The Banking Market of the Euro area in International Comparison –
Analysis of the Status Quo and Description of a Possible Future Positioning

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List of symbols

A	Initial wealth endowment; assets
$\bar{A}(\gamma)$	Minimal capital endowment for directed funding of project
b, B	Private benefit
c	Monitoring costs
C_0	Initial capital
C_i	Non-monetary effort
D	Delegation costs; supply of deposits
D_0	Initial deposits
E	Expected value; equity
f	Fraction of type 1 agents
g_i	Individual payment from entrepreneur to financial intermediary
G_N	Total payment from all entrepreneurs to financial intermediary
h	Face value of debt contract
H_N	Overall face value of deposit contract
I	Investment costs
I_0	Initial value of deposit insurance
I_m	Informed capital of intermediary
I_u	Demand for uninformed capital
k	Capital
K	Monitoring costs, capital
K_m	Informed capital
L	Total amount of loans
m	Number of entrepreneurs required to finance project
m_p, m_g	Profit margin
N	Number of entrepreneurs; number of banks; labour
p,P	Probability
P_1, P_2	Value of currency
P_A	Price for assets
P_D	Interest rate
PD	Banks default rate
r	Deposit rate
r_1	Return in T=1
r_2	Return in T=2
r_i, r_{-i}	Banks deposit interest rate and competitors deposits interest rate
r_L	Loan rate
r_E	Cost of equity
$r_p(k)$	Optimal interest rate
$\hat{r}_p(k)$	Critical interest rate

R	Market interest rate
R_{DD}	Return of investment into productive technology
R_f	Return to firm
R_H	Return of successful project
R_m	Return to intermediary
R_u	Return to investor
S	Saving rate; set of productive technology
t	Proportion of type 1 agents; point in time
T	Time point
U	Utility
V_0	Initial value of banks equity
X_0	Value of banking charter
$\tilde{y}$	Random output variable
$\bar{y}$	Upper threshold of random output variable
y	Realized output; input
Y	Output of an economy
z	Payment of entrepreneur to capital providers
Z_N	Total payment from financial intermediary to depositors
α	Payoff prudent asset
β	Interest rate for informed capital; share of loans
γ	Interest rate
γ, β	Payoff gambling asset
δ	Discount factor
Δ	Delta, difference
ε	Excess demand for liquidity; elasticity of deposit volume
θ	Probability gambling asset
π_i , π_p, π_g	Profit
ρ	Banks opportunity costs, correlation between loans
Φ^*	Non-pecuniary penalty

List of abbreviations

ATM	Automated Teller Machine
bn	Billion
BoE	Bank of England
BoJ	Bank of Japan
BRRD	Bank Recovery and Resolution Directive
CAGR	Compound Annual Growth Rate
CDR IV	Capital Requirements Directive IV
DGSD	Deposit Guarantee Schemes Directive
DICJ	Deposit Insurance Corporation of Japan
EBA	European Banking Authorization
ECB	European Central Bank
EDIS	European Deposit Insurance Scheme
e.g.	Exempli Gratia
FDI	Foreign Direct Investments
FDIC	Federal Deposit Insurance Corporation
FED	Federal Reserve System
FRED	Federal Reserve Economic Data
GR	Growth Rate
HHI	Herfindahl-Hirschmann Index
IMF	International Monetary Fund
IT	Information Technology
mn	Million
NIMA	Net Interest Margin Based on Assets
NIML	Net Interest Margin Based on Loans
NPL	Non-performing Loans
OECD	Organization for Economic Cooperation and Development
ONS	Office for National Statistics
PBR	Price to Book Ratio
RSD	Relative Standard Deviation
RWA	Risk-Weighted Assets
SRB	Single Resolution Board
SRF	Single Resolution Fund
SRM	Single Resolution Mechanism
SSM	Single Supervisory Mechanism
UK	United Kingdom
US	United States

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1. Introduction

Since the founding of the European Union and its Common Market predecessor, the markets of the participating states have undergone severe transformation. This is especially a result of the four principles of the single European market – free movement of goods, free movement of persons, free movement of services and free movement of capital – as subsequently, the participating European states embarked on a journey from single domestic markets to one single European market.

This was underlined by the Maastricht Treaty, which was signed in 1992 with the ambition to create a European economic and monetary union. The aim of creating an economic and monetary union goes hand in hand with the establishment of a shared banking market. Consequently, the European Central Bank was founded in 1998 as a supranational central bank for the participating member states of the envisioned monetary union. With the introduction of the euro as a demand deposit in 1999 and as a currency in 2002, the foundation for a European banking market was laid. However, as only a portion of the European Union adopted the euro, the term 'Euro area' banking market is a more precise way of describing the banking market subjected to a European Central Bank.

The banking market is of immense importance as it acts as a pivotal driver of economic growth and prosperity within the Euro area. This impact is achieved through the provision of financial intermediary services, the coordination of capital within economies, and further transformation functions. However, the banking market is not without problems, as was evident in the 2008 financial crisis, which started in the United States of America and led to a worldwide economic crisis. This crisis was triggered by banks excessively issuing loans and complex financial products such as mortgage-backed securities.

The catalyst of the financial crisis in 2008 was the bankruptcy of Lehman Brothers, and the ensuing financial crisis led to the European debt crisis. In the aftermath, the Euro area countries decided on a centralized approach for banking supervision and regulation through the founding of the European Banking Union. This underlines again the intertwinement between the banking market and the real market, as well as the importance of a well-functioning financial system, which includes the banking market. This is especially true in continental Europe, as the continental European financial system is classically understood as bank-oriented.

One aspect of the aftermath of the financial crisis in 2008 and the European debt crisis has been low interest rates in the Euro area and worldwide, which has influenced the core

functions of banks. Additionally, further measures, such as higher capital and liquidity ratios and a more prudent supervisory system, have been implemented. These measures have influenced the banking market of the Euro area as a whole, as well as single international relevant banking institutions in the Euro area, which are in competition with other international acting banks located outside of the Euro area, such as in the United States or the United Kingdom. As these banks and their respective banking markets are subjected to similar but not identical measures, it is interesting to understand the different developments these markets took. With the outbreak of the Corona pandemic in 2020, a new economic crisis arose that tested the robustness of the Euro area banking market and the measures imposed following the former crisis.

With the economic changes of this time in mind, it is interesting to research how the Euro area banking market developed in that era, especially when comparing it to the development of other similar banking markets. Moreover, such findings can be used as lessons learned and serve as a foundation for the future positioning of the Euro area banking market. This leads to the research objective of this thesis: How does the Euro area banking market compare internationally in terms of economic ratios and profitability ratios at the institutional level, and how does the Euro area banking market need to position itself in the future based on its performance and upcoming economic policy challenges?

This dissertation aims to provide a theoretical overview of the following: the provisioning of financial services; banks as institutions; the economic specifics of the banking market, especially regarding competition; the use of information technology in the banking market; and the reasoning behind the necessity to regulate the banking market. Based on this theoretical overview, comparable banking markets are defined, as are key figures regarding the economy, the banking sectors, and single banking institutions. These key figures are analyzed within a defined observation period: 2009–2020. In addition, the main differences regarding a negative deviation of the Euro area banking market from its internationally comparable markets are considered and used as a starting point for a discussion on the future positioning of the Euro area banking market. Finally, the concept of an integrated Euro area banking market is defined, followed by a delta analysis of the current state of integration. With the identified delta in hand, measures are then defined to facilitate the future positioning of the Euro area banking market.

This dissertation does not conduct any regressions on the analyzed data but relies on the method of descriptive statistics. This procedure places a certain limitation on this work, as a deep dive into single correlations is not possible. However, through the broader

approach of descriptive statistics, it is possible to create a comprehensive overview and offer starting points for future deep dives.

Overall, this dissertation is structured in four parts, in addition to the introduction and conclusion. Firstly, in chapter two, the economic reasoning behind banks as financial intermediaries acting in the financial market is presented, including micro- and macro-economic approaches as well as the theory behind bank crises. Additionally, the topic of competition and its influence on stability in the banking market is discussed, with a special focus on how competition in the banking market influences economic growth and how the usage of information technology influences competition in the banking market. Subsequently, the topic of banking regulation is discussed with a theoretical approach and reasoning for state intervention, as well as providing an overview of current European banking regulations. Subsequently, chapter three defines both the internationally comparable markets to the Euro area banking market, as well as comparably constituent groups within the Euro area for further deep dives. Based on the defined internationally comparable markets and the internal groups, chapter three focusses on a macroeconomic analysis, comparing the Euro area with the defined markets, as well as an analysis and comparison of the banking sectors. Chapter four is more granular as it focusses on the profitability of the relevant international banks in the Euro area. Proxy banks for the Euro area and for internationally comparable markets are created and afterwards analyzed and compared regarding their profitability. Finally, chapter five focusses on an integrated Euro area banking market as a measure to mitigate the findings of the previous chapters. A concept for an integrated Euro area banking market is created, the delta between the concept and the current status of the Euro area banking market is identified, and measures regarding the closing of the delta are defined for the future positioning of the Euro area banking market.

Following this structure, this dissertation sheds light on the development of the banking market in the Euro area in the period 2009–2020. This period was characterized by different crises as well as the development of Euro area banks, which are internationally competitive. The analysis of this development is contextualized by benchmarking internationally comparable markets. Furthermore, by establishing a concept for an integrated Euro area banking market and defining measures for future positioning, this dissertation contributes, in particular, to the field of policymaking in the Euro area and the European Union, respectively.

2. Specifics of the Banking Market and European Regulation

In the ever-evolving landscape of modern financial markets, banks and financial intermediaries serve as important economic pillars in terms of stability and growth. This chapter serves as a starting point, providing a comprehensive exploration and delving into the web of concepts that underpin the world of banking and financial institutions. It aims to explain the complexities of the banking market, its micro- and macroeconomic functions, the rationale behind the existence of financial intermediaries, as well as the balance between stability and competition in the financial market. Furthermore, it explores the theoretical groundwork and real-world applications of regulatory frameworks.

This chapter starts by examining the fundamentals of the financial market. It explains the various functions financial intermediaries perform, providing insights into their significance within the broader financial ecosystem. It then explores the microeconomic and macroeconomic justifications for the existence of financial intermediaries, shedding light on the pivotal role banks play in efficiently allocating capital and mitigating information asymmetry.

Moving forward, the chapter embarks on a deep dive into the crucial dynamics of stability and competition within the banking sector. It analyzes the balance between fostering competition to enhance efficiency while ensuring the stability of the financial system. In addition, it analyzes how the application of modern information technology shapes this connection.

Lastly, it delves into the topic of banking regulation, exploring both theoretical frameworks and practical applications within the Euro area. This section justifies the role of regulators in safeguarding the stability and integrity of the banking market.

2.1. Economic Characteristics of the Banking Market

2.1.1. Financial Markets and Financial Intermediaries

The banking market in general can be understood as part of the financial market. In this virtual place, capital providers, individuals with capital surplus units and the willingness to offer them as an investment, meet capital borrowers, individuals with a capital deficit and the corresponding demand for an investment. In the financial market, financial contracts are traded, not capital directly. These financial contracts contain present and future payment claims that are agreed upon between the contracting parties. In practical terms, the investor commits to providing the borrower with a defined amount of capital units, whilst the borrower commits to paying the investor a defined amount of capital units at a

defined future date. In addition to investors and borrowers, financial intermediaries are a crucial part of the financial market. Financial intermediaries can be understood as mediators between investors and borrowers. In a more practical manner, banks are financial intermediaries, as they accept capital in the form of deposits from capital providers and issue loans to capital borrowers based on the raised capital. In a broader sense, institutions that facilitate trade between investors and borrowers can also be understood as financial intermediaries, for example, by providing advisory services or information with regard to financial contracts.[1]

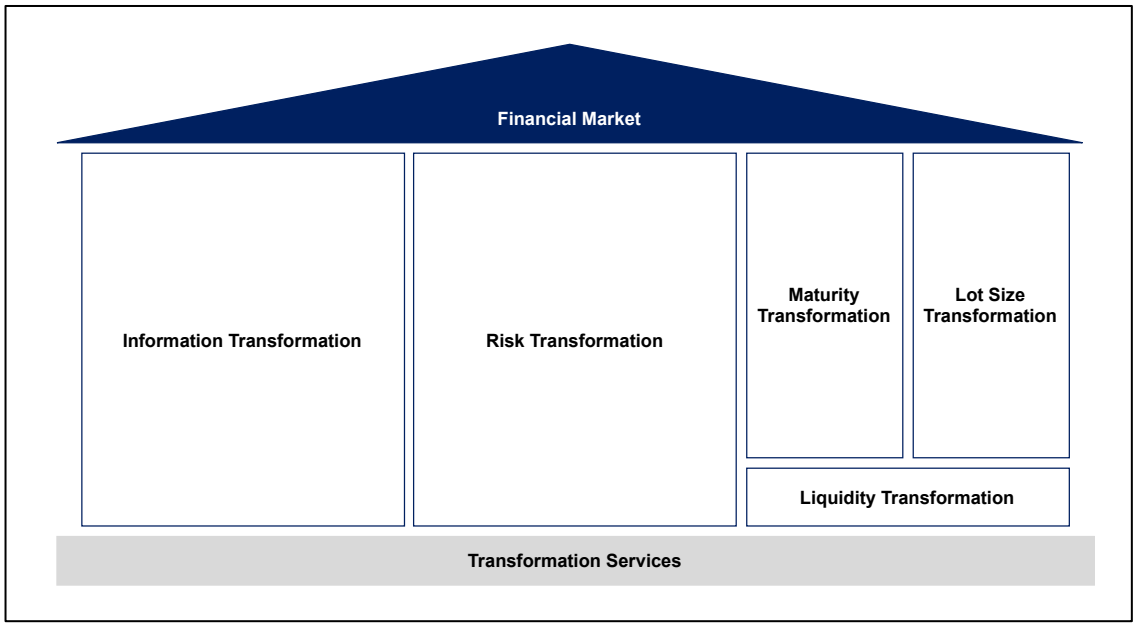
In a perfect market, the market mechanism works properly, ensuring no surplus or shortage of certain goods at the market clearing price. To ensure this mechanism, several market functions are necessary. Supply and demand for capital are balanced in such a manner that the capital borrowers receive the capital they need from the capital providers at a market clearing price that can be understood as interest. Subsequently, the price mechanism provides information on the scarcity of capital so that capital can be distributed efficiently based on this information. In addition to this allocative function, the financial market offers a coordinative function. This coordinative function can be understood as a market institution where capital providers and capital borrowers can meet and trade capital. However, the assumption that information on the financial market is distributed symmetrically between capital borrowers and capital providers is critical. Basically, the capital borrower is always more advantageously informed about the situation than the capital provider, which leads to information asymmetries that offer the capital borrower an opportunity to exploit the capital provider. Accordingly, the capital provider incurs costs for obtaining information. These costs are to be understood as transaction costs, which the investor wants to minimize.[2]

[1] Cf. Hartmann-Wendels et al (2019), pp. 2 ff.

[2] Cf. Pyndick, Rubinfeld (2018), pp. 52f.; Woeckner (2019), pp. 18f.; Hartmann-Wendels et al (2019), pp. 4; Cf. Varian (2011), p. 803; Büschgen, Börner (2003), pp. 19 f.

In addition to the functions of the market mechanism, three essential transformation services are performed on the financial market in connection with financial contracts: information transformation, risk transformation, and liquidity transformation of which liquidity transformation can be divided into maturity transformation and lot size transformations. Figure 1 illustrates the different transformation services of the financial market.

Figure 1: Transformation Functions in the Financial Market. Own Illustration



The transformation functions of the financial market are essential for resource allocation, risk management, and capital transformation within the economy. The financial market can provide these transformation functions alone. However, a financial intermediary can perform these functions as well. Which leads to the question whether it is more efficient to allow a financial intermediary to perform them or if the financial market alone is sufficient. As already described above, the financial market cannot be assumed to be perfect. Hence, transaction costs should be considered.

