible debt or lines of credit (it seems on the income statement). Banks borrow in international markets. Exchange rate fluctuations can affect the cost of servicing this debt. A rising domestic currency lowers the cost of foreign-currency debt, whereas a falling currency boosts it. This dynamic has a direct impact on the bank's total interest expense.

- Total noninterest income: Income from fiduciary activities, plus service charges on deposit accounts in domestic offices, plus trading gains (losses) and fees from foreign exchange transactions, plus other foreign transaction gains (losses), plus other gains (losses) and fees from trading assets and liabilities. Foreign currency transactions, including fees and earnings from trading activities, can account for a sizable amount of non-interest income. As a result, currency rate shifts can have a direct impact on the performance of this income flow.

- Additional Noninterest Income: which is Investment banking, advisory, brokerage, and underwriting; Venture capital revenue; Net Servicing fees; et securitization income; Insurance commission fees and income; Net gains (losses) on sales of loans; Net gains (losses) on sales of real estate owned; Net gains (losses) on sales of other assets (excluding securities); and other noninterest income. Overseas businesses could account for a sizable amount of Noninterest Income. As a result, banks with larger noninterest revenue may have greater foreign exposure, making the exchange rate an important influence on their profitability and operational strategy.

- Salaries and employee benefits: refer to the compensation that is paid to employees for their work, as well as any additional benefits that are provided to them. To calculate the total amount of salaries and employee benefits that an organization pays, you would need to have the total amount of salaries paid to employees and the cost of employee benefits. A weaker domestic currency entails greater foreign-currency costs, which can have an impact on profitability.

- Pre-tax net operating income: Net income (loss) before income taxes and extraordinary items and other adjustments minus gains (losses) on securities not held in trading accounts. Exchange rate fluctuation can have a substantial impact on the value of income generated abroad when it is repatriated or translated back to the domestic currency for banks with international operations. A positive movement/fluctuation in the exchange rate can increase a bank's pre-tax net operating income, while a negative movement/fluctuation can decrease it.

- Net income: Net interest income plus total noninterest income plus realized gains (losses) on securities and extraordinary items, less total noninterest expense, loan loss provisions and income taxes. Due to the fact that, banks frequently conduct foreign operations or invest in foreign assets, exchange rate fluctuations might affect the value of these assets and liabilities when they are repatriated or marked to market, reducing the bank's net income.

- Net operating income: Net income excluding discretionary transactions such as gains (losses) on the sale of investment securities and extraordinary items. Income taxes subtracted from operating income have been adjusted to exclude the portion applicable to securities gains (losses). Banks often have foreign investments or loans on their books. Fluctuations in exchange rates can impact the value of these assets and liabilities, thereby affecting the bank's NOI. Exchange rates fluctuations can also impact on trade volumes affecting the demand for foreign currency transactions.

- Yield on earning assets (%): Total interest income (annualized) as a percent of average earning assets. This ration gives information about banks' profitability and risk tolerance. Exchange rate fluctuations can have an impact on the returns on international assets or loans made in foreign currencies. If the domestic currency depreciates, the value of foreign investments or loan returns may rise in domestic currency terms, potentially resulting in a greater YEA. In contrast, an appreciation might diminish the value of returns from foreign assets, negatively hurting the YEA.

- Net operating income to assets (%): Net operating income (annualized) as a percentage of average total assets. Exchange rate fluctuations can have a direct impact on the value of a bank's assets and, as a result, its NOIA ratio if the bank has significant overseas investments. A positive exchange rate movement can increase the value of foreign assets and income, hence increasing the ratio, and vice versa.

- Efficiency ratio (%): Noninterest expense less amortization of intangible assets as a percent of net interest income plus noninterest income. This ratio measures the proportion of net operating revenues that are absorbed by overhead expenses, so that a lower value indicates greater efficiency. These banks where the efficiency ratio is lower have more streamlined operations that can respond swiftly to economic changes, including those caused by exchange rate movements. They can better handle foreign exchange risk and negotiate the global financial system's intricacies.

- Assets per employee ($millions): is a financial metric that measures the amount of assets that a bank has relative to the number of employees it has. It is calculated by dividing the bank's total assets by the number of employees it has. Total assets in millions of dollars as a percent of the number of full-time equivalent employees.

- Net loans and leases to total assets (%): Loan and lease financing receivables, net of unearned income, allowances, and reserves, as a percentage of total assets. Banks are often vulnerable to fluctuations in interest rates due to loans and leases. Because interest rate differentials across nations can influence exchange rates, banks with a high ratio may be more affected by exchange rate movements caused by interest rate fluctuations.

- Net loans and leases to deposits (%): Loans and lease financing receivables net of unearned income, allowances and reserves as a percent of total deposits. A higher percentage indicates that the bank is more vulnerable to liquidity issues, which might increase the bank's vulnerability to currency fluctuations.

- Total domestic deposits to total assets (%): Total domestic office deposits as a percentage of total assets. Banks with significant international obligations or assets may be more vulnerable to currency changes.

- Equity capital to assets (%): Total equity capital as a percent of total assets.

- Leverage (core capital) ratio (%): Tier 1 (core) capital as a percent of average total assets minus ineligible intangibles.

- Tier 1 risk-based capital ratio (%): Tier 1 (core) capital as a percent of risk-weighted assets as defined by the appropriate federal regulator for prompt corrective action during that time period.

- Total risk-based capital ratio (%): Total risk-based capital as a percent of risk-weighted assets as defined by the appropriate federal regulator for prompt corrective action during that time period.

Macroeconomic Variables

- 3-Month London Interbank Offered Rate (LIBOR) %: is the average interest rate at which leading banks borrow significant amounts of capital from other banks in the London market. Libor is the most widely used "benchmark" or benchmark for short-term interest rates. It influences bank borrowing costs, and indirectly interest rates paid to consumers and companies. When borrowing rates are high, it can restrict investment and consumption. Obtained from Federal Reserve Bank of ST. Louis (FRED).

- Effective Federal Funds Rate %: The domestic unsecured borrowings in dollars made by depository institutions from other depository institutions and some other entities, primarily government-sponsored enterprises, make up the federal funds market. The cost of interbank lending is influenced by the EFFR, which has an impact on banks' liquidity and overall lending capability. When the EFFR is high, borrowing costs increase up, which could result in fewer loans being made, tighter credit standards, and ultimately less investment and consumption. Moreover, changes in the EFFR may attract or discourage foreign investment. The demand for the domestic currency may increase as a result of the higher EFFR, thus enhancing its value. A higher EFFR may attract foreign investments looking for better returns. Obtained from Federal Reserve Bank of ST. Louis (FRED).

- 5-Year Treasury Constant Maturity Rate %: 5-Year Treasury Constant Maturity Rate % is an index published by the Federal Reserve Board based on the average yield of a range of Treasury securities, corresponding to a duration of 5 years. This index is used as a reference point to determine the value of other securities, such as corporate bonds. The interest rates at which banks can borrow are influenced by Treasury rates. Higher borrowing costs for banks may result from an increase in the 5-year Treasury rate. Because higher borrowing costs can slow down economic activity and affect foreign investment, these costs may have an indirect impact on the exchange rate. Obtained from Federal Reserve Bank of ST. Louis (FRED).

- Real Effective Exchange Rates for USA %: Real effective exchange rates are calculated as weighted averages of bilateral exchange rates adjusted by relative consumer prices. This indicates as a competitiveness indicator, since the flow of investments, especially foreign direct investments, which banks frequently facilitate or partake in, can be influenced by a favourable REER. Moreover, decisions about cross-border portfolio investments can be impacted by changes in the REER. As major participants in the financial market, banks must monitor these changes in order to optimize their portfolios and provide clients with the best advice possible. Obtained from Federal Reserve Bank of ST. Louis (FRED).

- GDP CQOQ Index: This index tracks the percent change for GDP price index and is seasonally adjusted at annual rates. It reflects the short-term economic growth of a country and the banks' decisions related to foreign exchange exposure. A strong growth rate may attract foreign investment, which will boost the value of the local currency. Banks play a vital role in facilitating these capital transfers as important financial intermediaries. Obtained from Bloomberg.

- U-3 Unemployment Rate %: The U-3 unemployment rate is the most reported unemployment rate in the United States and represents the number of people actively seeking work. Along with the rate of economic growth and inflation, the unemployment rate is one of the most widely reported and discussed economic indicators in a general state of the economy. In order to boost borrowing and investment, central banks may cut interest rates if unemployment is high and suggests economic stagnation or recession. Lower interest rates may, in turn, make a nation's currency less attractive to international investors, which would exert downward pressure on its exchange rate. On the other hand, a declining unemployment rate would point to an expansion of the economy, which could result in higher interest rates and a strengthening of the currency. As a result, the U-3 rate has an indirect impact on exchange rate movements by influencing monetary policy decisions and news sentiment. Obtained from Bloomberg.

- Net Sentiment Index (Exchange Rate News): News sentiment frequently influences the stock market in the financial sector. Investors' behaviour of events or news have a real impact on their decision-making processes, even beyond empirical evidence and economic indicators. The exchange rate is one of the most unpredictable and emotionally driven monetary instruments. Exchange rate news, with its vast outreach, can sway investor sentiment rapidly. For instance, negative thinking and currency sell-offs caused by bad news can lower the value of a particular currency. Positive news, on the other hand, might raise confidence, encouraging more spending and currency appreciation. These fluctuations have both a direct and indirect impact on banks due to their significant involvement in FX activities. Their capacity to generate money from forex activities depends on how exchange rates fluctuate, and consequently, how people feel about those fluctuations (Daniel, et al., 1998). Moreover, the three currencies -- USDJPY, USDEUR, and USDGBP -- were chosen because they are the most dynamic and frequently traded currency pairs in the world. They frequently influence the behaviour of the world's financial markets. The yen is indicative of East Asian market emotions, the euro reflects the sentiment of the Eurozone as a whole, and the British pound provides information about the UK, which is especially important in light of recent events like Brexit.

4.4 Exploratory data analysis

In order to test the appropriateness of the data for use in the proposed models, a range of exploratory data analyses was carried out. This exercise is useful where there are a lot of predictor variables and their impact on each other is unknown.

4.4.1 Correlation Matrix

The next step in data analysis is to review whether the data is highly correlated. The Pearson's two-way correlation matrix with statistical significance for all variables is shown from the Appendices 1 to 8 Pearson's correlation matrices demonstrate the statistical relationship or association between two variables, based on the amount each variable varies in relationship to the other. It is not a test of causality since the variances can be caused by another (unknown) variable. The coefficients from a correlation test range from +1 (perfect positive correlation) to -1 (perfect negative correlation), and where 0 indicates no relationship at all between the variables in question (Hair, et al., 2019; Field, 2009).

The main purpose of the correlation matrix is to determine how closely related variables move. Appendices 1 to 8 indicate that two combinations of variables appear to have high levels of correlation (greater than 0.9) which suggests multicollinearity. Multicollinearity can be a concern where there is a strong correlation between the predictor variables. If for example, two variables are perfectly or highly correlated with each other, this suggests that they are in effect measuring similar things. This creates a problem in interpreting the regression output because it becomes less reliable as the two variables add the same influence on the model. Multicollinearity can cause two basic types of problems, the coefficient estimates can swing abruptly based another independent variable found in the model, being the coefficients very sensitive to small changes in the model and second is that multicollinearity reduces the precision of the estimated coefficients. Consequently, the presence of multicollinearity might lead to misleading p-values when detecting significant independent variables, which may threaten the validity of the statistical model. We decided to exclude several independent variables with substantial intercorrelations in order to reduce this problem.

In the total dataset (appendices 1 to 3), there is a notably strong correlation of 0.9929 between the Total risk-based capital ratio% (variable 24) and the Tier 1 risk-based capital ratio% (variable 23). On the other hand, the net sentiment index of the exchange rate news (Variable 30), shows a negative relationship with both ROA and ROE, -0.0438 and -0.0434 respectively. Also, the comparison between the Net Sentiment Index (Exchange rate news) with NIM, there is a slight positive correlation of 0.0126.

According to the sample with the 118 largest USA Banks by total assets (appendices 4 and 5), there is one combination of variables that creates high correlation, these variables are also the Total risk-based capital ratio (%) (variable 24) and the Tier 1 risk-based capital ratio (%) (variable 23), 0.9927.

In the analysis of the 30 smallest US banks by total assets (appendices 7 and 8), a near-perfect positive correlation of 0.99 was found between the Tier 1 risk-based capital ratio% (Variable 23) and the Total risk-based capital ratio% (Variable 24). Such a high correlation implies a strong linear relationship between these variables. To avoid the effects of multicollinearity, the Total risk-based capital ratio % (Variable 24) was removed from the subsequent analyses.

According to the above, in all three models (ROA, ROE, and NIM) it seems that there are only three variables which affect the correlation of the variables more, Additional Noninterest Income/ Total interest income, Tier 1 risk-based capital ratio%, and Total risk-based capital ratio (%), causing multicollinearity. To address the issue of multicollinearity, we decided to remove one of these variables to avoid the high correlation and alteration of the results.

It can be statistically inferred that the other variables seem to measure different things, so there is no possibility of multilinearity within the data set, however, conceptually again it can be argued that any profitability measures such as ROA, ROE or NIM measures effectively similar things, so again, they will not be integrated into the same model, as there is no sense and logic to do so.

4.5 Parametric Data Analysis

For all data analyzes, it is important to understand the nature of the data before constructing models and making research conclusions. This includes evaluating the data and its behavior in order to determine the most appropriate statistical tests that can be performed. The most common tests are parametric tests, given that the data must be normally distributed. There are four assumptions that must be followed in order to use parametric tests. These are:

- Data is normally distributed. This is usually expressed as the standard error, which is the standard deviation of sample means.
- Homogeneity of variance.
- Data should be measured on an interval scale.
- Independence: this means that the results of one participant is independent of any other – hence the ROA of one bank does not depend on any way on another bank.

Data transformation is where each score is transformed by a mathematical function *(Field, 2009; Hair, et al., 2019)* without affecting the underlying relationships between the variables but changing the units of measurement into a standard. According to Field et al, (2012), data transformation could be done by 4 different methods, log transformation, square root transformation, reciprocal transformation, and reverse score transformation. Therefore, it has been decided to convert some of the data in this study into physical logarithms (ln), namely the variable of total assets and Total interest income. Other robust techniques will be used to ensure the validity of the data regression findings. These will be discussed in a later section.

4.6 Testing for normal distribution of data

Initially, histograms of all variables (dependent and independent) were designed to determine the approximate distribution of the data and to determine whether there were obvious extremes or whether the data were or were not normally distributed. Appendices 9 shows histograms of all variables used in the study, starting from the dependent variable, ROA, ROE, and NIM. It can be readily seen that some of the variables do not appear to have a normal distribution. Hence further analyses were undertaken.

4.7 Module Robustness

In order to assess whether data modeling is robust, further testing of the data in a model sample will be executed. An exploratory ordinary least squares (OLS) regression was estimated with the panel data from the US Banks list we collected. The model was then tested to assess its durability. This process will be discussed in Chapter 5.

4.7.1 Explanatory OLS regression

To ascertain more precisely which variables are likely to have the most impact in the model, a sample multiple regressions was estimated using the stepwise Forward approach, where the variables are selected by the p-value. The equation tested was used with dependent and independent variables based on the literature review, as discussed in Chapter 2 and Chapter 3, using the most popular banks' profitability measures, which are ROA, ROE and NIM plus most of the independent variables suggested by the literature. The resulting of OLS regression model (non-statistical nomenclature) is:

$$\text{ROA} = \text{X01} + \text{X02} + \text{X03} + \text{X04} + \text{X05} + \ldots. + \text{X30} \qquad (4.7.1)$$

This is expressed as follows using statistical nomenclature and the shortened acronyms for the variables,

$$ROA_{it} = a \ + \ + b_1\ X01_{it} + b_2\ X02_{it}\ + \ldots + b_n\ X30_n + e_{it} \qquad (4.7.2)$$

Where: α is the intercept, b is the variable parameter, i is an individual bank, t is a given year, and Ɛ is the error term.

The same equation was used with ROE and NIM as dependent variables in the first term. A further analysis will be discussed in the next chapter, analyzing, and studying the methodology used in this dissertation.

4.8 Conclusion

The process of choosing the data sources, gathering the data, analyzing the data, and examining each variable's features have all been examined in this chapter. 148 US banks and institutions provided with data during a 21-year period, resulting in a sample of 3108 observations (from 1998 to 2018). In addition, a number of independent variables that fall into the categories of banking and macroeconomic issues were chosen for this study. Based on the literature review, which was examined in Chapter 2, these factors have been chosen. The OLS Regression Models are then briefly mentioned before being applied and thoroughly described in the chapter that follows.

Chapter 5

5 Empirical Results

5.1 Introduction

In seeking to understand the complex dynamics underpinning on this research subject, the empirical analysis undertaken in this chapter is central. Through a rigorous examination of the available data, this chapter provides a comprehensive exploration of the data set, illuminating key patterns and relationships inherent within. We begin by developing descriptive statistics, offering a first look at the fundamental characteristics of the data set. This serves as the foundation, setting the stage for the finer analyzes that follow.

To ensure model robustness and fit, choosing the best autoregressive model for regression analyzes is crucial (Paul, et al., 2016). The subsequent section outlines the efforts made in this regard, providing a comprehensive overview of the process and rationale behind the chosen model for each of the three regression settings. The Stepwise Forward technique as described by Paul et al. (2016) was used, after realizing the crucial role that feature selection plays in enhancing model accuracy and interpretation. Using this method, the variables in the models were narrowed down and only those variables that have a significant impact on how the dependent variable changes were retained. The next step involved testing for panel unit root, which prepares the ground for further regression analyses, to determine whether the panel possess a unit root and consequently determine their stationarity. Also, the regression techniques of pooled OLS, fixed effects, and random effects models are applied, each of which provides distinct insights and sheds light on a different part of the behaviour of the data.

Finally, we use the Generalized Method of Moments (GMM) for dynamic panel data to address potential endogeneity while also utilizing its dynamism. This innovative approach offers a sophisticated understanding, considering any delays effects and providing an expanded overview of this study's topics.

5.2 Descriptive Statistics

The first step in data analysis is to perform some basic descriptive statistical analysis to evaluate the mean, median, maximum, minimum, standard deviation, Skewness, Kurtosis and Jarque-Bera values for the data. The results of these are presented in Appendix 9 (panel A) comparing it with the sample adding 2 periods (one dummy variable): before the crisis and after the economic crisis (see panel B in the appendices). Most of the banking variables have been collected from the FDIC reporting parent banks/banking institutions from 1998 to 2018. All variables show positive means values, with the exception of exchange rate news which is considered the most important variable for the models in this dissertation. Descriptive statistics also show that average ROE (7.80) is higher than NIM (3.61) and ROA (0.81) as the corresponding measures of banks' profitability. Some of them represent high value of kurtosis. These variables where have the kurtosis close to 3, have a normal distribution. According to Appendix 9 (Panel A), only two of the total variables have kurtosis close to 3, Yield on earning assets and GDP index.

Based on the standard deviation, when the value is high, the data are widely dispersed (less dependable), and when it is low, the data are closely grouped around the mean (more reliable). According to appendix 9, it seems that the variable of exchange rates news gives 43.01729, while the Loan and leases loss allowance/ Total Assets is close to 0.43. The values of the Jarque-Bera statistics show that the series are normally distributed since the p-value of all the series are not statistically significance at 5%. This implies that the null hypothesis that says each variable is normally distributed is not rejected.

5.3 Optimized Autoregressive Model

To select the number of AR delays in each row, we calculate for m = 1 and gradually increase the number of autoregressive delays (lags) until V_n is not serially associated. To do this, several models with higher AR commands were calculated and the number of autoregressive delays (lags), m, were chosen, that minimize the Swartz Criterion, SIC information. This process is done with the dependent variables, ROA, ROE and NIM.

5.3.1 The best autoregressive model for Total Sample (N=148, T=21)

Following this process, it was observed that for ROA and all independent variables, the SIC selects an AR (2) model in which we have the lowest Swartz Criterion 2.079440. As we start from AR (1), it was noted that the SIC is quite high, prompting the addition of another lag (Lag, yt−2), resulting in a decrease in the Swartz Criterion. Adding one more lag, the Swartz Criterion Information increasing again. Throughout the study, multiple tests were conducted by adding a time lag to assess any reduction in this information. It was observed that with each additional lag, the Swartz Criterion Information alternated between increasing and decreasing, reaching a total of 4 lags. Finally, the AR (2) was chosen due to its minimal Swartz Criterion value of 2.079440.

Table 4: The best autoregressive models in ROA, based on SIC.

AUTOREGRESSIVE MODEL	R-SQUARED	S.E. OF REGRESSION	MEAN DEPENDENT VARIABLE	S.D. DEPENDENT VARIABLE	SCHWARZ CRITERION
AR(1)	0.461658	0.661847	0.796406	0.897462	2.085618
AR(2)	0.513334	0.634834	0.785420	0.900243	2.079440
AR(3)	0.519454	0.637812	0.770583	0.904398	2.173131
AR(4)	0.527102	0.640400	0.762971	0.908765	2.273849

Note 1: In the first column represent 4 autoregression models with all independent variables and ROA as dependent variable. The second column seems to be the S.E. of regression that measures the disturbance of the error term in the regression. The third column represents the mean dependent variable, fourth column represents the standard deviation of dependent

variable, ROA, and the last column contains the Schwarz criterion information (SIC) in which measures the best autoregressive model.

Following this previous process, it was found that for ROE and all independent variables, the SIC selects an AR (2) model with the lowest Swartz Criterion value of 6.424004.

Table 5: The best autoregressive models in ROE, based on SIC.

AUTOREGRESSIVE MODEL	R-SQUARED	S.E. OF REGRESSION	MEAN DEPENDENT VARIABLE	S.D. DEPENDENT VARIABLE	SCHWARZ CRITERION
AR(1)	0.472608	5.807746	7.645372	7.956611	6.429444
AR(2)	0.518756	5.572763	7.502622	7.946995	6.424004
AR(3)	0.519960	5.587603	7.312575	7.927221	6.513655
AR(4)	0.523775	5.61044	7.179085	7.938771	6.615715

Note 2: In the first column represent 4 autoregression models with all independent variables and ROE as dependent variable. The second column seems the S.E. of regression that measures the disturbance of the error term in the regression. Third column represents the mean dependent variable, fourth column represents the standard deviation of dependent variable, ROA, and the last column contains the Schwarz criterion information (SIC) in which measures the best autoregressive model.

Finally, it was found that the best autoregressive model for NIM is an AR (1), due to the lowest Swartz Criterion value, 0.945866.

Table 6: The best autoregressive models in NIM, based on SIC.

AUTOREGRESSIVE MODEL	R-SQUARED	S.E. OF REGRESSION	MEAN DEPENDENT	S.D. DEPENDENT	SCHWARZ CRITERION

			MEAN DEPENDENT VARIABLE	S.D. DEPENDENT VARIABLE	
AR(1)	0.832271	0.374745	3.601201	0.910374	0.948041
AR(2)	0.847017	0.360171	3.589511	0.910965	0.945866
AR(3)	0.853040	0.353696	3.575269	0.906912	0.993920
AR(4)	0.864533	0.340455	3.565905	0.902667	1.010228

Note 3: In the first column represent 4 autoregression models with all independent variables and NIM as dependent variable. The second column seems to be the S.E. of regression that measures the disturbance of the error term in the regression. The third column represents the mean dependent variable, fourth column represents the standard deviation of dependent variable, ROA, and the last column contains the Schwarz criterion information (SIC) in which measures the best autoregressive model.

5.3.2 The best autoregressive model in Sample of 118 Largest USA Banks by total assets (N=118, T=21)

Following the autoregressive analysis conducted on the entire sample of 148 USA Banks, a similar process was employed to determine the optimal autoregression model for ROA among the sample of 118 Largest USA banks by total assets.

The table below presents the findings, indicating that the best autoregressive mode for ROA among the sample of the 118 largest US banks is AR (1), due to the lowest Swartz Criterion value of 2.149351. Adding one lag each time, it was observed that the SIC is constantly increasing, so the best model is the one (AR1) with the lowest value.

Table 7: Best Autoregression Model on ROA, in the Sample of 118 Largest US Banks

AUTOREGRESSIVE MODEL	R-SQUARED	S.E. OF REGRESSION	MEAN DEPENDENT VARIABLE	S.D. DEPENDENT VARIABLE	SCHWARZ CRITERION
AR(1)	0.467179	0.677965	0.817845	0.922863	2.149351
AR(2)	0.528360	0.657619	0.798346	0.943480	2.196741

AR(3)	0.540174	0.658624	0.782552	0.948726	2.307725
AR(4)	0.557063	0.655693	0.773068	0.952832	2.417817

Note 4: In the first column represent 4 autoregression models with all independent variables and ROA as dependent variable. The second column seems to be the S.E. of regression that measures the disturbance of the error term in the regression. The third column represents the mean dependent variable, fourth column represents the standard deviation of dependent variable, ROA, and the last column contains the Schwarz criterion information (SIC) in which measures the best autoregressive model.

Finally, it was found that the best autoregressive model for NIM is an AR (2), due to the lowest Swartz Criterion value, 6.330064. Adding one more lag to both dependent and independent variables, SIC seems to be increasing.

Table 8: Best Autoregression Model on ROE, in the Sample of 118 Largest US Banks

AUTOREGRESSIVE MODEL	R-SQUARED	S.E. OF REGRESSION	MEAN DEPENDENT VARIABLE	S.D. DEPENDENT VARIABLE	SCHWARZ CRITERION
AR(1)	0.499191	5.507798	7.751292	7.733266	6.339001
AR(2)	0.549851	5.232712	7.605478	7.694065	6.330064
AR(3)	0.558272	5.212157	7.427044	7.676100	6.421189
AR(4)	0.566884	5.196903	7.281007	7.656686	6.530448

Note 5: In the first column represent 4 autoregression models with all independent variables and ROE as dependent variable. The second column seems to be the S.E. of regression that measures the disturbance of the error term in the regression. Third column represents the mean dependent variable, fourth column represents the standard deviation of dependent variable, ROE, and the last column contains the Schwarz criterion information (SIC) in which measures the best autoregressive model.

Finally, according to the minimum Schwarz Criterion Information, it was found that the best autoregressive model with dependent variable as NIM was AR (2), 0.875211.

Table 9: Best Autoregression Model on NIM, in the Sample of 118 Largest US Banks

AUTOREGRESSIVE MODEL	R-SQUARED	S.E. OF REGRESSION	MEAN DEPENDENT VARIABLE	S.D. DEPENDENT VARIABLE	SCHWARZ CRITERION
AR(1)	0.845747	0.359031	3.479145	0.908315	0.877979
AR(2)	0.862310	0.342153	3.468500	0.909655	0.875211
AR(3)	0.869404	0.334236	3.454729	0.905291	0.927385
AR(4)	0.881934	0.318852	3.444585	0.899755	0.948266

Note 6: In the first column represent 4 autoregression models with all independent variables and NIM as dependent variable. The second column seems the S.E. of regression that measures the disturbance of the error term in the regression. The third column represents the mean dependent variable, fourth column represents the standard deviation of dependent variable, NIM, and the last column contains the Schwarz criterion information (SIC) in which measures the best autoregressive model.

5.3.3 The best autoregressive model in Sample of 30 Smallest USA Banks by total assets (N=30, T=21)

Based on the above, it was tested and analyzed four autoregressive models in each dependent variable in the sample of 30 smallest US Banks by total assets, as previously categorized.

Table 10: Best Autoregression Model on ROA, in the Sample of 30 Largest US Banks

AUTOREGRESSIVE MODEL	R-SQUARED	S.E. OF REGRESSION	MEAN DEPENDENT VARIABLE	S.D. DEPENDENT VARIABLE	SCHWARZ CRITERION
AR(1)	00592703	0.513824	0.712080	0.784696	1.783586
AR(2)	0.632895	0.509329	0.702585	0.79502	2.054461

AR(3)	0.655433	0.514076	0.686278	0.799318	2.382809
AR(4)	0.688207	0.518131	0.6816450	0.811189	2.731135

Note 7: See note 5

Table 11: Best Autoregression Model on ROE, in the Sample of 30 Largest US Banks

AUTOREGRESSIVE MODEL	R-SQUARED	S.E. OF REGRESSION	MEAN DEPENDENT VARIABLE	S.D. DEPENDENT VARIABLE	SCHWARZ CRITERION
AR(1)	0.544518	0.520503	7.228752	8.774728	6.724070
AR(2)	0.584951	6.040486	7.098055	8.867982	7.000752
AR(3)	0.606414	6.075987	6.862328	8.839462	7.322266
AR(4)	0.638781	0.527351	6.778193	8.959633	7.682246

Note 8: See note 6

Table 12: Best Autoregression Model on NIM, in the Sample of 30 Largest US Banks

AUTOREGRESSIVE MODEL	R-SQUARED	S.E. OF REGRESSION	MEAN DEPENDENT VARIABLE	S.D. DEPENDENT VARIABLE	SCHWARZ CRITERION
AR(1)	0.728495	0.398406	4.081288	0.745212	1.274769
AR(2)	0.751324	0.393165	4.065489	0.745695	1.536733
AR(3)	0.787593	0.375548	4.049390	0.743720	1.754837
AR(4)	0.823023	0.357177	4.043096	0.742234	1.987145

Note 9: See note 7

5.4 Criteria for selecting interpretative variables.

As mentioned above, the selection of the most important variables has been derived from Stepwise Least Squares. Specifically, we have used the Stepwise Forward method, which includes all data in the model, i.e., all the variables we have collected *(Paul, et al., 2016)*. The variable with the lowest p-value is added first, then the next one with the highest value is removed. Then both removed variables are checked based on the p value criterion forward. Those variables with the lowest p-value 0.01 are added back to the model. This process ends when the lowest p value of the variables within the model is less than the set forward retention criterion.

In statistics and econometrics, a distributed delay model is a model for time series data in which a regression equation is used to forecast the current values of a dependent variable based on both the current values of an explanatory variable and the delayed values of this explanatory variable. The mathematical equation is presented as follows:

$$Y_t = \text{a} + b_0 y_{t-1} + b_1 X_{i,t-1} + \ldots + b_n X_{n,t-1} \quad (5.3.1)$$

Where, Y_t is the value for period t of the dependent variable that we specifically look at NIM and we call the hysteresis weight and is placed in the values for i periods previously used in the explanatory variable x, so with t-1 we define the previous day from today. In equation (5.2.1), the dependent variable is influenced by the values of the independent variable arbitrarily in the past, so the number of delay weights is infinite, and the model is called an infinitely distributed lag model. In the alternative, second, equation, there is only a finite number of delay weights, indicating a hypothesis that there is a maximum lag beyond which the values of the independent variable do not affect the dependent variable. A model based on this assumption is called a finite delayed distribution model.

5.4.1 Feature selection with dependent variable ROA- ROE- NIM, total sample (N=148, T=21)

Therefore, according to the above equation (5.3.1), the following table is derived from the stepwise forward method showing the most important independent variables with a p-value < 0.01 that affects the ROA as dependent variable, selecting 17 as the most statistically significant variables from the total of 29. While the total sample of the independent variables were 30, it was identified that two variables, Total risk-based capital ratio% (variable 24) and the Tier 1 risk-based capital ratio% (variable 23), exhibit a high correlation coefficient of 0.9929, as previously discussed in chapter 4. Based on this, to mitigate multicollinearity issues, one of these variables, specifically variable 24, was removed from the analysis, as it likely does not affect statistically to the model. Following the exclusion of variable 24 from the total sample of independent variables, the remaining 29 external variables were retained for further analysis. These variables will be used to test stepwise forward with a lower p-value = 0.01[5].

Based on the Appendix 11, on the first column represents the most important statistical variables for the model with p-value < 0.01. From the ROA model parameters, it can be concluded that fluctuations in these variables are statistically significant in the profitability of the financial performance of US banks (ROA). With a dependent variable ROA, the R-square is equal to 0.90, which means 90.05% of the variance in the dependent variable is explained by the independent variables. The profitability of the F-statistic is equal to zero, which reveals that the model is statistically significant.

According to the second model (see Appendix 11) with dependent variable ROE, the Stepwise Forward method has chosen the best 13 regressors, after the constant, from the total group. As it is observed from the table above, the p-value of all these variables is smaller than 0.01, so all of these are statistically significant at 1% level. As dependent variable ROE, R-squared equals to 0.80, which means 80.30% of variation in the dependent variable is explained by the independent variables. The profitability of the F-statistic is equal to zero, which reveals that the model is statistically significant.

In the last model with NIM dependent variable (see Appendix 11), the Stepwise Backwards method selects the best 22 regressors, after the constant, from the total group. The p-value of all these variables is smaller than 0.01, so all of these are statistically significant at 1%. Finally, R-squared equals 0.89 for NIM model which means 89.89% of variation in the dependent variable is explained by the independent variables. The profitability of the F-statistic is equal to zero, which reveals that the model is statistically significant.

Based on all the above, it becomes evident that exchange rate news does not statistically significant across all model, while some of the variables are statistically significant having either a positive or negative effect in all three models in terms of profitability of the examined banks. The highest R-squared was found in the first model with a dependent variable ROA, reaching 90%.

[5] This process has been followed for all models and samples separately.

5.4.2 Feature selection with dependent variable ROA- ROE- NIM, sample of 118 Largest US Banks by total assets (N=118, T=21)

As previously mentioned, each of the models represents high correlation in some of the independent variables. On the sample of the 118 largest US banks by total assets, it has found that there is a high correlation relationship between two variables, the Total risk-based capital ratio (%) (variable 24) and the Tier 1 risk-based capital ratio (%) (variable 23), 0.9927. Building upon this observation, variable 24 was also removed from the total sample of US banks (see Chapter 4). Thus, all three models include 29 independent variables out of the total of 30 (see Appendix 12).

According to the first model, defining the ROA as measure of banks' profitability, the Stepwise Forwards method selects the best 15 regressors, after the constant, from the total group. This means that by adding one variable to the model at a time and testing it at each step, the model stops when it no longer improves by adding more variables. As a criterion for stopping this process, the lowest p values of each of these independent variables were defined. Therefore, the first model with ROA dependent variable, 15 independent variables with the lowest P-value have been selected, defining these variables as the most statistically significant. In this case, we have the sample of 118 Largest US banks as they have been divided based on their total assets in the year 2018.

The R-square of the model that has been selected is equal to 0.90, which means 90.09% of the variance in the dependent variable is explained by the independent variables. The profitability of the F-statistic is equal to zero, which reveals that the model is statistically significant. From the total selecting independent variables as they been affected most the profitability of the banks, 7 of these variables affect the model negatively with a statistical significance level of 0. Finally, none of these coefficients exceeds zero, without this meaning that they do not significantly affect this sample.

Based on the second model with dependent variable ROE, the Stepwise Forward method chosen the best 13 regressors, after the constant, from the total group. The table above indicated that the p-value of all these variables is smaller than 0.01, so all of these are statistically significant at 1% and all variables affect the dependent variable, the ROE, either positively or negatively, looking at the coefficients of each variable. In table 22, there are 7 variables which negatively affect the dependent variable, ROE, while only one variable seems to have a large positive and significant influence on the sample exceeding zero, this is Yield on earning assets (%) with coefficient 1.281589. As dependent variable ROE, R-squared equals to 0.89, which means 89.39% of variation in the dependent variable is explained by the independent variables. The profitability of the F-statistic is equal to zero, which reveals that the model is statistically significant.

In the last model, defining the NIM as measure of banks' profitability, the Stepwise Forwards method selects the best 20 regressors, after the constant, from the total group. Table 22 provides that the p-value of all these variables is smaller than 0.01, so all of these are statistically significant at 1%. None of these models showed a large negative or positive coefficient but everything seems to be close to zero. Finally, R-squared equals 0.84 for NIM model which means 84.59% of variation in the dependent variable is explained by the independent variables. The profitability of the F-statistic is equal to zero, which reveals that the model is statistically significant.

In this analysis of the 118 largest US banks by total asset, several findings were notable regarding the influence of exchange rate news and various independent variables on the banks' profitability (Ahmad, et al., 2016). Interestingly, exchange rate news did not show statistical significance in all models. This might be due to the fact that larger banks, particularly those in this sample, have operations that are more diversified and employ hedging techniques to mitigate the immediate effects of exchange rate fluctuations. Moreover, the news might already be factored into their operations, or these banks might have sufficient buffers to cushion against such effects.

Also, we can see that some of the independent variables appears to all these three models, such as **Net income/ Total interest income** both negatively and positively affecting the models, **Additional Noninterest Income/ Total interest income** and **Yield on earning assets (%)** positively affecting each model**.**

- Net Income/Total Interest Income:

The models illustrated both positive and negative influences due to the Net Income/Total Interest Income ratio. When the effect is positive, it indicates that banks accrue a significant portion of their net income from interest, potentially due to charging higher interest rates on loans than they offer on deposits (Dietrich & Wanzenried, 2011). This observation aligns with the findings of Dietrich and Wanzenried, who noted that during favorable economic conditions, such dynamics significantly bolstered bank profitability.

However, when the ratio negatively impacts profitability in the models, it might hint at banks overly depending on interest income. This excessive reliance can be detrimental, particularly in unstable economic scenarios where there's a risk of high loan default rates or slender interest rate margins. Such vulnerabilities can impede profitability, an insight mirrored in the study by Dietrich and Wanzenried, (2011) on Swiss banks. They highlighted that during economic downturns, banks' profitability could be jeopardized due to such factors. Additionally, the models also suggest that overemphasis on traditional banking can potentially sidestep other revenue avenues, culminating in an overall decline in profitability.

- Additional Noninterest Income/ Total interest income

This positive correlation resonates with the findings of Demirguc-Kunt and Huizinga, (1999), who explored bank profitability across several nations. Their study showed that banks with efficient income diversification—moving beyond just traditional interest income—often experience increased profitability. This becomes crucially important during times when interest incomes are constrained by a variety of external reasons. In such cases, non-traditional banking sources, such as service fees, fees, or trading income, emerge as crucial buffers, enhancing a bank's revenue model's resilience and sustainability. The models support a widened revenue approach that includes traditional and non-traditional channels as a strategic measure to strengthen profitability, in line with Demirguç-Kunt and Huizinga's study (Demirguc-Kunt & Huizinga, 1999).

- Yield on earning assets (%)

Higher yields on earning assets consistently led to higher profitability. Successful banks are those that can efficiently allocate resources to high-yielding opportunities, whether those opportunities come in the form of profitable investments or loans with an interest rate. It shows competent asset management and effective financial forecasting.

However, the best regression model through the p-value applying the stepwise forward proved to be the first, having in the first term the dependent variable ROA and in the second term of the regression 15 independent variables with value p greater than 0.01, based on the r-squared 0.90.

5.4.3 Feature selection with dependent variable ROA- ROE- NIM, sample of 30 Smallest Banks by total assets (N=30, T=21)

As we have been checked and found there are three variables which affect the correlation of the variables more, Additional Noninterest Income/ Total interest income % (var11), Tier 1 risk-based capital ratio % (var23), and Total risk-based capital ratio % (var24), causing multicollinearity. To address the issue of multicollinearity, one of these variables was removed. Thus, the three models include 27 independent variables out of the total 30 for the Stepwise Forward method (see Appendix 13).

According to the above and question 5.2.1, the analysis focused on examining and testing the Stepwise forward method to identify the independent variables that affect the greatest influence on the models. In this case, the analysis was conducted using a sample of 27 Smallest US banks as they have been divided based on their total assets in the year 2018. So, the following table shows the most important independent variables that resulted from the p value of 0.01 affecting the dependent variable ROA, selecting 7 as the most statistically significant variables with a lower p-value of 0.01 ($p\text{-value} < 0.01$). In the first model with dependent variable ROA, the R-square is equal to 0.95, which means 95.62% of the variance in the dependent variable is explained by the independent variables. The profitability of the F-statistic is equal to zero, which reveals that the model is statistically significant. From the total selecting independent variables as they been affected most the profitability of the banks, 3 of these variables affect the model negatively with a statistical significance level of 0.

In the case of the second model with dependent variable ROE, the Stepwise Forward method selected the 9 best regressors of the full sample, besides the constant. As we can see from the table above, the p-value of all these variables is smaller than 0.01, so all of these are statistically significant at 1% and all variables affect the dependent variable, the ROE, either positively or negatively, looking at the coefficients of each variable. One of these independent variables, Total deposits/ Total Assets, seems that effect high negatively the ROE with coefficient -2.802227, while net operating income in assets (%) affects the dependent variable more positively than the other variables. selected by the stepwise forward method, with a coefficient of 3.072106. As dependent variable ROE, R-squared equals to 0.89, which means 89.39% of variation in the dependent variable is explained by the independent variables. The profitability of the F-statistic is equal to zero, which reveals that the model is statistically significant.

In the last model, defining the NIM as measure of banks' profitability, the Stepwise Forwards method selects the 7 best regressors, after the constant, from the total group. As we can see from Appendix 13, the p-value of all these variables is smaller than 0.01, so all of these are statistically significant at 1%.

None of the models in this study showed a large negative or positive coefficient, but everything seems to be close to zero because the effects are negligible, it means that the models did not find a strong or statistically significant relationship between the variables being studied. The coefficients, which represent the strength and direction of the relationship between the variables, were all close to zero, indicating that there was little or no effect. This suggests that the effects of the variables on the outcome being studied were small or insignificant.

The fact that the effects are negligible could be due to several factors, such as a lack of a strong causal relationship between the variables, or a large amount of noise or variability in the data that makes it difficult to detect any meaningful effects. It may also be the case that the models simply were not able to capture the relationship between the variables due to limitations in the data or the model specification.

Finally, R-squared equals 0.94 for NIM model which means 94.58 % of variation in the dependent variable is explained by the independent variables. The profitability of the F-statistic is equal to zero, which reveals that the model is statistically significant, therefore the independent variables can explain a significant part of the variation in the dependent variable.

In this sample of 30 Smallest US Banks by total asset and based on all the above, the exchange rate news was not statistically significant for any of the models, meaning that it did not have a significant effect on the profitability of the banks. However, some of the other variables were found to be statistically significant, meaning that they had a significant effect on the profitability of the banks. These variables had either a positive or negative effect on the profitability of the banks, depending on the model. The study also found that the best regression model, as determined by the p-value using the stepwise forward method, was the first model. This model included the dependent variable (ROA) and 7 independent variables, all of which had a p-value of greater than 0.01. The r-squared value for this model was 0.95, indicating that it was able to explain a large portion of the variance in the dependent variable.

5.5 Panel Unit Root Test

We compute the summary panel unit root test, using individual fixed effects as regressors, and automatic lag difference term and bandwidth selection (using the Schwarz criterion for the lag differences, and the Newey-West method and the Bartlett kernel for the bandwidth). The results for the panel unit root test are presented below. Table 13 reports the panel unit root estimates for the possible determinants in the sample of 148 banks. The test specification exhibits that in all series the null hypothesis is rejected[7]. This implies that there is no cointegrated relationship because the variables are stationary series in panel with banks during the sample period (Im, et al., 2003; Pesaran, 2004; Levin, et al., 2002).

Table 13: Panel Unit root testing: I'm, Pesaran and Shin W-stat, ADF- Fisher and Levin, Lin & Chu

		I'm, Pesaran and Shin W-stat		**ADF - Fisher Chi-square**		**Levin, Lin & Chu t***		
		Statistic	Prof	Statistic	Prof	Statistic	Prof	Result
		Dependent Variables						
	ROA	-8.045	0	485.95	0	-6.6994	0	Reject null hypothesis
	ROE	-7.2035	0	456.543	0	-6.2565	0	Reject null hypothesis
	NIM	-7.6552	0	496.385	0	-7.0246	0	Reject null hypothesis
		Independent Variables						
1	**Total assets**	-20.505	0*	1100.86	0	-43.759	0	Reject null hypothesis
2	**Loan and leases loss allowance/ Total Assets**	-5.2088	0	435.496	0	-6.6494	0	Reject null hypothesis
3	**Total deposits/ Total Assets**	-2.8637	0.002	352.97	0.01	-3.2106	0	Reject null hypothesis
4	**Interest-bearing deposits/Total Assets**	-1.936	0.026	351.035	0.02	-3.407	0	Reject null hypothesis

5	**Average total assets/ Total Assets**	-16.638	0	812.683	0	-15.627	0	Reject null hypothesis
6	**Tier one (core) capital/ Total Assets**	-2.1218	0.017	369.652	0	-3.5676	0	Reject null hypothesis
7	**Tier 2 Risk-based capital/ Total Assets**	-6.2032	0	502.751	0	-8.8298	0	Reject null hypothesis
8	**Total interest income**	-7.0851	0	503.233	0	-7.0002	0	Reject null hypothesis
9	**Total interest expense/ Total interest income**	-1.8204	0.034	1015.44	0*	-9.4011	0	Reject null hypothesis
10	**Total noninterest income/ Total interest income**	-5.613	0	434.061	0	-6.63	0	Reject null hypothesis
11	**Additional Noninterest Income/ Total interest income**	-5.7841	0	466.314	0	-6.4574	0	Reject null hypothesis
12	**Pre-tax net operating income/ Total interest income**	-6.6609	0	454.665	0	-4.9927	0	Reject null hypothesis
13	**Net income/ Total interest income**	-5.682	0	434.144	0	-3.5496	0	Reject null hypothesis
14	**Yield on earning assets (%)**	-3.8037	1E-04	1103.42	0*	-12.846	0	Reject null hypothesis
15	**Net operating income to assets (%)**	-37.517	0	970.972	0	-239.16	0	Reject null hypothesis
16	**Efficiency ratio (%)**	-6.8619	0	485.453	0	-7.8759	0	Reject null hypothesis
17	**Assets per employee ($millions)**	-31.056	0	677.327	0	-17.556	0	Reject null hypothesis
18	**Net loans and leases to total assets (%)**	-3.7668	1E-04	372.496	0	-4.709	0	Reject null hypothesis
19	**Net loans and leases to deposits (%)**	-3.5692	2E-04	363.986	0	-3.7426	0	Reject null hypothesis

20	**Total domestic deposits to total assets (%)**	-4.9784	0	855.713	0	-11.276	0	Reject null hypothesis
21	**Equity capital to assets (%)**	-2.4363	0.007	353.965	0.01	-2.0284	0.2	Reject null hypothesis
22	**Leverage (core capital) ratio (%)**	-3.4251	3E-04	736.184	0	-7.6726	0	Reject null hypothesis
23	**Tier 1 risk-based capital ratio (%)**	-3.5621	2E-04	412.745	0	-3.4923	0	Reject null hypothesis
24	**Total risk-based capital ratio (%)**	-3.6326	1E-04	402.358	0	-3.6084	0	Reject null hypothesis
25	**3-Month London Interbank Offered Rate (LIBOR) %**	-19.549	0	907.54	0	-20.703	0	Reject null hypothesis
26	**5-Year Treasury Constant Maturity Rate %**	-14.228	0	675.556	0	-22.705	0	Reject null hypothesis
27	**Real Effective Exchange Rates For USA %**	-21.885	0*	1015.17	0*	-27.63	0*	Reject null hypothesis
28	**U- 3 US Unemployment Rate Total in Labor %**	-4.3113	0	1474.33	0*	-13.364	0	Reject null hypothesis
29	**GDP CQOQ Index**	-12.845	0	618.839	0	-12.998	0	Reject null hypothesis
30	**Exchange rates news (%)**	-31.194	0	1461.79	0	-33.008	0	Reject null hypothesis

5.6 OLS Regression Models

Based on the exploratory work carried out to clear the data and evaluate an example for modeling in the previous chapter, the current chapter refers especially to the Ordinary Least Squares regression analyzes (OLS) performed in this study. To assess the impact of the bank's profitability on the relationship between exchange rate news and profitability measures, first, the relationship between exchange rate news and ROA will be evaluated. Based on previous research, this relationship is expected to be positive. The analysis proceeds with an examination of the relationship between ROE and exchange rate, followed by a conclusion focusing on the

NIM, as the third measure of the bank's performance. Three different models (pooled ordinary least squares (1), random effects (2) and fixed effects (3)) were employed for each model. The dataset comprises US data consisting of 148 banks, including 3,108 observations from 1998 to 2018. Before selecting one of these OLS regressions, it is imperative to underline some of the hypothesis.

A pooled OLS regression assumes that the differences in data between cross-sections and time periods are insignificant so that they can be ignored and treated using a simple OLS regression. However, the distinctions between the two can be significant. In these cases, individual effects must be inserted into the model. Three functional estimation techniques are employed. They are pooled ordinary least square (OLS), Random effect model, and the Fixed effect model. The selection between Random Effects and Fixed Effects is guided by the results of Hausman’s specification test.

An OLS Fixed Effect model applied to panel estimations using the Hausman test. The Hausman test is a test for the hypothesis that the explanatory variables are **strictly exogenous**. If the null hypothesis that the explanatory variables are strictly exogenous is rejected, it leads to the conclusion that the explanatory variables in the fixed effects model are endogenously determined.

Three different models have been tested and evaluated, the first one includes the total sample (N=148) with the total number of banks assembled, the second one includes only the largest banks where the total assets are highest that $100,000 (N=118), and the third model is these banks with lowest total assets (total assets < $100,000, N = 30). The time span is same for all these samples, during the period from 1998 to 2018, t= 21.

5.6.1 OLS Regression Model in the Total Sample, N=148, T= 21

Thus, table 25 presents the results of creating 3 different OLS regression models based on the dependent ROA variable, including 3108 observations. For each variable the coefficient and the standard error are presented. Before applying and evaluating the results of these three models, three different steps were undertaken. First, the highly correlated independent variable, Total risk-based capital ratio (%), was removed. Secondly, the remaining variables were selected based on the Stepwise Forward method with a p-value less than 0.01, as we previously discussed. Lastly, the OLS models were tested both with and without the inclusion of a dummy variable representing the economic crisis (See Chapter 4). This step aimed to ascertain whether a dummy variable would yield superior results compared to models without the dummy variable, thereby enhancing the empirical model with additional information.

Since these steps have applied and evaluated, it was found that these **tests reject the n**ull hypothesis, so in this dataset the Fixed effect model is suitable (inconsistent) based on the Hausman test (value $p < 0.01$). Appendix 14 shows that the exchange rate news variable does not influence the dependent variable, the bank's profitability (ROA), since this independent variable has not been selected by Stepwise Forward method. However, the factor which affects the dependent variable and improves the model above the OLS, effect and fixed models, is the Yield on earning assets with coefficient 0.2630, 0.163972, and 0.199220, separately, and is also statistically significant at 1%.

The model without dummies was tested using three different statistical tests on a sample of 148 US banks with ROA as the dependent variable. The first test was the Lagrange Multiplier Test, which tested the relationship between the dependent variable and the independent variables in the model. The p-value for this test was less than 0,01, indicating that there is a significant relationship between the variables. The second test was the F test for individual effects, which tested for a significant difference between the model and the data. The p-value for this test was also less than 0, indicating that there is a significant difference. The third test was the Hausman Test, which tested whether the model was a good fit to the data. The p-value for this test was less than 0, indicating that the model is not a good fit to the data (see table 14)

The model with dummies was also tested using the same three statistical tests on the same sample of 148 US banks with ROA as the dependent variable. The results of these tests were like the tests conducted on the model without dummies. The p-values for the Lagrange Multiplier Test, F test, and Hausman Test were all less than 0, indicating significant effects, significant differences between the model and the data, and a poor fit to the data, respectively. The empirical results of these tests can also be found in Table 14.

Regarding the tests run to determine which model to be chosen, the LM test was statistically significant ($p<0.01$), meaning that the null hypothesis of homoscedasticity is rejected, and heteroscedasticity can be assumed. For the F test, comparing the fixed effect model and Pooled OLS to examinate how much the fixed effect model can improve well-being was also statistically significant ($p <0.01$), i.e., indicates that the Fixed Effects model is more appropriate than the Pooled model. This then requires a review and application of the Hausman test to assess which model (between FE and RE) should be used. Here the Hausman test is statistically significant at less than 1% level ($p < 0.01$), which can be interpreted as evidence against the use of the Random Effect model (Wooldridge, 2010). Therefore, in this regression, the most appropriate results to test would be the Fixed Effect model which is the most consistent and efficient.

Regarding the Durbin-Watson statistic (DW), it is used to check the autocorrelation in residues from a statistical model or regression analysis. The Durbin-Watson statistic has a value between 0 and 4. When the value is close to 2.0 it indicates that there is no autocorrelation detection in the sample. Values from 0 to less than 2 units in positive autocorrelation and values from 2 to 4 mean negative autocorrelation. According to the table below, the DW test yields values ranging from 1 to 2, specifically up to 1.42. This indicates the presence of positive autocorrelation across all three models.

Table 14 presents the evaluation of various models using LM, F test, and the Hausman Test to determine their acceptability. Specifically, for the second model with dependent variable ROE, the rejection of the Null Hypothesis indicates a preference for the Fixed Effect Model (Hausman test: p-value < 0). Across these regression models, the exchange rate variable does not influence the dependent variable, namely the bank's profitability (ROE). This aligns with previous observations, where the Stepwise Forward method did not choose the exchange rate news as statistically significant variables, implying that its higher p-value exceeded 0.01.

In summary, the estimates for the three panel table methods, i.e., OLS, Fixed and Random effect, and the data of the Lagrange Multiplier and Hausman tests indicate that the Fixed Effect model estimate is preferred to explain the impact on banks' profitability (see Appendix 15).

In contrast to the previous models, the exchange rate does not affect the models for the dependent variable NIM on a sample of 148 US banks, indicating that the bank's profitability is not sensitive to these announcements. The model without dummies was tested using three different statistical tests. The first test was the Lagrange Multiplier Test, which tested the relationship between the dependent variable and the independent variables in the model. The p-value for this test was 0, indicating that there is a significant relationship between the variables. The second test was the F test for individual effects, which tested for a significant difference between the model and the data. The p-value for this test was also 0, indicating that there is a significant difference. The third test was the Hausman Test, which tested whether the model was a good fit to the data. The p-value for this test was less than 0, indicating that the model is not a good fit to the data.

The model with dummies was also tested using the same three statistical tests. The results of these tests were like the tests conducted on the model without dummies. The p-values for the Lagrange Multiplier Test, F test, and Hausman Test were all 0, indicating significant effects, significant differences between the model and the data, and a poor fit to the data, respectively. The empirical results of these tests can also be found in Appendix 16.

In the third and last model, the analysis involved testing three different models with Net Interest Margin (NIM) as the dependent variable to determine the preferred model using LM, F test and the Hausman Test. Ultimately, the Fixed Effect model emerged as the most appropriate regression approach for this analysis.

Table 14: Results of Lagrange Multiplier Test, F-test, and Hausman Tests for 148 USA Banks

Total Sample 148 US Banks, Dependent Variable ROA		
No Dummies		
Lagrange Multiplier Test	1011.64 (5.30591e-222)	Alternative Hypothesis: Significant effects
F test	F (147, 2947)	Alternative hypothesis: significant effect
	8.57107 (1.27175e-140)	
Hausman Test	chisq = 284.613 (3.88052e-051),	Alternative hypothesis: one model is inconsistent
	df = 16	
Including Dummies		
Lagrange Multiplier Test	1031.2 (2.96829e-226)	Alternative hypothesis: significant effects
F test	F (147, 2942)	
	8.66166 (2.10477e-142)	Alternative hypothesis: significant effect
Hausman Test	chisq = 286.656 (1.46844e-051),	Alternative hypothesis: one model is inconsistent.
	df = 16	
Total Sample 148 US Banks, Dependent Variable ROE		
Dummies		
Lagrange Multiplier Test	689.686 (5.23089e-152)	Alternative Hypothesis: Significant effects
F test	F (147, 2946)	Alternative hypothesis: significant effect
	5.59558 (2.42779e-080)	

Hausman Test	chisq = 117.399 (2.03014e-018),	Alternative hypothesis: one model is inconsistent
	df = 14	
Including Dummies		
Lagrange Multiplier Test	701.315 (1.54757e-154)	Alternative hypothesis: significant effects
F test	F (147, 2945)	
	5.70872 (1.15419e-082)	Alternative hypothesis: significant effect
Hausman Test	chisq = 123.195 (1.48665e-019),	Alternative hypothesis: one model is inconsistent.
	df = 14	
Total Sample 148 US Banks, Dependent Variable NIM		
Without dummies		
Lagrange Multiplier Test	3450.56 (0.000)	Alternative Hypothesis: Significant effects
F test	F (147, 2941)	Alternative hypothesis: significant effect
	16.7618 (2.17836e-288)	
Hausman Test	chisq = 278.66 (2.79688e-049),	Alternative hypothesis: one model is inconsistent
	df = 17	
Including Dummies		
Lagrange Multiplier Test	3317.04 (0.000)	Alternative hypothesis: significant effects
F test	F (147, 2940)	
	16.4011 (1.94092e-282)	Alternative hypothesis: significant effect
Hausman Test	chisq = 270.329 (1.43757e-047),	Alternative hypothesis: one model is inconsistent.

	df = 17	

5.6.2 OLS Regression Model in the sample of 118 Largest US Banks sample, N=118, T= 21

As observed in previous analysis, three different models were tested with Return on Assets as the dependent variable, utilizing a sample comprising the top 118 highest banks based on total assets exceeding $100.000, over a 21 years-period, between 1998 and 2018 (as discussed in chapter 3). Before conducting the regression, analyses and interpreting their outcomes, attention was given to identifying highly correlated independent variables that could potentially influence the results or lead to incomplete information. The correlation table, as created and analyzed (see Chapter 3), found that three independent variables are highly correlated with the risk of erroneous results or incomplete information. To address this issue, one of the combination variables causing correlation higher than 0.90 was removed, specifically the Total risk-based capital ratio (Variable 24) with a correlation coefficient of 0.9927.

It was found that this test rejects the null hypothesis, so in this dataset the Fixed effect model is suitable (inconsistent) based on the Hausman test (value $p < 0.01$). The results (see Appendix 17) show that the exchange rate news has negatively impact on all these models, but it is statistically significant at the 0.05 level only for the first model, OLS Pooled regression model. The Yield on earning assets percentage appears to have the greatest positive impact on banks' profitability, as indicated by its positive coefficient in all the specified regression analyses (OLS Pooled, Fixed Effect, and Random Effect) when analyzing a sample of 118 of the largest US banks. This means that an increase in the Yield on Earning Assets percentage is associated with an increase in banks' profitability in each of these regression models. One possible reason is that a higher yield on earning assets can increase the amount of interest income that a bank generates, which can boost its overall profitability. A higher yield on earning assets may also indicate that a bank is able to make more profitable investments, which can further contribute to its profitability. Additionally, a higher yield on earning assets may indicate that a bank is able to charge higher interest rates on loans, which can also contribute to its profitability.

On contrast, the independent variable with the highest negative impact on Return on Assets (ROA) appears to be the Total interest income (ln), with coefficients of -0.231491, -0.150371, and -0.196251 on all regressions as mentioned earlier. However, the independent variables in this analysis do not have particularly strong effects on the dependent variable, as none of the coefficients are greater than 1 or -1. Instead, the coefficients are close to zero, which suggests that the independent variables have only a small or moderate effect on the dependent variable.

This may be because the independent variables are not strongly correlated with the dependent variable, or because there are other factors that are more influential in determining the value of the dependent variable. It could also be that the sample size or the specific regression method being used is limiting the magnitude of the coefficients.

The first model, which used ROA as the dependent variable and did not include dummies, was tested on a sample of 118 US banks using three different statistical tests. The first test was the Lagrange Multiplier Test, which tested the relationship between the dependent variable and the independent variables in the model. The p-value for this test was less than 0, indicating that there is a significant relationship between the variables. The second test was the F test for individual effects, which tested for a significant difference between the model and the data. The p-value for this test was also less than 0, indicating that there is a significant difference. The third test was the Hausman Test, which tested whether the model was a good fit to the data. The p-value for this test was less than 0, indicating that the model is not a good fit to the data.

It is possible that the independent variables in the model are not strongly correlated with the dependent variable, or that there are other factors that are more influential in determining the value of the dependent variable. It could also be that the sample size or the specific regression method being used is limiting the magnitude of the coefficients.

The model with dummies was also tested using the same three statistical tests. The results of these tests were like the tests conducted on the model without dummies. The p-values for the Lagrange Multiplier Test, F test, and Hausman Test were all less than 0, indicating significant effects, significant differences between the model and the data, and a poor fit to the data, respectively (see table 15).

The Lagrange Multiplier test was statistically significant ($p < 0.01$), meaning that the null hypothesis of homoscedasticity is rejected, and heteroscedasticity can be assumed. The F test, which compares the fixed effect model and the pooled OLS model to examine how much the fixed effect model can improve the fit, was also statistically significant ($p < 0.01$), indicating that the Fixed Effects model is more appropriate than the Pooled model. The Hausman test, which is used to assess which model (between the Fixed Effects model and the Random Effects model) should be used, was statistically significant at less than 1.

Table 15 indicates that this test rejects the null hypothesis, so in this dataset the Fixed effect model is suitable (inconsistent) based on the Hausman test (value $p < 0.01$). The Yield on earning assets (%) seems to appear the highest positively relationship between an independent variable and the dependent variable in all the following regressions, OLS Pooled, Fixed Effect, and Random effect, with coefficients of 1.28159, 1.05045, and 1.17144, respectively, in the sample of 118 largest US Banks. Even after the inclusion of the dummy variable for the financial crisis in the subsequent regressions, the positive impact of the Yield on earning assets on ROE persists. In contrast, the independent variable with the highest negative impact on Return on Equity (ROE) appears to be the Tier one (core) capital/ Total Assets, with coefficients of -0.432570, -0.585045, and -0.505864 on all regressions as mentioned earlier (see Appendix 18).

The model test statistics in this analysis are being used to assess the fit and significance of two different models. The first model is a regression model that does not include dummy variables, and the second model is a regression model that does include dummy variables.

For both models, the results of the Lagrange Multiplier Test and the F test for individual effects suggest that there are significant effects of the independent variables on the dependent variable. This means that the independent variables are likely to be meaningful predictors of the dependent variable.

The results of the Hausman Test for both models indicate that one of the models is inconsistent. This suggests that the two models may be giving different results, and that one of the models may not be accurately capturing the relationship between the independent variables and the dependent variable. It is not clear from the information provided which of the two models is the inconsistent one.

According to the Lagrange Multiplier test was statistically significant ($p < 0.01$), meaning that the null hypothesis of homoscedasticity is rejected, and heteroscedasticity can be assumed. Regarding the F test, comparing the fixed effect model and Pooled OLS to examinate how much the fixed effect model can improve well-being was also statistically significant ($p < 0.01$), i.e., indicates that the Fixed Effects model is more appropriate than the Pooled model. This then requires a review and application of the Hausman test to assess which model (between FE and RE) should be used. Finally, the Hausman test is statistically significant at less than 1% level ($p < 0.01$), which can be interpreted as evidence against the use of the Random Effect model (Wooldridge, 2010). So, the Null hypothesis is rejected, and Random

Effect model is inconsistent. Therefore, in this regression, the most appropriate results to test would be the Fixed Effect model which is the most consistent and efficient (see table 15).

Three different regressions were conducted: OLS Pooled, OLS Fixed Effect, and OLS Random Effect models, including 2,478 observations. The dependent variable in these regressions was Net Interest Margin (NIM), while the 15 most statistically significant independent variables, identified through the Stepwise Forward method (see Chapter 4), were included. The regression findings showed that this test rejects the null hypothesis, indicating the suitability of the fixed effect model based on the Hausman test (value $p < 0.01$). Detailed results are provided in Appendix 19.

Among the independent variables, yield on earning assets (%) demonstrated the highest positive relationship with the dependent variable across all regressions: OLS Pooled, Fixed Effect, and Random effect. The coefficients were 0.596252, 0.450408, and 0.534538, respectively, in the sample of 118 largest US Banks. Even with the inclusion of the dummy variable representing the financial crisis, Yield on earning assets continued to positively influence ROE. On contrast, the independent variable with the highest negative impact on Return on Equity (ROE) appears to be the 5-Year Treasury Constant Maturity Rate %, with coefficients of -0.126238, -0.0930747, and -0.110074 across all regressions as previously noted.

The description and evaluation of all these three tests are the same as the previous models have been tested earlier. According to the above, the Lagrange Multiplier test was statistically significant ($p < 0.01$). The F test indicates that the Fixed Effects model is more appropriate than the Pooled model. Then requires a review and application of the Hausman test to assess which model (between FE and RE) should be used. Finally, the Hausman test is statistically significant at less than 1% level ($p < 0.01$), which can be interpreted as evidence against the use of the Random Effect model (Wooldridge, 2011). So, the Null hypothesis is rejected, and Fixed Effect model is appropriate (see table 15).

Table 15: Results of Lagrange Multiplier Test, F-test, and Hausman Tests for 118 USA Banks

Largest Sample 118 US Banks, Dependent Variable ROA		
No Dummies		
Lagrange Multiplier Test	492.429 (4.21978e-109	Alternative Hypothesis: Significant effects
F test	F (117, 2345)	Alternative hypothesis: significant effect
	6.79061 (5.96021e-084)	
Hausman Test	chisq = 223.165 (9.82441e-040),	Alternative hypothesis: one model is inconsistent
	df = 14	
Including Dummies		
Lagrange Multiplier Test	506.34 (5.05878e-041)	Alternative hypothesis: significant effects
F test	F (117, 2344)	
	6.9291 (3.42323e-086)	Alternative hypothesis: significant effect
Hausman Test	chisq = 229.427 (5.05878e-041),	Alternative hypothesis: one model is inconsistent.
	df = 14	
Largest Sample 118 US Banks, Dependent Variable ROE		
Dummies		
Lagrange Multiplier Test	391.031 (4.93767e-087)	Alternative Hypothesis: Significant effects
F test	F (147, 2947)	Alternative hypothesis: significant effect
	1.49458e-017 (4.73167e-055)	
Hausman Test	chisq = 107.988 (1.49458e-017),	Alternative hypothesis: one model is inconsistent

	df = 12	
Including Dummies		
Lagrange Multiplier Test	399.513 (7.03054e-089)	Alternative hypothesis: significant effects
F test	F (147, 2346)	
	5.1135 (1.54502e-056)	Alternative hypothesis: significant effect
Hausman Test	chisq = 112.144 (2.25189e-018),	Alternative hypothesis: one model is inconsistent.
	df = 12	
Largest Sample 118 US Banks, Dependent Variable NIM		
Without dummies		
Lagrange Multiplier Test	690.154 (8.2306e-211)	Alternative Hypothesis: Significant effects
F test	F (147, 2345)	Alternative hypothesis: significant effect
	11.3836 (1.76735e-155)	
Hausman Test	chisq = 538.907 (5.16557e-106),	Alternative hypothesis: one model is inconsistent
	df = 14	
Including Dummies		
Lagrange Multiplier Test	985.712 (2.2911e-216)	Alternative hypothesis: significant effects
F test	F (147, 2344)	
	11.5622 (4.20296e-158)	Alternative hypothesis: significant effect
Hausman Test	chisq = 543.909 (4.47588e-107),	Alternative hypothesis: one model is inconsistent.
	df = 14	

5.6.3 OLS Regression Model in the sample of the smallest USA Banks sample (N=30, T= 21)

This section examines three different models with Return on Assets- Return on Equity-Net Interest Margin as dependent variables on a sample of 30 smallest banks (total assets > \$100.000), over a 21 years-period, between 1998 and 2018 and including 630 observations. Before conducting tests on the three different regressions and subsequent analysis, the focus was on identifying high correlations that could potentially be influenced by the independent variables. The correlation table, as created and analyzed (see Chapter 4), found that three independent variables are highly correlated with the risk of erroneous results or incomplete information. Following that, it was decided to take these variables out of the analysis for correlations greater than 0.89: Total risk-based capital ratio, Additional Noninterest Income/Total interest income, and Tier 1 risk-based capital ratio. Specifics about the outcomes are contained in Appendices 20, 21, and 22.

The Yield on earning assets (%) seems to appear the highest positively relationship between an independent variable and the dependent variable in all the following regressions, OLS Pooled, Fixed Effect, and Random effect, with coefficients of 0.102580, 0.0880805, and 0.0918881, respectively, in the sample of 30 smallest US Banks by total assets (total assets < 100,000\$). Given that positive relationship, banks should prioritize strategies that can enhance this yield. This could involve optimizing their assets portfolios, reallocating investments, or diversifying into higher-yielding assets. The following regressions demonstrate that the Yield on Earning Assets positively affects the ROA, appearing statistically significant at 0.01 even when the dummy variable, the financial crisis, is added. On contrast, the independent variable with the highest negative impact on Return on Assets (ROA) appears to be the Total assets (ln) with coefficients of -0.0773365, -0.124720, and -0.108668 on all regressions as mentioned earlier. This suggests that banks accumulate more assets, their return on these assets diminishes. This may imply that banks are not efficiently leveraging their growing assets or that there are diminishing returns to scale. There is a point in this table that to look out for the total assets positively affect the ROA in the pooled OLS regression, including the financial crisis as another independent variable, (dummy variable) with coefficient 0.255899 and not statistically significant at any of the levels, while this variable seems to negatively affect all the other models we have created.

Table 16 shows that a fixed effect model is suitable for the given dataset. This conclusion is based on the results of several statistical tests that were conducted on two models, one with dummies and one without dummies. The null hypothesis was rejected in both models, indicating that there are significant effects in the data. The tests used include the Lagrange Multiplier Test, the F test for individual effects, and the Hausman Test. The p-values for all these tests were less than the threshold for statistical significance, indicating that the results are statistically significant. The model without dummies had similar test statistics to the model with dummies, with slightly higher values in some cases. Overall, the results suggest that the fixed effect model is suitable for this dataset.

The description and evaluation of all these three regressions are the same as the previous models have been tested earlier. For more details, Lagrange Multiplier test was statistically significant ($p<0.01$). The F test indicates that the Fixed Effects model is more appropriate than the Pooled model. Then requires a review and application of the Hausman test to assess which model (between FE and RE) should be used. Finally, the Hausman test is statistically significant at less than 1% level ($p < 0.01$), which can be interpreted as evidence against the use of the Random Effect model (Wooldridge, 2011). So, the Null hypothesis is rejected, and Random Effect model is inconsistent. Therefore, in this regression, the most appropriate results to test would be the Fixed Effect model which is the most consistent and efficient.

The following two more models with ROE and NIM as dependent variables and 27 independent variables out of a total of 30, rejecting variables 11, 24 and 23 because they presented a high correlation (see Chapter 4). Table 31 presents the three regressions with dependent variable ROE with and without the financial crisis as an extra independent variable. The regressions results presented below reveal multiple variables exhibiting both positive and negative effects on the dependent variable, with coefficients of these variables are higher than 1 or -1.

The Net operating income to assets (%) seems to appear the highest positively relationship between an independent variable and the dependent variable, ROE, in all the following regressions, OLS Pooled, Fixed Effect, and Random effect, with coefficients of 3.07374, 1.76666, and 2.23153, respectively, in the sample of 30 smallest US Banks by total assets (total assets < 100,000$). This indicates that banks with higher operational efficiencies tend to achieve better equity returns. These banks must streamline their operations, cut superfluous expenditures, and ensure that their resources are used best to maximize net operating income relative to assets. Even after introducing the dummy variable for the financial crisis into the regressions, it becomes evident that net operating assets (%) positively affect ROA. This effect is statistically significant at the 0.05 level in the OLS Pooled regression and at the o.1 level in the Random Effects regression. However, the coefficient for the net operating assets is not statistically significant at any of the level in the Fixed Effects regression.

The second independent variable that seems to positively affect the model and mainly the banks' profitability, is the total domestic deposits in total assets (%) with coefficient of 2.72816, 1.503376 and 2.94519 in each of the following regressions, but none of them is statistically significant at any of the levels. On contrast, the independent variable with the highest negative impact on Return on Equity (ROE) appears to be the Total deposits/ Total Assets (%) with coefficient of -2.80383 and a level of significance in the OLS Pooled regression, and the coefficients of −1.55446 and −2.00884 which are not statistically significant at any of these levels for the fixed and random effect regressions. This indicates that banks offer relatively high interest rates to attract deposits but are unable to deploy these funds effectively to generate higher returns.

The negative coefficients linked with 'Assets per employee' across all regression models suggest that banks' human resource management may be inefficient. Employee training, better resource allocation, and the deployment of productivity-enhancing technologies may be beneficial.

According to table 16, the results show that a fixed effect model is suitable for the given dataset. This conclusion is based on the results of several statistical tests that were conducted on two models, one with dummies and one without dummies. These models were compared to OLS, pooled, and random effect models. The null hypothesis was rejected in all these models, indicating that there are significant effects in the data. The test used to determine the suitability of the fixed effect model was the Hausman Test, which had a p-value less than 0.01. This suggests that the fixed effect model is consistent with the data. The other models were also tested using the Lagrange Multiplier Test and the F test for individual effects. The p-values for these tests were all less than the threshold for statistical significance, indicating that the results are statistically significant. Overall, the results suggest that the fixed effect model is suitable for this dataset.

In this third model, where the Net Interest Margin serves as the dependent variables, the analysis reveals that the most prominent positive relationship with statistical significance at the 0.01 level is observed with the Yield on earning assets (%), consistent with the majority of previous findings. Additionally, as indicated in table 16, the coefficients of all other variables are negligible, hovering around zero.

However, the factors which positively affect the dependent variables and improve the model are the Net operating income to assets (%) with coefficient 1. 87404 and 1.84902 without and with dummies separately and is also statistically significant at 5% on OLS Fixed Effect model with Dependent variable NIM. This implies that banks with higher operating efficiency (as measured by the net operating income to assets ratio) have higher returns on equity. However, the negative coefficient for Total Deposits/Total Assets suggests that there may be an inverse association between the proportion of total deposits to total assets and the ROE. The relationship, however, is not statistically significant, implying that while there may be a tendency, it is not strong enough to be consistently consistent across the sample. A high deposits-to-assets ratio, as previously noted, may result in inefficiencies in capital deployment or increased expenses associated with managing such deposits. Finally, table 16 indicates that in the OLS Fixed Effect model with the Net Interest Margin all independent variables have coefficients close to zero and affect the model either positively or negatively.