Financial intermediaries offer several advantages. They excel in information transformation by gathering and processing detailed data about market participants. They reduce information asymmetries, continuously monitor capital borrowers, and maintain close relationships to ensure repayment capability. This centralized approach significantly lowers the transaction costs associated with independently gathering information from each market participant. Financial markets rely on the price mechanism to convey information about capital borrowers' creditworthiness. While market prices reflect collective sentiment and available information, this process involves substantial transaction costs for individual capital providers. Financial intermediaries, through economies of scale and expertise, can perform information transformation more efficiently. Risk transformation

aligns the risk profiles of capital providers and borrowers, mitigating potential losses through diversification and risk management strategies. Financial intermediaries pool resources from multiple capital providers, spreading risk across various capital borrowers. This risk pooling allows intermediaries to offer diversified financial services, which help capital providers manage and mitigate risks more effectively. Financial markets enable risk transformation through a matching mechanism between capital providers and borrowers. However, the process of matching the specific risk profiles of capital providers and borrowers often involves significant transaction costs. Financial intermediaries reduce these costs by leveraging their ability to pool risks and offer financial services catering to different risk appetites. Liquidity transformation is crucial for ensuring that capital providers can access their funds when needed. This function is divided into maturity transformations and lot size transformations. Maturity transformation involves converting short-term deposits into long-term loans, effectively aligning the maturities of financial assets and liabilities. Financial intermediaries accept short-term deposits and provide long-term loans, offering liquidity to capital providers while funding long-term capital borrowers. In financial markets, liquidity transformation occurs through the buying and selling of financial contracts. Markets provide a matching mechanism for the preferences of capital borrowers and capital providers. However, matching the exact maturities desired by capital providers and borrowers can lead to higher transaction costs. Financial intermediaries, through pooling the funds of capital providers, ensure continuous liquidity more efficiently. Lot size transformations involve aggregating small deposits from many capital providers to fund larger loans. Financial intermediaries bridge the gap between the small amounts of capital that individual capital borrowers can provide, and the large sums required by capital borrowers. This aggregation process allows intermediaries to match the investment sizes more efficiently, reducing the transaction costs associated with the financial markets' buying and selling of financial contracts to achieve the same goal. [3]

To conclude, financial intermediaries often perform transformation functions more efficiently than financial markets alone. This efficiency stems from their ability to reduce information asymmetry, pool and diversify risks, and provide liquidity through both maturity and lot size transformations. Their essential role in performing these critical

[3] Cf. Büschgen, Börner (2003). pp. 22 f.; Hartmann-Wendels et al (2019), pp. 5 ff.; Freixas, Rochet (2008), p. 4

functions supports the stability and functionality of the financial market. However, this efficient provision of transformation functions through financial intermediaries is conditional on minimizing transaction costs. If a financial market converts to a perfect market and transaction costs are minimized, the efficiency hypothesis for financial intermediaries loses weight. Neo-institutionalism and microeconomists provides further arguments for the existence and efficiency of financial intermediaries.

2.1.2. Micro Economical Approach to Discuss the Existence of Banks

The discussions concerning microeconomic approaches to financial intermediaries or banks, are more theoretical than the discussions concerning the different functions of the financial market. There have been several approaches to discussing the microeconomic functions of financial intermediaries in literature. Three of the most important ones are Diamond (1984), Holmstrom/Tirole (1997), and Diamond/Dybvig (1983). Both Diamond (1984) and Holmstrom/Tirole (1997) describe the lending function of banks, thus from the perspective of capital borrowers. Diamond/Dybvig (1983), on the other hand, describe the behaviour of depositors of a bank, thus from the perspective of capital providers.

In describing the relationship between a bank and a capital borrower, Diamond (1984) assumes a model of risk-neutral investors who demand capital for a large-scale investment project. There are *N* entrepreneurs in the economy without personal wealth who have access to production technology for an undividable investment project that produces stochastic returns. The amount of needed capital for the investment exceeds the entrepreneur's private wealth as well as the wealth of a single capital provider. In detail, the projects require a normalized input of *1* today and produce an output one period later. An output which exceeds the competitive market interest rate *R* is expected by the entrepreneur. Both capital provider and capital borrower are assumed risk neutral. This means that the entrepreneur undertakes the project if the funding can be secured. Due to the competitive market interest rate *R*, the entrepreneur must convince the capital providers that a rate of return that at least equals *R* or exceeds it will be paid. Each capital provider has $1/m < 1$ available capital to invest. Therefore, as stated above, because the needed input is *1*, the entrepreneur must borrow from $m>1$ capital providers in order to secure the funding of the project. Due to the competitive nature of the financial market, the project is funded if the expected return is at least *R* or exceeds it; alternatively, the amount of *R/m* per capital provider can be considered as the threshold for investing. The total

output of the project is described by the random variable $\tilde{y}$, $0 \leq \tilde{y} \leq \bar{y}$; $\bar{y} < \infty$. The entrepreneur and the capital providers agree that,

$$E_{\tilde{y}} = R + K > 0 \tag{1}$$

so that the expected value of $\tilde{y}$ cannot be 0 and that it exceeds *R* by the value of possible monitoring costs *K*. For simplicity, the value of $\tilde{y}$ doesn't depend on any actions of the entrepreneur. The real value of $\tilde{y}$ is freely observable for the entrepreneur but not for the capital providers. Hence, information asymmetry occurs. At the end of the output period, the entrepreneur decides on the return, which is paid to the capital providers. It is always feasible for the entrepreneur to claim a low value of *y*, so she can keep the difference between the actual rate of return and the stated rate of return. If *z* is the amount the entrepreneur pays to the *m* capital providers and *y* is the realization of $\tilde{y}$, then the entrepreneur keeps $y - z \geq 0$. Consequently, the entrepreneur must choose an incentive compatible contract to secure the funding of the project through capital providers. Firstly, monitoring costs *K* can be considered. However, monitoring costs are always costly and therefore not feasible. On the other hand, the payment from the entrepreneur to the capital provider is observable at no cost. Therefore, the variable *z* can be used for this purpose. For incentive compatibility, it is important that the capital providers can enforce a non-pecuniary penalty if $z = 0$. The non-pecuniary penalty can be understood as the bankruptcy penalty, leading the entrepreneur to loss of reputation, a bankruptcy process or having to explain poor performance to capital providers. Nevertheless, the capital providers do not enjoy this non-pecuniary penalty or gain any utility from it.[4]

The optimal contract, if only *z* is observeable, maximizes the expected return of the entrepreneur, whilst minimizing the expected return to the capital providers to *R*. The face value of this debt contract is *h,* and it is set so that

$$\left\{P(\tilde{y} < h) * E_{\tilde{y}}[\tilde{y}|y < h\right] + P(\tilde{y} \geq h) * h\} = R \tag{2}$$

holds, meaning that the expected face value of the contract is equal to *R*. The non-pecuniary penalty is described by

$$\Phi^*[z] = \max[h - z; 0] \tag{3}$$

meaning the non-penuciary penalty is applied if the observable amount *z* paid to the capital providers undercuts *h*. Furthermore, the disutility for the entrepreneur from the non-penecuary penalty equals the difference of *h* and *z*. With this optimal contract, the

[4] Cf. Diamond (1984), pp. 395 f.

entrepreneur has no incentive to lie about the amount of $\tilde{y}$. In the case that $\tilde{y}$ is observable at some monitoring costs K and there is a willingness to pay for these monitoring costs, the entrepreneur can be better off by including monitoring costs without making the capital providers worse off. The cost of monitoring cannot be shared across the capital providers; thus, it applies to every one of the m capital providers. Accordingly, if the total amount of monitoring costs is less than the expected non-pecuniary penalty, capital providers will choose this form of contract as they suffer from the non-pecuniary penalty as well. Hence, as long as $m * K \leq E_z[\Phi^*(z)]$ holds, a debt contract with a costly monitoring of $\tilde{y}$ is more desirable than a contract with a non-pecuniary penalty. This is feasible for both single capital providers and a small number of capital providers because the overall cost of monitoring increases with the number of capital providers, while the lent amount per capital provider decreases. Thus, $m * K \leq E_z[\Phi^*(z)]$ is unlikely to hold. In the case where m is large, monitoring needs to be delegated to a central entity to realize the benefits of contracts with monitoring. This entity needs to be incentivized to conduct monitoring and enforcement of the contract, so the capital providers pay a delegation cost, D. It follows that delegated monitoring with a central entity is efficient if,

$$K + D \leq \min\{m * K;\ E_z[\Phi^*(z)]\} \tag{3}$$

meaning the total cost of delegated monitoring is smaller or equal to the minimum of either the total costs of undelegated monitoring or the non-pecuniary penalty. Such a central entity could be a financial intermediary, like a bank, which receives payments from the entrepreneur and makes payments to the capital providers.[5]

The financial intermediary is located between the entrepreneur and the capital providers, who, in this context, are depositors. Furthermore, the financial intermediary is a risk-neutral agent with zero personal wealth. The task of monitoring the entrepreneurs' project outcome is delegated to the intermediary and costs K units of goods per entrepreneur. Depositors can only observe the payment they receive from the financial intermediary and not the entrepreneurs' project outcome and delegation costs D. Thus, a similar problem arises between the depositors and the financial intermediary to that between the capital providers and the entrepreneur. Accordingly, the depositors can either monitor the financial intermediary or agree on a contract with a non-pecuniary penalty. If the depositors choose to monitor the financial intermediary, the cost of delegated monitoring

[5] Cf. Diamond (1984), pp. 397 f.

consists of the monitoring costs of the financial intermediary K and delegation costs D, which are $m * K$, because every depositor monitors the financial intermediary. Hence

$$K + D = (m + 1) * K \geq \min \{m * K;\ E_z[\Phi^*(z)]\} \tag{4}$$

meaning it is never efficient for the depositors to monitor the financial intermediary. Consequently, a contract with a non-pecuniary penalty for the financial intermediary in case of bankruptcy needs to be discussed. The individual payment from one entrepreneur to the financial intermediary is described by $g_i(\tilde{y}_i)$ and the overall payment from all N entrepreneurs in the economy is described by

$$G_N = \sum_{i=1}^{N} g_i(\tilde{y}_i) \tag{5}$$

The total payment of the financial intermediary to the depositors is described by

$$Z_N \leq G_N - N * K \tag{6}$$

The overall face value of the deposit contract is H_N and is set so that

$$\left\{P(G_N < H_N) * E_{G_N}[G_N |\ G_N < H_N\right] + (1 - P(G_N < H_N)) * H_N\} \geq N * R \tag{7}$$

Consequently, the non-pecuniary penalty is defined by

$$\Phi(Z_N) = \max\left[H_N - Z_N, 0\right] \tag{8}$$

so, the expected return of the financial intermediary is $E_{G_N}(G_N) - H_N$. Therefore monitoring is chosen so that $E_{G_N}(G_N)$ is maximized. In the case that the financial intermediary lends to only one entrepreneur, the delegation costs can be described by the expected value of the non-pecuniary penalty $E_{Z_N}[H_N - Z_N]$. Thus, the overall cost of delegated monitoring can be described by

$$K + E_{Z_N}[H_N - Z_N] > E_z[\Phi^*(z)] = E_z[h - z] \tag{9}$$

Therefore, delegated monitoring with only one entrepreneur is not efficient, which assumes that the financial intermediary lends to more than one entrepreneur. The outcomes of these projects are identical, stochastic, and independently distributed, and the expected outcome is described by

$$E[\tilde{y}_i] > R + K \tag{10}$$

Following the weak law of large numbers, the probability that the project of an entrepreneur defaults decreases as the number of entrepreneurs increases

$$lim_{N\to\infty}\ P(G_N < H_N) = 0 \tag{11}$$

Thus, for a sufficiently large number of entrepreneurs, $Z_N = H_N = N * R$ always holds, and the non-pecuniary penalty is always zero, as well as the delegation costs D. Accordingly, the overall costs of delegated monitoring with a sufficiently large number of entrepreneurs can be described by

$$K + D = K < \min(m * K;\ E_z[\Phi^*(z)]) \quad (12)$$

Thus, a financial intermediary with a sufficiently large number of entrepreneurs to lend to, or, in other words, a well-diversified financial intermediary, reduces the costs of monitoring and increases the efficiency of the financial market.[6]

The Diamond model (1984) describes a simple banking system with only one bank and no competition. Furthermore, the non-pecuniary penalty is a theoretical concept lacking in practical implementation. Additionally, the described financial intermediary has no equity capital and faces no internal incentive problems as would occur in the real world. However, overall, the model is a good approach to theoretically describing why a well-diversified financial intermediary is a more efficient approach to lending than the financial market.

Holmström/Tirole (1997) analyze in their model whether a financial intermediary is more efficient than the financial market without being well-diversified or having a contract that includes a non-pecuniary penalty. There are three types of agents in this model: firms, intermediaries, and investors. The model consists of two periods. In the first period, investment decisions are taken, whilst in the second period, returns from those investments are realized. Furthermore, with limited liability, it follows that all parties are risk-neutral and cannot end up with a negative cash position. All firms in the model have access to the same technology but have different initial wealth endowments, described by A. In the first period, every firm has one economically positive project with investment costs of I. Thus, if $I > A$, the firm needs an external funding of $I - A$. In the second period, the investment generates either a financial return of zero if the project fails or a return of R_H if the project is successful. In the absence of incentives or external monitoring, an entrepreneur who runs a firm could reduce the probability of success by enjoying a private benefit. There are three versions of the project from which the entrepreneur can privately choose:

Project	**Type 1**	**Type 2**	**Type 3**
Private benefit	0	b	B
Probability of success	p_H	p_L	p_L

Table 1: Project Types. Source: Holstrom/Tirole (1997), p. 668.