Table 16: Results of Lagrange Multiplier Test, F-test, and Hausman Tests for 30 USA Banks

Smallest Sample 30 US Banks, Dependent Variable ROA		
No Dummies		
Lagrange Multiplier Test	86.5384 (1.37049e-020)	Alternative Hypothesis: Significant effects
F test	F (29, 572)	Alternative hypothesis: significant effect
	7.17553 (5.13375e-024)	
Hausman Test	chisq = 224.69 (1.56711e-035),	Alternative hypothesis: one model is inconsistent
	df = 23	
Including Dummies		
Lagrange Multiplier Test	86.8342 (1.18011e-020)	Alternative hypothesis: significant effects
F test	F (29, 572)	
	7.1758 (5.20391e-024)	Alternative hypothesis: significant effect
Hausman Test	chisq = 225.094 (1.3032e-035),	Alternative hypothesis: one model is inconsistent.
	df = 23	
Smallest Sample 30 US Banks, Dependent Variable ROE		
Dummies		
Lagrange Multiplier Test	115.889 (5.0272e-027)	Alternative Hypothesis: Significant effects
F test	F (29, 591)	Alternative hypothesis: significant effect
	5.43485 (5.45764e-017)	
Hausman Test	chisq = 31.3359 (0.000),	Alternative hypothesis: one model is inconsistent

	df = 9	
Including Dummies		
Lagrange Multiplier Test	112.719 (2.48579e-026)	Alternative hypothesis: significant effects
F test	F (29, 590)	
	5.44117 (5.18411e-017)	Alternative hypothesis: significant effect
Hausman Test	chisq = 32.1136 (0.000),	Alternative hypothesis: one model is inconsistent.
	df = 9	
Smallest Sample 30 US Banks, Dependent Variable NIM		
Without dummies		
Lagrange Multiplier Test	22.1225 (2.55792e-006)	Alternative Hypothesis: Significant effects
F test	F (29, 592)	Alternative hypothesis: significant effect
	3.1197 (1.4428e-007)	
Hausman Test	chisq = 35.9178 (2.85989e-006),	Alternative hypothesis: one model is inconsistent
	df = 6	
Including Dummies		
Lagrange Multiplier Test	55.3347 (1.01656e-013)	Alternative hypothesis: significant effects
F test	F (29, 572)	
	3.26632 (3.26632e-022)	Alternative hypothesis: significant effect
Hausman Test	chisq = 49.939 (0.000),	Alternative hypothesis: one model is inconsistent.
	df = 22	

5.7 Dynamic Panel GMM estimation results.

After estimating the models using the OLS Fixed Effect method, the analysis is supplemented with the Arellano and Bond difference Generalized Method of Moments (GMM) approach. This involves taking the first difference of all variables and their lagged forms. To use them as instruments for the exogenous (predetermined) and endogenous variables in the regression. Arellano and Bond developed a test for testing if the panels suffer from serial correlation. assuming that the error term is not autocorrelation. Thus, the most imperative procedure in testing the statistical properties of this model is testing for the validity of instruments, which requires testing for the presence of first and second order autocorrelation in the disturbance term. Appendices 23 to 28, represent the Dynamic panel model both GMM single and GMM system equations on three different samples. a) the total sample with all collected USA banks (N=148, T=21), b) the sample of the 118 Largest Bank by total assets (N=118, T= 21). and c) the sample of the 30 smallest banks by total assets (N=30, T= 21).

Subsequently, a Sargan test is used to confirm the validity of the instruments in both GMM models, Sargan test is not rejected to all these models, which implies that the first difference instrumental variables are not correlated with error term.

5.7.1 Difference-Single GMM estimation

The focus in this study will be on the estimation of single equation, autoregressive-distributed lag models from panels with 3 different samples of cross-section units, each observed for many time periods over 21 years, from 1998 to 2018 (T=21). When lagged dependent variables are included as regressors, the simple estimation procedures are asymptotically valid only when there are many observations in the time dimension (T). A possible answer to this problem was devised by Arellano and Bond (1991), to subtract the individual results and then evaluate with instrument variables (IV), using its values as instruments the dependent variable lagged one or more periods. The following tables present the results using the Generalized Method of Moments (GMM) estimator models introduced by Arellano and Bond (1991) for each of the three. The GMM estimator also controls endogeneity using the lag values, the levels of the endogenous and predetermined variables are instruments. All these models consist of the ROA, ROE, and NIM as a dependent variable with a lagged dependent variable and set of other explanatory variables (independent variables) different each time including one lag also.

5.7.2 Difference-GMM Dynamic Panel estimation with the total Sample of 148 US Banks by Total Assets (N=148. T=21)

Before evaluating and analyzing the results of the following tables, it is worth noting and mentioning that the independent variables differ in each model. This was because the Stepwise Forward method had selected different independent variables in each model on the total sample with 148 US banks, keeping these variables at a value lower than 0.01 (see Chapter 3). Based on that, 17 independent variables exanimated on the first models, with dependent variable ROA, including one lag for each variable, 13 and 19 independent variables with their lags, have been selected and evaluated for the second and third model separately. As depicted in Appendix 23, it is evident that none of the models considered incorporate the primary variable of interest, i.e., the news of the exchange rate. This is attributed to the fact that this determinant has a higher value of p than 0.01. Thus, the new exchange rates are not selected by Stepwise Forward as a statistically significant variable for the bank's profitability.

Therefore, the dynamic models to be evaluated will be:

$\Delta ROA_{i,t} = \beta_1 \Delta ROA_{i,t-1} + \beta_2 Total\ assets_{i,t-1} + \beta_3 Interest - bearing\ deposits/$
$Total\ Assets_{i,t-1} + \beta_4 Interest - bearing\ deposits/$
$Total\ Assets_{i,t-1} + \beta_5 Average\ total\ assets/$
$Total\ Assets_{i,t-1} + \beta_6 Tier\ one\ (core)\ capital/$
$Total\ Assets_{i,t-1} + \beta_7 Total\ interest\ income_{i,t-1} + \beta_8 Total\ interest\ expense/$
$Total\ interest\ income_{i,t-1} + \beta_9 Total\ noninterest\ income/$
$Total\ interest\ income_{i,t-1} + \beta_{10} Additional\ Noninterest\ Income/$
$Total\ interest\ income_{i,t-1} + \beta_{11} Pre - tax\ net\ operating\ income/$
$Total\ interest\ income_{i,t-1} + \beta_{12} Net\ income/$
$Total\ interest\ income_{i,t-1} + \beta_{13} Yield\ on\ earning\ assets_{i,t-1} +$
$\beta_{14} Net\ operating\ income\ to\ assets_{i,t-1} + \beta_{15} Efficiency\ ratio_{i,t-1} +$
$\beta_{16} Total\ domestic\ deposits\ to\ total\ assets_{i,t-1} +$
$\beta_{17} Leverage\ (core\ capital)\ ratio_{i,t-1} + \beta_{18} 3 -$
$Month\ London\ Interbank\ Offered\ Rate\ (LIBOR_{i,t-1} + \beta_{19} U -$
$3\ US\ Unemployment\ Rate\ Total\ in\ Labor_{i,t-1} + \varepsilon_{it}$ (5.5.1)

$\Delta ROE_{i,t} = \beta_1 \Delta ROE_{i,t-1} + \beta_2$ Tier one (core) capital/ Total Assets $_{i,t-1}$ +
β_3 Total noninterest income/ Total interest income $_{i,t-1}$ +
β_4 Additional Noninterest Income/ Total interest income $_{i,t-1}$ +

$\beta\ _5$Additional Noninterest Income/ Total interest income $_{i,t-1}$ + $\beta_6 Pre-tax\ net\ operating\ income/\ Total\ interest\ income\ _{i,t-1}$ + $\beta_7 Net\ income/\ Total\ interest\ income\ _{i,t-1}$ + $\beta_8 Yield\ on\ earning\ assets_{i,t-1}$ + $\beta_9 Net\ operating\ income\ to\ assets_{i,t-1}$ + $\beta_{10} Efficiency\ ratio_{i,t-1}$ + β_{11}Assets per employee$_{i,t-1}$ + $\beta_{12} Aet\ loans\ and\ leases\ to\ deposits\ _{i,t-1}$ + $\beta_{13} Total\ domestic\ deposits\ to\ total\ assets_{i,t-1}$ + $\beta_{14} Equity\ capital\ to\ assets\ _{i,t-1}$ + $\beta_{15} E$Tier 1 risk − based capital ratio$_{i,t-1}$ + ε_{it} *(5.5.2)*

$\Delta NIM_{i,t}$= $\beta\ _1 \Delta NIM_{i,t-1}$ + $\beta\ _2 Total\ Assets\ _{i,t-1}$ + $\beta\ _3 Loan\ and\ leases\ loss\ allowance/\ Total\ Assets_{i,t-1}$ + $\beta\ _4 ATotal\ deposits/\ Total\ Assets_{i,t-1}$ + $\beta\ _5\ Interest-bearing\ deposits/Total\ Assets_{i,t-1}$ + $\beta\ _6 Tier\ one\ (core)\ capital/\ Total\ Assets_{i,t-1}$ + $\beta\ _7 Total\ interest\ income\ _{i,t-1}$ + $\beta\ _8 Total\ noninterest\ income/\ Total\ interest\ income_{i,t-1}$ + $\beta\ _9 Additional\ Noninterest\ Income/\ Total\ interest\ income_{i,t-1}$ + $\beta\ _{10} Net\ income/\ Total\ interest\ income\ _{i,t-1}$ + $\beta\ _{11} Yield\ on\ earning\ assets_{i,t-1}$ + $\beta\ _{12} Net\ operating\ income\ to\ assets_{i,t-1}$ + $\beta\ _{13} Assets\ per\ employee_{i,t-1}$+ $\beta\ _{14} Net\ loans\ and\ leases\ to\ total\ assets\ _{i,t-1}$+ $\beta\ _{15} Net\ loans\ and\ leases\ to\ deposits\ _{i,t-1}$ + $\beta\ _{16} Total\ domestic\ deposits\ to\ total\ assets_{i,t-1}$+ $\beta\ _{17} Leverage\ (core\ capital)\ ratio_{i,t-1}$ + $\beta\ _{18} 3-Month\ London\ Interbank\ Offered\ Rate\ (LIBOR)\ _{i,t-1}$ + $\beta\ _{19} U-3\ US\ Unemployment\ Rate\ Total\ in\ Labor_{i,t-1}$ + ε_{it} *(5.5.3)*

Where i = 1,2, 3,…, 148 are the cross-sectional units, specifically the number of banks we have collected for this research, t = 1998,…., 2018 is the time period. As evidenced by Table 34, the significance of the coefficients for the lags of the dependent variables, namely Return on Assets, Return on Equity, and Net Interest Margin, indicates that these profitability measures are significantly affected by their respective lagged values from the previous year (t-1). Moreover, even with the inclusion of the financial crisis as a dummy variable in the dynamic models, the results reveal that the coefficients of the lagged dependent variables continue to exert a positive and statistically significant effect on the profitability measures.

According to the macroeconomic determinants of bank profitability, one variable has the biggest positive and statistically significant relationship to the bank's profitability. This variable is the Yield on earning assets % which it seems to has the highest positive effect on all the models that have been created, ROA, ROE, and NIM, as measures of banks' profitability, with coefficients 0.163371, 0.953115 and 0.641955, respectively, including and not including dummies. However, none of those variables that seem to negatively affect banks' profitability have a significant effect.

Finally, the majority of independent variables (both with and without dummies) have a negative and positive effect having the correlation coefficient close to zero, indicating a weak influence or lack of strong influence of the variables in this sample. This has both positive and negative consequences, as changes in the independent variables will not greatly change banks' profitability.

The Sargan test was used to determine whether the econometric model is valid or not, and whether the instruments are correctly specified or not. So, based on the table 35, three Sargan's tests results (with dependent variables ROA, ROE and NIM) are presented in the following:

a. Sargan test of overidentifying restrictions with **ROA** as dependent variable

H0: overidentifying restrictions are valid,

Chi^2 (114) = 127.191

Prob > chi2 = 0.9998

b. Sargan test of overidentifying restrictions with **ROE** as dependent variable

H0: overidentifying restrictions are valid,

Chi^2 (114) = 128.103

Prob > chi2 = 0.9998

c. Sargan test of overidentifying restrictions with **NIM** as dependent variable

H0: overidentifying restrictions are valid,

Chi^2 (114) = 140.447

Prob > chi2 = 0.9967

Above all these, it quite clearly indicates that the Sargan test was decided that instruments are suitable, so this test did not reject the null hypothesis since the p-value appears to be higher than 0.05. The Sargan test also did not reject the null hypothesis for the models including the dummy variable, the financial crisis, since all the following models present high p-value, higher than 0.05.[6]

[6] The higher p-value of the Sargan Test, the better for the model.

5.7.3 Difference-GMM Dynamic Panel estimation with the Sample of 118 US Banks by Total Assets (N=148. T=21)

Appendix 24 presents the result using Arellano and Bond (1991) difference GMM estimations in a sample of the 118 largest US banks by total assets. Three different models have been tested and evaluated with Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM) as dependent variables for each model with a lagged dependent variable and set of other explanatory variables (different for each model). Table 15 gives that the independent variables have been selected for the first models by Stepwise Forward method, with ROA as dependent variable, 13 and 15 independent variables selected for the second and third models as they had been chosen by Stepwise Forward method, with p-value lower than 0.01. None of these models include exchange rate news, as shown in the previous sample, the sample with all US banks due to the high p-value. The coefficients of the lagged dependent variables confirm the significance of including this variable in all specifications and the effect in it.

In the first column, each variable is defined numerically. Indication 1 (-1) means that the specific variable contains one lag. The second column of the Appendix 24 represents the specification of the difference dynamic panel model with dependent variable ROA, column 3 Also shows the specifications of the same dynamic panel model with dependent variable ROE, and in the column 4 are presented the specifications of the difference dynamic panel model with dependent variable NIM. Also, there are some other columns from 6 to 8, which present the dynamic panel models that were proposed by Arellano and Bond (1991) with a difference that a dummy variable has been added, the Financial Crisis.

It clearly demonstrates the result for the largest US banks, the biggest positive relation between bank's profitability and independent variables observed by the external variables of Yield on earning assets (%) with coefficient +0.177278 presenting statistically significant level at 0.01, while the biggest negative effect came from the Loan and leases loss allowance/ Total Assets, with coefficient −0.243623 and statistically significant level at 0.01. The Loan and leases loss allowance/ Total Assets as refer as the reserve for bad debts and it this is directly related to the credit risk which is mentioned in the charges that will most likely be utilized against an institution's operating income. Also, this reserve reduces the book value of the institution's loan and leases to the amount that the financial institution reasonably expects to receive.

According to the second model, the highest positive relationship between dependent (ROE) and the sample of the independent variables was also observed by the Yield on earning assets with coefficient +0.653226. The Yield on earning assets positively affected all these models, with dependent variables ROA, ROE, and NIM (coefficient of +0.479513) respectively, presenting a significance level at 0.01. The higher the Yield on earning assets, the greater the income from the loans and investments it makes. This is due to good banking policy, such as ensuring proper pricing of loans and proper investment management, but also the company's ability to gain a larger market share. Based on this, there is a logical positive relationship between a bank's profitability and the yield on earning assets, since a rise in the yield of earning assets equals an increase in the bank's profit. Conversely, the lower yield on earning assets leads to increased risk of insolvency, as it occurs adding one lag to this ratio (coefficient of -0.451298). When this ratio is low, a bank provides loans that are not performing well, as the amount of interest on these loans is close to the value of earning assets.

Regarding the total assets, a positive coefficient indicates that as the value of the independent variable increases, the mean of the dependent variable also tends to increase. So, when the total assets of a bank or financial institution increase, this also implies an increase in profitability. As evident from the table, it is observed that the total assets (ln) positively affect the bank's profitability, since the coefficient is +0.287737 and is statistically significant at 0.01. According to the literature review, the total assets are closely related with ROA, since the ROA is the net income divided by total assets.

As regards the diagnostic test, the Sargan test **did not reject** the null hypothesis that the instrumental variables were uncorrelated with the residuals, indicating that the instrumental variables were valid. So, based on the table 36, three Sargan's tests results (with dependent variables ROA, ROE and NIM) are presented in the following:

b. Sargan test of overidentifying restrictions with **ROA** as dependent variable

H0: overidentifying restrictions are valid,

Chi^2 (114) = 99.1461

Prob > chi2 = 1.000

c. Sargan test of overidentifying restrictions with **ROE** as dependent variable

H0: overidentifying restrictions are valid,

Chi^2 (114) = 79.9884

Prob > chi2 = 1.000

d. Sargan test of overidentifying restrictions with **NIM** as dependent variable

H0: overidentifying restrictions are valid,

Chi^2 (114) = 109.461

Prob > chi2 = 1.000

Above to all these, it quite clearly indicates that the Sargan test was decided that instruments are suitable, so this test did not reject the null hypothesis since the p-value appears to be higher than 0.05The Sargan test also did not reject the null hypothesis for the models including the dummy variable, the financial crisis, since all the following models present high p-value, higher than 0.05.

5.7.4 Difference-GMM Dynamic Panel estimation with the Sample of 30 US Banks by Total Assets (N=148. T=21)

The implications of exchange rate news on the financial robustness of banks, particularly in the context of US banks, have been an area of burgeoning research. Employing the Arellano and Bond (1991) difference single GMM estimations on a sample of 30 smaller US banks (in terms of total assets) provides with some intriguing insights (see Appendix 25).

Three different models have been tested and evaluated with Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM) as dependent variables for each model with one lagged dependent variable and set of other explanatory variables including also their one lag (different for each model). Interestingly, out of these, the exchange rate news emerged as a significant determinant only in the context of the Net Interest Margin, suggesting the differential role of exchange rate fluctuations on varying dimensions of bank profitability.

The findings showed that while the Stepwise Forward approach was used to choose 7 independent variables for the first model, which included ROA as the dependent variable, 9 and 7 independent variables were used in the successful models, respectively. The first two models' obvious lack of exchange rate news highlights its non-significance due to a high p-value, reflecting findings from other studies on larger US banks.

However, the third model presented another perspective. The news on the exchange rate showed statistical significance, which had a negative effect on the Net Interest Margin. This may indicate that these banks lack proper risk management procedures or hedging tools, leaving them subject to fluctuations in the currency rate (Dominguez & Frankel, 1993). Such vulnerability highlights the detrimental effects of exchange rate news on profitability, which is indicated by a coefficient of -3.13168e-05.

According to the first model, with dependent variable ROA, it clearly seems that the Yield to total assets (%) serves as a substantial contributor to bank profitability, with coefficient of +0.117322. The internal independent variable affects both the ROE and NIM, presenting statistically significant level at 0.01 and coefficients of +2.18510 and +0.674465. Whoever, none of the other selected independent variables exhibit coefficients lower than 1, as evidenced by the table, where the coefficients are observed to be very close to zero.

In the context of the ROE model, a notable observation is the profound influence of Yield to Total Assets (%) on bank profitability, with positive coefficient of +2.18510, which means that a positive increase of the Yield of total assets, the profitability of banks will notice increase equally.

The presence of relevant factors provides light on the complex aspects of bank profitability, drawing on the GMM estimations founded in Arellano and Bond's (1991) framework (Offiong, et al., 2016). The results in particular are consistent with the rest of the research. For instance, the study by Offiong, et al., (2016), which similarly observed that for certain banking tiers, exchange rate news might not wield a direct influence on profitability indicators such as ROA and ROE, while bank characteristic variables, banks size and capital adequacy exerted positive significant effect on commercial banks profitability, is consistent with the insignificance of exchange rate news in influencing ROA and ROE in the initial models. This may reflect the banks' strategic risk management techniques or the type of exposures they have.

5.8 System GMM estimation

This analysis conducts the same explanatory variables set as it used in difference GMM technique. System GMM estimator combines the regression in difference with regression in levels. Therefore, the system GMM estimator in dynamic panel data models is more efficient than the first difference GMM estimator. However, there are two major diagnostic tests for differences in GMM estimates, the Sargan test of overidentifying restrictions checks whether the instruments are uncorrelated with the error term, which is a condition for their validity, and second the Arellano-Bond test of no second-order autocorrelation tests if lags of the dependent variable or any instruments are endogenous, which would make them inappropriate instruments (Roodman, 2009). The Sargan test serves as a statistical tool utilized to assess the validity of an econometric model. It is commonly applied within the framework of instrumental variables regression, a method employed to estimate model parameters when certain variables are endogenous (i.e., they are correlated with the error term).

5.8.1 System GMM estimation in the Total sample (N=148. T=21)

Appendix 26 gives the results of dynamic system GMM estimation, including the same sample of explanatory variables (17 independent variables in the model with ROA as dependent variable, 13 independent variables in the model with ROE as dependent variable, and 19 independent variables in the model with NIM as dependent variable) of the total dataset of 148 US banks have been collected and analyzed in this study, on Chapter 3. These variables have been evaluated and selected by the Stepwise Forward by choosing the best independent variables with the lowest p-value 0.01. The results of these models show that most of these coefficients from are very close to zero and these represent negative influence on ROA and ROE and NIM. These dependent variables are negatively affected by 17/35, 17/35 and 20/39 independent variables, including both internal and external determinants as well as macroeconomic factors, the constant, and one lag of each independent variable, respectively. The lagged dependent variable is positive and highly statistically significant at the 1% level, each of the following models. This means that the fragility of banks dependent on the fragility of the banking system last year (t-1) exacerbates the current banking/ financial fragility.

In the first column, the ROA is affected both negatively and positively by the explanatory variables and the instruments. Is noticed that there is no high or low influence of one or more variables in the model, bank profitability, as the coefficients of regression are very close to zero.

In the second column, the ROE is negatively affected by 17 variables having negative coefficients and lending banks to bankruptcy and declining profits. The biggest positive influence comes from the Yield on earning assets (%) to ROE (1.22849) with statistically significant at 1%, while the variables which negatively influence the dependent variable present coefficients of 0.38 and below.

In the last column with dependent variable NIM, it is clearly that most of the variables negatively affect the sample of the Total US banks (N= 148), including 19 independent variables and their one lags as instruments, as they selected by Stepwise Forward. It is observed that almost all independent variables are statistically significant p-value at 1%, but none of these has high influence in the model. The highest positive influence appears by the Yield on earning assets (%) with coefficient 0.633721, while, as previously shown, all other variables have coefficients close to zero, mainly those with a negative sign.

The results shown for the p values of the Sargan test for all three models separately are greater than 0.05, which suggest that the null hypothesis of the valid overidentifying instruments is acceptable, so all instruments are valid.

5.8.2 System GMM estimation in the sample of 118 largest US banks (N=118. T=21)

Appendix 27 gives the results of dynamic system GMM estimation. including the same sample of explanatory variables (15 independent variables in the model with ROA as dependent variable, 13 independent variables in the model with ROE as dependent variable, and 15 independent variables in the model with NIM as dependent variable)[7] but only the 118 Largest banks by total asset, as discussed and analyzed in Chapter 3. The GMM System estimator combines the regression in difference with regression in levels. Therefore, all models have been used for a Dynamic panel GMM System, calculating the lags of the first difference both dependent (ROA, ROE, and NIM) and independent variables. Also, the Sargan test satisfies the validity of the instruments in the system GMM estimator, affirming earlier discussions.

The results of these models shown that the coefficients from the first and second column is very close to zero and the most of these represent negative influence on ROA and ROE, ROA is negatively affected by 16/30 independent variables, including both internal and external determinants as well as macroeconomic factors, the constant, and their lags. In the second column. There are 17 variables with negative coefficients, lending banks to bankruptcy and declining profits. On the other side, in the last column with dependent variable NIM, most of the variables, 16 out of 30, positively affect the sample of the largest US banks (N= 118, T=21). Based on the table 35 and 36, the sign and value of coefficients are similar in comparison to all these models and these coefficients suggest that the exogenous change to all these determinants implies a major significantly change in the banks' profitability.

The yield on earning assets (%) appears to have the largest positive influence in all three models, with coefficient 0.207505 (0.00276910) ***, 1.03641 (0.0247984) ***, and 537595 (0.00615349) *** and statistically significant at 1%, respectively to each model. This means that an increase in yield on earning assets will lead to an increase in bank profitability. In contrast, all the other independent variables with their instruments present coefficient close to zero, this means that the variables have little effect on the models, with the result that banks' profitability does not change much negatively or positively. The positive lagged each dependent variable suggest the existence of significant dynamic effect on the banks' profitability. Also, most of the external variables are statistically significance at 1%.

[7] The GMM system includes the lags of explanatory variables as instruments in the first differences.

The specifications tests indicate that all these models are well specified in terms of endogeneity and instruments valid. The Sargan test reports that the null hypothesis of the over identifying restrictions is valid to each of the three models (e.g., Sargan Test: $x^2(207)$ = 101.777 [1.000]).

5.9 Conclusion

This chapter aimed to conduct an empirical analysis of the overreaction hypothesis concerning the impact of unexpected dollar announcements against, three major foreign currencies: the sterling, the yen, and the euro. The focus was directed at understanding how these announcements influenced the U.S. banking system, specifically examining their effects on the profitability of U.S. banks and the determinants of this profitability. The second research is to find out through which channels they can influence the performance of banks.

Due to its specific structure in the banking system, a net sentiment index was conducted based on the fluctuations of the exchange rates of these currencies. Employing a different estimation method from the majority of empirical studies in this area, was deemed arguably preferable, considering the potential non-stationarity of the data (Apergis & Pragidis, 2019) A number of macroeconomic variables were taken into account while determining how to position banks' proxies within the financial markets, including asset size, liquidity, capitalization ratio, interest rates, and others. Furthermore, the impact of the domestic currency net sentiment index was also investigated as a possible important factor affecting the profitability of banks.

Similar findings were obtained for all samples—the total US banks, the largest US banks by total assets, and the smallest US banks by total assets—after analysis of particular banking characteristics that indicate a bank's access to profitability. Additionally, there was a persistent positive correlation between bank profitability and the Yield on Earning Assets %, indicating that better asset returns are linked to higher profitability. This could be a result of better asset management and lending practices. Moreover, the results also showed that there is another positive relationship between total assets and banks profitability in the sample included the total US banks.

The negative coefficients linked with Assets per employee suggest that banks' human resource management may be inefficient. Employee training, better resource allocation, and the deployment of productivity-enhancing technologies may be beneficial. Moreover, the Loan and leases loss allowance/Total assets and the Total deposits/Total assets shows that they negatively impact the bank's profitability. A greater loan and lease loss reserve to total assets ratio implies that the bank anticipates that a significant number of its loans and leases may fail or become non-performing. This entails allocating a considerable portion of their resources as provisions, which has a direct influence on profitability. However, if a bank relies substantially on deposits as its major source of funding, it may face increased interest payment commitments (particularly in a rising interest rate environment), lowering its net interest margin and thus profitability.

In contrast, the findings for the net sentiment index under unexpected exchange rate announcements suggest that they affect only one particular robust model, the one with the smallest sample by the total assets. These findings are robust to the number of instruments selected and estimation methods. However, these results need to be interpreted with caution due to the caution raised before regarding the number of instruments in comparison to the cross-sectional sample.

In conclusion, the empirical data suggests that U.S. banks exhibit no discernible reaction to exchange rate announcements for the domestic currency, the dollar, or to the insights these events impart. This behavior can be potentially understood through the lens of the underreaction hypothesis in behavioral finance.

The underreaction hypothesis by constructed models for the investor sentiment based on psychological evidence, as it was investigated by Barberis et al. (1998), argues that when investors are presented with new evidence, they may take some time to change their perspectives, which could cause stock prices to react slowly to the information (Barberis, et al., 1998). Similar to this, Kahneman and Tversky (1979) highlight how some investors are cautious about modifying their assumptions in the face of new information. They may not immediately fully consider the significance of new information due to this cognitive bias, leading to an initial underreaction until later evidence forces a belief revision (Kahneman & Tversky, 1979).

Furthermore, Jegadeesh and Titman (1993) offer direct evidence that stocks that have historically outperformed do so again in the future, and vice versa. This outcome is in line with the underreaction theory. Investors may build their expectations or views on existing knowledge, and when new information contradicts these assumptions, there may be uncertainty or a delay (lag) in adjusting to the new information (Jegadeesh & Titman, 1993).

Additionally, from an institutional perspective, banks may have stringent internal risk management procedures in place that prevent rapid, impulsive changes in strategy or portfolio allocation. With their layered decision-making structures, banks might inherently respond to market news at a slower pace, ensuring that decisions are made with due diligence rather than on impulse (Berger, et al., 2000).

Chapter 6

6 Conclusion and Policy Implications

6.1 Conclusion

This dissertation examined the influence of exchange rate news using a net sentiment index on banks' profitability for the time period 1998-2018 by employing panel model analysis by investigating the Overreaction Hypothesis. It focused primarily on understanding the effects of these announcements on the US banking system, specifically on their impact on US bank profitability and the factors driving this profitability. Through an exhaustive search among a panel of 30 potential regressors revealed that the profitability of US banks is affected by various internal and external or macroeconomic factors. The internal banks factors used in this study have an influence on all three models, where ROA, ROE, and NIM are used as banks' profitability measures. Yield on earnings assets (%) seems to have the most significant positive impact on profitability across all the models and samples, while Total Deposits/Total Assets (%) have the largest negative and significant effect in determining profitability, in the sample of the 30 Smallest US Banks.

Additionally, this study showed that banks' profitability is not affected by unexpected exchange rate announcements, which implies that investors underreact to immediate or new information, highlighting a potential misalignment with the overreaction hypothesis. Therefore, it is posited that bank performance is essentially dependent on the fundamentals, rather than news. The evidence presented in this paper does not justify banking profit or debt management activities if investors react to good or bad information about the appreciation or depreciation of the US dollar. Banks appear to underreact to exchange rates news as well as to information conveyed by the event. In conclusion, there was no support for the overreaction hypothesis to unexpected exchange rate news in the banking system. Finally, the analysis does not explore alternative explanations rooted in the phenomenon such as psychological factors. This is an interesting avenue for further research.

6.2 Summary of the thesis

The amount and frequency of exchange rate fluctuations, which serve as vital indications of a country's economic stability, have a significant impact on the macroeconomic policy of open economies. Commercial banks may be directly and significantly impacted by changes in exchange rates and are moderately susceptible to them.

This comprehensive study was designed to delve into the dynamics between exchange rate news and bank financial performance by examining the dynamics of the Overreaction Hypothesis in the context of the US banking sector. Over the course of 21 years, the study collected data on more than 800 US institutions (1998 to 2020). After screening, the dataset was narrowed down to 148 banks as a result of bankruptcy and mergers with larger corporations (banking or investment). The study creates a net sentiment index based on unexpected announcements of domestic currency and the US dollar, and then uses GMM techniques to analyze this relationship. The study also examines the impact of the net sentiment index on banks' profitability in combination with other banking and macroeconomic factors. This is the first time that the relationship between exchange rate news and profitability has been analyzed in this way.

To analyze and investigate the Overreaction Hypothesis, this study is based on public news categorized as either favourable or unfavourable based on exchange rate fluctuations for three different exchange rates. The analysis generates a net sentiment index based on the characteristics of these announcements. The data for this index is obtained from fluctuations in three basic exchange rates per year, with the US dollar serving as the domestic currency. The news is categorized as positive or negative based on major changes in exchange rates over time.

This chapter is structured as following: section 6.1 gives the empirical results based on the whole study, 6.2 summaries the main findings of each of the previous five chapters and 6.3 discusses how those findings relate to the four main research questions. The policy implications of these findings are examined in section 6.4. In sections 6.5 and 6.6 the limitations of the research and areas for further research will be assessed. In the final section of this chapter the main contributions to knowledge of this research program are summarized.

6.3 Key findings

To address the main research questions of this thesis presented in the previous section, chapter 1 provides a general discussion of financial performance, exchange rates, unexpected news, and bank performance, the Overreaction Hypothesis in financial Markets and psychology, the difficulties of research based on sentiment analysis of news, the aim and research objectives of this study, and the significance of this study. These areas were assessed to identify the characteristics of the US banking system, the way in which exchange rate windfalls are conducted, and their relevance to the empirical research conducted in Chapter 2.

Related to the first and the second research questions, chapter 2 critically assesses the theory of the Overreaction Hypothesis and empirical studies related to the issue of how banks profitability is affected by exchange rate news, behaviour, and financial markets This analysis made it easier to identify the factors that could be taken into account as possible predictors of bank profitability in Chapter 3. Furthermore, through a critical analysis of empirical studies, the mail gaps and weaknesses in the existing empirical literature were identified. This informed the selection of the estimation strategy and method to be adopted in the data analysis reported in chapter 3.

Based on the literature review, studies have found that internal factors such as liquidity, provisioning policy, capital adequacy, expense management, and bank size, as well as external factors like economic and macroeconomic variables, affect the profitability of banks (Ongena, et al., 2012; Mora, et al., 2013; Rahman, et al., 2015). These factors have been studied using dynamic GMM techniques and variables like ROA, ROE, and NIM. Factors such as operating efficiency, loan growth, financial costs, capital strength, credit risk, ownership structure, bank size, non-interest income, cost efficiency, off-balance sheet activities, liquidity, GDP growth, and inflation have been found to affect bank profitability. Some studies have focused on specific regions, such as Southeast Europe, Switzerland, South Asia, and the Middle East, and have found that certain factors may be more important in these regions. In addition, factors such as counterparty and credit risk, as well as exchange rates, can affect the profitability of banks. Some studies have found a negative relationship between credit risk and financial performance, while others have found a positive relationship between credit risk management and bank profitability (Kargi, 2014). Interest rate and exchange rate fluctuations have also been found to impact the yields of banks, and banks may be more vulnerable to exchange rate risks in certain economic conditions. Both internal and external factors play a role in determining bank profitability.

Furthermore, existing research was carefully examined to identify areas requiring further investigations. This facilitated the selection of the optimal approach for data analysis and the presentation of findings in chapter 3. It was argued that the main weaknesses of previous studies were related to their data series and estimation method(s) used (see section 2.3.5). In chapter 4, data collection chapter, it represents and analyzes the 30 total variables divided into 24 variables for banks (assets and liabilities, income and expenses, performance and conditions1), and 5 macroeconomic variables and finally the most important variable which is the exchange rate News.

In respect of the first investigation, chapter 4 provided a comprehensive analysis of the association between exchange rates news and banks' profitability, creating a net sentiment index based on the unexpected announcements of domestic currency, US dollar, and then using GMM techniques. The index was created by Apergis and Pragidis (2019). Through the creation and examination of multiple models, the variables that had the greatest impact on bank profitability were identified. The findings suggest that while a number of variables were included in all models, the exchange rate news variable did not appear to significantly impact profitability. A review of empirical studies on developed and transition economies from the Central and Eastern European region revealed the primary limitations and deficiencies in the estimation methods previously employed. As a result, the most suitable method for empirical analysis was selected in Chapter 5.

Having already identified and analyzed the most significant independent variables for each model utilized, the analysis proceeded to assess the impact of exchange rate news using a net sentiment index on banks' profitability over the period 1998-2018, employing panel model analysis. Through an exhaustive search among a pool of 30 potential regressors, it was determined that US banks' profitability is affected by various internal and external or macroeconomic factors. The internal banks factors used in this study have an influence on all three models, where ROA, ROE, and NIM are used as banks' profitability measures. Chapter 5 reveals that YOEA yielded the most significant positive impact on profitability across all models and samples, while Total Deposits/Total Assets (%) have the largest negative and significant effect in determining profitability, in the sample of the 30 Smallest US Banks.

Finally, this study demonstrates that the banks' profitability remains unaffected by unexpected exchange rate announcements, suggesting that investors may initially underreact to new information. The findings align with the results of Kahneman and Tversky (1979), highlighting that investors may not immediately fully consider the significance of new information due to this cognitive bias, leading to an initial underreaction until later evidence forces a belief revision.

Hence, the argument posits that bank performance is essentially dependent on the fundamentals, rather than news. For example, the metric Yield on earning assets (%)

consistently comes up as a substantial contributor to profitability across models, but indicators such as Total Deposits/Total Assets (%) show negative associations, particularly in smaller banks. Such patterns demonstrate that, independent of the global currency news landscape, banks' operational and financial complexities are more important in determining their profitability.

The evidence presented in this paper does not justify banking profit or debt management activities if investors react to good or bad information about the appreciation or depreciation of the US dollar. Investors appear to underreact to exchange rates news as well as to information conveyed by the event. In conclusion, no support was found for the overreaction hypothesis to unexpected exchange rate news in the banking system. Finally, the board issues of why investors banks may react little or not at all to public information about the US dollar, nor is whether a different explanation of behavior could be based on other phenomena. This is an interesting avenue for further research.

6.4 Policy Implications

Unexpected news can serve as a channel that affects the profitability of banks through various means, such as changes in loans and assets. As previously discussed, it is important for a central bank to understand the effectiveness and operation of the exchange rate both of announcements and fluctuations and bank lending channels in the monetary transmission mechanism. These channels can help the central bank pursue its objectives by implementing appropriate monetary policy measures that will be transmitted to prices and economic activity.

To fully assess the impact of unexpected news on banks' profitability through these channels, it is necessary to summarize and link the findings from the previous chapters on this topic and investigate the Overreaction Hypothesis. This will provide a more comprehensive understanding of how unexpected news can affect banks' profitability and inform the central bank's decision-making process.

As argued in the previous section, the findings of chapters suggest that exchange rate announcements can impact the smallest banks. This could be explained by the fact that the smallest banks have a significant amount of foreign currency on its balance sheet, an exchange rate announcement could impact the value of that currency. This could impact on the bank's profitability and financial stability. Also, another reason would be that many small banks support businesses that engage in international trade. If an exchange rate announcement leads to significant changes in the value of the domestic currency, it could impact on the cost of imports or exports for these businesses.

In addition, funding and liquidity play an important role. Exchange rate announcements can also affect the funding and liquidity of small banks. For example, if the domestic currency strengthens, it could make it more expensive for a small bank to access funding from foreign sources. This could affect the bank's ability to finance its operations and growth.

6.5 Limitations of the thesis

The main limitations of this research arise from the following: I) the limitations of the theoretical analysis related both to the relationship between exchange rate news/announcements and bank profitability and to the channels through which banks can be influenced. II) the limitation on the literature review and what the other researchers have studied. According to the two limitations, the theoretical and empirical literature examines the relationship between foreign exchange rates, banks, and investors. Exchange rate fluctuations can affect the credit risk, liquidity risk, and market risk of banks, which can impact their profitability. According to global economic theory, there is a strong connection between the domestic currency and interest rates, which can move in either a positive or negative direction. Specifically, an appreciation or depreciation of the domestic currency will result in a corresponding increase or decrease in interest rates. Lowering interest rates can make exports more competitive while also increasing the cost of lending. Therefore, exchange rate changes can have both positive and negative impacts on banks' assets and liabilities, such as lending to companies involved in international trade and the risk of transfer associated with default on loan repayment. These limitations have restricted the analysis from providing more explicit policy recommendations as to whether the unexpected exchange rate news can affect bank's profitability, and which are these channels may be affected by any unexpected announcement of dollar.

6.6 Further research

In this study, the analysis suggests that banks and investors do not demonstrate significant reaction to unexpected exchange rate announcements, implying a tendency to immediately to new information. The evidence presented in this article does not justify banking profit or debt management activities if banks react to good or bad information about the appreciation or depreciation of the dollar. Banks appear to underreact to exchange rates news as well as to information conveyed by the event. Consequently, no support is found for the overreaction hypothesis to unexpected exchange rate news in the banking system, employing various analytical techniques. Finally, the different explanation of psychological behavioral factors based on other phenomena is not addressed. It may be necessary to reinterpret the evidence in this paper. This is left as an area for future research.

One possible explanation for this underreaction is the fast adaption of knowledge in the aftermath of the announcement. Because investors and banks require time to analyse and evaluate the impact of the news, the rapid transmission of data may leave little room for immediate reactions. Furthermore, the complexity of financial markets, as well as the necessity for meticulous risk assessment, could be contributing to the observed underreactions. One possible further research could be done by investigating the time of the new announcement to the market. These findings pave the way for future research into the precise mechanisms of underreactions and their impact on banks and investors, as well as research into the precise timing of news and market shift. Understanding why market players tend to undervalue new information is critical for unravelling the intricacies of investor behaviour and its implications for banking strategies and operations.

The study can be expanded to include the impact of the global financial crisis on the results by including a longer time frame and using more advanced models. For instance, in 2009, some banks experienced a decrease in external funding sources and a significant decline in the quality of their loan portfolio as indicated by the non-performing loan ratio (NPL ratio). Fluctuations in the exchange rate can significantly affect the ratio of non-performing loans to total lending for banks and create credit risk, leading to an increase in non-performing loans. These banks have raised their lending rates while simultaneously tightening the terms of their loans, such as by mandating higher collateral coverage. Examining the effects of these modifications brought on by the world financial crisis may yield more insightful information.

6.7 Contribution to knowledge

This section describes the main contributions to knowledge made by the thesis after the earlier overview of the main findings of the thesis with respect to the primary research issues. Theoretical, methodological, and empirical contributions to knowledge can be categorized into the following three categories. Firstly, it delves into the intricate relationship between currency movements and a bank’s exchange rate fluctuations to banking risk. This theoretical contribution emphasizes the fact that exchange rate fluctuations can affect a bank's liquidity, potentially causing liquidity-related risks similar to those caused by insufficient coverage of liabilities to depositors and borrowers, ultimately posing a risk to the bank's stability (Rahman et al., 2015). Furthermore, the thesis emphasizes the essential significance of exchange rate changes in shaping the financial landscape, as banks allocate a major amount of their capital to assets vulnerable to market volatility, such as equity investments and financial ratios.

Furthermore, this research sheds light on banks' financial performance, which is defined by their capacity to strategically leverage decisions and investments in pursuit of financial stability and profitability. The research investigates the complex relationship between exchange rate dynamics and bank financial performance. It emphasises that banks operate in a dynamic market in which exchange rate movements, both expected and unanticipated, can have a substantial impact on investment decisions, risk management techniques, and a bank's overall financial health. Understanding this complex interplay is critical for banks and financial institutions, especially those involved in foreign exchange markets, because it may guide risk management practises and strategic decision-making (Jeanne & Rancière, 2011).

In addition, the study makes a theoretical contribution by investigating the overreaction hypothesis of exchange rate news for the US dollar currency and its consequences for bank profitability. This theoretical approach provides useful insights into how investor psychology and mood can cause overreactions to currency news, resulting in short-term misalignments and cyclical patterns (De Bondt & Thaler, 1985). The study provides the results of that investors tends to underreact to unexpected exchange rate announcements for the US Dollar currency. This research sheds light on a nuanced aspect of investor behaviour, adding depth to our theoretical understanding. By analysing these and their impact on bank operations and decision-making processes, the study provides insight into the delicate interplay between exchange rate movements and bank profitability. This detailed understanding of investor underreaction adds another layer of complication to the theoretical framework, deepening the grasp of how news sentiment influence market dynamics.

Another theoretical contribution to knowledge of this research is that it provides valuable information that can be used to evaluate US banks' involvement in foreign exchange transactions, catering to the needs of an expanding customer base in foreign markets, and capitalizing on profit opportunities arising from exchange rate fluctuations (Frankel & Froot, 1987)..

Apart from the theoretical contribution, this study also makes a significant methodological contribution by examining the link between the exchange rate movements and bank profitability using data analytic technique. A net sentiment index has been created to determine the announcements to examine the investor behavior. The study gives an insightful understanding of the implications of news according to the exchange rates on banking operations by analyzing real-world data, which can drive investor's strategic decision-making.

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Appendices

Appendix 1: Correlation Matrix, Total Sample, 148 US Banks by total assets

	ROA	ROE	NIM	Total assets	Loan and leases loss allowance/ Total Assets	Total deposits/ Total Assets	Interest-bearing deposits/Total Assets	Average total assets/ Total Assets	Tier one (core) capital/ Total Assets	Tier 2 Risk-based capital/ Total Assets	Total interest income	Total interest expense/ Total interest income	Total noninterest income/ Total interest income	Additional Noninterest Income/ Total interest income
ROA	1	0.8767	0.3791	0.0733	-0.0912	-0.186	-0.1728	-0.0723	0.2213	0.0622	0.1039	-0.034	0.1217	0.1326
ROE		1	0.2613	0.0879	-0.1134	-0.1686	-0.1627	-0.1548	-0.0664	0.0557	0.1191	0.0497	0.1588	0.1556
NIM			1	-0.3813	0.3409	0.1613	-0.0056	-0.0147	0.1574	0.0635	-0.3214	-0.2229	-0.1112	-0.0409
Total Assets				1	-0.0485	-0.4648	0	-0.0275	-0.1551	0.3102	0.9861	0.0002	0.1857	0.0993
Loan and leases loss allowance/ Total Assets					1	0.0044	-0.0875	0.1754	0.045	0.2845	-0.0302	-0.1549	-0.0515	-0.0329

Total deposits/ Total Assets						1	0.6978	0.0424	-0.0732	-0.1728	-0.4828	-0.2154	-0.0678	-0.0789	-
Interest-bearing deposits/Total Assets							1	0.0037	0.0294	-0.2358	-0.3351	0.1622	-0.3078	-0.265	-
Average Total Assets/ Total Assets								1	0.1969	0.006	-0.0201	0.1103	0.0318	0.0303	-
Tier one (core) capital/ Total Assets									1	-0.087	-0.1552	-0.1276	-0.0604	-0.0062	0
Tier 2 Risk-based capital/ Total Assets										1	0.3292	0.0185	0.0273	-0.0282	0
Total interest income											1	0.075	0.1516	0.0779	0
Total interest expense/												1	-0.1371	-0.1141	-

Total interest income															
Total noninterest income/ Total interest income													1	0.9509	[illegible]
Additional Noninterest Income/ Total interest income														1	[illegible]
Pre-tax net operating income/ Total interest income															
Net income/ Total interest income															

Yield on earning assets (%)															

Appendix 2: Correlation Matrix, Total Sample, 148 US Banks by total assets

Correlation Matrix, Total Sample, 148 US Banks by total assets	Yield on earning assets (%)	Net operating income to assets (%)	Efficiency ratio (%)	Assets per employee ($millions)	Net loans and leases to total assets (%)	Net loans and leases to deposits (%)	Total domestic deposits to total assets (%)	Equity capital to assets (%)	Leverage (core capital) ratio (%)	Tier 1 risk-based capital ratio (%)	Total risk-based capital ratio (%)	3-Month London Interbank Offered Rate (LIBOR) %	5-Year Treasury Constant Maturity Rate %
ROA	0.2614	0.4047	-0.2326	-0.0039	0,0192	0,1261	-0.159	0,1602	0.1755	0.0999	0.1056	0.1334	0.1486
ROE	0.2645	0.3451	-0.2031	-0.0079	0.008	0.1128	-0.1818	-0.0904	-0.0755	-0.0793	-0.0765	0.175	0.2064
NIM	0.5729	0.1602	-0.0409	-0.1112	0.3039	0.1747	0.2428	0.0977	0.1235	-0.0969	-0.0995	0.0807	0.11

Total assets	-0.2962	0.0284	-0.1166	0.1305	-0.0682	0.1524	-0.5889	0.0192	-0.1169	-0.112	-0.0864	-0.1061	-0.1317
Loan and leases loss allowance/ Total Assets	0.1215	-0.0389	0.0016	-0.0468	0.2051	0.157	0.0241	0.0466	0.0379	-0.1588	-0.1383	-0.1368	-0.129
Total deposits/ Total Assets	-0.0444	-0.0414	0.0226	-0.0138	-0.0822	-0.562	0.8425	-0.1227	-0.0818	-0.0095	-0.0233	-0.0318	-0.0303
Interest-bearing deposits/Total Assets	0.1432	-0.0561	0.0158	0.0342	0.388	-0.3103	0.6489	-0.052	0.0209	0.1298	0.1126	0.1124	0.1524
Average total assets/ Total Assets	-0.1398	-0.0334	0.0397	-0.007	-0.0267	-0.0457	0.0445	0.1265	0.1318	0.1237	0.1237	-0.1171	-0.1487
Tier one (core) capital/ Total Assets	-0.0337	0.1102	-0.041	-0.0202	-0.0098	0.0311	0.04	0.7302	0.901	0.7313	0.727	-0.0488	-0.0693

Tier 2 Risk-based capital/ Total Assets	0.0652	0.0241	-0.082	-0.0459	0.046	0.083	-0.3002	0.0737	-0.0288	-0.2	-0.0924	0.0649	0.073
Total interest income	-0.1767	0.0577	-0.1211	0.1201	-0.0264	0.1968	-0.598	0.0153	-0.1128	-0.1243	-0.0978	-0.0271	-0.0441
Total interest expense/ Total interest income	0.55	-0.0267	0.0008	-0.0112	0.0023	0.097	-0.2393	-0.1032	-0.0926	0.0091	0.0133	0.5573	0.6014
Total noninterest income/ Total interest income	-0.1929	0.0592	0.0058	-0.0293	-0.2048	-0.1421	-0.1765	-0.0363	-0.0568	-0.001	0.0009	-0.0991	-0.1106
Additional Noninterest Income/ Total interest income	-0.1207	0.0603	0.0088	-0.0265	-0.1199	-0.0659	-0.0727	-0.0021	-0.0097	0.0406	0.0364	-0.0789	-0.0896

Pre-tax net operating income/ Total interest income	-0.1232	0.6217	-0.8045	0.0511	-0.1147	-0.0628	-0.1259	0.0785	0.0743	0.0635	0.0697	-0.0387	0.0465
Net income/ Total interest income	-0.1104	0.3457	-0.1913	0.0405	-0.117	-0.0091	-0.2071	0.1382	0.1421	0.1089	0.1151	-0.0484	-0.0531
Yield on earning assets (%)	1	0.023	-0.012	-0.1146	0.2347	0.2262	0.0431	-0.0589	-0.0589	-0.1133	-0.1104	0.6092	0.6767
Net operating income to assets (%)		1	-0.6161	0.0408	-0.024	0.0069	-0.1407	0.0804	0.1636	0.0776	0.0779	0.0706	0.0813
Efficiency ratio (%)			1	-0.0396	0.0344	0.0157	0.0297	0.0044	0.0447	0.0362	0.0301	-0.019	-0.0257
Assets per employee ($millions)				1	-0.139	-0.0946	-0.0246	-0.0123	-0.0112	0.1053	0.1034	-0.0323	-0.0467

Net loans and leases to total assets (%)					1	0.8454	0.08	-0.0634	-0.0316	-0.4023	-0.4145	0.0392	0.0122
Net loans and leases to deposits (%)						1	-0.3432	0.0168	0.0268	-0.2953	-0.3014	0.0535	0.0322
Total domestic deposits to total assets (%)							1	-0.0619	-0.0166	0.0423	0.015	-0.0416	-0.0404
Equity capital to assets (%)								1	0.7944	0.6408	0.6549	-0.0443	-0.0571
Leverage (core capital) ratio (%)									1	0.7952	0.7954	-0.0335	-0.0475
Tier 1 risk-based capital ratio (%)										1	0.9929	-0.0019	0.0028

Total risk-based capital ratio (%)											1	0.0057	0.0116
3-Month London Interbank Offered Rate (LIBOR) %												1	0.8624
5-Year Treasury Constant Maturity Rate %													1
Real Effective Exchange Rates For USA %													
U- 3 US Unemployme													

nt Rate Total in Labor %														
GDP CQOQ Index														
Exchange rates news (%)														

Appendix 3:Correlation Matrix, Total Sample, 148 US Banks by total assets

Correlation Matrix, Total Sample, 148 US Banks by total assets	Real Effective Exchange Rates for USA %	U- 3 US Unemployment Rate Total in Labor %	GDP CQOQ Index	Exchange rates news (%)
ROA	0.1548	-0.1146	-0.1869	-0.0438
ROE	0.2024	-0.1759	-0.2094	-0.0434
NIM	0.0714	-0.1386	-0.0131	0.0126
Total assets	-0.0664	0.1352	0.0437	-0.0027
Loan and leases loss allowance/ Total Assets	-0.1545	0.0542	0.2032	0.0635
Total deposits/ Total Assets	0.0181	-0.0034	-0.0176	-0.0277
Interest-bearing deposits/Total Assets	0.055	-0.1665	0.002	0.0045
Average total assets/ Total Assets	-0.1798	0.188	0.1228	0.0198
Tier one (core) capital/ Total Assets	-0.0387	0.0825	-0.0011	-0.0018
Tier 2 Risk-based capital/ Total Assets	0.0081	-0.0601	0	0.01

Total interest income	-0.0286	0.061	0.0182	-0.0065
Total interest expense/ Total interest income	0.2523	-0.4774	-0.1749	-0.0419
Total noninterest income/ Total interest income	-0.0371	0.0982	0.0157	-0.0073
Additional Noninterest Income/ Total interest income	-0.0237	0.078	0.0046	-0.115
Pre-tax net operating income/ Total interest income	0.0513	0.0397	-0.0909	-0.0276
Net income/ Total interest income	0.0742	0.0649	-0.1509	-0.0352
Yield on earning assets (%)	0.3425	-0.6103	-0.2353	-0.0461
Net operating income to assets (%)	0.0644	-0.0565	-0.0793	0.0064
Efficiency ratio (%)	-0.0323	0.0319	0.0153	0.0006
Assets per employee ($millions)	-0.0004	0.0497	-0.0158	-0.0219

Net loans and leases to total assets (%)	0.0243	0.0373	-0.0596	-0.0252
Net loans and leases to deposits (%)	0.0175	0.0271	-0.0474	-0.0078
Total domestic deposits to total assets (%)	0.015	-0.0034	-0.0093	-0.0258
Equity capital to assets (%)	-0.0271	0.0531	0.0056	-0.0103
Leverage (core capital) ratio (%)	-0.0205	0.0545	-0.124	-0.0099
Tier 1 risk-based capital ratio (%)	0.004	-0.0238	-0.0084	-0.0021
Total risk-based capital ratio (%)	0.0055	-0.0333	-0.0081	-0.0011
3-Month London Interbank Offered Rate (LIBOR) %	0.3694	-0.3469	-0.6399	-0.1679
5-Year Treasury Constant Maturity Rate %	0.5052	-0.5327	-0.5641	-0.0922

Real Effective Exchange Rates For USA %	1	-0.6504	-0.7155	-0.2256
U- 3 US Unemployment Rate Total in Labor %		1	0.2963	0.0524
GDP CQOQ Index			1	0.3001
Exchange rates news (%)				1

Appendix 4: Correlation Matrix, Sample of the 118 Largest US Banks by total assets

Correlation Matrix, Sample of the 118 Largest US Banks by total assets	ROA	ROE	NIM	Total assets	Loan and leases loss allowance/ Total Assets	Total deposits/ Total Assets	Interest-bearing deposits/Total Assets	Average total assets/ Total Assets	Tier one (core) capital/ Total Assets	Tier 2 Risk-based capital/ Total Assets	Total interest income	Total interest expense/ Total interest income	Total noninterest income/ Total interest income	Additional Noninterest Income/ Total interest income
ROA	1	0.9481	0.2421	-0.0269	-0.1188	-0.2153	-0.0563	-0.1324	0.3225	0.0902	0.1201	0.1258	-0.114	-0.0661
ROE		1	0.2107	-0.018	-0.1278	-0.1763	0.012	-0.118	0.1446	0.0922	0.1371	0.1876	-0.1432	-0.1036
NIM			1	-0.215	0.2658	0.1623	0.0118	-0.0851	0.0336	0.4118	0.1311	-0.0555	0.0605	0.0204
Total assets				1	-0.068	-0.0504	-0.2227	0.1046	-0.1932	-0.0545	0.8386	-0.335	0.15	0.1592
Loan and leases loss allowance/ Total Assets					1	0.072	-0.034	0.1182	-0.0025	0.673	0.0009	-0.0889	-0.0182	0.0067
Total deposits/ Total Assets						1	0.4944	-0.0221	-0.2574	0.0811	-0.0823	-0.1919	0.1578	0.1411

Interest-bearing deposits/Total Assets							1	-0.0962	-0.2154	-0.0159	-0.0666	0.3984	-0.092	-0.071
Average total assets/ Total Assets								1	0.1635	0.0599	0.1086	-0.1735	0.4133	0.3883
Tier one (core) capital/ Total Assets									1	-0.0534	-0.2006	-0.0805	-0.0873	-0.0689
Tier 2 Risk-based capital/ Total Assets										1	0.0883	-0.0331	-0.0783	-0.0661
Total interest income											1	0.0407	0.124	0.1192
Total interest expense/ Total interest income												1	-0.2132	-0.2141

Total noninterest income/ Total interest income													1	0.9581
Additional Noninterest Income/ Total interest income														1

Appendix 5: Correlation Matrix, Sample of the 118 Largest US Banks by total assets

Correlation Matrix, Sample of the 118 Largest US Banks by total assets	Pre-tax net operating income / Total interest income	Net income/ Total interest income	Yield on earning assets (%)	Net operating income to assets (%)	Efficiency ratio (%)	Assets per employee ($millions)	Net loans and leases to total assets (%)	Net loans and leases to deposits (%)	Total domestic deposits to total assets (%)	Equity capital to assets (%)	Leverage (core capital) ratio (%)	Tier 1 risk-based capital ratio (%)	Total risk-based capital ratio (%)	3-Month London Interbank Offered Rate (LIBOR) %
ROA	0.9014	0.9356	0.2575	0. 4706	-0.2147	0.00164	-0.0202	0.1062	-0.1573	0.1383	0.1483	0.0879	0.0936	0.1225
ROE	0.8377	0.8707	0.2948	0. 3968	-0.0458	-0.323	0.3056	0.2247	0.1693	0.1519	0.1736	-0.053	-0.0562	0.0665
NIM	0.094	0.0619	0.5578	0.1907	-0.0458	-0.323	0.3056	0.2247	0.1693	0.1519	0.1736	-0.053	-0.0562	0.0665

Total assets	0.0688	0.1182	-0.4045	0.0644	-0.126	0.2651	-0.1595	0.0315	-0.5401	-0.0556	-0.2121	-0.2117	-0.183	-0.1216
Loan and leases loss allowance/ Total Assets	-0.1687	-0.176	0.1002	-0.0476	0.0086	-0.1678	0.2609	0.2293	0.0299	0.0322	0.0207	-0.2024	-0.1791	-0.1671
Total deposits/ Total Assets	-0.1968	-0.222	-0.0029	-0.0449	0.0085	-0.0881	0.0741	-0.5664	0.8159	-0.0713	-0.0308	0.0482	0.0339	-0.0305
Interest-bearing deposits/Total Assets	-0.1789	-0.1747	0.3323	-0.0716	0.0138	-0.0518	0.0623	-0.3062	0.6616	-0.0194	0.0612	0.1698	0.1518	0.109
Average total assets/ Total Assets	-0.0631	-0.0814	-0.2114	-0.0458	0.0393	-0.0177	-0.0235	-0.0278	0.0145	0.1275	0.1375	0.1279	0.1271	-0.1061

Tier one (core) capital/ Total Assets	0.3752	0.3552	-0.0715	0.1158	-0.0276	0.0376	-0.0239	0.0026	0.104	0.7041	0.8314	0.7324	0.7271	-0.0682
Tier 2 Risk-based capital/ Total Assets	0.0281	0.0236	0.2403	0.0315	-0.0238	-0.0698	-0.0042	0.044	-0.3284	0.051	-0.0509	-0.2097	-0.1015	0.0612
Total interest income	0.0986	0.1254	0.1106	0.1035	-0.1924	0.2384	-0.1148	0.0806	-0.5496	-0.059	-0.2071	-0.2239	-0.1943	-0.0345
Total noninterest income/ Total interest income	-0.0253	-0.0655	0.745	-0.054	0.0136	0.144	0.0018	0.0795	-0.2104	-0.1132	-0.1061	0.0102	0.0142	0.5521

Total noninterest income/ Total interest income	-0.0771	-0.0941	-0.1309	0.0817	0.0046	-0.0953	-0.2476	-0.1823	-0.1722	-0.0499	-0.0689	-0.009	-0.0075	-0.1079
Additional Noninterest Income/ Total interest income	-0.0221	-0.0429	-0.1512	0.0815	0.0086	-0.1034	-0.1489	-0.0956	-0.0548	-0.0117	-0.0169	0.0363	0.0315	-0.0836
Pre-tax net operating income/ Total interest income	1	0.9543	0.045	0.7716	-0.8131	0.125	-0.1491	0.0974	-0.1131	0.0485	0.0404	0.0391	0.0453	-0.0546

Net income/ Total interest income		1	-0.0083	0.4004	-0.7655	0.0903	-0.1696	-0.0514	-0.2029	0.0995	0.0987	0.0799	0.0863	-0.0642
Yield on earning assets (%)			1	-0.0487	-0.0023	-0.3184	0.2397	0.259	0.0062	-0.0315	-0.0389	-0.2036	-0.0824	0.6106
Net operating income to assets (%)				1	-0.7531	0.1893	-0.0483	-0.005	-0.1073	0.0856	0.1339	0.0745	0.0769	0.051
Efficiency ratio (%)					1	-0.1385	0.0499	0.0321	0.0163	0.0199	0.0659	0.0474	0.0414	-0.0087
Assets per employee ($millions)						1	-0.184	-0.1014	-0.1493	0.066	0.0659	0.1884	0.1849	-0.131
Net loans and leases to total assets (%)							1	0.8359	0.1281	-0.0809	-0.0468	-0.3997	-0.4158	0.0385

Net loans and leases to deposits (%)								1	-0.3003	-0.0133	-0.0013	-0.3097	-0.3188	0.0524
Total domestic deposits to total assets (%)									1	-0.0074	0.0463	0.1019	0.0723	-0.0404
Equity capital to assets (%)										1	0.7778	0.6328	0.6461	-0.491
Leverage (core capital) ratio (%)											1	0.8025	0.8023	-0.0532
Tier 1 risk-based capital ratio (%)												1	0.9927	-0.0043

Total risk-based capital ratio (%)													1	0.0032
3-Month London Interbank Offered Rate (LIBOR) %														1

Appendix 6: Correlation Matrix, Sample of the 30 Smallest US Banks by total assets

Correlation Matrix, Sample of the 30 Smallest US Banks by total assets	ROA	ROE	NIM	Total assets	Loan and leases loss allowance/ Total Assets	Total deposits/ Total Assets	Interest-bearing deposits/Total Assets	Average total assets/ Total Assets	Tier one (core) capital/ Total Assets	Tier 2 Risk-based capital/ Total Assets	Total interest income	Total interest expense/ Total interest income	Total noninterest income/ Total interest income	Additional Noninterest Income/ Total interest income
ROA	1	0.8685	0.4359	0.0748	-0.0924	-0.1989	-0.1866	-0.0581	0.2001	0.0543	0.1079	-0.0624	0.1346	0.1451
ROE		1	0.3006	0.1125	-0.1038	-0.1872	-0.1982	-0.1466	-0.1139	0.0595	0.1465	0.0218	0.1908	-0.185
NIM			1	-0.299	0.3758	0.0497	-0.0534	-0.0368	0.2138	0.0598	-0.2342	-0.2208	-0.1078	-0.024
Total assets				1	0.0495	-0.3585	-0.3628	0.0094	-0.2603	0.3563	0.9823	-0.0623	0.1721	0.0659
Loan and leases loss allowance/ Total Assets					1	0.0604	-0.1262	0.1471	0.138	0.3333	0.0729	-0.1716	-0.0493	-0.0227

Total deposits/ Total Assets						1	0.7211	0.0042	-0.0229	-0.1847	-0.3803	-0.1783	-0.0505	-0.062
Interest-bearing deposits/Total Assets							1	-0.002	0.0717	-0.2554	-0.3381	0.1672	-0.3152	-0.2699
Average total assets/ Total Assets								1	0.2031	0.0004	0.021	-0.0681	0.0213	0.0223
Tier one (core) capital/ Total Assets									1	-0.1162	-0.261	-0.1435	-0.074	-0.0134
Tier 2 Risk-based capital/ Total Assets										1	0.3766	0.0127	0.0262	-0.0337
Total interest income											1	0.0154	0.1303	0.0401
Total noninterest												1	-0.1528	-0.1262

income/ Total interest income														
Total noninterest income/ Total interest income													1	0.9489
Additional Noninterest Income/ Total interest income														1

Appendix 7: Correlation Matrix, Sample of the 30 Smallest US Banks by total assets

Correlation Matrix, Sample of the 30 Smallest US Banks by total assets	Pre-tax net operating income / Total interest income	Net income/ Total interest income	Yield on earning assets (%)	Net operating income to assets (%)	Efficiency ratio (%)	Assets per employee ($millions)	Net loans and leases to total assets (%)	Net loans and leases to deposits (%)	Total domestic deposits to total assets (%)	Equity capital to assets (%)	Leverage (core capital) ratio (%)	Tier 1 risk-based capital ratio (%)	Total risk-based capital ratio (%)	3-Month London Interbank Offered Rate (LIBOR) %
ROA	0.4096	0.8345	0.2773	0.2679	-0.8195	0.116	0.2302	0.2857	-0.1924	0.2598	0.3104	0.131	0.13	0.188
ROE	0.3739	0.7698	0.2717	0.2479	-0.7634	0.0803	0.2257	0.2705	-0.1558	0.0859	0.1389	0.004	-0.0016	0.2094
NIM	0.0288	0.1246	0.5735	0.0926	-0.1693	-0.2402	0.546	0.4984	0.1284	0.008	0.022	-0.2334	-0.2224	0.1783

Total assets	0.2445	0.2336	-0.2856	-0.0148	0.0014	0.2602	0.0163	0.0234	-0.0403	-0.2119	-0.187	-0.1444	-0.1483	-0.3285
Loan and leases loss allowance/ Total Assets	-0.1059	-0.1586	0.1308	-0.0521	0.0059	-0.0856	0.3315	0.3159	0.0718	0.0126	-0.0207	-0.1667	-0.1353	-0.0747
Total deposits/ Total Assets	-0.033	-0.1371	-0.1043	-0.1239	0.2147	-0.1661	0.1238	-0.1599	0.903	-0.2684	-0.277	-0.2835	-0.2843	-0.016
Interest-bearing deposits/Total Assets	-0.1444	-0.2713	0.1097	-0.0322	0.0211	-0.1223	0.0284	-0.1127	0.4375	-0.2362	-0.2228	-0.2064	-0.2131	0.2003
Average total assets/ Total Assets	-0.0622	-0.0506	0.1214	-0.167	0.1314	-0.0104	-0.0046	0.0006	-0.059	0.127	0.084	0.1159	0.1193	-0.1134

Tier one (core) capital/ Total Assets	0.0402	0.1058	-0.0125	0.1339	-0.3126	0.0657	-0.0461	0.0247	-0.2453	0.9165	0.9564	0.7745	0.773	0.525
Tier 2 Risk-based capital/ Total Assets	0.0611	0.0709	0.059	-0.0027	-0.1235	-0.1053	0.447	0.5209	0.0838	-0.0547	-0.0774	-0.4037	-0.3644	0.0088
Total interest income	0.2262	0.2131	-0.1556	0.0511	-0.1406	0.133	0.1868	0.2046	-0.799	-0.2753	-0.201	-0.236	-0.236	-0.0222
Total noninterest income/ Total interest income	-0.1631	-0.2416	0.5322	0.07	-0.2041	-0.1234	-0.1049	-0.0436	-0.1842	-0.1269	-0.551	-0.0274	-0.0284	0.6105

Total noninterest income/ Total interest income	0.2221	0.367	-0.2044	-0.0519	0.222	-0.1223	-0.0151	-0.0628	0.1484	-0.0843	-0.1159	-0.0247	-0.0236	-0.0863
Additional Noninterest Income/ Total interest income	0.1652	0.3071	-0.119	-0.0307	0.1553	-0.0625	0.0122	-0.0302	0.1302	-0.0734	-0.0917	-0.0237	-0.0233	-0.0991
Pre-tax net operating income/ Total interest income	1	0.5215	0.1359	0.2399	-0.8056	0.1683	0.1514	0.2003	-0.1703	0.3097	0.3552	0.2034	0.201	0.0855

Net income/ Total interest income		1	-0.1154	-0.4127	-0.7655	0.1922	0.1343	0.186	-0.1922	0.2984	0.3359	0.1942	0.192	0.0294
Yield on earning assets (%)			1	-0.05	-0.2329	-0.3988	0.2716	0.2716	0.0508	-0.1308	-0.102	-0.2036	-0.1955	0.6133
Net operating income to assets (%)				1	-0.4127	0.8271	0.0526	0.0915	-0.5234	0.1044	0.349	0.1374	0.1279	0.1234
Efficiency ratio (%)					1	-0.3215	-0.2263	-0.2816	0.2739	-0.27	-0.3521	-0.1214	-0.1189	-0.1948
Assets per employee ($millions)						1	-0.098	-0.0453	-0.5004	0.0535	0.2779	0.1572	0.1457	-0.1199
Net loans and leases							1	0.9574	0.1141	-0.1029	-0.0726	-0.5534	-0.5509	0.0189

to total assets (%)														
Net loans and leases to deposits (%)								1	-0.1446	-0.0311	0.0059	-0.4717	-0.469	0.0294
Total domestic deposits to total assets (%)									1	-0.2519	-0.3694	-0.2955	-0.2921	-0.0463
Equity capital to assets (%)										1	0.8996	0.7354	0.7354	-0.343
Leverage (core capital) ratio (%)											1	0.7772	0.773	0.0759
Tier 1 risk-based												1	0.9986	0.0309

capital ratio (%)														
Total risk-based capital ratio (%)													1	0.0303
3-Month London Interbank Offered Rate (LIBOR) %														1

Appendix 8: Correlation Matrix, Sample of the 30 Smallest US Banks by total assets

Correlation Matrix, Sample of the 30 Smallest US Banks by total assets	5-Year Treasury Constant Maturity Rate %	Real Effective Exchange Rates for USA %	U- 3 US Unemployment Rate Total in Labor %	GDP CQOQ Index	Exchange rates news (%)
ROA	0.1732	0.1438	-0.0904	-0.1777	-0.0384
ROE	0.2021	0.1603	-0.126	-0.1801	-0.0379
NIM	0.1983	0.0666	-0.0987	-0.0239	0.0123
Total assets	-0.4	-0.1997	0.3441	0.1308	-0.007
Loan and leases loss allowance/ Total Assets	-0.721	-0.1226	0.095	0.1336	0.039
Total deposits/ Total Assets	0.0057	0.069	0.1353	-0.0792	-0.0281
Interest-bearing deposits/Total Assets	0.283	0.1447	-0.1787	-0.0315	0.013
Average total assets/ Total Assets	-0.1666	-0.1022	0.1889	0.0395	0.0131
Tier one (core) capital/ Total Assets	0.0313	0.0064	0.0676	-0.0359	-0.0206

Tier 2 Risk-based capital/ Total Assets	0.0064	-0.0524	0.0501	0.0622	0.0182
Total interest income	-0.056	-0.0355	0.0653	0.0313	-0.0275
Total noninterest income/ Total interest income	0.6941	0.3032	-0.6011	-0.175	-0.0322
Total noninterest income/ Total interest income	-0.1087	-0.0286	0.1604	-0.0138	-0.0066
Additional Noninterest Income/ Total interest income	-0.1356	-0.063	0.1601	-0.0281	-0.0239
Pre-tax net operating income/ Total interest income	0.0542	0.1114	0.0201	-0.1788	-0.0325
Net income/ Total interest income	-0.0014	0.0725	0.0578	-0.1416	-0.026
Yield on earning assets (%)	0.6858	0.3408	-0.5791	-0.2143	-0.0515

Net operating income to assets (%)	0.1386	0.061	-0.0638	-0.0853	0.0419
Efficiency ratio (%)	-0.1949	-0.1192	0.1062	0.1193	0.0136
Assets per employee ($millions)	-0.1526	-0.0968	0.1264	0.0298	0.0336
Net loans and leases to total assets (%)	-0.0027	0.0035	0.109	-0.0305	-0.0157
Net loans and leases to deposits (%)	0.0018	-0.0137	0.0578	-0.0103	-0.0076
Total domestic deposits to total assets (%)	-0.036	0.0517	0.1353	-0.0537	-0.0484
Equity capital to assets (%)	-0.0528	-0.0548	0.0884	0.0639	0.0105
Leverage (core capital) ratio (%)	0.0569	0.0108	0.053	-0.0442	-0.0073
Tier 1 risk-based capital ratio (%)	0.0221	0.0205	-0.041	-0.0255	-0.0091
Total risk-based capital ratio (%)	0.022	0.0181	-0.045	-0.0212	-0.008

3-Month London Interbank Offered Rate (LIBOR) %	0.8622	0.3693	-0.3235	-0.6408	-0.168
5-Year Treasury Constant Maturity Rate %	1	0.5052	-0.5011	-0.5647	-0.0922
Real Effective Exchange Rates For USA %		1	-0.6151	-0.7157	-0.2256
U- 3 US Unemployment Rate Total in Labor %			1	0.2753	-0.0486
GDP CQOQ Index				1	0.3001
Exchange rates news (%)					1

Appendix 9: Descriptive statistics for the dependent and independent variables

Panel A: Sample Mean of Key Variables											
Descriptive Statistics of Key Variables for the Full Sample of US Banks											
		Mean	***Median***	***Maximum***	***Minimum***	***Std.Dev.***	***Skewness***	***Kurtosis***	***Jarque-Bera***	***Sum***	***Sum Sq. Dev.***
Dependent Variables											
1	*ROA*	*0.811159*	*0.759245*	*11.66711*	*-12.51574*	*0.894821*	*0.457485*	*45.91364*	*238593.1*	*2521.083*	*2487.789*
2	*ROE*	*7.809711*	*7.151459*	*64.22928*	*-66.45905*	*7.950978*	*-0.228713*	*17.42189*	*26961.93*	*24272.58*	*196418.5*
3	*NIM*	*3.617411*	*3.565835*	*10.09392*	*0.243848*	*0.915508*	*0.787853*	*7.872105*	*3395.524*	*11242.91*	*2604.145*
Independent Variables											
1	*Total Assets*	*13.31971*	*13.10130*	*21.52030*	*6.870484*	*2.333609*	*1.069147*	*4.290983*	*807.9424*	*41397.65*	*16919.89*
2	*Loan and leases loss allowance/ Total Assets*	*0.771389*	*0.710140*	*4.924738*	*0*	*0.429051*	*2.061491*	*13.78449*	*17262.88*	*2397.477*	*571.9509*