The probability of success for project type 1 is higher than for projects types 2 and 3:

[6] Cf. Diamond (1984), pp. 398 ff.

$$\Delta p = p_H - p_L > 0 \tag{13}$$

Furthermore, only projects of type 1 are economically feasible. This is due to both the interest rate γ paid on the investment *I* and the fact that the private benefit from type 3 is larger than the private benefit from type 2 $b < B$. Meaning that:

$$p_H R - \gamma I > 0 > p_L R - \gamma I + B > p_L R - \gamma I + b \tag{14}$$

Thus, the entrepreneur will always prefer type 3 projects over type 2 projects. On the other hand, there are many intermediaries in the market. As the intermediaries monitor the firms they lend capital to, the entrepreneurs cannot choose type 3 projects and thus have a maximal private benefit of b. Monitoring of the firms is costly and is described by $c > 0$. Additionally, intermediaries must invest some of their capital as an incentive together with the investors in the project. This capital, K_m,is called 'informed capital', whereas the investors' capital is called 'uninformed capital', because investors cannot monitor the firms they lend capital to. There is only a small number of individual investors in the market, and they expect γ as the interest rate paid on their investment.[7]

First, the direct financing scenario without intermediaries is analyzed. The firms need funding of $I - A$ in the first period, and the project generates a return on investment of

$$R_H = R_f + R_u \tag{15}$$

where R_f is the return of the firm and R_u is the return of the investors in the second period. The incentive-compatible return on investment for the entrepreneur needs to fulfil

$$R_f \geq \frac{B}{\Delta p} \tag{16}$$

so that the entrepreneur always chooses type 1 projects. Consequently, the expected return on investment of the individual investor is $p_H \left(R - \frac{B}{\Delta p}\right)$. The expected return on investment needs to be at least as large as an investment on the financial market with the interest rate γ, thus

$$p_H \left(R - \frac{B}{\Delta p}\right) \geq \gamma (I - A) \tag{17}$$

Therefore, a minimal amount of *A* dependent on γ can be defined as the point at which individual investors start to invest in the project of the firm

$$\bar{A}(\gamma) = I - \frac{p_H}{\gamma}(R - \frac{B}{\Delta p}) \tag{18}$$

[7] Cf. Holmstrom/Tirole (1997), p. 667-670

This means that if the firm's initial wealth endowment exceeds $\bar{A}(\gamma)$, direct financing is possible. In the case of indirect financing, the intermediary acts between the firms and the individual investors and monitors the firms. Hence, the return of investment consists of three parts: the return of the firm R_f; the return of the intermediary R_m; and the return of the investor's R_u, so that

$$R_H = R_f + R_m + R_u \tag{19}$$

Due to monitoring, the entrepreneur's incentive-compatible return on investment is described by $R_f \geq \frac{b}{\Delta p}$, and the intermediary's incentive-compatible return on investment is defined as $R_m \geq \frac{c}{\Delta p}$. Thus, the expected return on investment for the investor is

$$E(R_u) = p_H \left[R_H - \frac{(b+c)}{\Delta p}\right] \tag{20}$$

This investment by the intermediary is called 'informed capital' I_m and is a fraction of the bank's overall informed capital K_m. Moreover, the firm must pay an interest rate of

$$\beta = \frac{p_H R_m}{I_m} \tag{21}$$

on the informed capital invested. Because monitoring is costly, the interest rate on informed capital exceeds the interest rate on uninformed capital $\beta > \gamma$ .Thus, firms always prefer uninformed capital over informed capital and only borrow the minimal incentive-compatible amount of informed capital

$$I_m(\beta) = \frac{p_H * c}{\Delta p * \beta} \tag{21}$$

Consequently, the demand for uninformed capital from individual investors is described by

$$I_u = I - A - I_m(\beta) \tag{22}$$

The condition for funding this uninformed capital is

$$p_H \left(R_H - \frac{b+c}{\Delta p}\right) \geq \gamma[I - A - I_m(\beta)] \tag{23}$$

Accordingly, a minimal amount of A dependent on γ and β can be defined as the amount at which individual investors fund the project of the firm

$$\underline{A}(\gamma, \beta) = I - I_m(\beta) - \frac{p_H}{\gamma}\left(R - \frac{b+c}{\Delta p}\right) \tag{24}$$

Hence, there are three types of firms: well-capitalized firms with $A \geq \bar{A}(\gamma)$ who choose direct financing over the financial market; poorly capitalized firms with $A < \underline{A}(\gamma, \beta)$

who cannot secure funding; and normal capitalized firms with $\underline{A}(\gamma, \beta) \leq A < \bar{A}(\gamma)$. Normal capitalized firms seek funding through an intermediary that then monitors them.[8]
This model shows that with the help of competitive financial intermediaries, more firms can secure funding for their projects and that, therefore, financial intermediaries are, again, more efficient than funding over the financial market. Furthermore, it shows, contrary to Diamond (1984), that the financial intermediary does not need to be well diversified to be efficient, nor is the non-pecuniary penalty necessary. The capital of the financial intermediary and the firm is an incentive and has a signaling effect for investors.
Both models, Diamond (1984) and Holmstrom/Tirole (1997), focus on the existence of financial intermediaries based on the lending business, and the capital demand of firms or entrepreneurs. Hence, both models are based on the needs of capital borrowers. Conversely, the model of Diamond/Dybvig (1983) seeks to explain the existence of financial intermediaries based on the deposit business. The model focusses on the demand of capital providers to invest their capital. The deposit business of a financial intermediary can be seen as an implementation of the described liquidity transformation. In this aspect, the financial intermediary can be seen as an insurer that provides liquidity or cash when the depositors indicate a demand for it. The model consists of the time points $T = 0,1,2$. Additionally, a single homogeneous good is considered as well as an agent that uses productive technology to invest one unit of the good at $T = 0$. This investment yields a result of $R_{DD} > 1$ units of the good at $T = 2$. If production is stopped in $T = 1$, the result is equal to the initial investment, meaning one unit of the good. Each agent has a privately observable and uninsurable probability of being type 1 or type 2. For agents of type 1, consumption is only relevant in $T = 1$, while for agents of type 2, consumption is only relevant in $T = 2$. In $T = 0$, an agent does not know the type, as it is revealed in $T = 1$. Agents can store units of the good for free and unobservably. Thus, an agent of type 2 who gets units of the good in $T = 1$ will store them and consume them only in $T = 2$. A proportion $t\epsilon(0,1)$ of the agents is of type 1, each agent has exactly one unit of the good available in $T = 0$.[9]
First, a model without a financial intermediary is considered. In this model, agents of type 1 always finish production in $T = 1$ with a yield of 1 to satisfy their consumption. Agents

[8] Cf. Holmstrom/Tirole (1997), p. 670-676

[9] Cf. Diamond/Dybvig (1983), p. 405 f.

of type 2 always carry out the project until $T = 2$, with a yield and consumption of R. Assuming that in $T = 1$ the type of agent is publicly observable, it is possible to issue an optimal insurance contract. Through this insurance contract, the agents can maximize their expected utility ex-ante at $T = 0$. This contract promises the agents, if they are of type 1 in $T = 1$, a payoff greater than one. In return, if the agents are of type 2 in $T = 2$, they sacrifice a certain amount of R and are paid a smaller profit. Accordingly, agents of type 1 have a consumption greater than 1, and agents of type 2 have a consumption less than R. Assuming that agents are risk-averse, they are willing to sacrifice consumption if they are type 2, to allow themselves greater consumption if they are type 1. However, this optimal insurance contract can only be achieved with the absence of information asymmetries; otherwise, there are exploitation opportunities for the agents. In a financial market without a financial intermediary, it is hard to conduct such a defined insurance contract. Hence, a financial intermediary needs to be considered to provide liquidity when it is needed and set incentives to mitigate information asymmetries. The financial intermediary guarantees the agents or investors a reasonable return if they want to terminate the project before the end. This contract can be understood as a deposit contract. However, the type of agent must be publicly observable in $T = 1$ otherwise the optimal result cannot be achieved through opportune action by the agents. Consequently, in a model with a financial intermediary, information asymmetries, and deposit contracts, agents are promised a fixed return of r_1 in $T = 1$ per unit deposited in $T = 0$. Deposit withdrawals are serviced sequentially until the bank has no assets left. Accordingly, the payout to an agent depends only on his place in the queue and not on information about other agents in the queue behind him. The bank invests the deposits received in $T = 0$ using the same productive technology as in the above model without a financial intermediary. Thus, all agents who withdraw their deposits in $T = 1$ receive a return of r_1. The remaining assets of the bank are liquidated in $T = 2$ and the remaining agents are served from this amount so that they receive a return of r_2 which is lower than R_{DD}. Thus, the model with a financial intermediary and information asymmetries can achieve the same result as the model with an optimal insurance contract and no information asymmetries. A second possible outcome of the model is a bank run. When this occurs, all agents in $T = 1$ want to withdraw their deposits because they are unclear about the bank's solvency. The bank's assets are insufficient to satisfy these withdrawals because the value of the deposits is greater than the value of the assets. Hence, for all deposit contracts that promise a $r_1 > 1$, bank

runs are a possible outcome. One mitigation could be a lower r_1 in which the total sum is equal to the financial intermediary's assets. However, in this case, a return of $r_1 = 1$ offers no incentive to conclude a deposit contract with a financial intermediary since the result is the same as the model without a financial intermediary and no liquidity insurance.[10]

	Agent of type 1	**Agent of type 2**
Model without financial intermediary	1	R
Model with financial intermediary and optimal result	r_1	r_2
Model with financial intermediary and bank run	$0\ or\ r_1$	$0\ o\ r_1$

Table 2: Model-Dependent Comparison of the Agents' Payoffs. Source: Diamond/Dybvig (1983), p. 401 ff.

In the case of a model with a financial intermediary and the occurrence of a bank run, agents are worse off than with the model without a financial intermediary and optimal insurance. However, agents will enter into a deposit contract with a financial intermediary if the probability of the optimal result outweighs the risk of a bank run. It follows that the optimal result of deposit contracts dominates the outcome of optimal insurance contracts, which will be discussed later in more detail. This is the case when a bank run is based on public observable economic data, for example, fundamental data on the state of the financial intermediary, such as a bank's balance sheets, negative government predictions about the state of the bank, or a bank run occurring at another bank. Therefore, banks with deposit contracts must ensure that they act confidentially towards depositors in order to prevent a bank run.[11]

The model is one of the first feasible attempts to explain the existence of financial intermediaries with regard to the deposit business. Furthermore, it was the starting point for many other models, for instance, Jacklin (1987), Wallace (1988), Allen/Gale (1997). Nevertheless, it is criticized for failing to describe the probability of a bank run, meaning that it cannot be empirically verified. Furthermore, because the sequential operation is

[10] Cf. Diamond/Dybvig (1983), p. 406 ff.

[11] Cf. Diamond/Dybvig (1983), p. 409 f.

crucial for the model and because r_2 is not fixed, it is residual revenue and hence not a deposit contract.

The findings of neo-institutionalist microeconomic models align with the arguments presented in the previous chapter regarding the provision of transformation functions within the financial market. These models demonstrate that financial intermediaries enhance the efficiency of providing transformation functions. Consequently, the existence of financial intermediaries in the financial market leads to increased efficiency and overall welfare gains. Diamond (1984) and Holmstrom/Tirole (1997) illustrate in their models that financial intermediaries improve efficiency by providing information transformation through monitoring and by facilitating risk transformation through diversification in loan portfolios. Furthermore, Diamond/Dybvig (1983) show that financial intermediaries enhance efficiency in liquidity transformation. However, a potential drawback to relying on financial intermediaries is the risk of a bank run, which could trigger a bank panic and potentially lead to the collapse of the financial system.

2.1.3. Bank Runs and Bank Panics

Based on the findings of the previous chapter, bank runs and the ensuing bank panics are analyzed in the following section. In a bank panic, several banks experience a bank run at the same time. Delving deeper into the topic, there are two explanations for such an event: the structure of the banking sector can trigger a bank panic, and the structure of the 'interbank market' can promote contagion among banks.[12]

Regarding the first explanation, the scenario assumes that the banking sector consists of many small, independent banks that do not trade with each other and conduct risky investments. These banks do not have diversified portfolios because of their limited size and localization. From a depositor's point of view, all banks are homogeneous. Furthermore, these banks invest in a local, risky project. In $T = 1$, all depositors receive the same macroeconomic information but cannot monitor the status of their bank's project. In the event that this information triggers a bank run at one bank, depositors at other banks will also participate in a bank run. The depositors are unable to specifically distinguish between the economic performance of the banks, as they view all banks as homogeneous. Thus, a bank run occurring at a single bank can turn into a bank panic. The above scenario has been especially observable in the United States of America. To counter this, there is

[12] Cf. Freixas/Rochet (2008), p. 235

a banking sector structure that includes large commercial banks or banking coalitions, similar to savings banks or cooperative banks. These banks can then encourage business relationships with each other to mitigate spikes in liquidity demand from depositors. Moreover, large commercial banks have diversified portfolios, allowing depositors to adequately assess the state of the bank from the macroeconomic information in $T = 1$, preventing an inefficient bank run and a corresponding bank panic. Furthermore, if several small banks form a banking coalition, they can partially mirror the diversification of the large commercial banks under the condition, that they can credibly verify their liquidity and diversification.[13]

The above-described business structure between banks can be understood as a form of an interbank market, which leads to the second explanation for bank panics – the contagion of banks within this aforementioned market. Bhattacharya/Gale (1987) varied the model of Diamond/Dybvig (1983) to explain the interbank market. In $T = 0$, the bank must make a portfolio investment decision between a safe short-term investment or a risky long-term investment. The share-safe short-term investment should reflect the expected payout to the agents of type 1, and the risky long-term investment should reflect the payout to the agents of type 2. The received consumption good cannot be stored over a period of time by the agents. Thus, a bank run is not possible, as there is never an incentive for type 2 agents to withdraw their deposits in $T = 1$. However, banks now face the problem of liquidity shocks. In this case, the bank has more type 1 agents than depositors in $T = 1$, which it initially considered in the portfolio formation in $T = 0$. Accordingly, a single bank cannot serve all depositors since the risky investment in $T = 1$ cannot be liquidated and the bank needs to declare bankruptcy. Moreover, it is assumed that there are many banks in the market, all of which make an investment decision in $T = 0$. In their decisions, they consider that in $T = 1$ there is either a low or high proportion of type 1 agents. The respective share of type 1 agents is weighted with a probability, and thus the average value of the required safe investments is defined. If a bank faces a liquidity shock in $T = 1$, it can borrow liquidity from another bank that has a lower share of type 1 agents than calculated. In return, the borrowing bank in $T = 1$ can repay the liquidity in $T = 2$ with the pay-off from the risky long-term investment since the lending bank needs the liquidity to serve its type 2 agents. Through these trade mechanisms in the interbank

[13] Cf. Gorton/Huang (2005), pp. 1619 ff.

market, the risk of a liquidity shock can be spread among all participating banks. However, there is the possibility that banks can infect each other with a bank run via the same market mechanism and thus trigger a bank panic or even a financial crisis. Important factors determining the extent of the contagion are the liquidity reserves of the banks, the individual level of a bank's debt, and the structure of credit relationships in the interbank market. Combining the arguments posited by Bhattacharya/Gale (1987) and Allen/Gale (1998) allows an analysis of a possible contagion mechanism. The allocation of liquidity through the interbank market is contrasted with a corresponding consumption profile of type 1 and type 2 agents, which is independent of the banks' respective liquidity allocations. It is assumed that there is one mismatch between allocation and consumption. All banks, except one, experience an average demand for liquidity from their depositors. The excluded bank experiences a demand that exceeds the average demand of its depositors by an amount ε. Now the cumulative demand for liquidity is greater than the estimated consumption profile of the banks. This shock affects the bank with the increased and mismatched demand. Furthermore, it can also affect other banks through the mechanism of the interbank market. For example, there are three banks in the banking sector: Bank 1, Bank 2, and Bank 3. Now, Bank 1 has a demand for liquidity that exceeds the average by ε. Each bank borrows money from its immediate neighbour, as in the chained credit relationship in Figure 1. Bank 1 has a liquidity deficit of ε and offsets this with loans from Bank 2. Since Bank 2 has taken exactly the average demanded liquidity into account in the portfolio formation, it must now also compensate for a liquidity deficit of ε with loans from Bank 3. This last bank, therefore, also has a liquidity deficit of ε and tries to offset this with loans from Bank 1. However, Bank 1 has no excess liquidity and must liquidate long-term investments, which is either not possible or involves high costs and can lead Bank 1 into bankruptcy. If Bank 1 declares bankruptcy, it cannot meet the liquidity demand of Bank 3 and so the latter also considers the possibility of declaring bankruptcy. This contagion mechanism can also be transferred to Bank 2, resulting in the bankruptcy of all banks in this sector and an ensuing financial crisis.[14]

[14] Cf. Freixas/Rochet (2008), pp. 233-240

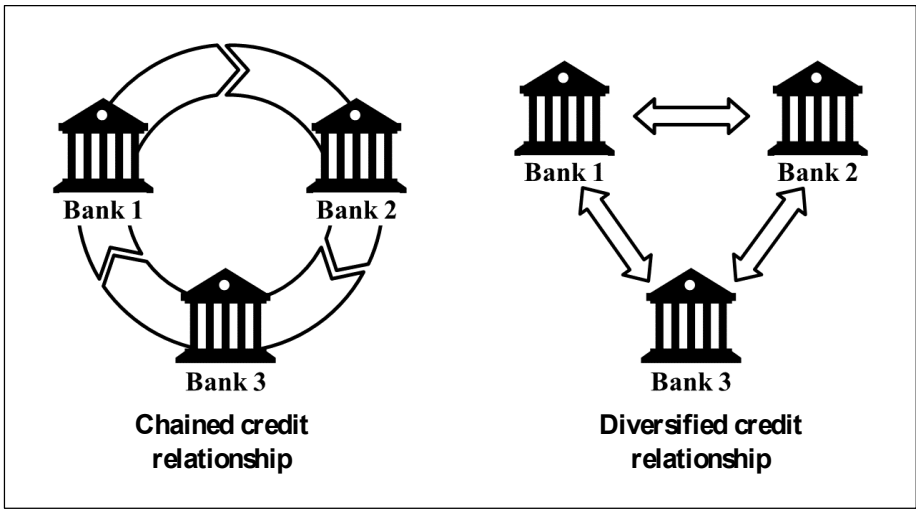


Figure 2: Examples of Credit Relationship Structures in the Interbank Market. Source: Freixas/Rochet (2008), p.241

For this mechanism to be triggered, banks must have a large amount of debt and a small number of liquid reserves. Thus, this 'contagion' can be avoided by diversifying the credit relationships, as shown in Figure 2. While in chained credit relationships the liquidity deficit is transferred in full ε to all banks, in a diversified credit relationship it is only ε/2 since bank 1 draws loans from two banks. In this way, the liquidity reserves are more efficient in a diversified credit relationship, and a domino effect can be prevented.[15]

The above-mentioned explanations of bank panics caused by either the structure of an institution or the interbank market are addressed by models from Diamond / Rajan (2004) and Allen / Gale (2004). Both models focus on the understanding of how liquidity and solvency issues in banks can lead to bank panics and, subsequently, financial crises, emphasizing the critical role of liquidity and the interactions between financial intermediaries and markets.

Diamond and Rajan (2004) focus on the performance of liquidity transformation by funding long-term, illiquid assets with short-term liabilities. This maturity mismatch creates a vulnerability, as banks must maintain sufficient liquidity to meet withdrawal demands. A liquidity shock, where a significant number of depositors simultaneously demand their funds, can force banks to sell long-term assets at depressed prices, leading to a liquidity shortage or a liquidity shock. Allen and Gale (2004) continue the scenario at this point. Minor liquidity shocks can have large impacts due to the interconnectedness of markets and banks. When banks are forced to liquidate assets to meet withdrawal demands, it can

[15] Cf. Freixas/Rochet (2008), pp. 240 f.

depress asset prices and weaken other institutions holding similar assets, creating a ripple effect. Consequently, a negative feedback loop is created when initial liquidity shocks lead to asset fire sales. The decline in asset values reduces the bank's net worth, prompting further withdrawals and additional asset sales, perpetuating the cycle of declining asset values and increasing withdrawals. This initial shock can be amplified as interconnected institutions face similar pressures, leading to systemic risk. As a result, a liquidity crisis in one bank can lead to a loss of confidence in others, prompting a broader bank run and a potential systemic crisis. Going back to the starting point of the models, an information asymmetry between banks and depositors can lead to a bank panic. If depositors suspect that a bank is facing liquidity problems, their collective action to withdraw funds can create bank panic, that was feared but not real. As such, expectations in the interbank market can lead to an amplification of actions. Minor rumors or perceived risks can trigger significant reactions from market participants, leading to liquidity shortages, financial instability and a bank panic.[16]

Therefore, the interbank market, especially its structure and information asymmetries, is an internal possibility that enables the financial system to prevent collapse following a bank run, liquidity shock or bank panic. Nevertheless, if the lending structure of the interbank market is not sufficiently diversified, it can ironically trigger contagion between banks following a bank run or liquidity shock. The following section discusses further measures to prevent bank runs and bank panics.

2.1.4. Prevention of Bank Runs and Bank Panics

The prevention of a bank run or a liquidity shock can be achieved by various measures: the bank can suspend the withdrawal of deposits; the regulator can ensure the liquidity of the banks through 'narrow banking'; the central bank can act as the lender of last resort, or a deposit insurance scheme can be implemented.

The first measure is to suspend deposit withdrawals. It is assumed a bank suspends deposit withdrawals in $T = 1$ after a certain threshold of withdrawals has been exceeded. With this mechanism in place, a bank run can be prevented because the incentive for type 2 agents to withdraw their deposits in $T = 1$ is removed. They now know that by suspending withdrawals in $T = 1$, deposits can be paid back into $T = 2$. However, for this mechanism to work, the bank must know the exact share of type 1 agents *t*, so that it can

[16] Cf. Diamond / Rajan (2004), pp. 615-647; Allen/Gale (2004), pp. 123-150

define the threshold value for the suspension of the pay-out. In addition, the value *t* cannot be stochastically distributed. Moreover, the stochastic distribution of *t* can be assumed to be highly likely, and hence, it is a critical assumption. Only if the bank can observe its share of type 1 agents *t* and its distribution is not stochastic can a suspension of pay-outs prevent a bank run.[17]

The second measure, the 'narrow banking' method, aims to ensure that the bank can meet depositors' demand for liquidity under all possible conditions. For this purpose, the regulator sets limits on the bank's portfolio formation in $T = 0$. There are different approaches to enforcing these requirements. The bank must either always hold sufficient liquid assets or must have sufficient liquid assets after liquidating its portfolio to be able to serve all depositors in the event of a bank run. Focusing on the first approach, a bank can be liquid in $T = 0$ if it can service all withdrawals in $T = 1$, or illiquid if this is not the case. However, in the case of a liquid bank, the agent's consumption is lower than in a model without a bank. Based on the condition that the bank must hold sufficient liquid assets in $T = 1$ to service any withdrawals, regardless of whether it is a type 1 or type 2 agent. Thus, there is no distribution of risk and corresponding profit between type 1 and type 2 agents. This second approach of narrow banking achieves the same solution as a model without banks, and is therefore more desirable than the first approach, but does not achieve the optimal result without specifications on the liquid ability of the portfolio.[18]

The third measure, the 'lender of last resort', is based on the ideas of Bagehot (1873). Lenders of last resort are central banks that issue loans to economically stable but illiquid banks so that they can meet their withdrawal obligations. However, these loans have to be granted at penalty interest rates so that the bank does not use them for their normal operational business. Furthermore, the bank must deposit a corresponding security with the central banks. In addition, the central banks must communicate in advance that they are prepared to provide any amount of money to save the bank, so that the necessary credibility is established. Goodfriend/King (1988) argue that the functions of the lender of last resort can be performed more efficiently by the free market than by a central bank, thus negating the necessity of regulatory supervision. Rochet/Vives (2004), on the other hand, argue that the free market is not sufficiently efficient in the sense of the modern interbank market and that coordination failures can occur between lenders and borrowers.

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[17] Cf. Diamond/Dybvig (1983), pp. 410 f.

[18] Cf. Freixas/Rochet (2008), pp. 222 ff.

Thus, a lender of last resort in the sense of a central bank can be necessary to complement the interbank market.[19]

The last discussed measure to prevent bank runs and bank panics is to insure deposits through a public or private deposit insurance scheme. In a private deposit insurance scheme, the bank pays an ex-ante insurance premium and steps in when the bank needs liquidity, while a state deposit insurance scheme is financed through taxes. In the model of Diamond/Dybvig (1983), a tax-financed deposit insurance system is discussed. Depositors who withdraw their deposits in $T = 1$ can be taxed for the withdrawals. However, this taxation only takes effect when a defined threshold of withdrawals is exceeded. Following the collection, the amount of tax is paid back directly to the bank so that the bank can service further withdrawals. A tax on withdrawals from deposits reduces the consumption of the agents. As a result, it is never worthwhile for agents of type 2 to withdraw deposits in $T = 1$ and store the granted good for consumption in $T = 2$. This mechanism effectively prevents bank runs and allows the bank to pursue its liquidation strategy regardless of depositor demand. With the condition that the state can credibly threaten to levy such a tax in place, bank runs can be prevented without such a tax ever being levied. Private deposit insurers must credibly signal the guarantee of deposits to depositors through appropriate reserves in order to prevent a bank run.[20]

Therefore, there are several measures available to prevent a bank run in the first place before it can trigger a bank panic. With the regulatory efficient implementation of one of these measures, the possible negative effects of financial intermediaries acting on the financial markets can be ruled out. This all supports the efficiency of transformation functions provided by financial intermediaries. Nevertheless, most of the measures require knowledge regarding the operation of financial intermediaries, such as banks, and especially knowledge of a bank's balance sheet. Hence, these measures are dependent on information asymmetry and involve monitoring costs. These costs need to be considered by the regulator before implementing one of the aforementioned measures.

2.1.5. Banks as Business Operations in the Financial Market

After analyzing the fundamentals of the financial market and justifying the existence of banks as financial intermediaries, it is important to understand how these institutions

[19] Cf. Freixas/Rochet (2008), p. 243

[20] Cf. Freixas/Rochet (2008), p. 222; Diamond/Dybvig (1983), pp. 413 - 416

operate and, in particular, to understand the structure of a bank's balance sheet, a bank's income statement, as well as the operational risks banks face. In the following, the focus is laid on commercial banks – institutions that collect deposits from the public and issue loans to invest these deposits.

Assets	***Liabilities***
Cash Assets	*Long-Term Deposits*
Loans	*Short-Term Deposits*
Securities	*Other Liabilities*
	Bank Capital

Table 3: Bank Balance Sheet. Source: VanHoose (2017) pp. 4–9

To visualize this topic, Table 3 provides a rough generalization of a bank's balance sheet. On the asset side of a bank balance sheet are cash assets, loans, and securities. Cash assets are liquid assets, and a distinction can be made between cash assets deposited by individual customers and those deposited by financial institutions. The most important cash asset connected to individual customers is currency held to meet their need for cash on short term withdrawals. Additionally, checks from depositors or cash drafts for immediate credits can be classified as cash assets connected to individual customers as well. Deposits that the bank holds at other private banks and reserves held at a central bank are cash assets connected to financial institutions. Loans are the other major category of assets on a bank's balance sheet. Loans can be classified into commercial, consumer, real estate, and interbank loans. The last form of assets are securities like bonds or Treasury bills. On the corresponding side of the bank's balance sheet are the liabilities. These consist of long-term deposits, short-term deposits, other liabilities, and bank capital. Long-term deposits have a defined maturity and are not immediately available for depositors to withdraw. Conversely, short-term deposits are immediately withdrawable for depositors and, in most cases, hold the largest position on the liability side of a commercial bank's balance sheet. Under the category 'other liabilities' are purchased funds such as interbank borrowings, central bank borrowings, or subordinated notes and debentures. The final category, bank capital, is a bank's equity capital. It can be described as the net worth of a bank or the amount by which the assets exceed the liabilities of the bank.[21]

[21] Cf. VanHoose (2017), pp. 4-9

Income	*Expenses*
Interest Rate Income	*Interest Rate Expenses*
Non-Interest Rate Income	*Loan Loss Provision Expenses*
	Real Resource Expenses

Table 4: Bank Income Statement. Source: VanHoose (2017) pp. 10–12

In addition to a bank's balance sheet, it is important to understand a bank's income statement, as a bank's profit is derived from this. Table 4 is a simplified illustration of a bank's income statement. The most important stream of income for a bank is interest rate income. Nearly two-thirds of the income of U.S. commercial banks is derived from interest rates. Loans and securities issued by the bank generate this form of income, as seen on the asset side of the bank's balance sheet in Table 3. The remaining income, the so-called 'non-interest rate income', is derived from trading profits, customer service charges, loan management fees, and other bank-related services. For the bank to be able to generate interest-rate income, it needs to raise funds from deposits or other liabilities. A bank can only raise these funds if it pays a competitive interest rate. Consequently, interest rate expenses are part of a bank's income statement on the expense side. The probability of a capital borrower defaulting must always be considered. As such, a bank holds a cash asset position to mitigate the consequences of a possible default. If a capital borrower defaults, the bank needs to add new cash to the cash asset position as it decreases due to the default. This transaction is called 'loan loss provision expense'. Besides expenses related to capital, such as deposits and loans, banks also incur resource expenses connected with traditional factors of production, such as labour, capital, and land. These expenses make up the largest part of the expenses of U.S. commercial banks.[22]

Commercial banks face several challenges whilst acting as financial intermediaries. On the one hand, they have to deal with asymmetrical information, and on the other hand, they face several risks. Asymmetric information arises if one party of a financial contract possesses information that is not accessible to the other party. This usually is a result of what is either known as 'ex-ante adverse selection' or as 'ex-post moral hazard'. Ex-ante adverse selection occurs before the issuing of a loan. Capital borrowers who conduct projects with a high failure rate are often individuals who most strongly seek loans from a bank. To address this, banks need to screen all potential capital borrowers to exclude

[22] Cf. VanHoose (2017), pp. 10-12

projects with a high failure rate from their portfolio. Ex-post moral hazard occurs after screening has been conducted – when a capital borrower undertakes actions that raise the failure possibility of the project after the loan or security has been issued. Hence, banks need to monitor their capital borrowers and adjust the financial conditions of the financial contract if the project risk is raised. Screening and monitoring are costly and are part of the real resource expenses of a bank. Generally, banks face several kinds of risks: credit risks, market risks, liquidity risks, and systematic risks. The risk occurring from an ex-post moral hazard can be understood as a credit risk, which translates directly onto a bank's balance sheet. As such, credit risk considers the possibility that loans issued by a bank could decrease in value or default. In addition to credit risks, banks face market risks: price risk, interest rate risk, and liquidity risk. Price risk refers to the value of securities, as the market price of these can potentially decrease, reducing the value of an asset and shortening the balance sheet. Conversely, interest rate risk affects both sides of a balance sheet. A bank can face the possibility that interest paid on liabilities, such as deposits, rises more rapidly than interest rates on assets, such as loans. This shrinks the interest rate income and, in extreme cases, to a point where a bank can observe a negative income. Lastly, banks face liquidity risks regarding cash assets and deposits. This risk occurs if a bank doesn't have sufficient cash to satisfy customer demand, as described in the previous chapter on bank runs and bank panics. Credit, market, and liquidity risks, however, are all calculable and can be mitigated by investment and portfolio decisions. Systematic risk, however, can be understood as the risk of bank panics or even financial crises occurring.[23]

2.1.6. Macroeconomic Function of Financial Intermediaries

As described in the previous chapters, financial intermediaries, especially banks, play a crucial role in the financial market regarding the efficient provision of transformation functions. From a macroeconomic perspective, financial intermediaries that take deposits from capital providers and issue loans to capital borrowers are called commercial banks. Commercial banks and a functional banking sector are essential for a well-functioning economy, as they play a major role in coordinating capital in that they align supply and demand from capital providers and capital borrowers, respectively. Additionally, commercial banks play a major role in the monetary policies of states and central banks.