3	*Total deposits/ Total Assets*	*78.88191*	*81.07621*	*95.98983*	*31.39310*	*9.612372*	*-1.130796*	*4.487285*	*948.8222*	*245165.0*	*287079.7*
4	*Interest-bearing deposits/Total Assets*	*68.03177*	*69.26318*	*92.56287*	*0*	*10.91634*	*-1.018987*	*5.860390*	*1597.405*	*211442.7*	*370250.1*
5	*Average Total Assets/ Total Assets*	*97.32893*	*9.69330*	*168.1665*	*20.57452*	*5.310012*	*-0.081843*	*43.54048*	*212840.6*	*302498.3*	*87605.66*
6	*Tier one (core) capital/ Total Assets*	*10.19097*	*9.627159*	*49.30993*	*3.209332*	*3.232407*	*2.934533*	*24.71221 9*	*65509.54*	*31673.55*	*32463.34*
7	*Tier 2 Risk-based capital/ Total Assets*	*0.807937*	*0.721934*	*7.335504*	*0*	*0.572901*	*4.055859*	*30.29125*	*104974.3*	*2511.069*	*1019.766*
8	*Total Interest Income*	*10.26198*	*10.06484*	*18.05998*	*0.216574*	*2.247644*	*1.022618*	*4.318798*	*766.9272*	*31894.22*	*15696.26*

9	*Total interest income Total interest expense/ Total interest income*	*31.97028*	*31.77764*	*484.4560*	*0.925264*	*18.60421*	*4.712949*	*113.9938*	*1606896*	*99363.62*	*1075384*
10	*Total non-interest income/ total interest income*	*23.81969*	*2.27403*	*1533.768*	*-38.47320*	*61.16877*	*15.88473*	*337.7242*	*14639921*	*74031.59*	*11625210*
11	*Additional Noninterest Income/ Total interest income*	*16.62659*	*7.627859*	*1533.768*	*-38.47320*	*57.75622*	*18.82516*	*432.7221*	*24097180*	*54675.44*	*10364273*
12	*Pre-tax net operating income/total*	*19.98456*	*20.75761*	*149.4882*	*-768.4437*	*33.39159*	*-11.56519*	*214.3929*	*5856244*	*62112*	*3464300*

	interest income										
13	*Net income/ Total interest income*	*16.50936*	*15.65649*	*148.3191*	*-256.5898*	*17.09601*	*-2.183165*	*51.77876*	*310596.9*	*51311.09*	*908094.3*
14	*Yield on earning assets %*	*5.555338*	*5.413127*	*14.7067*	*0.396253*	*1.657417*	*0.364604*	*3.331455*	*83.08799*	*17265.99*	*8535.021*
15	*Net operating income to assets %*	*0.747451*	*0.724099*	*72.54810*	*-37.27939*	*2.159545*	*11.74127*	*537.0752*	*37009511*	*2323.077*	*14489.92*
16	*Efficiency ratio (%)*	*73.16215*	*70.2977*	*1805.094*	*2.713235*	*56.23234*	*19.19614*	*453.5346*	*26476970*	*227387.9*	*9824571*
17	*Assets per employee ($millions)*	*5.029348*	*4.204460*	*78.38458*	*0.265994*	*4.335331*	*7.453074*	*91.56310*	*1044497*	*15631.21*	*58396.37*

18	*Net loan and leases to total assets (%)*	*64.81787*	*67.37809*	*101.3994*	*5.870086*	*15.58782*	*-1.017831*	*4.335704*	*767.6791*	*201454.0*	*754938.9*
19	*Net loans and leases to deposits (%)*	*83.91176*	*84.06378*	*226.3897*	*6.798118*	*24.74093*	*0.188696*	*4.948278*	*509.9983*	*260797.8*	*1901837*
20	*Total domestic deposits to total assets (%)*	*77.62800*	*80.93508*	*95.98983*	*10.68618*	*12.36286*	*-1.889080*	*7.852140*	*4897.399*	*241267.8*	*474874.6*
21	*Equity capital to assets (%)*	*10.95597*	*10.32512*	*89.63000*	*3.676324*	*4.087883*	*6.833723*	*104.8841*	*1368450*	*34051.15*	*51920.43*
22	*Leverage (core capital) ratio (%)*	*10.36171*	*9.723951*	*74.66772*	*3.227418*	*3.511004*	*4.766792*	*59.90288*	*431083.0*	*32204.18*	*38300.45*
23	*Tier 1 risk-based capital ratio (%)*	*16.66220*	*14.75297*	*146.7733*	*5.762712*	*8.002877*	*3.858029*	*35.72206*	*146370.1*	*51786.13*	*198991.1*

24	*Total risk-based capital ratio (%)*	*17.87095*	*15.87538*	*147.2607*	*6.754683*	*7.995730*	*3.907079*	*35.52628*	*144913.1*	*55542.91*	*198635.8*
25	*3-Month London Interbank Offered Rate (LIBOR) %*	*2.310698*	*1.425000*	*6.400000*	*0.246100*	*2.072464*	*0.721076*	*2.006035*	*397.2763*	*7181.648*	*13344.90*
26	*5-Year Treasury Constant Maturity Rate %*	*2.954762*	*2.690000*	*6.360000*	*0.720000*	*1.464104*	*0.482313*	*2.429183*	*162.6954*	*9183.400*	*6660.166*
27	*Real Effective Exchange Rates for USA %*	*109.6586*	*111.9800*	*126.9200*	*95.50000*	*9.303351*	*0.078219*	*1.924896*	*152.8516*	*340818.8*	*268918.1*

28	*U- 3 US Unemployment Rate Total in Labor %*	*8.060908*	*9.592267*	*9.957754*	*-2.500000*	*2.921163*	*-1.412394*	*3.385118*	*1052.542*	*25053.30*	*26512.64*
29	*GDP CQOQ Index*	*5.805277*	*5.000000*	*10.00000*	*3.900000*	*1.768508*	*1.043807*	*2.918886*	*565.2303*	*18042.80*	*9717.513*
30	*Exchange rates news (%)*	*-3.703704*	*-11.11111*	*77.77778*	*-100.0000*	*43.01729*	*-0.002919*	*2.622738*	*18.4374*	*- 11511.11*	*5749465*

Note 10: This table presents the summary descriptive statistics of all the variables used in this study (the observations are 3184, the same for the 34 variables)

Appendix 10: Results from the descriptive statistics of Key Variables for the Full Sample of US Banks

Panel B: Sample Mean of Key Variables During Pre-crisis and Post-Crisis Period											
Descriptive Statistics of Key Variables for the Full Sample of US Banks											
		Mean	***Median***	***Maximum***	***Minimum***	***Std. Dev.***	***Skewness***	***Kurtosis***	***Jarque-Bera***	***Sum***	***Sum Sq. Dev.***
Dependent Variables											
1	*ROA*	*0.811159*	*0.759245*	*11.66711*	*-12.51574*	*0.894821*	*0.457485*	*45.91364*	*238593.1*	*2521.083*	*2487.789*
2	*ROE*	*7.809711*	*7.151459*	*64.22928*	*-66.45905*	*7.950978*	*-0.228713*	*17.42189*	*26961.93*	*24272.58*	*196418.5*
3	*NIM*	*3.617411*	*3.565835*	*10.09392*	*0.243848*	*0.915508*	*0.787853*	*7.872105*	*3395.524*	*11242.91*	*2604.145*
Independent Variable											
1	*Total Assets*	*13.31971*	*3.10130*	*21.52030*	*6.870484*	*2.333609*	*1.69147*	*4.290983*	*807.9424*	*41397.65*	*16919.89*
2	*Loan and leases loss allowance/ Total Assets*	*0.771389*	*0.710140*	*4.924738*	*0*	*0.429051*	*2.061491*	*13.78449*	*17262.88*	*2397.477*	*571.9509*

3	*Total deposits/ Total Assets*	*78.88191*	*81.07621*	*95.98983*	*31.39310*	*9.612372*	*-1.130796*	*4.487285*	*948.8222*	*245165.0*	*287079.7*
4	*Interest-bearing deposits/Total Assets*	*60.03177*	*69.26318*	*92.56287*	*0*	*10.91634*	*-1.018987*	*5.860390*	*1597.405*	*211442.7*	*370250.1*
5	*Average Total Assets/ Total Assets*	*97.32893*	*97.69330*	*168.1665*	*20.57452*	*5.310012*	*-0.081843*	*43.54048*	*212840.6*	*302498.3*	*87605.66*
6	*Tier one (core) capital/ Total Assets*	*10.19097*	*9.627159*	*49.30993*	*3.209332*	*3.232407*	*2.934533*	*24.71219*	*65509.54*	*31673.55*	*32463.34*
7	*Tier 2 Risk-based capital/ Total Assets*	*0.807937*	*0.721934*	*7.335504*	*0*	*0.572901*	*4.055859*	*30.29125*	*104974.3*	*2511.069*	*1019.766*
8	*Total Interest Income*	*10.26198*	*10.06484*	*18.05998*	*0.216574*	*2.247644*	*1.022618*	*4.318798*	*766.9272*	*31894.22*	*15696.6*

9	*Total interest income Total interest expense/ Total interest income*	*31.97028*	*31.77764*	*484.4560*	*0.925264*	*18.60421*	*4.712949*	*113.9938*	*1606896*	*99363.62*	*1075384*
10	*Total non-interest income/ total interest income*	*23.81969*	*12.27403*	*1533.768*	*-38.47320*	*61.16877*	*15.88473*	*337.7242*	*14639921*	*74031.59*	*11625210*
11	*Additional Noninterest Income/ Total interest income*	*16.62659*	*7.627859*	*1533.768*	*-38.47320*	*57.75622*	*18.82516*	*432.7221*	*24097180*	*51675.44*	*10364273*
12	*Pre-tax net operating income/total*	*19.98456*	*20.75761*	*149.4882*	*-768.4437*	*33.39159*	*- 11.565199*	*214.3929*	*5856244*	*62112.00*	*3464300*

	interest income										
13	*Net income/ Total interest income*	*16.50936*	*16.65649*	*148.3191*	*-256.5898*	*17.09601*	*-2.183165*	*51.77876*	*310596.9*	*51311.09*	*908094.3*
14	*Yield on earning assets %*	*5.555338*	*5.413127*	*14.17067*	*0.396253*	*1.657417*	*0.364604*	*3.331455*	*83.08799*	*17265.99*	*8535.021*
15	*Net operating income to assets %*	*0.747451*	*0.724099*	*72.54810*	*-37.27939*	*2.159545*	*11.74127*	*537.0752*	*37009511*	*2323.077*	*14489.92*
16	*Efficiency ratio (%)*	*73.16215*	*70.29777*	*1805.094*	*2.713235*	*56.23234*	*19.19614*	*453.5346*	*26476970*	*227387.9*	*9824571*
17	*Assets per employee ($millions)*	*5.029348*	*4.204460*	*78.38458*	*0.265994*	*4.335331*	*7.453074*	*91.56310*	*1044497*	*15631.21*	*58396.37*

18	*Net loan and leases to total assets (%)*	*64.81787*	*67.37809*	*101.3994*	*5.870086*	*15.58782*	*-1.017831*	*4.335704*	*767.6791*	*201454.0*	*754938.9*
19	*Net loans and leases to deposits (%)*	*83.91176*	*84.06378*	*226.3897*	*6.798118*	*24.74093*	*0.188696*	*4.948278*	*509.9983*	*260797.8*	*1901837*
20	*Total domestic deposits to total assets (%)*	*77.62800*	*80.93508*	*95.98983*	*10.68618*	*12.36286*	*-1.889080*	*7.852140*	*4897.399*	*241267.8*	*474874.6*
21	*Equity capital to assets (%)*	*10.95597*	*10.32512*	*89.63000*	*3.676324*	*4.087883*	*6.833723*	*104.8841*	*1368450*	*34051.15*	*51920.43*
22	*Leverage (core capital) ratio (%)*	*10.36171*	*9.723951*	*74.66772*	*3.227418*	*3.511004*	*4.766792*	*59.90288*	*431083*	*32204.18*	*38300.45*
23	*Tier 1 risk-based capital ratio (%)*	*16.66220*	*14.75297*	*146.7733*	*5.762712*	*8.002877*	*3.858029*	*35.72206*	*146370.1*	*51786.13*	*198991.1*

24	*Total risk-based capital ratio (%)*	*17.87095*	*15.87538*	*147.2607*	*6.754683*	*7.995730*	*3.907079*	*35.52628*	*144913.1*	*55542.91*	*198635.8*
25	*3-Month London Interbank Offered Rate (LIBOR) %*	*2.310698*	*1.425000*	*6.400000*	*0.246100*	*2.072464*	*0.721076*	*2.006035*	*397.2763*	*7181.648*	*13344.90*
26	*5-Year Treasury Constant Maturity Rate %*	*2.954762*	*2.690000*	*6.360000*	*0.720000*	*1.464104*	*0.482313*	*2.429183*	*162.6954*	*9183.400*	*6660.166*
27	*Real Effective Exchange Rates for USA %*	*109.6586*	*111.9800*	*126.9200*	*95.50000*	*9.303351*	*0.078219*	*1.924896*	*152.8516*	*340818.8*	*268918.1*

28	*U- 3 US Unemployment Rate Total in Labor %*	*8.060908*	*9.592267*	*9.957754*	*-2.500000*	*2.921163*	*-1.412394*	*3.385118*	*1052.542*	*25053.30*	*26512.64*
29	*GDP CQOQ Index*	*5.805277*	*5.000000*	*10.00000*	*3.900000*	*1.768508*	*1.043807*	*2.918886*	*565.2303*	*18042.80*	*9717.513*
30	*Exchange rates news (%)*	*-3.703704*	*-11.11111*	*77.77778*	*-100.0000*	*43.01729*	*-0.002919*	*2.622738*	*18.43574*	*- 11511.11*	*5749465*
DV	*Dummy Variable Financial Crisis*	*0.523810*	*1.000000*	*1.000000*	*0*	*0.499513*	*-0.095346*	*1.009091*	*518.01077*	*1628.000*	*775.2381*

Note 11: This table presents the summary descriptive statistics of all the variables used in this study (the observations are 3184, the same for the 34 variables)

Appendix 11: Coefficient estimations outputs for ROA-ROE-NIM Model Parameters for the total sample with N=148, T=21

Stepwise forward p-value=0.01								
Sample of 148 Largest US Banks								
ROA			**ROE**			**NIM**		
Variable	**Coefficient**	**Prob**	**Variable**	**Coefficient**	**Prob**	**Variable**	**Coefficient**	**Prob**
C	-1.963	0.000	**c**	3.416	0.0001	**C**	0.224	0.3689
Net income/ Total interest income	0.048	0.000	**Net income/ Total interest income**	0.430	0.000	**Yield on earning assets (%)**	0.657	0.000
Yield on earning assets (%)	0.251	0.000	**Yield on earning assets (%)**	1.385	0.000	**Interest-bearing deposits/Total Assets**	-0.013	0.000
Total noninterest income/ Total interest income	-0.004	0.000	**Equity capital to assets (%)**	-0.242	0.000	**Pre-tax net operating income/ Total interest income**	-0.001	0.000

Net operating income to assets (%)	0.055	0.000	**Tier one (core) capital/ Total Assets**	-0.462	0.000	**Leverage (core capital) ratio (%)**	0.038	0.000
Pre-tax net operating income/ Total interest income	-0.004	0.000	**Net operating income to assets (%)**	0.282	0.000	**GDP CQOQ Index**	0.067	0.000
Tier one (core) capital/ Total Assets	0.033	0.000	**Pre-tax net operating income/ Total interest income**	-0.043	0.000	**Net operating income to assets (%)**	0.049	0.000
Leverage (core capital) ratio (%)	-0.016	0.000	**Efficiency ratio (%)**	-0.020	0.000	**Loan and leases loss allowance/ Total Assets**	0.160	0.000
3-Month London Interbank Offered Rate (LIBOR) %	-0.025	0.000	**Total domestic deposits to total assets (%)**	-0.032	0.000	**Real Effective Exchange Rates for USA %**	0.006	0.000

Total assets	0.140	0.000	**Tier 1 risk-based capital ratio (%)**	0.093	0.000	**5-Year Treasury Constant Maturity Rate %**	-0.043	0.000
Efficiency ratio (%)	-0.001	0.000	**Total noninterest income/ Total interest income**	-0.040	0.000	**Tier one (core) capital/ Total Assets**	0.013	0.005
GDP CQOQ Index	0.017	0.000	**Additional Noninterest Income/ Total interest income**	0.033	0.000	**Net loans and leases to deposits (%)**	-0.013	0.000
Loan and leases loss allowance/ Total Assets	-0.100	0.000	**Assets per employee ($millions)**	-0.080	0.000	**Net loans and leases to total assets (%)**	0.020	0.000
Total interest expense/ Total interest income	-0.002	0.000	**Net Loans and leases to deposits (%)**	0.010	0.002	**Total noninterest income/ Total interest income**	-0.003	0.000
Total interest income	-0.128	0.000				**Net income/ Total interest income**	0.003	0.000

Additional Noninterest Income/ Total interest income	0.003	0.000	**Total interest income**	-0.131	0.000
Total domestic deposits to total assets (%)	-0.001	0.001	**Assets per employee ($millions)**	0.012	0.000
Average total assets/ Total Assets	0.003	0.003	**3-Month London Interbank Offered Rate (LIBOR) %**	-0.077	0.000
			Total deposits/ Total Assets	0.013	0.000
			Total assets	0.091	0.000
			Additional Noninterest Income/ Total interest income	0.003	0.000

					Total domestic deposits to total assets (%)	-0.011	0.000
R-squared	0.900542		**R-squared**	0.803036	**R-squared**	0.898936	
S.E. of regression	0.282975		**S.E. of regression**	3.536101	**S.E. of regression**	0.345075	
Durbin-Watson stat	1.188948		**Durbin-Watson stat**	1.120616	**Durbin-Watson stat**	1.207576	

Note 12: Total sample with 148 US Banks. The stepwise forward method is presented in the table. The first column shows all independent variables which have been selected and evaluated by p-value<0.01. Also, presented the coefficients and p-value of each independent variable and the constant of each model ROA-ROE-NIM). The R-squared, Standard deviation (S.E) of regression and Durbin-Watson stat show in the last rows of the table.

Appendix 12: Coefficient estimations outputs for ROA-ROE-NIM Model Parameters for the sample of 118 largest us banks by total assets, N=118, T= 21

Stepwise forward p-value=0.01								
Sample of 118 Largest US Banks								
ROA			**ROE**			**NIM**		
Variable	***Coefficient***	***Prob***	***Variable***	***Coefficient***	***Prob***	***Variable***	***Coefficient***	***Prob***
C	*-2.957*	*0.000*	***c***	*3.480*	*0.001*	***C***	*-1.827*	*0.000*
Net income/ Total interest income	*0.046*	*0.000*	***Net income/ Total interest income***	*0.398*	*0.000*	***Yield on earning assets (%)***	*0.650*	*0.000*
Yield on earning assets (%)	*0.771*	*0.000*	***Yield on earning assets (%)***	*1.281*	*0.000*	***Total interest expense/ Total interest income***	*-0.022*	*0.000*
Total noninterest income/ Total interest income	*-0.004*	*0.000*	***Equity capital to assets (%)***	*-0.243*	*0.000*	***5-Year Treasury Constant Maturity Rate %***	*-0.050*	*0.000*

Net operating income to assets (%)	*0.134*	*0.000*	***Tier one (core) capital/ Total Assets***	*-0.432*	*0.000*	***Leverage (core capital) ratio (%)***	*0.048*	*0.000*
Pre-tax net operating income/ Total interest income	*-0.005*	*0.000*	***Net operating income to assets (%)***	*0.545*	*0.000*	***GDP CQOQ Index***	*0.072*	*0.000*
Tier one (core) capital/ Total Assets	*0.044*	*0.000*	***Pre-tax net operating income/ Total interest income***	*-0.049*	*0.000*	***Net operating income to assets (%)***	*0.065*	*0.000*
Leverage (core capital) ratio (%)	*-0.026*	*0.000*	***Efficiency ratio (%)***	*-0.016*	*0.000*	***Loan and leases loss allowance/ Total Assets***	*0.193*	*0.000*
5-Year Treasury Constant Maturity Rate %	*-0.031*	*0.000*	***Total domestic deposits to total assets (%)***	*-0.044*	*0*	***Real Effective Exchange Rates For USA %***	*0.007*	*0.000*
Total assets	*0.254*	*0.000*	***Tier 1 risk-based capital ratio (%)***	*0.074*	*0.000*	***5-Year Treasury Constant Maturity Rate %***	*-0.086*	*0.000*

Total interest income	*-0.230*	*0.000*	***Total noninterest income/ Total interest income***	*-0.040*	*0.000*	***Total deposits/ Total Assets***	*0.030*	*0.000*
GDP CQOQ Index	*0.020*	*0.000*	***Additional Noninterest Income/ Total interest income***	*0.035*	*0.000*	***Interest-bearing deposits/Total Assets***	*-0.012*	*0.000*
Average total assets/ Total Assets	*0.003*	*0.000*	***Assets per employee ($millions)***	*-0.085*	*0.000*	***Efficiency ratio (%)***	*0.000*	*0.000*
Total interest expense/ Total interest income	*-0.001*	*0.000*	***Real Effective Exchange Rates for USA %***	*0.024*	*0.0032*	***Total noninterest income/ Total interest income***	*-0.004*	*0.000*
Loan and leases loss allowance/ Total Assets	*-0.114*	*0.000*				***Net income/ Total interest income***	*0.004*	*0.000*
Additional Noninterest Income/ Total interest income	*0.002*	*0.000*				***Total interest income***	*-0.191*	*0.000*

				Tier 1 risk-based capital ratio (%)	*-0.012*	*0.000*
				Assets per employee ($millions)	*0.009*	*0.000*
				Total assets	*0.157*	*0.000*
				Additional Noninterest Income/ Total interest income	*0.004*	*0.000*
				Total domestic deposits to total assets (%)	*-0.010*	*0.000*
R-squared	*0.900963*	***R-squared***	*0.893929*	***R-squared***	*0.845956*	
S.E. of regression	*0.290865*	***S.E. of regression***	*2.848908*	***S.E. of regression***	*0.360333*	

Durbin-Watson stat	*1.274333*	***Durbin-Watson stat***	*1.25336 0*	***Durbin-Watson stat***	*1.1828 45*

Note 13: Sample of the 118 US Banks by total assets. The stepwise forward method is presented in the table. The first column shows all independent variables which have been selected and evaluated by p-value<0.01. Also, presented the coefficients and p-value of each independent variable and the constant of each model ROA-ROE-NIM). The R-squared, Standard deviation (S.E) of regression and Durbin-Watson stat show in the last rows of the table.

Appendix 13: Coefficient estimations outputs for ROA-ROE-NIM Model Parameters for the total sample with N=30, T=21

Stepwise forward p-value=0.01								
Sample of 30 Smallest US Banks								
ROA			**ROE**			**NIM**		
Variable	**Coefficient**	**Prob**	**Variable**	**Coefficient**	**Prob**	**Variable**	**Coefficient**	**Prob**
C	0.828	0.000	**c**	5.374	0.033	**C**	1.32	0.000
Net income/ Total interest income	0.053	0.000	**Net income/ Total interest income**	0.422	0.000	**Yield on earning assets (%)**	0.714	0.000
Yield on earning assets (%)	0.103	0.000	**Yield on earning assets (%)**	0.721	0.000	**Total interest expense/ Total interest income**	-0.056	0.000

Efficiency ratio (%)	-0.007	0.000	**Tier one (core) capital/ Total Assets**	-0.774	0.000	**Total deposits/ Total Assets**	0.071	0.000
Pre-tax net operating income/ Total interest income	-0.009	0.000	**Net operating income to assets (%)**	3.072	0.000	**U- 3 US Unemployment Rate Total in Labor %**	0.037	0.000
Total assets	-0.076	0.000	**Assets per employee ($millions)**	-0.813	0.000	**GDP CQOQ Index**	0.023	0.000
Total noninterest income/ Total interest income	0.002	0.000	**Interest-bearing deposits/Total Assets**	0.093	0.000	**Total domestic deposits to total assets (%)**	-0.075	0.000

Net loans and leases to deposits (%)	0.001	0.000	**Total noninterest income/ Total interest income**	-0.032	0.000	**Equity capital to assets (%)**	0.009	0.001
			Total deposits/ Total Assets	-2.802	0.000			
			Total domestic deposits to total assets (%)	2.726	0.000			
R-squared	0.956255		**R-squared**	0.893929		**R-squared**	0.945832	
S.E. of regression	0.163349		**S.E. of regression**	2.848908		**S.E. of regression**	0.174696	
Durbin-Watson stat	0.935748		**Durbin-Watson stat**	1.253360		**Durbin-Watson stat**	0.819755	

Note 14: Sample of the 30 smallest US Banks by total assets. The stepwise forward method is presented in the table. The first column shows all independent variables which have been selected and evaluated by p-value<0.01. Also, presented the coefficients and p-value of each independent variable and the constant of each model ROA-ROE-NIM). The R-squared, Standard deviation (S.E) of regression and Durbin-Watson stat show in the last rows of the table.

Appendix 14: Regression results for model Return on Assets-ROA (Pooled, Fixed Effected, and Random Effected)

Total sample, N=148, T=21

Dependent Variable ROA

		Without Dummies			With Dummies		
	Variables Total Sample N=148	OLS Pooled ROA	OLS (Fixed Effect) ROA	OLS (Random Effect) ROA	OLS Pooled ROA	OLS (Fixed Effect) ROA	OLS (Random Effect) ROA
	Constant	−1.90351 (1.30708)	-0.173869 (0.988421)	-1.044665 (1.09033)	−1.88434 (1.31812)	−0.293899 (0.996391)	-1.03945 (1.09191)
1	**Total assets**	0.141288 (0.144518)	0.0369375 (0.0972563)	0. 0912306 (0.115864)	0.144296 (0.145689)	0.0509556 (0.101028)	0.0967114 (0.117932)
2	**Loan and leases loss allowance/ Total Assets**	NA	NA	NA	NA	NA	NA
3	**Total deposits/ Total Assets**	NA	NA	NA	NA	NA	NA
4	**Interest-bearing deposits/Total Assets**	0.00119269 (0.00173505)	0.00156972 (0.00266651)	0.00163725 (0.00159415)	0.00112655 (0.00175320)	0.00151003 (0.00264317)	0.00149877 (0.00147396)
5	**Average total assets/ Total Assets**	0.00222054 (0.00345177)	0.00179905 (0.00367549)	0.00172652 (0.00351940)	0.00224861 (0.00343311)	0.00188323 (0.00365197)	0.00177684 (0.00349416)
6	**Tier one (core) capital/ Total Assets**	0.0372066 (0.0118310)	0.000138080 (0.0226362)	0.0176392 (0.0132305)	0.0373187	0.000842513 (0.0228280)	0.0179248 (0.0134198)

					(0.0119131) ***		
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
8	**Total interest income**	−0.132619 (0.138936) ***	−0.0598352 (0.0820064)	−0.0913530 (0.109727)	−0.135365 (0.140243)	−0.0629183 (0.0838366)	−0.0952805 (0.111935)
9	**Total interest expense/ Total interest income**	−0.00211132 (0.00182641)	-0.00195436 (0.00197940)	−0.00221943 (0.00207764)	−0.00227967 (0.00192930)	−0.00221050 (0.00218866)	−0.00246410 (0.00226108)
10	**Total noninterest income/ Total interest income**	−0.00482923 (0.000727034) ***	−0.00694830 (0.00190094) ***	−0.00618189 (0.001114477) ***	−0.00485519 (0.000729322) ***	−0.00699938 (0.00189517) ***	0.00622883 (0.00110888) ***
11	**Additional Noninterest Income/ Total interest income**	0.00359567 (0.000735489) ***	0.00586864 (0.00193914) ***	0.00502037 (0.0.00114419) ***	0.00362710 (0.000741194) ***	0.00593762 (0.00193550) ***	0.00507693 (0.00114064) ***
12	**Pre-tax net operating income/ Total interest income**	−0.00451189 (0.00108274) ***	−0.00373877 (0.00110422) ***	−0.00408156 (0.00105842) ***	−0.00452620 (0.00107894) ***	−0.00378952 (0.00107952) ***	-0.00410792 (0.00104242) ***
13	**Net income/ Total interest income**	0.0487526 (0.00250929) ***	0.0467534 (0.00243437) ***	0.0474056 (0.00249109) ***	0.0486737 (0.00255344) ***	0.0465540 (0.00247210) ***	0.0472472 (0.00253324) ***

14	**Yield on earning assets (%)**	0.236884 (0.0647468) ***	0.163972 (0.0404462) ***	0.199220 (0.0579005) ***	0.235355 (0.0655484) ***	0.161297 (0.0403398) ***	0.196365 (0.0583694) ***
15	**Net operating income to assets (%)**	0.0552357 (0.0316043) *	0.0325516 (0.0200744)	0.0412807 (0.0251731)	0.0553387 (0.0317245) *	0.0330746 (0.0204441)	0.0415257 (0.0253367)
16	**Efficiency ratio (%)**	−0.00149677 (0.000618149) **	−0.00173615 (0.000518872) ***	−0.00166871 (0.00052510) ***	−0.00150742 (000622931) **	−0.00174287 (0.000521162) ***	-0.00168357 (0.00036872) ***
17	**Assets per employee ($millions)**	NA	NA	NA	NA	NA	NA
18	**Net loans and leases to total assets (%)**	NA	NA	NA	NA	NA	NA
19	**Net loans and leases to deposits (%)**	NA	NA	NA	NA	NA	NA
20	**Total domestic deposits to total assets (%)**	−0.00252852 (0.00165006)	−0.00521372 (0.00302820) *	−0.00440540 (0.00204075) **	−0.00249383 (0.00164968)	−0.00506062 (0.00305225) *	−0.00421190 (0.00202559) **
21	**Equity capital to assets (%)**	NA	NA	NA	NA	NA	NA
22	**Leverage (core capital) ratio (%)**	−0.0199903 (0.0114195) *	−0.0181252 (0.0114651)	−0.0173884 (0.0111806)	−0.0199275 (0.0114811) *	−0.0180107 (0.0116186)	−0.0172852 (0.0113301)

23	**Tier 1 risk-based capital ratio (%)**	NA	NA	NA	NA	NA	NA
25	**3-Month London Interbank Offered Rate (LIBOR) %**	−0.0198605 (0.0126196)	−0.00398918 (0.00689627)	−0.0106926 (0.0105517)	−0.0238441 (0.0105524) **	−0.00977775 (0.00614467)	−0.0163355 (0.00922496) *
26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA
27	**Real Effective Exchange Rates for USA %**	NA	NA	NA	NA	NA	NA
28	**U- 3 US Unemployment Rate Total in Labor %**	0.0157369 (0.00909073) *	0.00627093 (0.00553436)	0.0106620 (0.00846047)	0.00793011 (0.00527637)	0.00793011 (0.00527637)	0.0125940 (0.00803860)
29	**GDP CQOQ Index**	NA	NA	NA	NA	NA	NA
30	**Exchange rates news (%)**	NA	NA	NA	NA	NA	NA
	Financial Crises	NA	NA	NA	−0.0609057 (0.0311816) *	−0.0609057 (0.0311816) *	-0.0553787 (0.0280479) **
	S.E. of regression	0.285294	0.244622	0.294224	0.285156	0.244107	0.294221
	R-squared	0.898905	0.929211	NA	0.899035	0.929533	NA
	Mean dependent var	0.811159	0.811159	0.811159	0.811159	0.811159	0.811159
	S.D. dependent var	0.894821	0.894821	0.894821	0.894821	0.894821	0.894821

Hausman test	NA	NA	62.0635 [2.34183e-007]	NA	NA	62.4423 [2.01889e-007]
F statistic	(17, 147) 219.8468	(17, 147) 107.547	NA	(18, 147) 225.1386	(18, 147) 141.496	NA
P-value (F)	2.46e-95	7.1171e-074	NA	2.51e-97	3.17681e-083	NA
Durbin-Watson stat	1.079303	1.422951	1.422951	1.081350	1.429232	1.429232

Note 15: Dependent variable is Return on Assets (ROA). The first column presents the coefficients and the standard error for each independent variable (in total 30), applying the Pool model, OLS Fixed Effect model, and Random Effect Model. An independent variable, dummy, the financial crisis has been creating by adding further information to the models. Also, an independent variable was subtracted from the total of 30, because it caused a high correlation. ****Correlation is significant at the 0.01 level, ** Correlation is significant at the 0.05 level, *Correlation is significant at the 0.01 level.*

Appendix 15: Regression results for model Return on Equity-ROE (Pooled, Fixed Effected, and Random Effected)

Total sample, N=148, T=21

Dependent Variable ROE

		Without Dummies			With Dummies		
	Variables Total Sample N=148	OLS Pooled ROE	OLS (Fixed Effect) ROE	OLS (Random Effect) ROE	OLS Pooled ROE	OLS (Fixed Effect) ROE	OLS (Random Effect) ROE
	Constant	2.26546 (3.40646)	7.51706 (5.04507)	5.71212 (3.71238)	2.82604 (3.43120)	8.72776 (4.96451) *	6.57913 (3.71498) *
1	**Total assets**	NA	NA	NA	NA	NA	NA
2	**Loan and leases loss allowance/ Total Assets**	NA	NA	NA	NA	NA	NA
3	**Total deposits/ Total Assets**	NA	NA	NA	NA	NA	NA
4	**Interest-bearing deposits/Total Assets**	NA	NA	NA	NA	NA	NA
5	**Average total assets/ Total Assets**	NA	NA	NA	NA	NA	NA
6	**Tier one (core) capital/ Total Assets**	−0.443508 (0.127711) ***	−0.587424 (0.134357) ***	-0.520229 (0.117305) ***	-0.425368 (0.128210) ***	-0. 568711 (0.138447) ***	−0.500492 (0.118852) ***

7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
8	**Total interest income**	NA	NA	NA	NA	NA	NA
9	**Total interest expense/ Total interest income**	NA	NA	NA	NA	NA	NA
10	**Total noninterest income/ Total interest income**	−0.0380221 (0.0128838) ***	−0.0748389 (0.0125537) ***	−0.0565528 (0.0119989) ***	-0.0382240 (0.0128676) ***	−0.0744737 (0.0125020) ***	−0.0566951 (0.0119716) ***
11	**Additional Noninterest Income/ Total interest income**	0.0305119 (0.0118020) **	0.0651385 (0.0121136) ***	0.0476731 (0.0108634) ***	0.0309990 (0.0117336) ***	0.0650516 (0.0120279) ***	0.0481156 (0.0107620) ***
12	**Pre-tax net operating income/ Total interest income**	-0.0425049 (0.0197705) **	−0.340988 (0.0246111)	−0.037903 (0.0223395) *	-0.0422946 (0.0195527) **	−0.0339958 (0.0240443)	−0.0376075 (0.0219523) *
13	**Net income/ Total interest income**	0. 428417 (0.0338569) ***	0.399306 (0.0369742) ***	0.410191 (0.0356515) ***	0.427681 (0.0337116) ***	0.396743 (0.0364682) ***	0.408387 (0.0353761) ***
14	**Yield on earning assets (%)**	1.38994 (0.112104) ***	1.25211 (0.118090) ***	1.32352 (0.119453) ***	1.26914 (0.154825) ***	1.02975 (0.165254) ***	1.14756 (0.170757) ***

15	**Net operating income to assets (%)**	0.303149 (0.143887) **	0.272062 (0.141280) *	0.272976 (0.133229) **	0.297288 (0.147189) **	0.246360 (0.1409460) *	0.257105 (0.135489) *
16	**Efficiency ratio (%)**	-0.0190022 (0.00905307) **	−0.0186777 (0.0106192) *	−0.0189096 (0.00987507) *	-0.0189972 (0.00905811) **	-0.0191162 (0.0105561) *	-0.0191397 (0.00985053) *
17	**Assets per employee ($millions)**	−0.0763321 (0.0428639) *	−0.121739 (0.0698370) *	−0.0945076 (0.0539552) *	−0.0735586 (0.0434137) *	−0.113082 (0.0694328)	−0.0887602 (0.0544264)
18	**Net loans and leases to total assets (%)**	−0.0328851 (0.0703536)	-0.00570956 (0.0808900)	−0.0158304 (0.0715299)	−0.0326203 (0.0704300)	0.000491385 (0.0799339)	−0.0130357 (0.0713659)
19	**Net loans and leases to deposits (%)**	0.0308089 (0.0527138)	0.0110127 (0.0596709)	0.0160882 (0.0529542)	0.0320690 (0.0527426)	0.0101138 (0.0591338)	0.0166645 (0.0528872)
20	**Total domestic deposits to total assets (%)**	-0.0135719 (0.0421981)	−0.0499008 (0.0654862)	−0.0405946 (0.0461877)	−0.0108966 (0.0418529)	-0.0480899 (0.0653193) **	−0.0378402 (0.0460565)
21	**Equity capital to assets (%)**	−0.240047 (0.131642) *	-0.141204 (0.0905195)	−0.176899 (0.107004) *	−0.238288 (0.130878) *	−0.139918 (0.0903728)	−0.175010 (0.106298) *
22	**Leverage (core capital) ratio (%)**	NA	NA	NA	NA	NA	NA
23	**Tier 1 risk-based capital ratio (%)**	0.0777045 (0.0471725)	0.0452584 (0.0561835)	0.0602863 (0.0471869)	0.0696566 (0.0478313)	0.0364237 (0.0551883)	0.0512642 (0.0467726)

25	**3-Month London Interbank Offered Rate (LIBOR) %**	NA	NA	NA	NA	NA	NA
26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA
27	**Real Effective Exchange Rates for USA %**	NA	NA	NA	NA	NA	NA
28	**U- 3 US Unemployment Rate Total in Labor %**	NA	NA	NA	NA	NA	NA
29	**GDP CQOQ Index**	NA	NA	NA	NA	NA	NA
30	**Exchange rates news (%)**	NA	NA	NA	NA	NA	NA
	Financial Crises	NA	NA	NA	−0.563935 (0.301804) *	-1.49097 (0.0529980) ***	−0.729910 (0.331392) **
	S.E. of regression	3.533155	3.200851	3.565735	3.528356	3.189379	3.564039
	obs	3108	3108	3108			
	R-squared	0.803427	0.846333	NA	0.804025	0.847484	NA
	Mean dependent var	7.809711	7.809711	7.809711	7.809711	7.809711	7.809711
	S.D. dependent var	7.950978	7.950978	7.950978	7.950978	7.950978	7.950978
	Hausman test	NA	NA	100.843 [3.26906e-015]	NA	NA	105.757 [3.70378e-016]
	F statistic	(14, 147)	(14, 147)	NA	(15, 147)	(15, 147)	NA

	121.3263	51.9443		156.1132	53.999	
P-value (F)	3.05e-73	1.19411e-049	NA	3.33e-82	5.44264e-052	NA
Durbin-Watson stat	1.028922	1.272408	1.272408	1.028701	1.273846	1.273846

Note 16: Dependent variable is Return on Equity (ROE). The first column presents the coefficients and the standard error for each independent variable (in total 30), applying the Pool model, OLS Fixed Effect model, and Random Effect Model. An independent variable, dummy, the financial crises has been creating by adding further information to the models. Also, an independent variable was subtracted from the total of 30, because it caused a high correlation ****Correlation is significant at the 0.01 level, ** Correlation is significant at the 0.05 level, *Correlation is significant at the 0.01 level.*

Appendix 16: Regression results for model Net Interest Margin-NIM (Pooled, Fixed Effected, and Random Effected)

Total sample, N=148, T=21

Dependent Variable NIM

		Without Dummies			With Dummies		
	Variables Total Sample N=148	OLS Pooled NIM	OLS (Fixed Effect) NIM	OLS (Random Effect) NIM	OLS Pooled NIM	OLS (Fixed Effect) NIM	OLS (Random Effect) NIM
	Constant	−2.58771 (1.11733) **	−1.13203 (0.813075)	−1.34411 (0.735501) *	−2.67839 (1.07027) **	−1.05057 (0.803140)	−1.33554 (0.725452) *
1	**Total assets**	0.0778200 (0.0711147)	-0.0131536 (0.0537317)	−0.0194500 (0.0464529)	0.0607179 (0.0676090)	-2.0238520 (0.0539427)	−0.0280179 (0.0457505)
2	**Loan and leases loss allowance/ Total Assets**	0.292052 (0.0481545) ***	0.282805 (0.0398748) ***	0.298770 (0.0408211) ***	0.280073 (0.0473465) ***	0.278526 (0.0396759) ***	0.292501 (0.0406629) ***
3	**Total deposits/ Total Assets**	0.0351647 (0.00681748) ***	0.0262343 (0.00611640) ***	0.0275021 (0.00628356) ***	0.0333652 (0.00666977) ***	0.0253510 (0.00599452) ***	0.0263239 (0.00619553) ***
4	**Interest-bearing deposits/Total Assets**	−0.0319982 (0.00355267) ***	-0.0141828 (0.00310914) ***	−0.0191796 (0.00303740) ***	−0.0307913 (0.00338807) ***	−0.0138064 (0.00297125) ***	−0.0184914 (0.00284088) ***

5	**Average total assets/ Total Assets**	NA	NA	NA	NA	NA	NA
6	**Tier one (core) capital/ Total Assets**	0.00989244 (0.0145184)	0.00886225 (0.0189219)	0.00909250 (0.0151545)	0.00743596 (0.0140446)	0.00783406 (0.0187481)	0.00756909 (0.0149046)
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
8	**Total interest income**	-0.0964364 (0.0668064)	0.00871223 (0.0397896)	−0.0189266 (0.0410560)	−0.0797072 (0.060435)	0.0102836 (0.0395234)	−0.0135370 (0.0405827)
9	**Total interest expense/ Total interest income**	NA	NA	NA	NA	NA	NA
10	**Total noninterest income/ Total interest income**	−0.00378427 (0.00112380) ***	−0.000506107 (0.00112502)	−0.00172916 (0.000884897) *	−0.00365576 (0.00109776) ***	−0.000473326 (0.00113556) **	−0.00166315 (0.000894143) *
11	**Additional Noninterest Income/ Total interest income**	0.00244258 (0.00104286) **	−0.000629225 (0.00110199)	0.000466675 (0.000854058)	0.00228311 (0.00101844) **	−0.000658579 (0.00111337)	0.000405946 (0.000863447)
12	**Pre-tax net operating income/ Total interest income**	NA	NA	NA	NA	NA	NA
13	**Net income/ Total interest income**	0.00736272 (0.00212312) ***	0.00704599 (0.00143228) ***	0.00735684 (0.00156445) ***	0.00752739 (0.00215875) ***	0.00714324 (0.00147075) ***	0.00748194 (0.00160796) ***

14	**Yield on earning assets (%)**	0.544676 (0.0552851) ***	0.376638 (0.0327523) ***	0.418068 (0.0419769) ***	0.557189 (0.0544406) ***	0.381669 (0.0332788) ***	0.425865 (0.0426671) ***
15	**Net operating income to assets (%)**	0.0645782 (0.0197966) ***	0.0428110 (0.0120247) ***	0.0498826 (0.0141472) ***	0.0646385 (0.0205361) ***	0.0433382 (0.0122756) ***	0.0505080 (0.0146204) ***
16	**Efficiency ratio (%)**	NA	NA	NA	NA	NA	NA
17	**Assets per employee ($millions)**	−0.0217593 (0.00548626) ***	−0.0173220 (0.00458088) ***	−0.0170735 (0.00493615) ***	−0.0230873 (0.00556446) ***	−0.0176720 (0.00470111) ***	−0.0179522 (0.00505266) ***
18	**Net loans and leases to total assets (%)**	0.0108637 (0.00426541) **	0.0162995 (0.00541240) ***	0.0136795 (0.00473985) ***	0.0104339 (0.00421176) **	0.0159878 (0.00542061) ***	0.0133610 (0.00475982) ***
19	**Net loans and leases to deposits (%)**	−0.00535468 (0.00299448) *	-0.00705468 (0.00432463)	−0.00548423 (0.00358458)	−0.00557954 (0.00294970) *	−0.00709210 (0.00432044)	−0.00564234 (0.00359465)
20	**Total domestic deposits to total assets (%)**	0.00114906 (0.00443914)	−0.00790097 (0.00379333) **	−0.00252875 (0.00442037)	0.00116797 (0.00438948)	−0.00769247 (0.00384529) **	−0.00264960 (0.00443751)
21	**Equity capital to assets (%)**	NA	NA	NA	NA	NA	NA

22	**Leverage (core capital) ratio (%)**	0.0313239 (0.0132919) **	0.0146482 (0.0135313)	0.0185543 (0.0138719)	0.0321665 (0.0129172) **	0.0148638 (0.0133898)	0.0189963 (0.0135912)
23	**Tier 1 risk-based capital ratio (%)**	NA	NA	NA	NA	NA	NA
25	**3-Month London Interbank Offered Rate (LIBOR) %**	-0.164248 (0.0176296) ***	−0.113715 (0.0102955) ***	−0.127503 (0.0133628) ***	−0.145737 (0.0158890) ***	−0.109126 (0.00959206) ***	−0.119455 (0.0120670) ***
26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA
27	**Real Effective Exchange Rates for USA %**	0.00980853 (0.00348568) ***	0.00873069 (0.00141079) ***	0.00956132 (0.00177467) ***	0.0107861 (0.00329008) ***	0.00911265 (0.00142921) ***	0.0101029 (0.00177801) ***
28	**U- 3 US Unemployment Rate Total in Labor %**	0.103432 (0.0220075) ***	0.0736386 (0.00926984) ***	0.0854545 (0.0123669) ***	0.0996170 (0.0212326) ***	0.0734920 (0.00915415) ***	0.0843319 (0.0119998) ***
29	**GDP CQOQ Index**	NA	NA	NA	NA	NA	NA
30	**Exchange rates news (%)**	NA	NA	NA	NA	NA	NA
	Financial Crises	NA	NA	NA	0.176029 (0.0474338) ***	0.0532725 (0.0336417)	0.0849693 (0.0356507) **

S.E. of regression	0.450848	0.3401778	0.479465	0.448363	0.340551	0.477130
obs	2478	2478	2478	2478	2478	2478
R-squared	0.758969	0.868848	NA	0.761697	0.869068	NA
Mean dependent var	3.617411	3.617411	3.617411	3.617411	3.617411	3.617411
S.D. dependent var	0.915508	0.915508	0.915508	0.915508	0.915508	0.915508
Hausman test	NA	NA	447.618 [1.96131e-084]	NA	NA	440.178 [7.14283e-083]
F statistic	(19, 147) 220.5895	(19, 147) 56.8788	NA	(20, 147) 213.9043	(20, 147) 57.4485	NA
P-value (F)	7.02e-98	6.33631e-058	NA	4.83e-98	3.55005e-059	NA
Durbin-Watson stat	0.686605	0.997522	0.997522	0.684793	0.995483	0.995483

*Note 17: Dependent variable is Net Interest Margin (NIM). The first column presents the coefficients and the standard error for each independent variable, applying the Pool model, OLS Fixed Effect model, and Random Effect Model. An independent variable, dummy, the financial crises has been creating by adding further information to the models. Also, an independent variable was subtracted from the total of 30, because it caused a high correlation. ***Correlation is significant at the 0.01 level, ** Correlation is significant at the 0.05 level, *Correlation is significant at the 0.1 level.*

Appendix 17: Regression results for model Return on Assets in the sample of the largest banks, N=118 (Pooled, Fixed Effected, and Random Effected)

LARGEST US BANKS, N =118, T=21

DEPENDENT VARIABLE ROA

		Without Dummies			With Dummies		
	Variables Total Sample N=148	**OLS Pooled ROA**	**OLS (Fixed Effect) ROA**	**OLS (Random Effect) ROA**	**OLS Pooled ROA**	**OLS (Fixed Effect) ROA**	**OLS (Random Effect) ROA**
	Constant	−2.83470 (1.51132) *	−1.87274 (1.29644)	−2.37139 (1.38782) *	−2.77958 (1.52467) *	-1.95244 (1.30154)	−2.30801 (1.39762) *
1	**Total assets**	0.254737 (0.225748)	0.178099 (0.168028)	0.219009 (0.201583)	0.260286 (0.229638)	0.196667 (0.174662)	0.226270 (0.206383)
2	**Loan and leases loss allowance/ Total Assets**	−0.108296 (0.0641441) *	−0.104727 (0.0548442) *	−0.110966 (0.0635147) *	−0.104371 (0.0650564)	−0.0954640 (0.0542668) *	−0.105016 (0.0640844)
3	**Total deposits/ Total Assets**	NA	NA	NA	NA	NA	NA
4	**Interest-bearing deposits/Total Assets**	NA	NA	NA	NA	NA	NA
5	**Average total assets/ Total Assets**	0.00389115 (0.00491962)	0.00329903 (0.00496186)	0.00338567 (0.00502938)	0.00391067 (0.00491345)	0.00336583 (0.00494779)	0.00341333 (0.00502029)
6	**Tier one (core) capital/ Total Assets**	0.0447774 (0.0124783) ***	0.0173681 (0.0238045)	0.0334471 (0.0151017) **	0.0450631	0.0180032 (0.0240209)	0.0338221 (0.0153089) **

					(0.0125716) ***		
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
8	**Total interest income**	−0.231491 (0.222995)	−0.150371 (0.159389)	−0.196251 (0.198184)	−0.236745 (0.226942)	−0.157029 (0.164696)	-0.202460 (0.203002)
9	**Total interest expense/ Total interest income**	−0.00193398 (0.00204092)	−0.00136767 (0.00225285)	-0.00185129 (0.00240753)	−0.00212711 (0.00214249)	−0.00166876 (0.00247845)	−0.00210888 (0.00256898)
10	**Total noninterest income/ Total interest income**	−0.00428900 (0.000834111) ***	−0.00693201 (0.00194499) ***	−0.00545960 (0.00102967) ***	−0.00431716 (0.000839837) ***	-0.00692368 (0.00193542) ***	−0.00550923 (0.00103290) ***
11	**Additional Noninterest Income/ Total interest income**	0.00301358 (0.000801318) ***	0.00579722 (0.00195906) ***	0.00424144 (0.00101340) ****	0.00305327 (0.000811248) ***	0.00581169 (0.00195057) ***	0.00430680 (0.00101938) ***
12	**Pre-tax net operating income/ Total interest income**	−0.00530814 (0.00251994) **	−0.00398053 (0.00189420) **	−0.00458434 (0.00221820) **	−0.00532943 (0.00252442) **	-0.00406397 (0.00188157) **	−0.00460044 (0.00222037) **
13	**Net income/ Total interest income**	0.0462304 (0.00258661) ***	0.0441683 (0.00259943) ***	0.0449770 (0.00263784) ***	0.0461163 (0.00262508) ***	0.0439411 (0.0026221) ***	0.0447945 (0.00267942) ***
14	**Yield on earning assets (%)**	0.272889	0.202245	0.243276	0.270574	0.198355	0.239607

		(0.0750847) ***	(0.0501805) ***	(0.0718092) ***	(0.0757812) ***	(0.0500070) ***	(0.0723882) ***
15	**Net operating income to assets (%)**	0.135011 (0.0589946) **	0.103465 (0.0443857) **	0.118798 (0.0529578) **	0.135861 (0.0591305) **	0.105547 (0.0443711) **	0.119763 (0.0531003) **
16	**Efficiency ratio (%)**	NA	NA	NA	NA	NA	NA
17	**Assets per employee ($millions)**	NA	NA	NA	NA	NA	NA
18	**Net loans and leases to total assets (%)**	NA	NA	NA	NA	NA	NA
19	**Net loans and leases to deposits (%)**	NA	NA	NA	NA	NA	NA
20	**Total domestic deposits to total assets (%)**	NA	NA	NA	NA	NA	NA
21	**Equity capital to assets (%)**	NA	NA	NA	NA	NA	NA
22	**Leverage (core capital) ratio (%)**	−0.0270265 (0.0125832) **	-0.0285804 (0.0141831) **	−0.0266818 (0.0134502) **	−0.0270501 (0.0126722) **	−0.0285253 (0.0143251) **	−0.0267365 (0.0135964) **
23	**Tier 1 risk-based capital ratio (%)**	NA	NA	NA	NA	NA	NA

24	**Total risk-based capital ratio (%)**	NA	NA	NA	NA	NA	NA
25	**3-Month London Interbank Offered Rate (LIBOR) %**	NA	NA	NA	NA	NA	NA
26	**5-Year Treasury Constant Maturity Rate %**	−0.0419099 (0.0220479) *	-0.0188709 (0.0112129) *	−0.0315742 (0.0197447)	−0.0546227 (0.0187451) ***	−0.0357945 (0.0111974) ***	−0.0466049 (0.0173740) ***
27	**Real Effective Exchange Rates for USA %**	NA	NA	NA	NA	NA	NA
28	**U- 3 US Unemployment Rate Total in Labor %**	0.0148878 (0.00768735) *	0.00598141 (0.00502982)	0.0113584 (0.00760574)	0.0159088 (0.00742488) **	0.00680106 (0.00494858)	0.0124537 (0.00741019) *
29	**GDP CQOQ Index**	NA	NA	NA	NA	NA	NA
30	**Exchange rates news (%)**	NA	NA	NA	NA	NA	NA
	Financial Crises	NA	NA	NA	−0.0626978 (0.0369773) *	-0.0942451 (0.0384212) **	-0.0776557 (0.0366062) **
	S.E. of regression	0.291698	0.258313	0. 297505	0.291343	0.257324	0.297345
	R-squared	0.900395	0.925601	NA	0.900677	0.926202	NA
	Mean dependent var	0.832353	0.832353	0.832353	0.832353	0.832353	0.832353
	S.D. dependent var	0.921453	0.921453	0.921453	0.921453	0.921453	0.921453

Hausman test	NA	NA	126.791 [2.91814e-020]	NA	NA	506.34 [3.96773e-112]
F statistic	(15, 117) 172.6653	(15, 117) 218.17	NA	(16, 117) 176.3579	(16, 117) 205.459	NA
P-value (F)	2.85e-72	5.84283e-078	NA	7.04e-74	1.34144e-077	NA
Durbin-Watson stat	1.154507	1.428425	1.428425	1.157758	1.432988	1.432988

Note 18: The sample of the 118 largest US Banks. See note 2. An independent variable, dummy, the financial crises has been creating by adding further information to the models. Also, an independent variable was subtracted from the total of 30, because it caused a high correlation.

Appendix 18: Regression results for model Return on Equity in the sample of the largest banks, N=118 (Pooled, Fixed Effected, and Random Effected)

The Largest Banks, N=118, T=21

Dependent Variable ROE

		Without Dummies			**With dummies**		
	Variables	OLS Pooled ROE	OLS (Fixed Effect) ROE	OLS (Random Effect) ROE	OLS Pooled ROE	OLS (Fixed Effect) ROE	OLS (Random Effect) ROE
	Constant	3.48052 (3.05682)	7.40839 (2.40606) ***	5.37751 (2.67297) **	4.56951 (2.98267)	9.21669 (2.41403) ***	6.86565 (2.80031) **
1	**Total assets**	NA	NA	NA	NA	NA	NA
2	**Loan and leases loss allowance/ Total Assets**	NA	NA	NA	NA	NA	NA
3	**Total deposits/ Total Assets**	NA	NA	NA	NA	NA	NA
4	**Interest-bearing deposits/Total Assets**	NA	NA	NA	NA	NA	NA
5	**Average total assets/ Total Assets**	NA	NA	NA	NA	NA	NA

6	**Tier one (core) capital/ Total Assets**	-0.432570 (0.116147) ***	−0.585045 (0.143398) ***	−0.505864 (0.110869)	−0.416032 (0.119019) ***	-0. 561707 (0.149359) ***	−0.483597 (0.115317) ***
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
8	**Total interest income**	NA	NA	NA	NA	NA	NA
9	**Total interest expense/ Total interest income**	NA	NA	NA	NA	NA	NA
10	**Total noninterest income/ Total interest income**	−0.0405661 (0.0101744) ***	−0.0758336 (0.00943629) ***	−0.0549983 (0.00850360) ***	−0.0412566 (0.0101191) ***	-0. 0758603 (0.00948970) ***	−0.0556604 (0.00848867) ***
11	**Additional Noninterest Income/ Total interest income**	0.0351353 (0.00843757) ***	0.0672981 (0.00881810) ***	0.0478180 (0.00715753) ***	0.0360006 (0.00836085) ***	0. 0675242 (0.00888173) ***	0.0486901 (00718344) ***
12	**Pre-tax net operating income/ Total interest income**	−0.0498506 (0.0201253) **	−0.0406890 (0.0237869) *	−0.0454536 (0.0217609) **	−0.0493482 (0.0202626) **	-0. 0399647 (0.0236686) *	-0.0447706 (0.0218135) **
13	**Net income/ Total interest income**	0.398346 (0.0332081) ***	0.372888 (0.0351218) ***	0.384110 (0.0340423) ***	0.397882 (0.0333690) ***	0. 371005 (0.0349039) ***	0.382891 (0.0341056) ***
14	**Yield on earning assets (%)**	1.28159 (0.15711) ***	1.05045 (0.144781) ***	1.17144 (0.155012) ***	1.20419 (0.204963) ***	0.881807 (0.187511) ***	1.04650 (0.210560) ***

15	**Net operating income to assets (%)**	0.545023 (0.355706)	0.508422 (0.320630)	0.507719 (0.333964)	0.542359 (0.363423)	0. 490349 (0.325572)	0.497861 (0.341212)
16	**Efficiency ratio (%)**	−0.0167675 (0.00958249) *	−0.0168174 (0.0107286)	−0.0171357 (0.0100267)	−0.0165575 (0.00972218) *	-0. 0167455 (0.0107870)	-0.0169683 (0.0101368)
17	**Assets per employee ($millions)**	−0.0850454 (0.0416708) **	−0.149052 (0.0687649) **	−0.109149 (0.0504127)	−0.0822029 (0.0419601) *	-0. 140551 (0.0682951) **	−0.103718 (0.0502249) **
18	**Net loans and leases to total assets (%)**	NA	NA		NA	NA	NA
19	**Net loans and leases to deposits (%)**	NA	NA		NA	NA	NA
20	**Total domestic deposits to total assets (%)**	−0.0447830 (0.0252391) *	−0.0620248 (0.0272701) **	−0.0568964 (0.0237481) **	−0.0440074 (0.0253926) *	-0. 0585071 (0.0272191) **	−0.0549991 (0.0236483) **
21	**Equity capital to assets (%)**	−0.243788 (0.132978) *	−0.147955 (0.0938452)	−0.189364 (0.112831) *	−0.241840 (0.132716) *	-0.145453 (0.0933571)	−0.186697 (0.112135) *
22	**Leverage (core capital) ratio (%)**	NA	NA	NA	NA	NA	NA
23	**Tier 1 risk-based capital ratio (%)**	0.0744697 (0.0367137) **	0.0284154 (0.0477924)	0.0572610 (0.0380261)	0.0668187 (0.0395278) *	0.0148954 (0.0475960)	0.0459944 (0.0389642)
24	**Total risk-based capital ratio (%)**	NA	NA	NA	NA	NA	NA

25	**3-Month London Interbank Offered Rate (LIBOR) %**	NA	NA	NA	NA	NA	NA
26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA
27	**Real Effective Exchange Rates for USA %**	0.0240588 (0.0103480) **	0.0321106 (0.0107710) ***	0.0290243 (0.0103882) ***	0.0186272 (0.00868047) **	0.0246321 (0.00919271) ***	0.0223770 (0.00882301) **
28	**U- 3 US Unemployment Rate Total in Labor %**	NA	NA	NA	NA	NA	NA
29	**GDP CQOQ Index**	NA	NA	NA	NA	NA	NA
30	**Exchange rates news (%)**	NA	NA	NA	NA	NA	NA
	Financial Crises	NA	NA	NA	−0.424200 (0.387930)	−0.760185 (0.354527) **	−0.604562 (0.366703) *
	S.E. of regression	3.477129	3.186135	3.507738	3.475070	3.178383	3.507549
	obs	2478	2478	2478	2478	2478	2478
	R-squared	0.799855	0.839933	NA	0.800173	0.840778	NA
	Mean dependent var	7.913380	7.913380	7.913380	7.913380	7.913380	7.913380

S.D. dependent var	7.751865	7.751865	7. 751865	7.751865	7.751865	7.751865
Hausman test	NA	NA	148.384 [1.2056e-025]	NA	NA	143.701 [1.07035e-024]
F statistic	(13, 117) 142.8630	(13, 117) 51.3693	NA	(14, 117) 138.8595	(14, 117) 46.9722	NA
P-value (F)	2.84e-65	4.52274e-042	NA	7.27e-66	2.8489e-041	NA
Durbin-Watson stat	1.033626	1.255655	1. 255655	1.030835	1.250536	1.250536

Note 19: The sample of the 118 largest US Banks. See note 3

Appendix 19: Regression results for model Net Interest Margin in the sample of the largest banks, N= 118 (Pooled, Fixed Effected, and Random Effected)

LARGEST US BANKS, N=118, T=21

DEPENDENT VARIABLE NIM

		Without Dummies			With dummies		
	Variables	OLS Pooled NIM	OLS (Fixed Effect) NIM	OLS (Random Effect) NIM	OLS Pooled NIM	OLS (Fixed Effect) NIM	OLS (Random Effect) NIM
	Constant	0.300820 (0.549126)	1.87812 (0.756682) **	0.787313 (0.426722) *	0.405817 (0.636156)	1.80792 (0.750441) **	0.892768 (0.470261)
1	Total assets	−0. 0325280 (0.0136045) **	−0.0973803 (0.0447269) **	−0.0487494 (0.0164599) ***	−0.0325510 (0.0136857) **	-0.0847410 (0.0459417) *	-0.0479508 (0.0169195) ***
2	Loan and leases loss allowance/ Total Assets	0.205752 (0.0778101) ***	0.230271 (0.0573304) ***	0.236655 (0.0704384) ***	0.209975 (0.0750622) ***	0.241394 (0.0548634) ***	0.243430 (0.0679798) ***
3	Total deposits/ Total Assets	0.0199255 (0.00975416) **	0.0112451 (0.00568537) *	0.0165258 (0.00767569) **	0.0199920 (0.00979951) **	0.0117911 (0.00560904) **	0.0167934 (0.00762620) **
4	Interest-bearing deposits/Total Assets	−0.0138855 (0.00725414) *	−0.00412636 (0.00383071)	−0.0106161 (0.00568483) *	−0.0139010 (0.00732728) *	−0.00422874 (0.00388536)	−0.0106469 (0.00575831) *

5	Average total assets/ Total Assets	NA	NA	NA	NA	NA	NA
6	Tier one (core) capital/ Total Assets	NA	NA	NA	NA	NA	NA
7	Tier 2 Risk-based capital/ Total Assets	NA	NA	NA	NA	NA	NA
8	Total interest income	NA	NA	NA	NA	NA	NA
9	Total interest expense/ Total interest income	−0.0239618 (0.011165) **	−0.0181734 (0.00857840) **	−0.0210519 (0.0100422) **	−0.0243353 (0.0116929) **	−0.0186733 (0.00894820) **	−0.0215139 (0.0104737) **
10	Total noninterest income/ Total interest income	−0.00229777 (0.00105152) **	−0.00209043 (0.00132220)	−0.00231946 (0.000811251) ***	−0.00229299 (0.00105603) **	−0.00209084 (0.00131284)	-0.00233717 (0. 000790192) ***
11	Additional Noninterest Income/ Total interest income	0.00180146 (0.000937992) *	0.00153340 (0.00137416)	0.00173576 (0.000748373) **	0.00183142 (0.000919196) **	0.00156347 (0.00137519)	0.00179069 (0.000726402) **
12	Pre-tax net operating income/ Total interest income	NA	NA	NA	NA	NA	NA

13	Net income/ Total interest income	0.00633886 (0.00267756) **	0.00623502 (0.00192466) ***	0.00661180 (0.00239364) ***	0.00614853 (0.00285639) **	0. 00593679 (0.00201914) ***	0.00635810 (0.00253521) **
14	Yield on earning assets (%)	0.596252 (0.0559911) ***	0.450408 (0.0646958) ***	0.534538 (0.0648347) ***	0.593038 (0.0545062) ***	0.445879 (0.0641400) ***	0.529823 (0.0637752) ***
15	Net operating income to assets (%)	NA	NA	NA	NA	NA	NA
16	Efficiency ratio (%)	−0.000453376 (0.000101448) ***	7.62669e-05 (0.000242723)	−0.000170518 (0.000121167)	−0.000463441 (9.64451e-05) ***	9.09762e-05 (0.000235261)	−0.000172895 (0.000120536)
17	Assets per employee ($millions)	0.0151606 (0.0110771)	0.0296805 (0.0144939) **	0.0221509 (0.0136488)	0.0161890 (0.0111507)	0.0312869 (0.0153889) **	0.0236630 (0.0139401)
18	Net loans and leases to total assets (%)	NA	NA	NA	NA	NA	NA
19	Net loans and leases to deposits (%)	NA	NA	NA	NA	NA	NA
20	Total domestic deposits to total assets (%)	NA	NA	NA	NA	NA	NA
21	Equity capital to assets (%)	NA	NA	NA	NA	NA	NA

22	Leverage (core capital) ratio (%)	0.0568687 (0.0199656) ***	0.0536987 (0.0160229) ***	0.0589754 (0.0167781) ***	0.0580123 (0.0192924) ***	0.0562748 (0.0156778) ***	−0.131141 (0.0189605) ***
23	Tier 1 risk-based capital ratio (%)	−0.0152587 (0.00875464) *	−0.0232925 (0.00828523) ***	−0.0201905 (0.00841370) **	−0.0157584 (0.00855993) *	−0.0245102 (0.00810900) ***	−0.0210083 (0.00821140) **
24	Total risk-based capital ratio (%)	NA	NA	NA	NA	NA	NA
25	3-Month London Interbank Offered Rate (LIBOR) %	NA	NA	NA	NA	NA	NA
26	5-Year Treasury Constant Maturity Rate %	−0.126238 (0.0391585) ***	−0.0930747 (0.0179551) ***	−0.110074 (0.0293988) ***	−0.143892 (0.0234703) ***	−0.114925 (0.0131591) ***	−0.131141 (0.0189605) ***
27	Real Effective Exchange Rates for USA %	NA	NA	NA	NA	NA	NA
28	U- 3 US Unemployment Rate Total in Labor %	0.0403163 (0.00965814) ***	0.0259412 (0.00488544) ***	0.110074 (0.00707969) ***	0.0416312 (0.00916564) ***	0.0269959 (0.00501752) ***	0. 0359023 (000682570) ***

29	GDP CQOQ Index	NA	NA	NA	NA	NA	NA
30	Exchange rates news (%)	NA	NA	NA	NA	NA	NA
	Financial Crises	NA	NA	NA	−0.0885779 (0.0919525)	-0.122618 (0.0601320) **	−0.109772 (0.0736100)
	S.E. of regression	3. 382596	0.313073	0.393166	0.382061	0.311729	0.392931
	R-squared	0. 825979	0.889015	NA	0.826536	0.890012	NA
	Mean dependent var	7.495139	3.495139	3.495139	3.495139	3.495139	3.495139
	S.D. dependent var	0.914367	0.914367	0.914367	0.914367	0.914367	0.914367
	Hausman test	NA	NA	447.687 [1.09662e-086]	NA	NA	505.674 [5.81202e-099]
	F statistic	(15, 117) 283.7846	(15, 117) 69.348	NA	(30. 117) 272.2193	(16, 117) 65.092	NA
	P-value (F)	2.05e-84	7.44793e-051	NA	1.66e-84	1.99916e-050	NA
	Durbin-Watson stat	0.748611	0.874848	0.874848	0.762299	0.901142	0.901142

Note 20: The sample of the 118 largest US Banks. See note 3

Appendix 20: Regression results for model Return on Assets in the sample of the smallest US banks, N= 30 (Pooled, Fixed Effected, and Random Effected)

SMALLEST US BANKS, N=30, T=21

DEPENDENT VARIABLE ROA

		Without Dummies			**With Dummies**		
	Variables Total Sample N=30	**OLS Pooled ROA**	**OLS (Fixed Effect) ROA**	**OLS (Random Effect) ROA**	**OLS Pooled ROA**	**OLS (Fixed Effect) ROA**	**OLS (Random Effect) ROA**
	Constant	0.841087 (0.441421) *	1.46493 (0.565527) **	1.26073 (0.452576) ***	-3.56199 (1.74689) **	1.46568 (0.277432) ***	1.26660 (0.455140) ***
1	**Total assets**	-0.0773365 (0.0304864) **	-0.124720 (0.0464091) **	-0.108668 (0.0354360) ***	0.255899 (0.230654)	-0.124804 (0.0235107) ***	-0.109399 (0.0367633) ***
2	**Loan and leases loss allowance/ Total Assets**	NA	NA	NA	NA	NA	NA
3	**Total deposits/ Total Assets**	NA	NA	NA	NA	NA	NA
4	**Interest-bearing deposits/Total Assets**	NA	NA	NA	NA	NA	NA
5	**Average total assets/ Total Assets**	NA	NA	NA	NA	NA	NA

6	**Tier one (core) capital/ Total Assets**	NA	NA	NA	NA	NA	NA
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
8	**Total interest income**	NA	NA	NA	NA	NA	NA
9	**Total interest expense/ Total interest income**	NA	NA	NA	NA	NA	NA
10	**Total noninterest income/ Total interest income**	0.00228438 (0.000797852) ***	0.00188935 (0.000724737) **	0.00199085 (0.000650391) ***	-0.00391389 (0.00152313) **	0.00188885 (0.000567292) ***	0.00198818 (0.00647145) ***
11	**Additional Noninterest Income/ Total interest income**	NA	NA	NA	NA	NA	NA
12	**Pre-tax net operating income/ Total interest income**	-0.00935826 (0.00344230) **	−0.00348308 (0.00228788)	−0.00460469 (0.00237956) *	-0.00587381 (0.00156755) ***	-0.00348335 (0.00141079) **	−0.00460886 (0.00238977) *
13	**Net income/ Total interest income**	0.0535484 (0.00407742) ***	0.0462040 (0.00320003) ***	0.0476157 (0.00322032) ***	0.0535573 (0.00406883) ***	0.0462045 (0.00153125) ***	0.0455630 (0.00260070) ***
14	**Yield on earning assets (%)**	0.102580	0.0880805 (0.0135386) ***	0.0918881 (0.0130115) ***	0.105905	0.0881120 (0.00616416) ***	0.0923116 (0.0140139) ***

		(0.0153221) ***			(0.0171198) ***		
15	**Net operating income to assets (%)**	NA	NA	NA	NA	NA	NA
16	**Efficiency ratio (%)**	-0.00804464 (0.00164150) ***	0.000511204 (0.000846369)	−0.00731647 (0.00137692) ***	-0.00811902 (0.00168203) ***	-0.00705614 (0.000803131) ***	-0.00733056 (0.00137240) ***
17	**Assets per employee ($millions)**	NA	NA	NA	NA	NA	NA
18	**Net loans and leases to total assets (%)**	NA	NA	NA	NA	NA	NA
19	**Net loans and leases to deposits (%)**	0.00172212 (0.00119472)	0.00167280 (0.00269940)	0.000856790 (0.000893125)	0.00161309 (0.00110828)	0.000510808 (0.000574966)	0.000848872 (0.000869750)
20	**Total domestic deposits to total assets (%)**	NA	NA	NA	NA	NA	NA
21	**Equity capital to assets (%)**	NA	NA	NA	NA	NA	NA
22	**Leverage (core capital) ratio (%)**	NA	NA	NA	NA	NA	NA
23	**Tier 1 risk-based capital ratio (%)**	NA	NA	NA	NA	NA	NA

24	**Total risk-based capital ratio (%)**	NA	NA	NA	NA	NA	NA
25	**3-Month London Interbank Offered Rate (LIBOR) %**	NA	NA	NA	NA	NA	NA
26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA
27	**Real Effective Exchange Rates for USA %**	NA	NA	NA	NA	NA	NA
28	**U- 3 US Unemployment Rate Total in Labor %**	NA	NA	NA	NA	NA	NA
29	**GDP CQOQ Index**	NA	NA	NA	NA	NA	NA
30	**Exchange rates news (%)**	NA	NA	NA	NA	NA	NA
	Financial Crises	NA	NA	NA	0.0160111 (0.0234357)	0.000186060 (0.0179868)	0.00223749 (0.0195412)
	S.E. of regression	0.163448	0.136606	0.168672	0.163492	0.136722	0.168780
	R-squared	0.956165	0.970808	NA	0.956212	0.970808	NA
	Mean dependent var	0.727841	0.727841	0.727841	0.727841	0.727841	0.727841
	S.D. dependent var	0.776320	0.776320	0.776320	0.776320	0.776320	0.776320
	Hausman test	NA	NA	32.152 [3.80638e-005]	NA	NA	32,4366 [2.59013e-085]
	F statistic	(7, 29)	(7, 29)	NA	(8, 29)	(8, 29)	NA

	320.5945	195.263		281.6733	175.344	
P-value (F)	1.06e-25	1.22464e-022	NA	2.32e-25	1.96099e-022	NA
Durbin-Watson stat	0.842675	1.188120	1.188120	0.845190	1.188123	1.188123

Note 21: The sample of the 30 smallest US Banks. See note 1. Also, 3 independent variables were subtracted from the total of 30, because it caused a high correlation

Appendix 21: Regression results for model Return on Equity in the sample of the largest banks, N= 30 (Pooled, Fixed Effected, and Random Effected)

SMALLEST BANKS, N=30, T=21

DEPENDENT VARIABLE ROE

		Without Dummies			With Dummies		
	Variables	**OLS Pooled ROE**	**OLS (Fixed Effect) ROE**	**OLS (Random Effect) ROE**	**OLS Pooled ROE**	**OLS (Fixed Effect) ROE**	**OLS (Random Effect) ROE**
	Constant	5.39176 (4.47648)	2.98475 (5.87502)	3.85244 (4.94144)	5.08066 (4.29694)	3.48027 (5.88052)	3.98305 (4.85079)
1	**Total assets**	NA	NA	NA	NA	NA	NA
2	**Loan and leases loss allowance/ Total Assets**	NA	NA	NA	NA	NA	NA
3	**Total deposits/ Total Assets**	-2.80383 (1.62282) *	−1.55446 (1.40773)	−2.00884 (1.49567)	-2.79299 (1.62453) *	−1,54868 (1.40187)	−2.00920 (1.49746)
4	**Interest-bearing deposits/Total Assets**	0.0935830 (0.0467684) *	0.0449862 (0.0570262)	0.0666872 (0.0518732)	0.0963323 (0.07481) *	0.0426916 (0.0545103)	0.0657762 (0.0510037)