[23] Cf. VanHoose (2017), pp. 13-16

Sollow (1957) and Swan (1956) posit that the output of an economy *Y* depends on capital *K* and labour *N* and is described by a Cobb-Douglas function:

$$Y = K^{\alpha} N^{\beta} \tag{25}$$

$$\text{with} \qquad \alpha + \beta = 1$$

The annual growth of the capital is determined by the savings rate *s* and the output *Y*, so that sY is the amount that is added to the capital stock and $s\frac{Y}{K}$ is the relative growth of the capital stock. Accordingly, the annual growth of the output can be described by

$$y = \alpha s \frac{Y}{K} + \beta n \tag{26}$$

In this model, the growth of labour is assumed to be constant, as the stock of labour cannot be increased in the short term. Thus, the only variable that influences the growth of the output is the growth rate of the capital stock, the saving rate *s*. For every *s* a unique equilibrium exists that defines the growth of the output. Consequently, an economy can only increase its output if the population waives consumption and reinvests the output in capital stock. This means that a major part of the current output needs to be reinvested into production to achieve a higher future output. The result is an investment spiral with increasing output but decreasing consumption. To counter this spiral, the concept of technical improvement needs to be introduced. If an economy can achieve a technical improvement, its production technology becomes more efficient. Hence, the economy can raise its output *Y* whilst the factors capital *K*, savings rate *s,* and labour *N* remain constant. This technical improvement can be achieved through research and development within an economy.[24]

Based on a combination of growth theory and the microeconomic aspects of financial intermediation, Greenwood/Jovanovic (1990) researched the relationship between financial intermediation, financial structure in an economy, and economic growth. In their model, agents have the opportunity to either use their capital for consumption or to invest it. The investment opportunities consist of two different types, the first with safe, low returns, and the second with risky, high returns. The second investment opportunity is to invest individually in production technology. The expected rate of return of the second investment opportunity is higher than the return of the first safe investment opportunity. Nevertheless, there is a risk that the investment in the second opportunity could fail, resulting in a zero return on investment. Although each agent can observe their own

[24] Cf. Swan (1956), pp. 334-361; Solow (1957), pp. 312-320

investment outcome in the second investment opportunity, due to the individual nature of the input, they cannot observe the investment outcome of others. However, agents can form coalitions that collect data to coordinate investments in the second investment opportunity, although these come with costs. These coalitions can be understood as financial intermediaries that provide information sharing, risk diversification, and transferring consumption over time. Agents who want to invest using a financial intermediary need to pay intermediation costs, which consist of the set-up costs and losses of failed investment projects. If there is more than one intermediary in the market, the intermediaries are going to compete for the lowest cost of intermediation. The only way to reduce these costs is to reduce failed projects. Thus, intermediaries steer capital into the most profitable areas or sectors of an economy, which leads to an overall higher growth rate in an economy. Subsequently, an overall higher growth leads to a decrease in the costs of financial intermediation, thus allowing a stronger financial structure in the economy, which leads again to an overall higher growth through more efficient investments. Hence, economies with financial intermediaries and a developed financial structure have higher growth rates and allow agents to invest in technical progress. Furthermore, economic growth fosters investment. Further empirical evidence from, e.g., King/Levine (1993), Levine/Zervos (1998), Levine (2005), and Hasan/Koetter/Wedow (2009) supports the theory that the growth of an economy is linked to a well-developed banking sector.[25]

As shown theoretically and empirically, capital is important in determining the strength of an economy. This is because, on the one hand, it determines the level of output of an economy, and on the other hand, through investments in research and development, it contributes to technical improvement and the growth of output. Financial intermediaries play a crucial role in both distributing this capital efficiently between capital providers and borrowers and steering the capital into the most profitable industry sectors of an economy. Thus, financial intermediaries play a significant role in determining the output growth and the growth rate of an economy.

In monetary economics, commercial banks play a crucial role regarding the money supply, money growth, and the distribution of wealth within an economy complementary to central banks. A central bank is normally a governmental institution with responsibility for monetary policies, such as steering the interest rate and providing the economy with

[25] Cf. Greenwood, Jovanovic (1990), pp. 1076-1100

currency, especially cash. To understand these mechanisms, it is important to understand what money is and how it is created. Money is an asset that can be used for the transaction of wealth between two individuals and pays no interest rate. Two types of money are used: currency, which consists of coins and bills; and checkable deposits from depositors within commercial banks. The overall demand for money in an economy is the sum of individual demand from people and firms. This is influenced by the level of transactions and the current market interest rate. The supply of money, especially currency, is steered by a central bank. The central bank creates currency and buys or sells bonds with it. Using this mechanism, it either increases or decreases the amount of currency supplied.[26]

Delving deeper into the topic of money creation, the volume of broad money in an economy consists of the currency in circulation and the number of checkable deposits. Hence, it is the result of the interaction of commercial banks and central banks with the money holding sector, consisting of households, non-monetary firms, and non-monetary financial firms. Moreover, the growth of broad money can reflect the current situation of an economy if the growth is consistent with the level of prices, income, and interest rates. Consequently, strong economic growth should be reflected in the growth of the amount of broad money. The volume growth of broad money is influenced by the money supply. The money supply is derived from the behaviour and interaction between the central bank and commercial banks. It can be divided into the supply of outside money from central banks, which consists of the provision of currency, and the supply of inside money, which is created by commercial banks. The money supply process is driven by the monetary action of a central bank through the adjustment of the level of outside money. Additionally, the volume of broad money is determined by the money multiplier, which is based on the actions of commercial banks with regard to inside money supplied by the central banks. The money multiplier is derived from the deposit banking activities of commercial banks. A commercial bank takes deposits from capital providers and lends this money in the form of loans to capital borrowers. If there is confidence in the banking system, the commercial bank only needs to hold a fraction of the money deposited as a liquid asset or currency. The remaining money deposited can be used for lending. Furthermore, when the bank lends money to a capital borrower, it is normally deposited by a bank, thus creating new inside money. Consequently, the level of the money multiplier depends on the

[26] Cf. Blanchard (2017), pp. 88-92

fraction of deposits a bank must hold in currency or liquid assets, and that if a central bank wants to increase the amount of broad money, they supply more outside money to the system, which the commercial banks then use to create more inside money via the money multiplier. Thus, in addition to their intermediation function between capital providers and capital borrowers, commercial banks play a major role in the money supply process through their intermediation function. Therefore, a change in the behaviour of banks regarding their intermediation function influences the money supply. In addition to determining the amount of currency supplied, a central bank can steer the amount of broad money with the official interest rate it sets. If the central bank lowers the official interest rate, credits supplied by commercial banks get cheaper for consumers. Consequently, more credits are supplied, and more households hold money. Additionally, by decreasing the official interest rate, commercial banks can alter their lending criteria or lower the spread between the official interest rate from the central bank and the asked for interest rate. Using this mechanism, banks can create more deposits and influence the amount of broad money to a certain degree. Moreover, all households have a target level of money they want to hold. However, if the households have access to more money via cheaper credits, they increase the level of money held in the short term but return to their target level of money in the mid-term by using the money for consumption. Consequently, commercial banks can support the growth in the overall money demand of an economy by extending lending either after a decrease in the official interest rate set by the central bank or by altering their lending criteria or spread between the official interest rate and asked for interest rate. It is important to understand that an increase in money supply leads to an increase in inflation through higher prices.[27]

Thus, in addition to the efficient provision of transformation functions, financial intermediaries, in the form of commercial banks, play a major role in the context of monetary economics as they are an important partner for the central banks in regard to money creation and have an influence on the rate of inflation. Furthermore, in the context of economic growth, it is important for an economy to have a functioning and stable financial sector consisting of several financial intermediaries to be able to achieve higher economic growth.

[27] Cf. ECB (2011), pp. 63-37; Berry et al (2007), pp. 378-380

2.2. Competition and Stability in the Banking Sector

On an abstract level, competition is always desirable in a market. Competition leads to an absence of market power, prices that tend towards marginal costs, and the maximization of welfare. In the banking sector, the effect of competition has been widely discussed and is described in detail in the following sections of this thesis. In the literature, there are two directions regarding the influence of competition on stability. The first is the 'competition fragility' theory. This argues that competition leads to lower loan and higher deposit rates, which gives the banks an incentive to gamble, increasing the probability of bankruptcy and thus decreasing the stability of the banking sector. Examples of researchers positing this theory are Keeley (1990), Allen/Gale (2000), and Hellmann/Murdock/Stiglitz (2000). The theory of 'competition stability', on the other hand, argues that market power leads to banks setting higher loan rates, which means that capital borrowers face the problem of moral hazard and therefore have an incentive to take higher risks, which increases the default rate of loans. Consequently, the default risk of the bank increases, and the stability of the banking sector decreases. This theory was initially posited by Boyd/De Nicolo (2005) and Hakenes/Schnabel (2007) and later refined by Martinez-Miera/Repullo (2010). Further ideas concerning the effect of competition in the banking sector and bank stability on economic growth are discussed by Claessens/Laeven (2005), De Guevara/Maudos (2011), and Fernandez/Suarez (2016), who identify positive empirical evidence of competition and stability in the banking sector on the growth of an economy. Finally, this part of the thesis discusses the effect of information technology on competition and stability in the banking sector.

2.2.1. Competition Fragility

Between the 1950s and the 1980s, the capital ratio, market value and book value of commercial banks decreased, and the bankruptcy risk of commercial banks in the USA increased. Keeley (1990) argues that liberalization of the banking sector led to this development. Before that period, banks had been protected from competition by the regulator; e.g., the chartering of a bank was expensive. However, these barriers were dismantled, and the banks faced competition, which led to an increase in risky investment behaviour among banks and a decrease in stability. This mechanism has been described within a theoretical framework. In detail, the model consists of two periods: the current period and the future period. Two states are possible in the future period, which are described by the current value of a currency depending on the future states P_1 and P_2. Thus, the risk-free

interest rate equals $\frac{1}{P_1+P_2} - 1$. Initially, the bank has the capital C_0 and the number of deposits D_0 for which the bank pays an interest rate of P_D. Additionally, the bank has no deposit insurance. The bank can invest in an asset security A for the price of P_A, and, depending on the decision regarding risk, it either has the payoff A_1 in state 1 or A_2 in state 2. However, in state 1, the risk of bankruptcy for the bank is greater. The value of the bank's equity V_0 is described by the value of its expected future cash flows:

$$V_0 = \frac{C_0+D_0}{P_A}(P_1A_1 + P_2A_2) - \frac{D_0}{P_D}(P_1 + P_2) \tag{27}$$

The first part of the term describes the expected cash flow from the investment into the asset, the second term describes the expected cash flow towards the depositors. If the market is competitive $P_A = P_1A_1 + P_2A_2$ and $P_D = P_1 + P_2$ hold, thus reducing the value of the bank's equity to the value of the initial capital $V_0 = C_0$. Now deposit insurance is introduced, which pays the depositors their obligations if the bank defaults in state 1. Thus, the value of the bank's equity is increased by the cash flow from the deposit insurance to the depositors if the bank defaults:

$$V_0 = \frac{C_0+D_0}{P_A}(P_2A_2) - \frac{D_0}{P_D}P_2 > C_0 \tag{28}$$

The term can be rewritten as:

$$V_0 = C_0 + I_0 \tag{29}$$

with I_0 decreasing in C_0. This means that the bank has an incentive to minimize the amount of capital invested and maximize the amount of deposit invested. With the deposit insurance covering the obligations of the depositors, the bank has an incentive to be riskier in investment decisions and, thus, increases the default risk. Following this model, if the market for banking is competitive, the banks are not able to gain monopoly rent, and there is a non-risk-related deposit insurance scheme in place, banks are incentivized to take higher risks and minimize their capital. One solution could be to contain competition by using a 'banking charter'. This banking charter needs to operate as a bank; it is costly and supplied by the government. The number of banking charters is limited; thus, it enables the holding entity to pay less for the assets and deposit them on the market under perfect competition. In this scenario, if the bank is insolvent, the depositors get their obligations paid by the deposit insurance; the deposit insurance gets the bank's capital plus the banking charter; and the owner of the bank receives nothing. Consequently, the value of the bank's equity is increased by the value of the banking charter:

$$V_0 = \frac{C_0+D_0}{P_A}(P_1A_1 + P_2A_2) - \frac{D_0}{P_D}(P_1 + P_2) + X_0 \tag{30}$$

with $X_0 = P_1X_1 + P_2X_2$

meaning that in state 1, $P_1X_1 > I_0$ must hold and that the bank has no incentive to make risky decisions, because the value of operating in one more period is higher than the value of the deposit insurance. Consequently, the reduction of competition leads to an increase in safer investments and decreases banking risks. The results are supported by the empirical findings of Keeley (1990), showing that banks with more market power hold more capital relative to assets and have lower default risks.[28]

Hellmann/Murdock/Stiglitz (2000) take up Keeley's argument (1990) regarding the value of a bank's equity, calling it 'franchise value'. They research the topic in a dynamic setting with regard to deposit rates and capital requirements. The mechanism works as follows: Market liberalization increases competition; competition increases the deposit rate and decreases the loan rates; ergo, it erodes profits. Lower profits imply a lower franchise value, leading to a moral hazard in the portfolio choice and an incentive for a bank to gamble and make riskier investments. In the model, the banks operate for $T \to \infty$ periods. Banks raise insured deposits $D(r_i, r_{-i})$ which depend positively on the interest rate paid by the bank and negatively on the interest rate paid by other banks. Furthermore, banks invest capital *k,* which depends on the amount of deposit raised, so that the total amount of funds is described by $(1 + k)D(r_i, r_{-i})$. After raising funds, banks face an allocation and moral hazard problem. They can either invest in a prudent asset with a payoff of α, or in a gambling asset with a payoff of γ with the probability θ or the payoff of β with the probability $(1 - q)$. The expected payoff of the prudent asset is larger than the expected payoff of the gambling asset $\alpha > \mathrm{q}\gamma + (1 - \mathrm{q})\beta$. If the gamble is successful, the bank has high private earnings with $\gamma > \alpha$. However, if the gamble fails and the payoff $\beta < \alpha$ is generated, the bank is not able to fulfil the obligations of the depositors, and the deposit insurance must compensate the depositors. The opportunity cost for the capital invested by the bank can be described with $\rho > \alpha$. At the end of every period, the banks get inspected by a regulator, evoking their banking charter if they cannot meet the obligations of their depositors. The per-period profit of the bank for a prudent investment can be described as:

$$\pi_p = m_p(r_i, k)D(r_i, r_{-i}) \tag{31}$$

with the profit margin $m_p(r_i, k) = \alpha(1 + k) - \rho k - r_i$

[28] Cf. Keeley (1990), pp. 1183-1200

and the per-period profit for the gambling investment with:

$$\pi_g = m_g(r_i, k)D(r_i, r_{-i}) \tag{32}$$

$$\text{with the profit margin } m_g(r_i, k) = \theta(\gamma(1+k) - r_i) - \rho k$$

In this dynamic setting, banks maximize their expected discounted profits $\sum_{t=0}^{T} \delta^t \pi_i$. Consequently, the expected profit for the prudent asset and thus, the value of the bank, can be described by:

$$V_p = \frac{\pi_p(r_i, r_{-i}, k)}{1-\delta} \tag{33}$$

This means the discounted per-period profits of a prudent investment for $T \to \infty$. The expected profits for an investment in a gambling asset can be described by:

$$V_g = \frac{\pi_g(r_i, r_{-i}, k)}{1-\theta\delta} \tag{34}$$

Meaning the discounted per period profits if the gambling assets are successful for $T \to \infty$. Now it is possible to derive the condition that leads to a bank investing in a prudent asset. If the one-period excess profit of an investment in gambling over a prudent asset is lower than the value of the banking charter, the bank decides to invest in the prudent asset:

$$\pi_g(r_i, r_{-i}, k) - \pi_p(r_i, r_{-i}, k) \leq (1-\theta)\delta V_p(r_i, r_{-i}, k) \tag{35}$$

From this point, a critical deposit rate can be derived to describe the point at which banks decide to invest in a gambling asset:

$$\hat{r}_p(k) = (1-\delta)\left(\frac{1-\theta\gamma}{1-\delta}\right)(1+k) + \delta(\alpha(1+k) - \rho k) \tag{36}$$

If a bank has a high discount factor $\delta \to 1$, it can pay out the net return on the asset as a deposit rate and still invest in the prudent asset. This is because the bank values keeping its banking charter and staying in business more than possibly realizing short-term profits from investments in the gambling asset. In the case that a bank wants to invest in the prudent asset, it faces a maximization problem regarding deposit rate and capital:

$$(r_p, k_p) = argmax_{r,k}\{V_p(r_i, r_{-i,}, k)\} \tag{37}$$

A symmetric equilibrium with $r_{-i} = r_p$ is necessary. The optimal deposit rate can be derived:

$$r_p(k) = \frac{(\alpha(1+k) - \rho k)\varepsilon}{\varepsilon + 1} \tag{38}$$

$$\text{with} \qquad \varepsilon = \frac{\partial D}{\partial r_i}\frac{r}{D}$$

describing the elasticity of the volume of deposits regarding the deposit rate. If the bank only invests in the prudent asset, it is never profitable to use its own capital k, because

the opportunity costs ρ exceed the return α, hence, the optimal deposit rate can be described by:

$$r_p(0) = \frac{\alpha\varepsilon}{\varepsilon+1} \tag{39}$$

The competitive rate approaches α, which makes the value of the banking charter very small, leading to a possible excess of the critical deposit rate $r_p(k) > \hat{r}_p(k)$. In this case, the bank changes its strategy and invests only in the gambling asset, paying $r_g(0)$ to the depositors. Consequently, in a sufficiently competitive banking sector, banks hold no capital, invest only in gambling assets, and pay the depositors $r_g(0)$, leading to a higher default rate for the banks and a decrease in the stability of the banking sector.[29]

A dynamic approach to studying the interconnection between bank risk-taking and competition has been carried out by Allen/Gale (2000). A two-date economy is considered with *N* banks that have access to a set of technological production technologies *S* and no capital. With the input of *y,* the technology yields an output of *Sy*. The probability that the investment in the production technology is successful is described by $p(S)$ with $p(0) = 1, p(\bar{S}) = 0, p' < 0, p'' \leq 0 \; \forall \; S \in [0, \bar{S}]$. Consequently, $p(S)S$ is a strictly concave function, where the probability of success decreases and the output increases if the function is followed to the right hand. The choice of a bank regarding *S* in the first date is unobservable; thus, the risk-taking can only be influenced by the bank itself. The banks face an upward sloping supply function of demands, which is described by the deposit rate $r_D(\cdot)$ with $r_D(0) \geq 0, r_D' > 0, r_D'' \geq 0$. This means that the supply of deposits increases with the deposit rate. The supply of deposits of a bank *i* is described by D_i. Consequently, the overall supply of deposits is described by $\sum_{i=1}^{N} D_i$. The deposit rate paid depends on the overall supply of deposits $r_D(\sum_{i=1}^{N} D_i)$, while the banks compete for deposits in a Nash fashion. Furthermore, the deposits are insured by flat-rate insurance with costs of $\alpha > 0$. Accordingly, the profit function of a bank *i* is described by:

$$\pi_i(S_i, D_i) = p(S_i)(S_i D_i - r_D(\textstyle\sum_{i=1}^{N} D_i)D_i - \alpha D_i) \tag{40}$$

Banks choose a set of (S_i, D_i), which is the best response to the strategy of other banks. To achieve this, $\pi_i(S_i, D_i)$ is maximized with the following conditions: $\frac{\partial \pi_i(S_i, D_i)}{\partial S_i} = 0$ and $\frac{\partial \pi_i(S_i, D_i)}{\partial D_I} = 0$. Which reduces in a symmetric equilibrium to $p'(S)(S - r_D(ND) - \alpha) + p(s)$ and $S - r_D(ND) - r_D'(ND)D - \alpha = 0$. Allen/Gale (2000) show that the unique

[29] Cf. Hellmann/Murdock/Stiglitz (2000), pp. 147-153

equilibrium implies that the risk-taking *S* and the overall supply of deposits increase with the number of banks *N*. The mechanism behind this process is that an increase in competition in the banking sector is associated with a decrease in profits, leading to a smaller buffer bank need to react to possible shocks and incentivizing banks to take higher risks in their investment decisions.[30]

The findings of the models – that an increase in competition leads to a decrease of the stability of a bank – is supported by empirical evidence by Jiminez/Saurina (2007), who researched the Spanish banking sector with regard to market power in the form of the Lerner Index and the ratio of non-performing loans showing the claimed relationship. Interestingly, neither Keeley (1990) nor Hellmann/Murdock/Stiglitz (2000) conclude that the number of banks should not be restricted but instead suggest prudent regulation such as deposit rate ceilings or capital regulations as countermeasures to the possible negative effects of a more competitive banking sector.

2.2.2. Competition Stability

The models described in the previous chapter focus on the deposit side of a bank and argue that policies such as liberalization of the banking market or deposit insurance lead to a moral hazard problem as they incentivize a less prudent banking investment strategy. This moral hazard problem occurs while attempting to solve the portfolio problem of a bank. However, the loan side of the bank cannot be ignored. As described by, e.g., Diamond (1984), banks also need to solve a contracting problem on the loan side, in which they deal with asymmetric information and moral hazard from capital borrowers. Consequently, it is interesting to research how competition influences this problem. A higher market power induces not only higher rents in the deposit market for a bank but also higher rents in the loan market and, thus, higher loan rates. If a capital borrower faces higher loan rates, a moral hazard problem occurs as there is an incentive to adjust to higher risk investing, potentially leading to a higher bankruptcy rate for capital borrowers. This effect spills over to the portfolio of a bank through higher defaulted loans, making the bank less stable. Consequently, the theory of competition stability is the opposite of competition fragility in the previous chapter. Boyd/De Nicolo (2005) created a model to research this topic. The model was further refined by Hakenes/Schnabel (2007) and Martinze-Miera/Repullo (2010).

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[30] Cf. Allen/Gale (2000), pp. 230-269; Boyd/De Nicolo (2005), pp. 1334-1336

Boyd/De Nicolo (2005) use the same base model as Allen/Gale (2000) but extend it to incorporate the loan market. The same *N* banks compete for deposits as well as for loans. Furthermore, banks have no direct control over the riskiness of capital borrowers' projects. The only influence they have is the loan rate r_L. A capital borrower chooses $S \in [0, \bar{S}]$ so that $p(S)(S - r_L)$ is maximized. Consequently, the maximization problem leads to:

$$S + \frac{p(S)}{p'(S)} = r_L \tag{41}$$

meaning if the bank increases the loan rate, the capital borrower chooses to increase the S with a riskier project. Moreover, the total amount of loans is denominated by L, and with the absence of capital from the bank, the total amount of loans equals the total amount of deposits:

$$L = \sum_{i=1}^{N} D_i \tag{42}$$

The banks face an inverse loan demand function that satisfies $r_L(0) > 0, r_L' < 0, r_L'' \leq 0$. Furthermore, the loan demand function is generated by a population of potential capital borrowers who have access to different production technologies and is dependent on the total amount of loans $r_L(L)$ or $r_L(\sum_{i=1}^{N} D_i)$. With this equation, it is possible to define S as a function of the bank's deposits D_i, so that $S(\sum_{i=1}^{N} D_i)$ applies. Additionally, the risk of the capital borrowers is perfectly correlated, meaning that it is possible to differentiate it into systematic and idiosyncratic risk. In summary, the profit function of the bank is only dependent on the deposits issued, and the bank cannot actively influence S:

$$\pi(D_i) = p(S(\sum_{i=1}^{N} D_i))(r_L(\sum_{i=1}^{N} D_i)D_i - r_D(\sum_{i=1}^{N} D_i)D_i - \alpha D_i) \tag{43}$$

Boyd/De Nicolo (2005) prove that in a symmetric Nash-equilibrium, S decreases in N and that the profit functions drift to the competition outcome of:

$$r_L(ND) - r_D(ND) - \alpha = 0 \tag{44}$$

The results of the model show that defaults on loans decrease when the number of banks increases, meaning that an increase in competition in the banking sector leads to increased stability in the banking sector.[31]

Boyd/De Nicolo (2005) were the first to include the loan market and consider a contracting problem in a model researching competition and stability within the banking sector. The model is rudimentary and gives an initial overview of how the identified loan market

[31] Cf. Boyd/De Nicolo (2005), pp. 1336-1338

effect works. Nevertheless, it can be criticized in that, in this model, the bank has no equity and all loans are perfectly correlated.

Hakenes/Schnabel (2007) refine the model of Boyd/De Nicolo (2005) regarding the correlation between loans and bank equity. They combine the contracting problem of Boyd/De Nicolo (2005) with the classic portfolio decision problem. The main argument for the refinement was that banks' and capital borrowers' risk-taking are complementary and so both need to be considered. The model follows mainly Boyd/De Nicolo's (2005), with some expansions. Instead of a two-period model, a three-period model is t_0, t_1, t_2 assumed. The capital borrowers choose S in t_1 privately depending on the loan rate r_L, the bank is only able to observe the outcome of the investment in t_2. The loan demand function, the deposit supply function and the deposit insurance are the same as in Boyd/De Nicolo (2005). Besides raising deposits, banks must hold capital or equity E_i to fund the loans $L_i = D_i + E_i$, where equity is a mandatory regulatory fraction of the issued loans $L_i = \beta E_i$. Equity, however, is expensive $r_E > p(0)r_L(0)$, meaning that a bank will never hold more equity than it is obliged to. The major addition to Boyd/De Nicolo (2005), therefore, is that the bank can influence the correlation between the issued loans $\rho \in [0,1]$ hence, the bank faces a portfolio problem. A natural correlation ρ_0 between the loans is assumed. With a non-monetary effort depending on the loan sizes

$$C_i(L_i, \rho_i) = L_i c(\rho_i) \tag{45}$$

it is possible to either increase or decrease this correlation. The function $c(\rho_i)$ is a strictly convex curve with its minimum at ρ_0, meaning that every deviation from the natural correlation is costly. If a bank chooses ρ_i all projects are perfectly correlated with the probability of ρ_i and uncorrelated with the probability of $1 - \rho_i$. In both cases, the payoff of the investment is $p(S)S$, but in the first case the probability of default equals $p(S)$, whilst in the second case, the probability of default is *0.* Thus, by setting ρ_i the bank can control its own risk. In t_o the banks sets D_i, L_i, ρ_i. Consequently, in t_1 the capital borrowers choose S, and in t_2 their output is observable by the bank. The bank gets repaid and the claims of the depositors are either paid by the bank or the deposit insurance depending on the success of the capital borrowers' investment. The expected return of the capital borrower is the same as in Boyd/De Nicolo (2005), meaning that the borrower increases the risk S in the loan rate r_L. However, the expected return of the bank changes due to the setting of ρ_i with $\bar{L}, \bar{D}$ representing the total amount of loans and deposits to

$$\pi_i = \rho_i p(S)[r_L(\bar{L})L_i - (r_D(\bar{D}) - \alpha)D_i] + (1 - \rho_i)[p(S)r_L(\bar{L})L_i - (r_D(\bar{D}) - \alpha)D_i] - r_E E_i - L_i c(\rho_i) \quad (46)$$

The function is maximized in regard of ρ_i and D_i to find a symmetric Nash-equilibrium. Further analysis shows that first, an increase in competition leads to more deposits collected, and second, as Boyd/De Nicolo show, an increase in competition decreases the risk taking of the capital borrower. However, the analysis also shows that an increase in competition leads banks to increase the correlation in their portfolios, thus increasing risk. This supports the argument that as competition gets more intense, the banks' profits erode and they start to specialize in one sector. This finding is consistent with the findings of charter value theory. The question is, which effect is more dominant, the change of behaviour from capital borrowers or the change of behaviour from the banks? To understand this, the overall effect on the bank default rate $PD = \rho(1 - p(S))$ needs to be considered. The analysis shows that when competition increases, the overall default rate decreases if and only if banks consider the risks of a high correlation and choose not to increase it. If the bank chooses to increase the correlation among the loans when competition increases, the effect on the bank's default rate is ambiguous.[32]

Hakenes/Schnabel (2007) refinement of Boyd/De Nicolo (2005) shows that not only one but two effects describe the interconnection of competition and stability in the banking sector. On the one hand, there is the so-called 'risk shifting effect', based on the decisions of capital borrowers, and on the other hand, the 'margin effect', which is based on the action of the bank. Nevertheless, it is unsatisfying that Hakenes/Schnabel (2007) are unable to ascertain which effect is dominant.

Martinez-Miera/Repullo (2010) argue, like Hakenes/Schnabel (2007), that the assumption of perfect correlation between the loans made in Boyd/De Nicolo (2005) is unrealistic. But unlike Hakenes/Schnabel (2007), they randomize the correlation of the loans based on a risk factor model. Consequently, a Boyd/De Nicolo (2005) model is assumed, where the outcome of the capital borrower's investment is random and, thus, the return of a bank's portfolio is stochastic. The results of the analysis show that in a symmetric Cournot-equilibrium, an increase in the number of banks leads to increase in the overall amount of loans and, thus, a decrease in the loan rate, lowering the default risk of the capital borrower. This is the 'risk shifting' effect. Furthermore, it is identified that for any

[32] Cf. Hakenes/Schnabel (2007), pp. 3-10

correlation parameter $\rho \in [0,1]$ and a sufficiently large number of banks, the default probability of a bank increases when the number of banks increases; this is the 'margin effect'. A numeric analysis of the model shows that both effects are relevant and lead to a u-shaped relationship between competition and stability in the banking sector.[33]

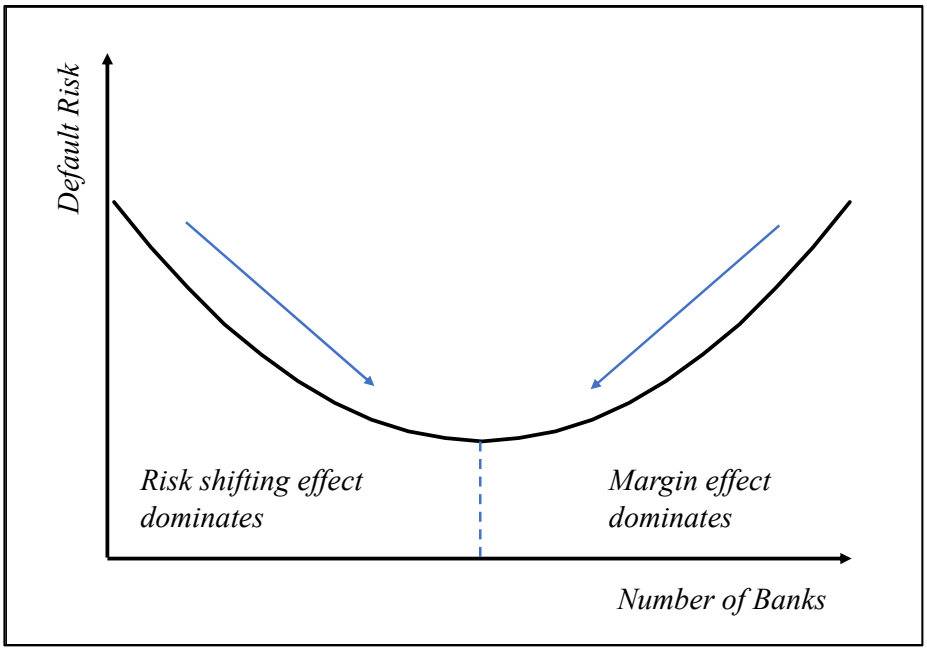

Figure 3: Relationship of Banks Default Risk and Number of Banks in the Banking Sector. Own Illustration

Figure 3 shows that in a monopolistic market with already high loan rates, the risk shifting effect dominates the margin effect. Meaning that more competition leads, in monopolistic banking markets, to more stability, while in competitive markets, the margin effect dominates the risk shifting effect. The profits of banks erode in competitive markets and incentivize higher risk taking, meaning, conversely, that a decrease in competition and an increase in loan rates and the profits of the bank increase the stability of the banking sector. The findings of Martinez-Miera/Repullo (2010) are supported by research by Tabak/Fazio/Cajueiro (2012) into the Latin American banking market and Jimenez/Lopez/Saurina (2013), who researched the Spanish banking market.