5	**Average total assets/ Total Assets**						
6	**Tier one (core) capital/ Total Assets**	−1.775177 (0.120540) ***	−0.731207 (0.191183) ***	−0.741101 (0.150543) ***	−1.773630 (0.121906) ***	−1.731906 (0.190280) ***	-0.741349 (0.150583) ***
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
8	**Total interest income**	NA	NA	NA	NA	NA	NA
9	**Total interest expense/ Total interest income**	NA	NA	NA	NA	NA	NA
10	**Total noninterest income/ Total interest income**	-0. 0325770 (0.0190151) *	−0.00106294 (0.0249405)	−0.0135839 (0.0187210)	−0.0327336 (0.0188216) *	−0.00171898 (0.0252219)	-0.0134533 (0.0187504)
12	**Pre-tax net operating income/ Total interest income**	NA	NA	NA	NA	NA	NA
13	**Net income/ Total interest income**	0.422913 (0.0950076) ***	0.454028 (0.0875876) ***	0.445791 (0.0910369) ***	0.423356 (0.0951425) ***	0.454151 (0.0874829) ***	0.445732 (0.0911916) ***
14	**Yield on earning assets (%)**	0. 720713	1.09461 (0.313760) ***	0.952476	0.759031	1.04394	0.937238 (0.315660) ***

		(0.0950076) ***		(0.317298) ***	(0.317581) **	(0.308758) ***	
15	**Net operating income to assets (%)**	3.07374 (1.43720) **	1.76666 (1.16955)	2.23153 (1.28158) *	3.07576 (1.43564) **	1.73045 (114430)	2.22484 (1.27171) *
16	**Efficiency ratio (%)**	NA	NA	NA	NA	NA	NA
17	**Assets per employee ($millions)**	−1.814211 (0.405826) *	−0.446121 (0.543629)	−0.569640 (0.467263)	−0.831968 (0.423185) *	−0.401193 (0.583876)	−0.559297 (0.491051)
18	**Net loans and leases to total assets (%)**	NA	NA	NA	NA	NA	NA
19	**Net loans and leases to deposits (%)**	NA	NA	NA	NA	NA	NA
20	**Total domestic deposits to total assets (%)**	2.72816 (1.62555)	1.503376 (1.38501)	2.94519 (1.48564)	2.71507 (1.62867)	1.49805 (1.37886)	1.94607 (1.48830)
21	**Equity capital to assets (%)**	NA	NA	NA	NA	NA	NA
22	**Leverage (core capital) ratio (%)**	NA	NA	NA	NA	NA	NA
25	**3-Month London Interbank Offered Rate (LIBOR) %**	NA	NA	NA	NA	NA	NA
26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA

27	**Real Effective Exchange Rates for USA %**	NA	NA	NA	NA	NA	NA
28	**U- 3 US Unemployment Rate Total in Labor %**	NA	NA	NA	NA	NA	NA
29	**GDP CQOQ Index**	NA	NA	NA	NA	NA	NA
30	**Exchange rates news (%)**	NA	NA	NA	NA	NA	NA
	Financial Crises	NA	NA	NA	0.221695 (0.390334)	−0.295477 (0.411207)	-0.0872705 (0.336944)
	S.E. of regression	2.848368	2.592173	2.876237	2.849648	2.592660	2.879837
	R-squared	0.893966	0.916290	NA	0.894042	0.916400	NA
	Mean dependent var	7.402143	7.402143	7.402143	7.402143	7.402143	7.402143
	S.D. dependent var	8.684484	8.684484	8.684484	8.684484	8.684484	8.684484
	Hausman test	NA	NA	71.0354 [9.53777e-012]	NA	NA	71.0647 [9.41196e-012]
	F statistic	(9, 29) 74.09343	(9, 29) 51.9081	NA	(10, 29) 67.31175	(10, 29) 51.5506	NA
	P-value (F)	1.39e-17	1.77221e-015	NA	2.52e-17	9.58944e-016	NA
	Durbin-Watson stat	1.084226	1.224031	1.224031	1.083651	1.228855	1.228855

Appendix 22: Regression results for model Net Interest Margin in the sample of the largest banks, N= 30 (Pooled, Fixed Effected, and Random Effected)

SMALLEST US BANKS, N=30, T=21

DEPENDENT VARIABLE NIM

		Without Dummies			**With Dummies**		
	Variables	**OLS Pooled MIM**	**OLS (Fixed Effect) MIM**	**OLS (Random Effect) MIM**	**OLS Pooled MIM**	**OLS (Fixed Effect) MIM**	**OLS (Random Effect) MIM**
	Constant	1.33618 (0.331442) ***	1.28468 (0.350740) ***	1.30485 (0.331032) ***	1.76627 (0.317824) ***	1.67846 (0.352730) ***	1.73348 (0.319071) ***
1	**Total assets**	NA	NA	NA	NA	NA	NA
2	**Loan and leases loss allowance/ Total Assets**	NA	NA	NA	NA	NA	NA
3	**Total deposits/ Total Assets**	0.0709997 (0.00368852) ***	0.0680209 (0.00441173)	0.0704493 (0. 00370297)	0.0672149 (0.00342132) ***	0.0653709 (0.00405215) ***	0.0667132 (0.00346185) ***
4	**Interest-bearing deposits/Total Assets**	NA	NA	NA	NA	NA	NA

5	**Average total assets/ Total Assets**	NA	NA	NA	NA	NA	NA
6	**Tier one (core) capital/ Total Assets**	NA	NA	NA	NA	NA	NA
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
8	**Total interest income**	NA	NA	NA	NA	NA	NA
9	**Total interest expense/ Total interest income**	-0.0562397 (0.00193163) ***	−0. 0523752 (0.00325587) ***	-0.0553289 (0.00213703) ***	−0.0605933 (0.00175798) ***	-0.0581356 (0.00295680) ***	−0.0599052 (0.00189842) ***
10	**Total noninterest income/ Total interest income**	NA	NA	NA	NA	NA	NA
12	**Pre-tax net operating income/ Total interest income**	NA	NA	NA	NA	NA	NA
13	**Net income/ Total interest income**	NA	NA	NA	NA	NA	NA
14	**Yield on earning assets (%)**	0.714875 (0.0202495) ***	0.684726 (0.0352720) ***	0.709182 (0.0230239) ***	0.693077 (0.0202945) ***	0.669414 (0.0325760) ***	0.686326 (0.0229220) ***
15	**Net operating income to assets (%)**	NA	NA	NA	NA	NA	NA

16	**Efficiency ratio (%)**	NA	NA	NA	NA	NA	NA
17	**Assets per employee ($millions)**	NA	NA	NA	NA	NA	NA
18	**Net loans and leases to total assets (%)**	NA	NA	NA	NA	NA	NA
19	**Net loans and leases to deposits (%)**	NA	NA	NA	NA	NA	NA
20	**Total domestic deposits to total assets (%)**	-0.0756861 (0.00182402) ***	−0.0725475 (0.00321459) ***	-0.0750932 (0.00199546)	−0.0736856 (0.00186228) ***	−0.0712588 (0.00296711) ***	−0.0730451 (0.00200335) ***
21	**Equity capital to assets (%)**	0.00963178 (0.00572184)	0. 0188706 (0.0124475)	0.0122318 (0.00699026) *	0.00406578 (0.00594303)	0.0148552 (0.0123198)	0.00779346 (0.00753203)
22	**Leverage (core capital) ratio (%)**	NA	NA	NA	NA	NA	NA
25	**3-Month London Interbank Offered Rate (LIBOR) %**	NA	NA	NA	NA	NA	NA
26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA
27	**Real Effective Exchange Rates for USA %**	NA	NA	NA	NA	NA	NA

28	**U- 3 US Unemployment Rate Total in Labor %**	0.0233028 (0.00603188) ***	0.0283374 (0.00376467) ***	0.0254335 (0.00536730) ***	0.0232147 (0.00590440) ***	0.0260497 (0.0623163) ***	0.0247509 (0.00508872) ***
29	**GDP CQOQ Index**	0.0361017 (0.00319988) ***	0.0324643 (0.00347375) ***	0.0350301 (0.00326033) ***	0.0649008 (0.00420187) ***	0.0623163 (0.00500706) ***	0.0641161 (0.00435438) ***
30	**Exchange rates news (%)**	0.000148540 (6.02026e-05) **	0.000167922 (6.95470e-05) **	0.000154536 (6.21948ε-05)	−9.19226e-05 (6.10014e-05)	-7.91634 -05 (6.38807-05)	−8.89422e-05 (6.08377e-05)
	Financial Crises				−0.264929 (0.0252166) ***	-0.270440 (0.0200178) ***	−0.269157 (0.0215927) ***
	S.E. of regression	0.174602	0.166553	0.174810	0.160687	0.152292	0.161031
	obs	630	630	630	630	630	630
	R-squared	0.945999	0.953158	NA	0.954337	0.960902	NA
	Mean dependent var	4.098365	4.098365	4.098365	4.098365	4.098365	4.098365
	S.D. dependent var	0.746569	0.746569	0.746569	0.746569	0.746569	0.746569
	Hausman test	NA	NA	58.6351 [2.55792 -006]	NA	NA	60.5459 [3.48638e-011]
	F statistic	(8, 29)	(8. 29)	NA	(9, 29)	(9, 29)	NA

	418.2285	232.035		456.4337	219.179	
P-value (F)	8.08e-28	3.67814e-024	NA	9.31e-29	3.3875e-024	NA
Durbin-Watson stat	0.630449	0.763213	0.763213	0.748420	0.904672	0.904672

Appendix 23: Difference-GMM Dynamic Panel estimation with the total Sample of 148 US Banks by Total Assets (N=148. T=21)

Total Sample. N= 148. T=21

GMM Single Equation

	Variables	Without Dummies			With Dummies		
	ROAt-1	0.201473 (0.00526779) ***			0.183840 (0.00552633) ***		
	ROEt-1		0.294319 (0.00357810) ***			0.281493 (0.00324248) ***	
	NIMt-1			0.433163 (0.0103000) ***			0.470240 (0.0106078) ***
	Constant	-0.00749209 (0.000736635) ***	-0.132713 (0.00450265) ***	0.0254194 (0.00148880) ***	0.00507338 (0.000826439) ***	−0.0271518 (0.00509663) ***	0.0137004 (0.00137092) ***
1	**Total assets**	0.126323 (0.0159524) ***	NA	−0.115402 (0.0275593) ***	0.108133 (0.0119717) ***	NA	−0.105564 (0.0246424) ***

1(-1)	**t-1**	−0.0232004 (0.0101321) **	NA	-0.00515563 (0.0172811)	−0.0132379 (0.00884242)	NA	0.00554005 (0.0181916)
2	**Loan and leases loss allowance/ Total Assets**	NA	NA	0.0958305 (0.0119045) ***	NA	NA	0.0878911 (0.0114807) ***
2(-1)	(-1)	NA	NA	0.00115955 (0.0134405)	NA	NA	-0.00175974 (0.0134575)
3	**Total deposits/ Total Assets**	NA	NA	−0.00464498 (0.0016487) ***	NA	NA	−0.00531693 (0.00173039) ***
3(-1)	(-1)	NA	NA	0.00253724 (0.00185739)	NA	NA	0.00256913 (0.00181586)
4	**Interest-bearing deposits/Total Assets**	-0.00132366 (0.000235804) ***	NA	−0.00373279 (0.000838074)	−0.000696999 (0.000241666) ***	NA	−0.00373371 (0.000849381) ***
4(-1)	**t-1**	-0.00196084 (0.000233452) ***	NA	−0.00142534 (0.000440622) ***	−0.00126946 (0.000226418) ***	NA	-0.00160711 (0.000438338) ***
5	**Average total assets/ Total Assets**	0.00294000 (0.000338943) ***	NA	NA	0.00264679 (0.000282300) ***	NA	NA

5(-1)	**t-1**	0.000104753 (0.000189420)	NA	NA	−0.000273219 (0.000181785)	NA	NA
6	**Tier one (core) capital/ Total Assets**	0.0171955 (0.00171629) ***	-0.141924 (0.0140770) ***	−0.0281886 (0.0019432) ***	0.0164171 (0.00146865) ***	−0.127285 (0.0141466) ***	−0.0288032 (0.00184508) ***
6(-1)	**t-1**	0.0140630 (0.00119431) ***	-0.188947 (0.0170615) ***	0.0202169 (0.00263065) ***	0.0136864 (0.00139978) ***	-0.219017 (0.166083) ***	0.0210386 (0.00258525) ***
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
7(-1)	**Tier 2 Risk-based capital/ Total Assets** (-1)	NA	NA	NA	NA	NA	NA
8	**Total interest income**	−0.0440556 (0.00225638) ***	NA	0.0165051 (0.00353825) ***	−0.0517307 (0.00233266) ***	NA	0.0216408 (0.00400954) ***
8(-1)	**t-1**	-0.00452206 (0.00179523) **	NA	−0.00471612 (0.00441247)	−0.0125397 (0.00201893) ***	NA	0.0100186 (0.00436515) **
9	**Total interest expense/ Total interest income**	0.000695847 (0.000344513) **	NA	NA	0.000502540 (0.000419418)	NA	NA

9(-1)	**t-1**	-0.00337281 (0.000229319) ***	NA	NA	−0.00267069 (0.000305274) ***	NA	NA
10	**Total noninterest income/ Total interest income**	−0.00373081 (0.000325135) ***	−0.0356833 (0.00294786) ***	0.00228579 (0.000269661) ***	−0.00346142 (0.000308911) ***	−0.0302862 (0.00338501) ***	0.00224504 (0.000295908) ***
10(-1)	**t-1**	-0.000687648 (0.000294744) **	-0.00891726 (0.00252924) ***	-0.000536386 (0.000660344)	-0.000662547 (0.000277602) **	−0.00949504 (0.00287231) ***	−0.000189118 (0.000679498)
11	**Additional Noninterest Income/ Total interest income**	0.00395887 (0.000303878) ***	0.0377670 (0.00260807) ***	−0.00370135 (0.000251045) ***	0.00382326 (0.000293715) ***	0.0328931 (0.00302887)	−0.00377348 (0.000283704) ***
11(-1)	**t-1**	1.60495e-05 (0.000280308)	-0.00117012 (0.00213014)	0.00145837 (0.000655915) **	-6.38124e-05 (0.000269329)	−0.00194541 (0.00247541)	0.00121879 (0.000679265) *
12	**Pre-tax net operating income/ Total interest income**	−0.00115263 (9.47747e-05) ***	−0.0124847 (0.00138826) ***	NA	−0.00132720 (0.000113202) ***	−0.0144312 (0.00157148) ***	NA
12(-1)	**t-1**	−0.00179294 (7.24883e-05) ***	-0.0115175 (0.00114156) ***	NA	-0.00188332 (7.08543e-05)	−0.0140685 (0.00111867) ***	NA

13	**Net income/ Total interest income**	0.0428604 (0.000159181) ***	0.354784 (0.00171668) ***	−0.000983949 (0.000138534) ***	0.0427041 (0.000146812) ***	0.351511 (0.00143932) ***	−0.000827487 (0.000137455) ***
13(-1)	**t-1**	−0.00720526 (0.000236269) ***	-0.0739232 (0.00174567) ***	0.000683434 (0.000233639) ***	-0.00667391 (0.000242936) ***	−0.0719059 (0.00137249) ***	0.000851130 (0.000229109) ***
14	**Yield on earning assets (%)**	0.163371 (0.00267860) ***	0.953115 (0.0213780) ***	0.641955 (0.00586600) ***	0.170077 (0.00300517) ***	0.822568 (0.0215631) ***	0.635849 (0.00608950) ***
14(-1)	**t-1**	-0.00531672 (0.00262614) **	-0.415136 (0.0222199) ***	−0.207663 (0.00491153) ***	0.0162842 (0.00369621) ***	−0.196417 (0.0201352) ***	-0.240090 (0.00523133) ***
15	**Net operating income to assets (%)**	0.0630569 (0.00511828) ***	0.355589 (0.0361201) ***	0.0661038 (0.00163750) ***	0.0611983 (0.00509530) ***	0.368897 (0.0356230) ***	0.0650969 (0.00176382) ***
15(-1)	**t-1**	0.00838662 (0.00116212) ***	-0.105478 (0.0180594) ***	-0.0279789 (0.00431690) ***	0.0122190 (0.00130000) ***	−0.0884106 (0.0188113) ***	−0.0307253 (0.00427202) ***
16	**Efficiency ratio (%)**	−0.000962192 (9.43719e-05) ***	−0.0197923 (0.000756523) ***	NA	−0.00115578 (9.39978e-05) ***	−0.0210059 (0.000757583) ***	NA

16(-1)	**t-1**	0.000378643 (3.73023e-05) ***	0.000151318 (0.000579601)	NA	0.000343444 (3.75127e-05) ***	-0.00117600 (0.000559536) **	NA
17	**Assets per employee ($millions)**	NA	−0.0857800 (0.00433530) ***	0.00100433 (0.00133430)	NA	−0.0953329 (0.00479152) ***	6.27835e-05 (0.00147270)
17(-1)	**Assets per employee ($millions)** (-1)	NA	0.112692 (0.00651410) ***	0.00696420 (0.00107754) ***	NA	0.112683 (0.00626221) ***	0.00586885 (0.00101938) ***
18	**Net loans and leases to total assets (%)**	NA	NA	0.00954896 (0.00113104) ***	NA	NA	0.00976163 (0.00114136) ***
18(-1)	**t-1**	NA	NA	−0.00295076 (0.000952199) ***	NA	NA	−0.00304795 (0.000990416) ***
19	**Net loans and leases to deposits (%)**	NA	0.00974574 (0.00128538) ***	−0.00350159 (0.000755140) ***	NA	0.00931617 (0.00133768) ***	−0.00359969 (0.000747940) ***
19(-1)	(-1)	NA	-0.00444654 (0.00175159) **	6.39601e-05 (0.000624484)	NA	−0.00615138 (0.00173951) ***	0.000180380 (0.000653898)

20	**Total domestic deposits to total assets (%)**	−0.000936808 (0.000333018) ***	-0.0256895 (0.00354176) ***	0.00692879 (0.00136683) ***	−0.000720145 (0.000315671) **	−0.0177296 (0.00283335) ***	-0.00653975 (0.00139442) ***
20(-1)	**t-1**	−0.00177870 (0.000378739) ***	0.00674370 (0.00320754) **	−0.000246089 (0.00162977)	-0.00162987 (0.000328935) ***	−0.00191229 (0.00349065)	−6.15672e-05 (0.00165016)
21	**Equity capital to assets (%)**	NA	−0.0564730 (0.0150136) ***	NA	NA	−0.0742902 (0.0151339) ***	NA
21(-1)	**t-1**	NA	0.0134191 (0.00860243)	NA	NA	0.0212022 (0.00832717) **	NA
22	**Leverage (core capital) ratio (%)**	−0.0397545 (0.00121562) ***	NA	0.0322234 (0.00114065) ***	−0.0373037 (0.00115656) ***	NA	0.0322491 (0.00115248) ***
22(-1)	**t-1**	-0.0164592 (0.00106543) ***	NA	−0.0168123 (0.00191041) ***	−0.0150476 (0.00112437) ***	NA	−0.0184352 (0.00195286) ***
23	**Tier 1 risk-based capital ratio (%)**	NA	−0.00299099 (0.00588678)	NA	NA	0.00346865 (0.00578787)	NA

23(-1)	(-1)	NA	−0.135293 (0.00571235) ***	NA	NA	−0.123036 (0.00555189) ***	NA
25	**3-Month London Interbank Offered Rate (LIBOR) %**	0.00158411 (0.000886592) *	NA	−0.0594450 (0.00179219) ***	−0.00866446 (0.000933096) ***	NA	−0.0519953 (0.00205221) ***
25(-1)	**t-1**	-0.0178436 (0.00108546) ***	NA	−0.143895 (0.00178374) ***	-0.0221894 (0.00107394) ***	NA	-0.137380 (0.00185910) ***
26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA
26(-1)	(-1)	NA	NA	NA	NA	NA	NA
27	**Real Effective Exchange Rates for USA %**	NA	NA	0.00659603 (0.000268149) ***	NA	NA	0.00536183 (0.000274380) ***
27(-1)	**t-1**	NA	NA	0.000196031 (0.000207737)	NA	NA	0.00247786 (0.000238429) ***
28	**U- 3 US Unemployment Rate Total in Labor %**	0.00541805	NA	0.0214396	0.00550091	NA	0.0193053 (0.00130114) ***

		(0.000609096) ***		(0.00125396) ***	(0.000485388) ***		
28(-1)	**t-1**	-0.00502042 (0.000454329) ***	NA	0.000854389 (0.000768478)	0.00106364 (0.000499582) **	NA	-0.000730882 (0.000808559)
29	**GDP CQOQ Index**	NA	NA	NA	NA	NA	NA
30	**Exchange rates news (%)**	NA	NA	NA	NA	NA	NA
	Financial Crisis	NA	NA	NA	-0.134809 (0.00642719) **	-1.10995 (0.386917) ***	0.121228 (0.00869682) ***
	Specification Tests						
	SE	0.306969	3.919113	0.267824	0.304837	3.892293	0.270654
	Sargan Test	127.191 Pr [0.9998]	128.103 Pr [0.9998]	140.447 Pr [0.9967]	129.172 Pr [0.9997]	127.262 Pr [0.9998]	138.59 Pr [0.9977]
	Wald chi2(31)	3.04037e+006 [0.0000]	1.36654e+006 [0.0000]	91990 [0.0000]	2.99227e+006 [0.0000]	917161 [0.0000]	90003.8 [0.0000]
	Number of instuments	225	590	590	226	218	230
	obs	2812	2812	2812	2812	2812	2812

Note 22: There are three dependent variables. Return on Assets (ROA). Return on Equity (ROE). and Net Interest Margin (NIM). including each lag. Asymptotic standard error in parenthesis; *** Significant at 1%; ** significant at 5%; significant at 10%. All estimates are generated by

Arellano–Bond two-step difference GMM. (Difference GMM. Arellano and Bond 1991). Sargan/Hansen is a test of the over-identifying restrictions for the GMM estimators.

Appendix 24: Difference Dynamic Panel estimation with Sample of 118 Largest US Banks by Total Assets (N=118. T=21)

Sample of the Largest US Banks by Total Assets. N= 118. T=21

GMM Single Equation

Variables	Without Dummies			**With Dummies**		
Variables						
ROAt-1	0.223840 (0.00620514) ***			0.206306 (0.00610291) ***		
ROEt-1		0.323542 (0.00669627) ***			0.320348 (0.00708510) ***	
NIMt-1			0.639007 (0.0195625) ***			0.679696 (0.0197543) ***
Constant	−0.00892025 (0.000615213) ***	−0.132226 (0.00791486) ***	−0.00353917 (0.00169347) **	−0.000172995 (0.000812627)	−0.0810349 (0.00858500) ***	-0.00779545 (0.00186101) ***

1	**Total assets**	0.287737 (0.0171053) ***	NA	−0.0519376 (0.0248444) **	0.276905 (0.0142252) ***	NA	−0.0493924 (0.0248281) **
1(-1)		-0.186970 (0.0125638) ***	NA	0.0228598 (0.0199134)	-0.172635 (0.0111260) ***	NA	0.0294378 (0.0210385)
2	**Loan and leases loss allowance/ Total Assets**	−0.243623 (0.00933546) ***	NA	0.122363 (0.0156608) ***	−0.234362 (0.00981423) ***	NA	0.119304 (0.0150437) ***
2(-1)		0.161121 (0.00496578)	NA	−0.0176602 (0.0203863)	0.163243 (0.00554926) ***	NA	-0.0240263 (0.0203910)
3	**Total deposits/ Total Assets**	NA	NA	0.00584759 (0.000867939) ***	NA	NA	0.00578228 (0.000938650) ***
3(-1)		NA	NA	−0.000333411 (0.00101093)	NA	NA	-0.000140054 (0.00104248)
4	**Interest-bearing deposits/Total Assets**	NA	NA	0.000988308 (0.000492503) **	NA	NA	0.000644115 (0.000515074)

4(-1)		NA	NA	−0.00475952 (0.000604786) ***	NA	NA	−0.00503271 (0.000628708) ***
5	**Average total assets/ Total Assets**	0.00904188 (0.000379371) ***	NA	NA	0.00864847 (0.000353963) ***	NA	NA
5(-1)		−0.00102687 (0.000240007) ***	NA	NA	-0.00148982 (0.000247579) ***	NA	NA
6	**Tier one (core) capital/ Total Assets**	0.0273874 (0.00129032) ***	−0.0860984 (0.0241912) ***	NA	0.0279597 (0.00136549) ***	−0.0774922 (0.0252616) ***	NA
6(-1)		0.00668267 (0.00113660) ***	-0.184445 (0.0216780) ***	NA	0.00513442 ((0.00146095) ***	-0.190333 (0.0219254) ***	NA
7	**Tier 2 Risk-based capital/ Total Assets**	NA					
8	**Total interest income**	−0.0728696 (0.00316093) ***	NA	NA	−0.0790733 (0.00340827) ***	NA	NA

8(-1)		0.0287867 (0.00199125) ***	NA	NA	0.0236948 (0.00197118) ***	NA	NA
9	**Total interest expense/ Total interest income**	−0.000360004 (0.000483623)	NA	−0.0167589 (0.00119712) ***	−0.000778221 (0.000500379)	NA	−0.0166858 (0.00127977) ***
9(-1)		-0.00367702 (0.0002976688) ***	NA	0.0173607 (0.00131329) ***	-0.00285149 (0.000314691) ***	NA	0.0186342 (0.00132852)
10	**Total noninterest income/ Total interest income**	−0.00225940 (0.000341713) ***	−0.0398526 (0.00451161) ***	−0.000334561 (0.000234854)	−0.00230798 (0.000301287) ***	−0.0382476 (0.00431125) ***	−0.000377970 (0.000242159)
10(-1)		-0.00269059 (0.000413725) ***	−0.000181565 (0.00355016)	0.00181231 (0.000585597) ***	−0.00226405 (0.000363909) ***	-0.000146796 (0.00338851)	0.00188010 (0.000606265) ***
11	**Additional Noninterest Income/ Total interest income**	0.00301478 (0.00168010) ***	0.0343813 (0.0281655)	−0.00132033 (0.000266657) ***	0.00300371 (0.000272707) ***	0.0370886 (0.00383957) ***	−0.00129049 (0.000267266) ***
11(-1)		0.00168010	0.0383856 (0.00398387) ***	−0.000635117 (0.000592793)	0.00134246	-0.0116368	-0.000718456 (0.000603328)

		(0.000374360) ***			(0.000340029) ***	(0.00288423) ***	
12	**Pre-tax net operating income/ Total interest income**	−0.00285124 (0.000173415) ***	−0.0247406 (0.00187474) ***	NA	−0.00282188 (0.000184607) ***	−0.0246371 (0.00191518) ***	NA
12(-1)		-0.00103245 (0.000107384) ***	-0.0109419 (00148842) ***	NA	-0.00121903 (0.000114542) ***	-0.0124167 (0.00146381) ***	NA
13	**Net income/ Total interest income**	0.0399819 (0.000163508) ***	0.325212 (0.00217586) ***	0.00119062 (0.000151209) ***	0.0397595 (0.000167304) ***	0.323097 (0.00230198) ***	0.00129538 (0.000164539) ***
13(-1)		-0.00838894 (0.000273560) ***	-0.0796797 (0.00246063) ***	0.000373718 (0.000129488) ***	-0.00783321 (0.000167304) ***	-0.0795851 (0.00263551) ***	0.000433305 (0.000128307) ***
14	**Yield on earning assets (%)**	0.177278 (0.00372080) ***	0.653226 (0.0247607) ***	0.479513 (0.00784913) ***	0.179712 (0.00404994) ***	0.561827 (0.0244734) ***	0.477770 (0.0079225) ***
14(-1)		−0.0363648 (0.00323176) ***	-0.451298 (0.0239013) ***	−0.369471 (0.0119084) ***	-0.0156875 (0.00367594) ***	-0.315260 (0.0244021) ***	-0.399323 (0.0125656) ***

15	**Net operating income to assets (%)**	0.134812 (0.00342512) ***	0.646600 (0.0756482) ***	NA	0.135189 (0.00354042) ***	0.670226 (0.0761411) ***	NA
15(-1)		−0.00970886 (0.00202871) ***	-0.215368 (0.0254209) ***	NA	−0.00362247 (0.00178516) **	-0.192543	NA
16	**Efficiency ratio (%)**	NA	−0.0170515 (0.00123436) ***	−0.00103977 (6.13825e-05) ***	NA	−0.0168968 (0.00131449) ***	−0.000998992 (6.17673e-05) ***
16(-1)		NA	−0.00166646 (0.000518142) ***	0.00126977 (7.54326e-05) ***	NA	-0.00189388 (0.000502532) ***	0.00129503 (8.32657e-05) ***
17	**Assets per employee ($millions)**	NA	−0.129437 (0.0120583) ***	0.0442050 (0.00380045) ***	NA	−0.131858 (0.0113194) ***	0.0440717 (0.00391002) **
17(-1)		NA	0.134770 (0.00706226) ****	−0.0216883 (0.00237671) ***	NA	0.133283 (0.00692043) ***	-0.0227288 (0.00254370) ***
18	**Net loans and leases to total assets (%)**	NA	NA	NA	NA	NA	NA

19	**Net loans and leases to deposits (%)**	NA	NA	NA	NA	NA	NA
20	**Total domestic deposits to total assets (%)**	NA	−0.0277937 (0.00458772) ***	NA	NA	−0.0222451 (0.00426585) ***	NA
20(-1)		NA	-0.000103859 (0.00354168)	NA	NA	-0.00164823 (0.00355493)	NA
21	**Equity capital to assets (%)**	NA	−0.0681466 (0.0207192)	NA	NA	−0.0766964 (0.0210249) ***	NA
21(-1)		NA	0.0221612 (0.0101310) **	NA	NA	0.0243704 (0.00986658) **	NA
22	**Leverage (core capital) ratio (%)**	−0.0463567 (0.000791891) ***	NA	0.0354357 (0.00188650) ***	−0.0460279 (0.000783504) ***	NA	0.0361886 (0.00197726) ***
22(-1)		−0.0123872 (0.00118539) ***	NA	-0.00309994 (0.00264120)	-0.0102561 (0.00122186) ***	NA	-0.00428999 (0.00276448)

23	**Tier 1 risk-based capital ratio (%)**	NA	−0.0247029 (0.00611620) ***	−0.0114605 (0.000950553) ***	NA	−0.0273485 (0.00588172) ***	−0.0119305 (0.00100813) ***
23(-1)		NA	−0.125366 (0.00680172) ***	−0.0138891 (0.00152815) ***	NA	-0.122765 (0.00684132) ***	-0.0138770 (0.00156222) ***
25	**3-Month London Interbank Offered Rate (LIBOR) %**	NA	NA	NA	NA	NA	NA
26	**5-Year Treasury Constant Maturity Rate %**	−0.0221180 (0.00168930) ***	NA	−0.0719168 (0.00244726) ***	−0.0306029 (0.00193430) ***	NA	−0.0659966 (0.00253246) ***
26(-1)		0.00574595 (0.00212461) ***	NA	−0.0388401 (0.00355903) ***	-0.0106888 (0.00208382) ***	NA	-0.0282742 (0.00360515)
27	**Real Effective Exchange Rates for USA %**	NA	0.0243728 (0.00160555) ***	NA	NA	0.0272221 (0.00169191) ***	NA
27(-1)		NA	0.0375654	NA	NA	0.0267594	NA

			(0.00146972) ***			(0.00153125) ***	
28	**U- 3 US Unemployment Rate Total in Labor %**	0.00956293 (0.000712275) ***	NA	−0.00111531 (0.00122479)	0.00653199 (0.000586162) ***	NA	−0.000766243 (0.00129206)
28(-1)		-0.0105109 (0.000684313) ***	NA	−0.0355394 (0.000973887) ***	-0.00513942 (0.000670822) ***	NA	-0.0387084 (0.00115814) ***
29	**GDP CQOQ Index**						
30	**Exchange rates news (%)**						
Financial Crisis		NA	NA	NA	−0.128894 (0.00732249) ***	−0.595537 (0.0632137) ***	0.0693852 (0.0102951)
	Specification Tests						
	SE	0.319709	3.882129	0.310209	0.316740	3.872484	0.313367
	Sargan Test	99.1461 [1.000]	79.9884 [1.000]	109.461 [1.000]	72.2582 [1.000]	107.628 [1.000]	108.72 [1.000]

Wald chi2 (31)	2.31083e+006	1.07705e+006	46647.3	6655.79	1.1951e+006	46678.1
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Number of Instruments	221	217	221	222	218	222
Number of Observations	2242	2242	2242	2242		

Appendix 25:Difference Dynamic Panel estimation with Sample of 30 Largest US Banks by Total Assets (N=30, T=21)

Sample of the Smallest US Banks by Total Assets. N= 30. T=21

GMM Single Equation

	Variables	Without Dummies			**With Dummies**		
	Variables						
	ROAt-1	-0.0239306			−0.0256186		
		(0174650)			(0.177826)		
	ROEt-1		-0.333939			−0.300211	
			(0.264549)			(0.268479)	
	NIMt-1			0.681540			0.575388
				(0.0579870) ***			(0.0711776) ***
	Constant	0. 000151829	0.756358	-0.00340490	-0.00302082	0.709849	0.0183801
		(0.00802620)	(0.394358) *	(0.00199281) *	(0.00905352)	(0.398658)	(0.00342185) ***
1	**Total assets**	0.0845114	NA	-0.0559221	0.129906	NA	−0.0327775
		(0.108127)		(0.149292)	(0.147475)		0.147911
1(-1)		-0.0537623	NA	NA	0.0100512	NA	NA
		(0.189659)			(0.180538)		

2	**Loan and leases loss allowance/ Total Assets**	NA	NA	NA	NA	NA	NA
3	**Total deposits/ Total Assets**	NA	−1.11173 (3.11606)	0.0677822 (0.00360711) ***	NA	−1.70284 (3.20827)	0.0719351 (0.00393680) ***
3(-1)		NA	−5.04708 (3.91008)	0.0546551 (0.00334895) ***	NA	−4.78113 (3.91374)	−0.0413965 (0.00517151) ***
4	**Interest-bearing deposits/Total Assets**	NA	−0.123537 (0.0922482)	NA	NA	−0.107419 (0.0946071)	NA
4(-1)		NA	−0.0579686 (0.116751)	NA	NA	−0.0450322 (0.117829)	NA
5	**Average total assets/ Total Assets**	NA	NA	NA	NA	NA	NA
6	**Tier one (core) capital/ Total Assets**	NA	−1.10434 (0.936482)	NA	NA	−1.07284 (0.936746)	NA
6(-1)		NA	−2.30210 (1.25359) *	NA	NA	-2.09121 (1.28683)	NA

7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
8	**Total interest income**	NA	NA	NA	NA	NA	NA
9	**Total interest expense/ Total interest income**	NA	NA	−0.0627267 (0.00202422) ***	NA	NA	−0.0635634 (0.00201790) ***
9(-1)		NA	NA	0.0436872 (0.00351518) ***	NA	NA	0.0397663 (0.00420271) ***
10	**Total noninterest income/ Total interest income**	0.00300466 (0.000899235) ***	−0.00606676 (0.0383775)	NA	0.00282156 (0.000896488) ***	−0.00605879 (0.0384019)	NA
10(-1)		-0.000949931 (0.00114579)	−0.0886914 (0.0298820) ***	NA	−0.000605727 (0.00126177)	-0.0789000 (0.0317280) **	NA
11	**Additional Noninterest Income/ Total interest income**	NA	NA	NA		NA	NA

12	**Pre-tax net operating income/ Total interest income**	-0.00271192 (0.00215282) **	NA	NA	−0.00222858 (0.00206597)	NA	NA
12(-1)		0.00216606 (0.00865423) **	NA	NA	0.00194912 (0.000878590) **	NA	NA
13	**Net income/ Total interest income**	0.0455136 (0.00245763) ***	0.376013 (0.116726) ***	NA	0.0451996 (0.00238281) ***	0.360191 (0.118822) ***	NA
13(-1)		-0.00203293 (0.00816854)	−0.0496679 (0.14380)	NA	−0.00176234 (0.00833828)	−0.0570202 (0.144797)	NA
14	**Yield on earning assets (%)**	0.117322 (0.0165795) ***	2.18510 (0.637898) ***	0.674465 (0.0149066) ***	0.116371 (0.0188519) ***	2.17946 (0.639218) ***	0.678992 (0.0145850) ***
14(-1)		−0.00634636 (0166475)	−0.983552 (0.876242)	−0.461571 (0.0403462) ***	−0.000316094 (0.0170544)	−1.01285 (0.880228)	
15	**Net operating income to assets (%)**	NA	3.56602 (2.98182)	NA	NA	4.11245 (3.06647)	NA
15(-1)		NA	6.85235	NA	NA	6.48358	NA

			(3.04091) **			(3.06837) **	
16	**Efficiency ratio (%)**	0.00680130 (0.00111000) ***	NA	NA	−0.00626914 (0.00113157)	NA	NA
16(-1)		−0.000543264 (0.00155834)	NA	NA	-0.000554684 (0.00113157) ***	NA	NA
17	**Assets per employee ($millions)**	NA	−2.56569 (1.13815) **	NA	NA	−2.46431 (1.15106) **	NA
17(-1)		NA	−3.26205 (1.72176) *	NA	NA	−2.96723 (1.75925)	NA
18	**Net loans and leases to total assets (%)**	NA	NA	NA	NA	NA	NA
19	**Net loans and leases to deposits (%)**	−0.000481819 (0.000545565)	NA	NA	−0.000458583 (0.000753162)	NA	NA
19(-1)		-0.00248044 (0.00114029) **	NA	NA	−0.00232259 (0.00125304) *	NA	NA
20	**Total domestic deposits to total assets (%)**	NA	1.31070 (3.00732)	−0.0721602 (0.00253385) ***	NA	1.92099 (3.10586)	−0.0753314 (0.00307128) ***
20(-1)		NA	5.03800	0.0511602	NA	4.79587	0.0406881