2.2.3. Competition and Economic Growth

As shown in the previous chapters, the banking sector plays a crucial role in regard to economic growth. Consequently, it is interesting to research the connection between competition in the banking sector and economic growth. Rajan (1992) and Peterson/Rajan

[33] Cf. Martinez-Miera/Repullo (2010), pp. 3638–3664

(1995) discuss two different kinds of banking scenarios. The first is 'relationship lending', in which banks and capital borrowers have a long-term relationship over several periods, so that a bank is willing to finance a capital borrower's project with the intention to earn returns on the investment in later periods. The second is 'transactional banking', in which the capital borrower chooses another bank every period to finance projects. Consequently, the banks compete every period to finance the projects of the entrepreneurs. Relationship lending tends to mean that banks are more likely to finance a capital borrower because they enjoy a long-term relationship and do not have to compete with other banks. Conversely, if banks have to compete, they are less likely to issue loans. On the other hand, relationship lending can be a dilemma for capital borrowers, because they cannot easily break from such a relationship without sending negative signals to other potential lenders. Consequently, relationship lending in a concentrated banking market can possibly hinder the issuing of loans. The case for transactional banking has been argued in the previous chapter in which Martinez-Miera/Repullo (2010) show in their empirically supported model that the overall supply of loans increases if competition increases.[34]

Claessens/Laeven (2005) conducted one of the first empirical analyses regarding the connection between competition in the banking sector and economic growth. Their findings suggest that industry sectors that are dependent on external financing grow faster in more competitive banking sectors, supporting the argument that competition in a banking sector is an important indicator for economic growth. Furthermore, De Guevara/Maudos (2011) confirm the findings of Claessens/Laeven (2005) in their study. However, they additionally find an inverted u-shaped relationship between competition in the banking sector and economic growth. This suggests that the growth rate is highest at a moderate level of competition. Fernandez/Suarez (2016) also find that banking stability has a positive impact on economic growth. If the findings of Fernandez/Suarez (2016) and the model of Martinez-Miera/Repullo (2010) are combined, they both support the results of the study of De Guevara/Maudos (2011). In the model of Martinez-Miera/Repullo (2010), the default probability, and thus, the stability of the banking sector, is also in a u-shaped

[34] Cf. Rajan (1992), pp. 1367-1400; Petersen/Rajan (1995), pp. 407-443; Claessens/Laeven (2005), pp. 563-564; Martinez-Miera/Repullo (2010), p. 3645

relation to competition, meaning that the default rate is lowest when competition is at a moderate level.[35]

Therefore, both theoretical and empirical studies show that competition in the banking sector is an important indicator of banking stability and economic growth. These findings are consistent with those in previous chapters especially the research of Greenwood/Jovanovic (1990), that describe the importance of a stable banking sector for the growth of an economy from a macroeconomic perspective. However, contrary to other industries, a high degree of competition is not desirable, as it decreases the stability of the banking sector and economic growth. Neither is a monopolistic environment desirable for the same reason. Consequently, a moderate level of competition can be viewed as ideal, because stability is achieved, and economic growth is high. Regulators have several measures to counter too much or too little competition, such as the liberalization of the banking sector, deposit rate ceilings, and capital quotes.

2.2.4. Competition and IT Adoption in Banking

The process of collecting, processing, and analyzing data plays a vital role in the banking sector. This has been greatly aided by technological advancements, particularly the introduction of computers, or IT in various forms like cloud computing, artificial intelligence, and online services. These advancements have significantly impacted how banks offer financial services by making data-related tasks more efficient and informed, enabling better financial decision-making. Economically, too, the evolution of IT has had a substantial effect on the financial services market. It has led to new digital players entering the market, the creation of innovative digital products, and reduced costs in providing financial services. This increased competition and diversity in banking and financial services can enhance operational efficiency and resilience. However, it's important to note that this can also potentially lower bank profitability and decrease the overall stability of the financial system. [36]

Ahnert et al. (2022) explore the relationship between the increased adoption of IT within the banking sector and its impact on entrepreneurial activities. Their study revolves around a model in which banks have the choice of either evaluating entrepreneurs through

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[35] Cf. Claessens/Laeven (2005), pp. 563-583; De Guevara/Maudos (2011), pp. 739-764; Fernandez/Suarez (2016), pp. 101-120

[36] Cf. FSB (2019), pp. 1, 17ff.

screening and assessing the provided information or collecting collateral. The infusion of IT makes the process of gathering and analyzing information for the purpose of screening relatively more cost-effective than collateral utilization. As a result, banks that have embraced higher levels of IT adoption display a tendency to extend loans more generously to young enterprises lacking collateral, thereby acting as a catalyst for fostering entrepreneurship. The empirical validation of this proposition has been substantiated by a comprehensive data analysis. The researchers used pre-2008 data regarding the adoption of IT by banks in the United States and the corresponding number of jobs created by start-up ventures. Their analysis unveils a significant pattern: regions in the United States that exhibit increased levels of banking IT adoption are associated with more robust employment generation through start-ups, in contrast to regions with lower banking IT adoption. This empirical observation reinforces the positive connection between the adoption of IT in banks and the subsequent creation of jobs.[37]

In addition to this constructive impact on an economy, IT can also have a stabilizing influence on the economic landscape, thereby increasing its resilience. Research by Pierri/Timmer (2021) focused on the examination of the development of non-performing loans, on the balance sheets of U.S. banks, related to the banks' level of IT adoption during the financial crisis of 2008. Their findings were significant: banks that embraced a higher degree of IT adoption exhibited a substantially smaller increase in their non-performing loan portfolio – 10% less – than the non-performing loans in banks with lower IT adoption, while observing an enhanced capacity to extend the volume of provided loans during times of crisis. This underscores how IT facilitates banks in selecting better borrowers, thereby fostering the creation of more resilient loan portfolios and, thus, more resilient banks and economies.[38]–

Research by Pierri/Timmer (2021) and Dadoukis et al. (2021) explores how pre-2020 IT spending impacted banks' market and accounting performance during the economic crisis following the Corona pandemic outbreak in 2020. Their analysis yields two insights. First, heightened IT investment prior to the Corona outbreak increased the ability of banks to generate future shareholder value, resulting in a lower decrease in market returns compared to banks with low IT spending. Second, the strategic utilization of IT increased the operational efficiency of banks by strengthening screening and monitoring capabilities,

[37] Cf. Ahnert et al. (2022), pp. 8-12, 28f.

[38] Cf. Pierri and Timmer (2021), pp. 25ff.

thereby enhancing the lending decision-making process by enabling the selection of optimal borrowers while simultaneously decreasing the likelihood of a borrower default. Furthermore, the increase in data analytics created a competitive advantage for banks, increasing customer satisfaction levels by identifying their needs at an early stage. Finally, banks characterized by substantial IT expenditure enjoyed a competitive advantage in expanding their customer base. This was achieved through digital banking platforms that mitigated customers' costs associated with seeking and transitioning to alternative banking institutions.[39]

The empirical findings from the studies mentioned above are backed by a theoretical model from Vives/Ye (2023) that explains the impact of different uses of IT in banks on competition and resilience in the whole banking sector. In the model, two banks compete in a 'Hotelling' way in a lending market and try to attract entrepreneurs who need investment for their projects. The banks are located at opposite ends of a city and compete to give loans to entrepreneurs spread out in the area between them. The banks need to attract investors for the provisions of the loans. In the model, the banks fulfil two roles: they provide capital to the entrepreneurs and monitor the funded projects. When the funded projects are monitored in a strong manner, they are more likely to succeed. However, monitoring is costly and becomes more expensive the farther the entrepreneurs are located from the bank. This 'distance' can be either literal or figurative if, for example, the bank has little knowledge regarding the business model of the entrepreneur. The banks have the opportunity to invest in two types of IT: IT-basic and IT-distance. IT-basic includes technologies regarding the collection and processing of data. IT-basic lowers the monitoring costs of entrepreneurs regardless of their distance from the bank. On the other hand, IT-distance includes technologies that specifically reduce the negative impact of distance on monitoring costs by, for example, increasing the speed of the internet connection, setting up online banking, or having an IT-related knowledge base regarding specific business models. This helps to lower the monitoring costs of entrepreneurs who are specifically located far away from the bank. To issue loans, the banks need to attract funds from investors since they don't possess their own capital. It is assumed that the IT of the bank is so advanced that it can individually price the rate of the loans per entrepreneur.[40]

[39]Cf. Dadoukis et al. (2021), pp.1ff.

[40] Cf. Vives and Ye (2023), pp. 1-5

In an initial state of equilibrium in which both banks have the same level of investment in IT-basic and IT-distance technology, the banks cannot serve every entrepreneur as monitoring is costly and the banks need to charge at least an interest rate consisting of the monitoring costs and the promised repayment to their investors. Hence, the entrepreneurs are divided between the two banks, with a marginal entrepreneur placed in the center of the city. In the area where only one bank can operate, it can charge a monopoly interest rate, whilst in the area where both banks are able to operate, the interest rate is competitive and varies depending on the distance of the entrepreneur from the bank. If one bank invests in more advanced IT, encompassing both IT-basic and IT-distance, it gains a competitive advantage over the other bank. As its profits from the issuing of loans increase due to lower overall monitoring costs and the opportunity to serve more entrepreneurs, the distance-related monitoring costs decrease. Furthermore, increased monitoring lowers the default probability. Ultimately, the marginal entrepreneur shifts towards the bank that makes an investment in IT. As this only holds true for the case in which only one bank invests in IT, it is important to analyze a case in which both banks invest in IT and its impact on competitiveness. Improving IT-basic does not affect the competition between the two banks much, as both banks become more profitable and motivated to monitor their borrowing entrepreneurs in their specific areas. Consequently, both banks become more stable and resilient, this effect can be understood as the cost-saving effect. On the other hand, enhancing IT-distance increases the competition between the banks by making them less 'unique', meaning that the areas in which both can charge a monopoly rate shrink. Hence, this leads to a decrease in both banks' profit. If this negative differentiation effect is strong enough, it outweighs the cost-saving effect on monitoring, as monitoring gets relatively costly to conduct. In this case, the banks become less stable because, with decreased monitoring, the chance of entrepreneurs defaulting increases and knowing this, the banks' investors ask for higher returns to cover the risk of entrepreneurs defaulting. Therefore, if the negative differentiation effect outweighs the positive cost-saving effect, it triggers a spiral that decreases the stability and resilience of the banks by increasing the risk of going bankrupt. Conversely, however, both types of IT improvements are beneficial for entrepreneurs, encouraging them to take on more investment projects. Through the cost-saving effects, the entrepreneurs profit from the increased monitoring as their project success probability increases. Additionally, the differentiation effect enables more entrepreneurs to fund their projects as a result of lower loan rates. However, the overall impact of the negative differentiation effect depends on the initial level of competition in

the market. When competition in the lending market is low, increased competition improves the overall health of the market as more entrepreneurs can conduct their projects through decreased funding costs. Additionally, the banks can generate more profit because of the increased volume of lending and decreased monitoring costs. However, a high level of competition in the lending market poses a problem, as it lowers market health by making the banks less likely to monitor entrepreneurs due to the negative differentiation effect outweighing the cost-saving effect. This increases the risk of the entrepreneurs' projects failing, both decreasing the overall profit of the entrepreneurs, and the banks, consequently making the market less stable and resilient.[41]

Considering these findings in context with those in the previous chapters, it is clear that a technologically advanced financial sector plays a pivotal role in promoting economic development. The adaptation of higher levels of IT within the banking sector not only stimulates the economy by infusing additional capital into start-up ventures and bolstering entrepreneurial projects, but it also enables a more advanced banking sector. Consequently, an increased level of IT adoption contributes to a well-developed banking sector and is thus desirable from an economic point of view. However, following the conclusions drawn from the correlation between competition and stability in the banking sector, the effect of IT investment is only favourable as long the investment leads to a *moderate* level of competition. To conclude, regulators are encouraged to promote banking IT investment and adoption, given their benefits for the economy. However, this encouragement must be regulated to prohibit ruinous competition among banks. It's essential to note that this balance extends beyond the area of IT investment and applies to the broader context of fostering competition within the banking sector generally.

2.3. Regulation of the Banking Market

2.3.1. Theory of Regulation and State Intervention

In the previous chapters, desired outcomes of the banking market are always connected with measures such as a mortarium, narrow banking, lenders of last resorts, deposit rate ceilings, or capital quotes. However, all these measures are imposed by the state to intervene in the banking market and influence the market equilibrium. Consequently, it is important to understand when and to what extent a state should be able to impose regulations on a market and, thus, intervene in it.

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[41] Cf. Vives and Ye (2023), pp. 47 f.

The commonly accepted justification for state intervention is when a market failure occurs. Meaning that the equilibrium of the market deviates from an ideal market result, as, for example, under perfect competition. As shown above, however, perfect competition in the banking market is, in the context of stability and growth, not desirable. Thus, it is not easy to justify at which point a market failure occurs in the banking market. In the literature, four categories have been defined to check whether a market failure occurs: external effects, market power, information asymmetries, and adjustment shortcomings. These four categories describe market failure at a meta level as a disturbance of the allocation effect of the market. If one of these criteria becomes relevant, state intervention in the form of a market regulation could be justified. However, state intervention in the market does not automatically lead to an improvement in the market or the achievement of the optimal market outcome for several reasons. First, the state needs to have all relevant information, such as consumption preferences or cost structures, in order to assure the optimal market outcome. Second, state interventions require a change in the incentive structure of economic agents. Thus, the state needs deep knowledge of the functioning of the regulated market. Third, state intervention replaces market allocation decisions with state decision-making processes. It is possible that these state decision-making processes are not oriented according to macroeconomic efficiency but rather reflect the interests of political decision-makers. Fourth, in the case of economic policy measures, the costs incurred must be taken into account, in particular transaction costs, which consist of information costs for the decision-making basis of the measures, control costs for the implementation of the measures, and costs for market participation incurred when private companies are commissioned to implement the measures. Finally, revenues or costs directly related to the measures and welfare losses due to a state intervention must be taken into account. Accordingly, to answer the question whether the state should intervene in the market, one must consider the extent to which the measures result in a higher level of welfare compared to the costs incurred without state intervention and market failure.[42]

2.3.2. Justification for State Intervention in the Banking Sector

To justify state intervention in the banking market, it is necessary to ascertain whether one of the four categories – external effects, market power, information asymmetries, and adjustment shortcomings – is relevant. In a perfect market, each actor pays for the costs

[42] Cf. Fritsch (2018), pp. 76-78

it causes. If this is not the case, there are external effects. External effects are present if the utility or profit function of an actor contains at least one variable that is not completely controlled by it but by other actors, in addition to its own action parameters. In the case of technological externalities, there is a direct connection between the profit and utility functions of several actors that is not captured by the market mechanism and thus leads to market failure, which can be a justification for state intervention. Technological externalities arise from production or consumption activities and can be both positive and negative. In aggregate, social costs and benefits are considered; these consist of the private costs and benefits for the actors and the external or social additional costs they cause, simplified as follows:[43]

$$Social\ benefit\ = Private\ benefit - \ external\ additional\ costs \qquad (47)$$

Based on the Diamond/Dybvig (1983) model, it can be researched whether bank runs lead to external addition costs that influence the social benefit and thus are technical externalities. If negative externalities occur, an intervention by the state to reduce their effect is justified. In the following, a bank with deposit contracts is considered, which guarantee $r_1 > 1$ in *T = 1* and $r_2 > r_1$ in *T = 2*. The utility function of the agents is $U(r) = r_i$ with $i \in [1; 2]$, so the utility equals the return of deposit contracts. A fraction $f < 1$ are agents of type 1, who withdraw the deposits in *T = 1*, to maximize their utility. The remaining fraction $1 - f$ are agents of type 2 who withdraw their deposits in *T = 2* to maximize their utility. The bank plans its liquidity with the fraction f. Consequently, the bank is solvent if a fraction f withdraws in *T = 1* and is not solvent if a fraction $f + \Delta < 1$ withdraws. Meaning that it cannot serve depositors in *T = 2*. Agents form their consumption expectations in *T = 1*. Agents of type 1 always withdraw their deposits and consume them directly, while agents of type 2 form an expected utility $EU_2(r)$. If the agents of type 2 expect the bank to be solvent in *T = 2*, $EU_2(r) = r_2$, they withdraw their deposits in *T = 2*. However, if a type 2 agent fears that the bank will fail, the expected utility equals $EU_2(r) = 0$, so the agent maximizes the utility by withdrawing the deposit in *T = 1* at the low terms $r_1 > 1$ & $r_1 < r_2$, storing it and consuming it in *T = 2*. If the number of agents of type 2 with $EU_2(r) = 0$ now reaches the value Δ so that $f + \Delta$ deposits are withdrawn in *T = 1* and the bank becomes insolvent due to such a bank run, the remaining agents of type 2 no longer receive any pay-outs in *T = 2*. To prove negative technical

[43] Cf. Fritsch (2018), pp. 82f.

externalities, the social utility with and without a bank run are compared. The private utility corresponds to the utility of all agents from the withdrawals in *T = 1* and *T = 2* and the external additional costs to the utility loss of agents who cannot be served in *T = 2*.