			(3.82455)	(0.00395594) ***		(3.82836)	(0.00484587) ***
21	**Equity capital to assets (%)**	NA	NA	−0.00830864 (0.00427408) *	NA	NA	-0. 00420843 (0.00594993)
21(-1)		NA	NA	0.00774255 (0.00724632)	NA	NA	0.0116961 (0.00688443) *
22	**Leverage (core capital) ratio (%)**	NA	NA	NA	NA	NA	NA
23	**Tier 1 risk-based capital ratio (%)**	NA	NA	NA	NA	NA	NA
25	**3-Month London Interbank Offered Rate (LIBOR) %**	NA	NA	NA	NA	NA	NA
26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA
27	**Real Effective Exchange Rates for USA %**	NA	NA	NA	NA	NA	NA

28	**U- 3 US Unemployment Rate Total in Labor %**	NA	NA	0.0154095 (0.00191938) ***	NA	NA	0.0128148 (0.00297387) ***
28(-1)		NA	NA	−0.0159377 (0.00249357) ***	NA	NA	-0.0123734 (0.00224262) ***
29	**GDP CQOQ Index**	NA	NA	0.0291590 (0.00343558) ***	NA	NA	0.0505254 (0.00495982) ***
29(-1)		NA	NA	−0.0346498 (0.00358421) ***	NA	NA	−0.0331453 (0.00256283) ***
30	**Exchange rates news (%)**	NA	NA	−3.13168e-05 (4.76283e-05)	NA	NA	0.0001 (5.12345e-05) ***
30(-1)		NA	NA	-0.000130147 (4.94854e-05) ***	NA	NA	0.000362498 0.000179042) ***
Financial Crisis		NA	NA	NA	-0.0138992 (0.0338706)	0.582812 (0.624972)	-0.234465

						(0.0245618) ***
SE	0.149895	3.995797	0.0.168473	0.150031	3.914421	0.162171
Sargan Test	11.025 [1.000]	5.71937 [1.000]	28.4661 [1.000]	10.9906 [1.000]	4.69644 [1.000]	27.6721 [1.000]
Wald chi2(31)	43438.1 [0.000]	4062.54 [0.000]	15573.6 [0.000]	50113.7 [0.000]	4096.71 [0.000]	13373.7 [0.000]
Number of instruments	205	209	207	206	210	208
Number of Observations	570	570	570	570		570

Appendix 26: Robustness checks- System Dynamic Panel Estimation in the Total US banks between the period 1998 and 2018. (N=148, T=21)

Total Sample. N= 148. T=21

GMM System Equation

	Variables	Without Dummies			**With Dummies**		
	ROAt-1	0.0623716 (0.00417026) ***			0.0460221 (0.00430532) ***		
	ROEt-1		0.147236 (0.00374782) ***			0.122078 (0.00539954) ***	
	NIMt-1			0.502495 (0.00756463) ***			0.515147 (0.00744995) ***
	Constant	−1.77703 (0.0617364) ***	4.37825 (0.457484) ***	-1.24248 (0.142266) ***	−1.79790 (0.0655986) ***	5.59892 (0.462045) ***	−1.25003 (0.136072) ***
1	**Total assets**	0.130773 (0.00907804) ***	NA	−0.0400549 (0.0174538) **	0.134793 (0.00914477) ***	NA	−0.0532368 (0.0179335) ***

1(-1)	**t-1**	0.0170777 (0.00968053) *	NA	0.0320781 (0.0170324) *	0.0231859 (0.0100763) **	NA	0.0177796 (0.0168704)
2	**Loan and leases loss allowance/ Total Assets**	NA	NA	0.123095 (0.0134621) ***	NA	NA	0.0988681 (0.0125039) ***
2(-1)	**Loan and leases loss allowance/ Total Assets** (-1)	NA	NA	−0.0375968 (0.0137242)	NA	NA	−0.0240198 (0.0135936) *
3	**Total deposits/ Total Assets**	NA	NA	0.00706393 (0.00147461) ***	NA	NA	0.00563497 (0.00145184) ***
3(-1)	**Total deposits/ Total Assets** (-1)	NA	NA	0.00743314 (0.00141790)	NA	NA	0.00543711 (0.00132169)
4	**Interest-bearing deposits/Total Assets**	0.000532873 (0.000201415) ***	NA	−0.00841105 (0.000654967) ***	0.000641727 (0.000201437) ***	NA	−0.00810952 (0.000718683) ***
4(-1)	**t-1**	0.000526042 (0.000183098) ***	NA	−0.00577450 (0.000578619) ***	0.000470524 (0.000176347) ***	NA	-0.00403068 (0.000536201) ***

5	**Average total assets/ Total Assets**	0.00295925 (0.000259696) ***	NA	NA	0.00299760 (0.000246916) ***	NA	NA
5(-1)	**t-1**	−0.000878715 (0.000161941)	NA	NA	−0.000915145 (0.000181617) ***	NA	NA
6	**Tier one (core) capital/ Total Assets**	0.0345207 (0.00207064) ***	−0.152902 (0.0196777) ***	−0.0220579 (0.00191976) ***	0.0345514 (0.00203296) ***	−0.132676 (0.0200597) ***	−0.0240424 (0.00184505) ***
6(-1)	**t-1**	0.0266561 (0.00111948) ***	-0.247530 (0.0163225) ***	0.0191149 (0.00207658) ***	0.0268867 (0.00121863) ***	-0.227443 (0.0168028) ***	0.0176381 (0.00197615) ***
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
7(-1)	**Tier 2 Risk-based capital/ Total Assets** (-1)	NA	NA	NA	NA	NA	NA
8	**Total interest income**	−0.0862868 (0.00415113) ***	NA	0.0126978 (0.00493440) **	−0.0897712 (0.00453660) ***	NA	0.0212475 (0.00486460) ***
8(-1)	**t-1**	−0.0490784 (0.00283296) ***	NA	2.48038e-05 (0.00514315)	0.000873479	NA	0.0187823 (0.00451878) **

					(0.000373066) **		
9	**Total interest expense/ Total interest income**	0.000951842 (0.000326066) ***	NA	NA		NA	NA
9(-1)	**t-1**	-0.00308234 (0.000270875) ***	NA	NA	−0.00351565 (0.000288686) ***	NA	NA
10	**Total noninterest income/ Total interest income**	−0.00284273 (0.000332957) ***	−0.0260423 (0.00322066) ***	0.00131634 (0.000304032) ***	−0.00314415 (0.000311383) ***	−0.0237684 (0.00354008) ***	0.00140791 (0.000296313) ***
10(-1)	**t-1**	-0.00172776 (0.000308348) ***	-0.00960972 (0.00299473) ***	-0.00194175 (0.000357068) ***	−0.00159363 (0.000290942) ***	−0.0134138 (0.00354889) ***	−0.00174310 (0.000336097)
11	**Additional Noninterest Income/ Total interest income**	0.00261353 (0.000307174) ***	0.0323176 (0.00290507) ***	−0.00244399 (0.000297042) ***	0.00291271 (0.000282871) ***	0.0315107 (0.00312344) ***	−0.00264285 (0.000290203) ***
11(-1)	**t-1**	0.000728988 (0.000288301) **	-0.00480966 (0.00270660) *	0.00274243 (0.000352332) ***	0.000585908 (0.000268856) **	−0.00220844 (0.00303431)	0.00261048 (0.000330659) ***

12	**Pre-tax net operating income/ Total interest income**	−0.00246853 (8.79902e-05) ***	−0.0317272 (0.00111646) ***	NA	−0.00248817 (9.64522e-05) ***	−0.0327609 (0.00153758) ***	NA
12(-1)	**t-1**	−0.00216392 (8.39716e-05) ***	−0.0186275 (0.000766917) ***	NA	−0.00220841 (7.40264e-05)	−0.0192710 (0.000948621) ***	NA
13	**Net income/ Total interest income**	0.0448114 (0.000145463) ***	0.382248 (0.00212277) ***	−0.000129235 (0.000183644)	0.0448065 (0.000149299) ***	0.381859 (0.00216130) ***	−0.000155929 (0.000173928)
13(-1)	**t-1**	−9.82857e-05 (0.000199382)	−0.0120135 (0.00172045) ***	0.000792086 (0.000198565) ***	0.000548581 (0.000199240) ***	−0.00420187 (0.00217863) *	0.00108592 (0.000198404) ***
14	**Yield on earning assets (%)**	0.188091 (0.00237822) ***	1.22849 (0.0210290) ***	0.633721 (0.00652295) ***	0.185911 (0.00264524) ***	1.00788 (0.0242694) ***	0.645409 (0.00598875) ***
14(-1)	**t-1**	0.0404089 (0.00229058) ***	−0.0457815 (0.0171814) ***	−0.265119 (0.00505831) ***	0.0462143 (0.00254829) ***	0.0118334 (0.0171863)	-0.274381 (0.00485464) ***
15	**Net operating income to assets (%)**	0.0536917 (0.00444686) ***	0.293547 (0.0462944) ***	0.0609302 (0.00174948) ***	0.0515760 (0.00515795) ***	0.280253 (0.0439189) ***	0.0599552 (0.00170647) ***

15(-1)	**t-1**	0.0129568 (0.00444686) ***	-0.0397429 (0.00699734) ***	−0.0299637 (0.00326547) ***	0.0137378 (0.00147950) ***	−0.0278329 (0.00981420) ***	−0.0292433 (0.00338605) ***
16	**Efficiency ratio (%)**	−0.00139587 (8.66359e-05) ***	−0.0226819 (0.000928963) ***	NA	−0.00146965 (9.71752e-05) ***	−0.0236196 (0.000942992) ***	NA
16(-1)	**t-1**	0.000136330 (4.61887e-05) ***	-0.00371393 (0.000365878)	NA	0.000130083 (4.85442e-05) ***	−0.00386828 (0.000413934) ***	NA
17	**Assets per employee ($millions)**	NA	−0.103128 (0.00587526) ***	−0.00428922 (0.00110323) ***	NA	−0.104287 (0.00571119) ***	−0.00564110 (0.00107980)
17(-1)	**Assets per employee ($millions)** (-1)	NA	0.0429154 (0.00502843) ***	−0.00456790 (0.00104087) ***	NA	0.0475415 (0.00494924) ***	-0.00612544 (0.00100779) ***
18	**Net loans and leases to total assets (%)**	NA	NA	0.00829750 (0.000968631) ***	NA	NA	0.00874036 (0.00104829) ***
18(-1)	**t-1**	NA	NA	−0.00279737 (0.000858213) ***	NA	NA	−0.00432252 (0.000925954) ***

19	**Net loans and leases to deposits (%)**	NA	0.00326419 (0.00169159) *	−0.00423191 (0.000593211) ***	NA	0.00475963 (0.00157956) ***	−0.00444278 (0.000621917) ***
19(-1)	**Net loans and leases to deposits (%)** (-1)	NA	0.00114431 (0.00184944)	0.000347116 (0.000547094)	NA	0.00282181 (0.00155182) *	0.000501447 (0.000599649)
20	**Total domestic deposits to total assets (%)**	−0.000448488 (0.000272346) *	−0.0403505 (0.00279448) ***	0.00130036 (0.00106664)	−0.000499206 (0.000294151) *	−0.0353322 (0.00252193) ***	0.000820929 (0.00110334)
20(-1)	**t-1**	−0.00178118 (0.000239218) ***	0.0116954 (0.00309299) ***	−0.000518440 (0.00125428)	−0.00181726 (0.000257859) ***	0.00755767 (0.00299121) **	0.000466054 (0.00125198)
21	**Equity capital to assets (%)**	NA	−0.136662 (0.0216261) ***	NA	NA	−0.152536 (0.0206233) ***	NA
21(-1)	**t-1**	NA	-0.0446026 (0.00842315) ***	NA	NA	-0.0446413 (0.00686704) ***	NA
22	**Leverage (core capital) ratio (%)**	−0.0321284 (0.00162454) ***	NA	0.0328596 (0.00123936) ***	−0.0316654 (0.00171188) ***	NA	0.0349475 (0.00113481) ***

22(-1)	**t-1**	-0.0170948 (0.00125683) ***	NA	−0.0127343 (0.00152400) ***	−0.0171307 (0.00136997) ***	NA	−0.0140149 (0.00149623) ***
23	**Tier 1 risk-based capital ratio (%)**	NA	0.0859479 (0.00606576) ***	NA	NA	0.0841966 (0.00645470) ***	NA
23(-1)	**Tier 1 risk-based capital ratio (%)** (-1)	NA	−0.0315018 (0.00487360) ***	NA	NA	−0.0414749 (0.00442469) ***	NA
25	**3-Month London Interbank Offered Rate (LIBOR) %**	0.00261699 (0.000766810) ***	NA	−0.0770611 (0.00210586) ***	−0.00623671 (0.000873636) ***	NA	−0.0502030 (0.00234793) ***
25(-1)	**t-1**	−0.0271674 (0.000908394) ***	NA	−0.130069 (0.00205335) ***	−0.0257784 (0.000898160) ***	NA	-0.130676 (0.00195298) ***
26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA
26(-1)	**5-Year Treasury Constant Maturity Rate %** (-1)	NA	NA	NA	NA	NA	NA
27	**Real Effective Exchange Rates for USA %**	NA	NA	0.00721148	NA	NA	0.00415853

				(0.000272811) ***			(0.000247033) ***
27(-1)	**t-1**	NA	NA	-0.000114551 (0.000227811)	NA	NA	0.00437673 (0.000241587) ***
28	**U- 3 US Unemployment Rate Total in Labor %**	0.00819743 (0.000548510) ***	NA	0.0193302 (0.00112981) ***	0.00790917 (0.000529190) ***	NA	0.0171020 (0.00115307) ***
28(-1)	**t-1**	−0.00231023 (0.000451540) ***	NA	0.00973264 (0.000926559) ***	0.00233999 (0.000442794) **	NA	0.000633575 (0.000931958)
29	**GDP CQOQ Index**	NA	NA	NA	NA	NA	NA
30	**Exchange rates news (%)**	NA	NA	NA	NA	NA	NA
	Financial Crisis	NA	NA	NA	−0.0658899 (0.00393517) **	-0.944041 (0.0410464) ***	0.223885 (0.00689475) ***
	Specification Tests						
	SE	0.269015	3.271048	0.245581	0.271054	3.303941	0.237809
	Sargan Test	130.727 Pr [1.000]	127.069 Pr [1.000]	141.821 Pr [0.9999]	131.928 Pr [0.9997]	137.667 Pr [1.000]	139.722 Pr [0.00]
	Wald chi2(31)	3.98759e+006	447230	253949	3.80397e+006	556779	299143

	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Number of instuments	244	236	248	245	237	249
obs	2960	2960	2960	2960	2960	2960

*Notes 9: Dependent variables are Return on Assets (ROA). Return on Equity (ROE) and Net Interest Margin (NIM).. SEs in parenthesis; *** Significant at 1%; ** significant at 5%; significant at 10%. System GMM (Blundell and Bond 1998). Sargan test is the test for over-identifying restrictions in GMM dynamic model estimation.*

Appendix 27: Robustness checks- System Dynamic Panel Estimation in the sample of the 118 largest US banks between the period 1998 and 2018. (N=118, T=21)

Sample of the Largest US Banks by Total Assets. N= 118. T=21

GMM System Equation

Variables	Without Dummies			**With Dummies**		
Variables						
ROAt-1	0.102389 (0.00553552) ***			0.0879211 (0.00531338) ***		
ROEt-1		0.172922 (0.00581501) ***			0.163728 (0.00612685) ***	
NIMt-1			0.701673 (0.0110446) ***			0.762460 (0.0151971) ***
Constant	−2.47213 (0.0669015) ***	0.932789 (0.320531) ***	0.607744 (0.0546949) ***	−2.34800 (0.0726654)	2.53897 (0.325338) ***	0.470229 (0.0472873) ***

1	**Total assets**	0.301573 (0.0137002) ***	NA	−0.0483257 (0.0218592) **	0.301779 (0.0132147) ***	NA	−0.0548161 (0.0240237) **
1(-1)	**(t-1)**	−0.105673 (0.0125571) ***	NA	0.0387210 (0.0220981) *	-0.0930450 (0.0133436) ***	NA	0.0459784 (0.0244332) *
2	**Loan and leases loss allowance/ Total Assets**	−0.213544 (0.00723586) ***	NA	0.101502 (0.0163026) ***	−0.201937 (0.00779785) ***	NA	0.0943037 (0.0170075) ***
2(-1)	**(t-1)**	0.126596 (0.00466311)	NA	−0.0471432 (0.0189681) **	0.113865 (0.00444904) ***	NA	−0.0440146 (0.0202376) **
3	**Total deposits/ Total Assets**	NA	NA	0.00864641 (0.000876382) ***	NA	NA	0.00834713 (0.000866668) ***
3(-1)	**(t-1)**	NA	NA	−0.00239465 (0.000852640) ***	NA	NA	−0.00215691 (0.000818218) ***
4	**Interest-bearing deposits/Total Assets**	NA	NA	−0.000428558 (0.000479342)	NA	NA	−0.000491508 (0.000489877)

4(-1)	**(t-1)**	NA	NA	−0.00427841 (0.000420314) ***	NA	NA	−0.00417215 (0.000451345) ***
5	**Average total assets/ Total Assets**	0.00816913 (0.000348360) ***	NA	NA	0.00758827 (0.000390148) ***	NA	NA
5(-1)	**(t-1)**	−0.00162232 (0.000170875) ***	NA	NA	-0.00181600 (0.000173516) ***	NA	NA
6	**Tier one (core) capital/ Total Assets**	0.0488502 (0.00184106) ***	−0.142182 (0.0211437) ***	NA	0.0494201 (0.00192046) ***	−0.138743 (0.0226097) ***	NA
6(-1)	**(t-1)**	0.0171670 (0.00136936) ***	-0.214523 (0.0211437) ***	NA	0.0178402 ((0.00139113) ***	−0.199363 (0.0190004) ***	NA
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
7(-1)	**(t-1)**	NA	NA	NA	NA	NA	NA

8	**Total interest income**	−0.140144 (0.00545667) ***	NA	NA	−0. 145278 (0. 00590191) ***	NA	NA
8(-1)	**(t-1)**	0.0338084 (0.0281746) ***	NA	NA	0. 0405109 (0. 00293929) ***	NA	NA
9	**Total interest expense/ Total interest income**	0.000110923 (0.000384353)	NA	−0.0154937 (0.00113288) ***	1.31072e-05 (0. 000409092)	NA	−0.0150271 (0.00116231) ***
9(-1)	**(t-1)**	-0.00349333 (0.000327689) ***	NA	0.0106699 (0.000956646) ***	-0. 00365013 (0. 000356822) ***	NA	0.0133191 (0.000949393) ***
10	**Total noninterest income/ Total interest income**	−0.00115552 (0.000359831) ***	−0.0269091 (0.00305586) ***	0.000326256 (0.000277097)	−0. 00117826 (0. 000366748) ***	−0.0275653 (0.00306180) ***	0.000216676 (0.000271553)
10(-1)	**(t-1)**	-0.00256624 (0.000376385) ***	−0.00383814 (0.00292982)	−0.000584541 (0.000331921) *	−0. 00255913 (0. 000403098) ***	-0.00383650 (0.00294294)	-0.000541865 (0.000331334)
11	**Additional Noninterest**	0.00119009 (0.000336740) ***	0.0342208 (0.00266194)	−0.00128292 (0.000254043) ***	0.00118721 (0.000346056) ***	0.0352371 (0.00270693) ***	−0.00115986 (0.000244205) ***

	Income/ Total interest income						
11(-1)	**(t-1)**	0.00139071 (0.000353202) ***	−0.00984410 (0.00257478) ***	0.00160550 (0.000316180) ***	0.00143975 (0.000376298) ***	−0.00979649 (0.00261546) ***	0.00153249 (0.000324062) ***
12	**Pre-tax net operating income/ Total interest income**	−0.00409455 (0.000163496) ***	−0.0382825 (0.00214029) ***	NA	−0.00415932 (0.000152539) ***	−0.0384392 (0.00197912) ***	NA
12(-1)	**(t-1)**	-0.00168258 (9.07877e-05) ***	−0.0181770 (0.00108190) ***	NA	−0.00176885 (8.80454e-05) ***	-0.0181805 (0.00103066) ***	NA
13	**Net income/ Total interest income**	0.0419596 (0.000145195) ***	0.350589 (0.00194891) ***	0.000638604 (0.000165953) ***	0.0418170 (0.000148360) ***	0.349915 (0.00214940) ***	0.000668911 (0.000184519) ***
13(-1)	**(t-1)**	-0.00229232 (0.000230360) ***	−0.0185998 (0.00224295) ***	0.000113458 (0.000126499)	−0.00187027 (0.000218047) ***	-0.0163908 (0.00229473) ***	0.000215012 (0.000129636) *
14	**Yield on earning assets (%)**	0.207505 (0.00276910) ***	1.03641 (0.0247984) ***	0.537595 (0.00615349) ***	0.205549 (0.00298347) ***	0.903604 (0.0248894) ***	0.534945 (0.00658306) ***

14(-1)	**(t-1)**	−0.0216971 (0.00312701) ***	−0.0643346 (0.0205086) ***	−0.340048 (0.00848176) ***	0.0282706 (0.00317288) ***	-0.00610311 (0.0244021) ***	−0.380214 (0.0109280) ***
15	**Net operating income to assets (%)**	0.136962 (0.00349929) ***	0.507521 (0.0633167) ***	NA	0.138366 (0.00317898) ***	-0.00610311 (0.0215895)	NA
15(-1)	**(t-1)**	−0.00996411 (0.00178532) ***	−0.0973744 (0.0100704) ***	NA	0.0130071 (0.00185041) **	−0.0905200 (0.0100476) ***	NA
16	**Efficiency ratio (%)**	NA	−0.0208929 (0.000972587) ***	−0.00126440 (5.84917e-05) ***	NA	−0.0210533 (0.000980232) ***	−0.00124012 (5.58611e-05) ***
16(-1)	**(t-1)**	NA	−0.00449464 (0.000433633) ***	0.00118770 (6.29847e-05) ***	NA	−0.00445088 (0.000411170) ***	0.00119886 (6.16262e-05) ***
17	**Assets per employee ($millions)**	NA	−0.142804 (0.00945780) ***	0.0356093 (0.00240284) ***	NA	−0.139936 (0.00836769) ***	0.0355455 (0.00256385) ***
17(-1)	**(t-1)**	NA	0.0718583 (0.00690759) ****	−0.0327173 (0.00227666) ***	NA	0.0743687 (0.00623237) ***	−0.0340098 (0.00254894) ***

18	**Net loans and leases to total assets (%)**	NA	NA	NA	NA	NA	NA
19	**Net loans and leases to deposits (%)**	NA	NA	NA	NA	NA	NA
20	**Total domestic deposits to total assets (%)**	NA	−0.0364916 (0.00294535) ***	NA	NA	−0.0313838 (0.00310636) ***	NA
20(-1)	**(t-1)**	NA	0.00415688 (0.00279533)	NA	NA	0.000768089 (0.00278845)	NA
21	**Equity capital to assets (%)**	NA	−0.138831 (0.0230999)	NA	NA	−0.133736 (0.0245074) ***	NA
21(-1)	**(t-1)**	NA	−0.0432629 (0.00713710) ***	NA	NA	-0.0384299 (0.00711610) **	NA
22	**Leverage (core capital) ratio (%)**	−0.0429330 (0.00103115) ***	NA	0.0318773 (0.00169250) ***	−0.0431989 (0.00107213) ***	NA	0.0323127 (0.00169480) ***

22(-1)	**(t-1)**	−0.0131078 (0.000994699) ***	NA	-0.0154499 (0.00196222) ***	-0.0128918 (0.00108729) ***	NA	−0.0176483 (0.00215789)
23	**Tier 1 risk-based capital ratio (%)**	NA	0.0777389 (0.00627303) ***	−0.00287262 (0.000817718) ***	NA	0.0699091 (0.00681939) ***	−0.00311654 (0.000843673) ***
23(-1)	**(t-1)**	NA	−0.0313105 (0.00508735) ***	−0.00272865 (0.000913954) ***	NA	−0.0388128 (0.00524406) ***	−0.00218934 (0.000979620) **
25	**3-Month London Interbank Offered Rate (LIBOR) %**	NA	NA	NA	NA	NA	NA
26	**5-Year Treasury Constant Maturity Rate %**	−0.0162253 (0.00137923) ***	NA	−0.0925619 (0.00294654) ***	−0.0303818 (0.00177949) ***	NA	−0.0823335 (0.00306224) ***
26(-1)	**(t-1)**	-0.0109927 (0.00210908) ***	NA	−0.0460284 (0.00375434) ***	-0.0249163 (0.00222197) ***	NA	−0.0338521 (0.00345901) ***

27	**Real Effective Exchange Rates for USA %**	NA	0.00835297 (0.00130850) ***	NA	NA	0.0137877 (0.00131146) ***	NA
27(-1)	**(t-1)**	NA	0.0407448 (0.00150267) ***	NA	NA	0.0255676 (0.00138350) ***	NA
28	**U- 3 US Unemployment Rate Total in Labor %**	0.0127930 (0.000790749) ***	NA	0.00426216 (0.00126088) ***	0.00889956 (0.000754255) ***	NA	0.00482997 (0.00133844) ***
28(-1)	**(t-1)**	-0.0102931 (0.000608015) ***	NA	−0.0312577 (0.000853315) ***	-0.00413990 (0.000580162) ***	NA	−0.0368019 (0.00124250) ***
29	**GDP CQOQ Index**	NA	NA	NA	NA	NA	NA
30	**Exchange rates news (%)**	NA	NA	NA	NA	NA	NA
Financial Crisis		NA	NA	NA	−0.102138 (0.00494312) ***	−0.541958 (0.0471231) ***	0.0790458 (0.00935966) ***

	Specification Tests						
	SE	0.269038	3.157359	0.240870	0.270238	3.175108	0.240104
	Sargan Test	101.777	100.853	107.784	101.864	102.569	109.366
		[1.000]	[1.000]	[1.000]	[1.0000]	[1.000]	[1.000]
	Wald chi 2	(31) 937839	533694	359568	910131	592907	438578
		[0.0000]	[0.000]	[0.000]	[0.000]	[0.0000]	[0.000]
	Number of Instruments	221	236	240	241	237	241
	Number of Observations	2360	2360	2360	2360	2360	

*Notes 10: Dependent variables are Return on Assets (ROA). Return on Equity (ROE) and Net Interest Margin (NIM). SEs in parenthesis; *** Significant at 1%; ** significant at 5%; significant at 10%. System GMM (Blundell and Bond 1998). Sargan test is the test for over-identifying restrictions in GMM dynamic model estimation.*

Appendix 28: Robustness checks- System Dynamic Panel Estimation in the sample of the 30 Smallest US banks between the period 1998 and 2018. (N=30, T=21)

Sample of the* Smallest *US Banks by Total Assets. N=* 30, *T=21

GMM System Equation

Variables	Without Dummies			With Dummies		
Variables						
ROAt-1	0.765384 (0.238226)			−0.00685507 (0.246858)		
ROEt-1		−0.258556 (0.240544)			−0.199575 (0.253295)	
NIMt-1			0.706162 (0.0339155) ***			0.559669 (0.0636902) ***
Constant	0. 504493 (1.31035)	−24.6560 (30.1286)	0.641839	−0.175002 (1.51946)	−25.0516 (30.5793)	0.984104 (0.177204) ***

				(0.115867) ***			
1	**Total assets**	−0.0765504 (0.133285)	NA	NA	−0.0561208 (0.138819)	NA	NA
1(-1)		0.0289679 (0.112250)	NA	NA	0.0519488 (0.116077)	NA	NA
2	**Loan and leases loss allowance/ Total Assets**	NA	NA	NA	NA	NA	NA
3	**Total deposits/ Total Assets**	NA	−1.56232 (3.85082)	0.0716215 (0.00130748) ***	NA	−0.868728 (3.96524)	0.0704788 (0.00143285) ***
3(-1)	**(t-1)**	NA	−5.47456 (5.38907)	-0.0529946 (0.00240269) ***	NA	−5.63190 (5.47696)	−0.0426328 (0.00491566) ***

4	**Interest-bearing deposits/Total Assets**	NA	0.0474254 (0.0538988)	NA	NA	0.0253371 (0.0594865)	NA
4(-1)	**(t-1)**	NA	0.0832030 (0.0460061) *	NA	NA	0.0933200 (0.0489717) *	NA
5	**Average total assets/ Total Assets**	NA	NA	NA	NA	NA	NA
6	**Tier one (core) capital/ Total Assets**	NA	−0.384351 (0.443108)	NA	NA	−0.106705 (0.533717)	NA
6(-1)	**(t-1)**	NA	-0.228111 (0.53763)	NA	NA	−0.433368 (0.579877)	NA
7	**Tier 2 Risk-based capital/ Total Assets**	NA	NA	NA	NA	NA	NA
8	**Total interest income**	NA	NA	NA	NA	NA	NA
9	**Total interest expense/ Total interest income**	NA	NA	−0.0639532 (0.00158410) ***	NA	NA	−0.0646061 (0.00167425) ***

9(-1)	**(t-1)**	NA	NA	0.0465575 (0.00223341) ***	NA	NA	0.0373058 (0.00359297) ***
10	**Total noninterest income/ Total interest income**	0.00263429 (0.000746371) ***	−0.000555438 (0.0225253)	NA	0.00248376 (0.000798887) ***	0.00374158 (0.0228350)	NA
10(-1)	**(t-1)**	-0.000790460 (0.00118346)	NA	NA	−0.000973137 (0.00119412)	NA	NA
11	**Additional Noninterest Income/ Total interest income**	NA	NA	NA	NA	NA	NA
12	**Pre-tax net operating income/ Total interest income**	−0.00526552 (0.00199972) ***	NA	NA	−0.00513069 (0.00207606) **	NA	NA
12(-1)	**(t-1)**	-0. 00145118 (0.00210021)	NA	NA	−0.00108023 (0.00229876)	NA	NA

13	**Net income/ Total interest income**	0.0488474 (0.00200080) ***	0.438671 (0.153254) ***	NA	0.0490207 (0.00202270) ***	0.462959 (0.157794) ***	NA
13(-1)	**(t-1)**	−0.00183959 (0.0122153)	−0.0907027 (0.282250)	NA	0.00196626 (0.0126009)	-0.124584 (0.292722)	NA
14	**Yield on earning assets (%)**	0.100179 (0.0117592) ***	1.48394 (0.637369) **	0.683087 (0.0127621) ***	0.104091 (0.0145824) ***	1.79387 (0.704840) **	0.678412 (0.0130598) ***
14(-1)	**(t-1)**	−0.00274272 (0330001)	-0.444281 (1.05191)	−0.469711 (0.0251268) ***	0.0122569 (0.0330567)	-0.559369 (1.09637)	−0.373458 (0.0468824) ***
15	**Net operating income to assets (%)**	NA	1.93925 (3.50746)	NA	NA	1.38782 (3.59660)	NA
15(-1)	**(t-1)**	NA	4.88268 (4.67825)	NA	NA	4.91115 (4.72735)	NA

16	**Efficiency ratio (%)**	−0.00679655 (0.00194081) ***	NA	NA	−0.00593630 (0.00212189) ***	NA	NA
16(-1)	**(t-1)**	0.000170691 (0.00191023)	NA	NA	0.000390247 (0.00211137)	NA	NA
17	**Assets per employee ($millions)**	NA	−0.452633 (0.607418)	NA	NA	−0.538978 (0.609150)	NA
17(-1)	**(t-1)**	NA	0.414709 (0.491566)	NA	NA	0.515706 (0.493956)	NA
18	**Net loans and leases to total assets (%)**	NA	NA	NA	NA	NA	NA
19	**Net loans and leases to deposits (%)**	0.000653785 (0.000521520)	NA	NA	0.000706979 (0.000532561)	NA	NA
19(-1)	**(t-1)**	0.000124018 (0.000616581)	NA	NA	0.000261126 (0.000713714)	NA	NA

20	**Total domestic deposits to total assets (%)**	NA	1.63372 (3.86002)	−0.0730847 (0.00131646) ***	NA	0.962496 (3.97125)	−0.0726781 (0.00129211) ***
20(-1)	**(t-1)**	NA	5.57762 (5.24632) *	0.0520236 (0.00271815) ***	NA	5.70109 (5.32888)	0.0413964 (0.00505763) ***
21	**Equity capital to assets (%)**	NA	NA	−0.00437303 (0.00447892)	NA	NA	−0.00273035 (0.00516215)
21(-1)	**(t-1)**	NA	NA	0.00530577 (0.00448081)	NA	NA	0.00312962 (0.00473238)
22	**Leverage (core capital) ratio (%)**	NA	NA	NA	NA	NA	NA
23	**Tier 1 risk-based capital ratio (%)**	NA	NA	NA	NA	NA	NA
25	**3-Month London Interbank Offered Rate (LIBOR) %**	NA	NA	NA	NA	NA	NA

26	**5-Year Treasury Constant Maturity Rate %**	NA	NA	NA	NA	NA	NA
27	**Real Effective Exchange Rates for USA %**	NA	NA	NA	NA	NA	NA
28	**U- 3 US Unemployment Rate Total in Labor %**	NA	NA	0.0177159 (0.00180543) ***	NA	NA	0.0176262 (0.00305472) ***
28(-1)	**(t-1)**	NA	NA	−0.0164818 (0.00132732) ***	NA	NA	-0.0106815 (0.00200192) ***
29	**GDP CQOQ Index**	NA	NA	0.0247294 (0.00214243) ***	NA	NA	0.0466351 (0.00493949) ***

29(-1)	**(t-1)**	NA	NA	−0.0312698 (0.00197966) ***	NA	NA	−0.0361041 (0.00359612) ***
30	**Exchange rates news (%)**	NA	NA	−7.04028e-05 (3.95164e-05) *	NA	NA	−0.000101014 (4.76242e-05) **
30(-1)	**(t-1)**	NA	NA	−0.000102960 (3.84591e-05) ***	NA	NA	−4.57226e-05 (3.92679e-05)
Financial Crisis		NA	NA	NA	0.00713846 (0.0274632)	0.742146 (0.773445)	−0.112130 (0.0175381) ***
	Specification Tests						
	SE	0.159550	3.535959	0.116272	0.170857	3.474178	0.115354
	Sargan Test	15.0079 [1.000]	8.2145 [1.000]	28.4442 [1.000]	14.9036 [1.000]	7.2633 [1.000]	28.1516 [1.000]

Wald chi2(31)	41020.1	7767.62	171001	42792.1	7722.74	58535.6
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Number of instruments	224	227	226	225	228	227
Number of observations	600	600	600	600	570	600

Appendix 29: Dataset

Financial Metrics	Variable Description	Variable Identifier	Unit/Transformation
Dependent Variables	ROA	-	*percentage*
	ROE	-	*percentage*
	NIM	-	*percentage*
Independent variables	Total assets	*Var 1*	*percentage*
	Loan and leases loss allowance/ Total Assets	*Var2*	*percentage*
	Total deposits/ Total Assets	*Var3*	*percentage*
	Interest-bearing deposits/Total Assets	*Var 4*	*percentage*
	Average total assets/ Total Assets	*Var 5*	*percentage*
	Tier one (core) capital/ Total Assets	*Var 6*	*percentage*
	Tier 2 Risk-based capital/ Total Assets	*Var 7*	*percentage*
	Total interest income	*Var 8*	*Ln (natural logarithm)*
	Total interest expense/ Total interest income	*Var 9*	*percentage*
	Total noninterest income/ Total interest income	*Var 10*	*percentage*

	Additional Noninterest Income/ Total interest income	*Var 11*	*percentage*
	Pre-tax net operating income/ Total interest income	*Var 12*	*percentage*
	Net income/ Total interest income	*Var 13*	*percentage*
	Yield on earning assets (%)	*Var 14*	*percentage*
	Net operating income to assets (%)	*Var 15*	*percentage*
	Efficiency ratio (%)	*Var 16*	*Ln (natural logarithm)*
	Assets per employee ($millions)	*Var 17*	*percentage*
	Net loans and leases to total assets (%)	*Var 18*	*percentage*
	Net loans and leases to deposits (%)	*Var 19*	*percentage*
	Total domestic deposits to total assets (%)	*Var 20*	*percentage*
	Equity capital to assets (%)	*Var 21*	*percentage*
	Leverage (core capital) ratio (%)	*Var 22*	*percentage*
	Tier 1 risk-based capital ratio (%)	*Var 23*	*percentage*
	Total risk-based capital ratio (%)	*Var 24*	*percentage*
	3-Month London Interbank Offered Rate (LIBOR) %	*Var 25*	*percentage*

	5-Year Treasury Constant Maturity Rate %	*Var 26*	*percentage*
	Real Effective Exchange Rates for USA %	*Var 27*	*percentage*
	U- 3 US Unemployment Rate Total in Labor %	*Var 28*	*percentage*
	GDP CQOQ Index	*Var 29*	*percentage*
	Exchange rates news (%)	*Var 30*	*percentage*