	No bank run	**Bank run**
Agents' private utility in T = 1	fr_1	fr_1
Agents' private utility in T = 2	$(1-f)r_2$	Δr_1
External additional costs	0	$(1-f-\Delta)r_2$

Table 4: State-Dependent Comparison of Private Benefit Agents and External Additional Costs

Theorem 1

The social benefit for the state without a bank run $fr_1 + (1-f)r_2$ is greater than the social benefit for the state with a bank run $(f+\Delta)r_1 - (1-f-\Delta)r_2$.

Proof

$$fr_1 + (1-f)r_2 > (f+\Delta)r_1 - (1-f-\Delta)r_2 \quad (48)$$

After rearranging terms with the variable r_2 to the left side and terms with r_1 to the right side of the inequality, we get:

$$(1-f)r_2 + (1-f-\Delta)r_2 > (f+\Delta)r_1 - fr_1 \quad (49)$$

Shortening and factoring out result in:

$$r_2(2-2f-\Delta) > \Delta r_1 \quad (50)$$

This inequality holds if $(2-2f-\Delta) > \Delta$, since $r_2 > r_1 > 1$. A conversion and shortening gives $(1-f) > \Delta$. Rearranging this formula again yields to:

$$f + \Delta < 1 \quad (51)$$

Therefore, the inequality is true and corresponds to the assumption from the model, so that the inequality holds, and the social benefit is greater for the state without a bank run than in the state with a bank run.

As shown in a chapter 2.1.6, in the context of monetary economics, commercial banks contribute to the creation of broad money as well as central banks in that if they alter their lending criteria, it is possible to issue more credits and stimulate the growth of broad money. An increase in broad money can have a positive impact on overall economic growth. However, it can also stimulate a higher rate of inflation or even a financial crisis, which is not desirable. Dell'Ariccia/Igan/Laeven (2008) proved in their paper that the expansion of the subprime mortgage market in the USA before the financial crisis of 2008 was linked to an ease of bank lending criteria. This lower lending criteria led to a higher

credit supply, which, in turn, led to an increase in house prices. This gave the banks an incentive to gamble and finally triggered the financial crisis. This was an example of negative externalities in the banking sector, or more precisely, in the credit market, and justified state intervention.

The previous chapter concludes that a moderate degree of competition in banking is desirable for optimal stability and economic growth, unlike other markets where complete competition is desirable. The degree of moderate competitiveness relates to the second category: market power. It can be argued that the state should intervene in the banking market to achieve an optimal level of competitiveness or impose counter- measures to reduce too much competition.

Information asymmetries occur when one side of a transaction cannot fully assess the quality of a good and the advantaged side does not have sufficient incentives to provide information to make the assessment available. This constellation can lead to a market in which only bad goods are traded. The portfolio problem and moral hazard mentioned by Keeley (1990), or Hellmann/Murdock/Stiglitz (2000) could incentivize banks to use deposits to gamble and risk bankruptcy without the knowledge of the depositors.[44] However, as there was no evidence of adjustment shortcomings in the discussed models, this category was not relevant. Nevertheless, the categories: external effects, market power, and information security were all relevant and could provide enough justification for state intervention in the banking market.

2.3.3. Overview of the current European Banking Regulation

As a consequence of the financial crisis of 2008 and the following sovereign debt crisis in the Euro area, the European Union decided to commit to the concept of a European Banking Union. The aim of the Banking Union was to achieve consistency in the implementation of new regulations and rules across the Euro area. The idea of the European Banking Union is based on single supervision, single resolution, and a European deposit insurance based on a single rule book, as shown in Figure 4. The first two pillars, a single supervisory mechanism and a single resolution mechanism, have already been agreed upon by the member states of the European area, whilst a European deposit insurance scheme is still under discussion.[45]

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[44] Cf. Fritsch (2018), p. 249

[45] Cf. Macchiarelli (2018), p. 3955

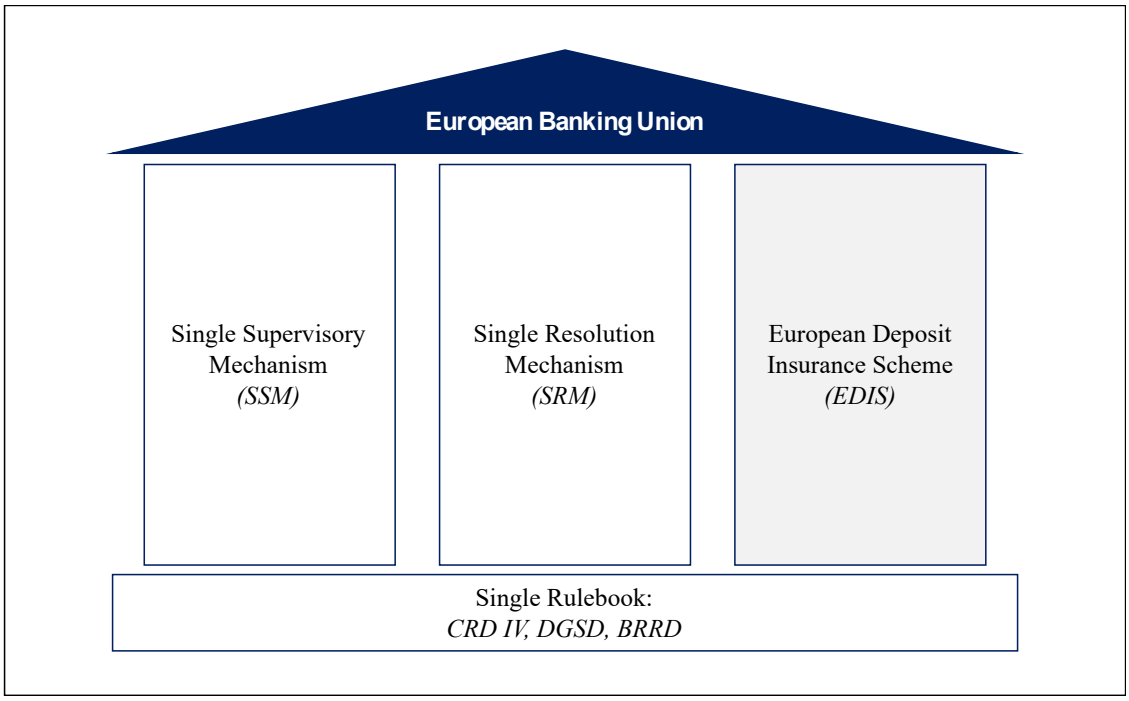

Figure 4: Structure of the European Banking Union. Own illustration

The single supervisory mechanism (SSM) ensures that one institution, the European Central Bank (ECB), is responsible for the supervision of all banks within the Euro area. However, the ECB is only responsible for banks of 'financial significance', leaving the remaining banks under the supervision of local authorities – the national central banks of the respective member countries. The ECB must adhere to the core principles established by the Basel Committee on Banking Supervision (BCBS): the implementation of clear and sustainable macroeconomic policies, a clear framework for financial stability, an effective crisis management and resolution framework to deal with bank failures, an adequate safety net to deal with crises, and to promote a well-developed public infrastructure and effective market discipline. Further prerequisites for the work of the ECB in the context of the SSM are operational independence, clear objectives and mandates, legal protection of supervisors, transparent processes, sound governance and adequate resources, and accountability. The single resolution mechanism (SRM) can be viewed as complementary to the SSM as it applies to all banks under the supervision of the ECB. The SRM aims to minimize the costs of a possible resolution of a bank following bankruptcy in terms of the effects on the financial systems and the money the state or the taxpayer must invest following the resolution of a bankrupt bank. The SRM consists of a single resolution authority, the single resolution board (SRB) and a single resolution fund (SRF). This

will be explained later in more detail, but basically, the SRB manages the orderly resolution of a bank in bankruptcy and is responsible for the management of the SRF.
The SRF finances the resolution actions following the decisions of the SRB, especially supporting the banks under resolution with loans, guarantees, loss coverage, or recapitalization. All banks under the SRM must contribute to the SRF according to the individual risk on their balance sheet. The last pillar, the European deposit insurance scheme (EDIS), aims to create an overarching European deposit insurance scheme as a replacement for the single national deposit insurance schemes. But unlike the other two pillars, the EDIS has not been implemented yet, and its design is still in discussion, especially its implementation in the Euro area. Supporting the three pillars of the European Banking Union is a single rulebook consisting of the capital requirements directive (CDR IV), the deposit guarantee schemes directive (DGSD), and the bank recovery and resolution directive (BRRD). The CDR IV defines the capital requirements banks need to hold as a buffer or signal, based on the international Basel III agreement. The DGSD harmonizes the rules and requirements for the national deposit insurance schemes, such as protecting deposits of private individuals up to 100,000 €. The BRRD enables European authorities to prevent banking crises following the insolvency of banks by effectively restructuring them. Like the SRM, it aims to avoid negative effects on achieving financial stability and reduce the necessity of resourcing government money.[46]
The European institutional landscape includes the European Banking Authority (EBA), an important regulatory agency alongside the ECB. The EBA plays a crucial role in establishing a regulatory framework for the national regulatory agencies of the member states. Specifically, the EBA is responsible for formulating unified regulatory and supervisory standards for banks across member states, which are then implemented through the respective national regulatory agencies. Additionally, the EBA conducts peer review analyses of these national regulatory agencies to ensure their effectiveness and compliance with the defined standards.[47]
Banking supervision and regulation in Europe has undergone a transformation through the establishment of the European Banking Union and the EBA, transitioning it from a national to a supranational level. The objective of the European Banking Union is to facilitate effective risk sharing among member states, employing the SRF at the institution

[46] Cf. Macchiarelli (2018), pp. 3955-3967

[47] Cf. European Union (2010b), p. 12-42

level and the EDIS at the consumer level. While this shift from national to supranational regulation has seen some success, not all European banks fall under the supervision of the ECB and, therefore, do not adhere to the SSM. Consequently, the risk sharing approach remains incomplete. Additionally, alongside the ECB, the national central banks of member countries still exist within the Euro area, maintaining a certain degree of independence. Furthermore, the EDIS is also unfinished, as the harmonization of deposit insurance schemes through the DGSD does not extend to the implementation of a Euro area-wide deposit insurance scheme. This hinders the establishment of a European risk-sharing mechanism at the consumer level. To conclude, the European Banking Union can be considered partially accomplished, as regulation and supervision have shifted, but the risk- sharing approach remains unfinished.

2.4. Financial Market Framework

The previous sections focus on how banks and financial intermediaries significantly impact financial markets by performing various essential functions. The discussion includes their roles at both microeconomic and macroeconomic levels and, particularly, their relationships with central banks. Additionally, the operations of banking institutions are examined, highlighting the effects of competition and technological advancements. The regulatory environment surrounding banks and financial markets is also reviewed, with a specific look at European banking regulations.

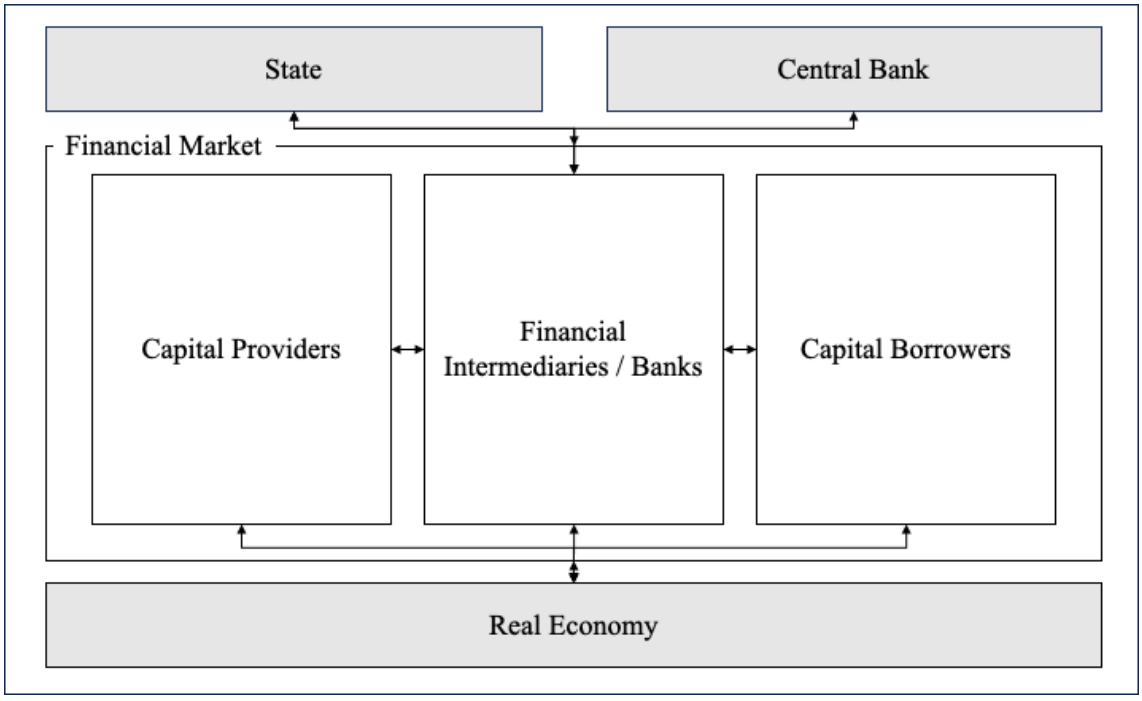

Figure 5: Financial Market Framework. Own illustration

To conclude, a framework is proposed that outlines the complex relationships and interactions between the financial market's participants and their surroundings, as illustrated in Figure 5. This framework aims to provide a clear and detailed understanding of the financial ecosystem's structure and how it operates.

Firstly, the transformation services – information transformation, risk transformation and liquidity transformation – provided by financial intermediaries, especially banks, concern capital providers and capital borrowers through a financial intermediary. Focusing on a microeconomic level, Diamond (1984) discusses the advantages banks gain through increasing efficiency in lending. As such, Diamond's model is primarily concerned with financial intermediaries and capital borrowers and secondarily with capital providers. Holmstrom/Tirole (1997) argue that several competitive financial intermediaries are beneficial for the success of capital borrowers' projects as a result of signaling and monitoring effects. Thus, their model is concerned with capital borrowers and financial intermediaries in the framework above. Diamond/Dybvig (1983) posit that financial intermediaries or banks create an advantage for capital providers through the timely distribution of liquidity according to the consumption preferences of capital providers through the collection and distribution of deposits. However, Diamond/Dybvig (1983) also discuss the possibility of a bank run and a subsequent bank panic, which can be understood as market failure in their model. Accordingly, several measures are introduced to support the argument for state intervention to prevent market failure. Consequently, Diamond/Dybvig's model (1983) involves capital providers, financial intermediaries, and the state in the framework. According to Freixas/Rochet (2008), banks in the financial market need to have diversified credit portfolios and diversified lending relationships with each other to mitigate the risk of bank runs and bank panics, as displayed in Figure 2. Accordingly, this model is concerned with financial intermediaries and, to some extent, with the state.

From a macroeconomic perspective, Greenwood/Jovanovic (1990) posit that a stable banking sector is beneficial for an economy through the efficient distribution of capital, which is supported by empirical studies. Hence, Greenwood/Jovanovic's model is primarily concerned with the real economy and financial intermediaries, especially banks, and secondarily with the state from a regulatory perspective. Furthermore, commercial banks support central banks in the money creation process and, to a certain degree, in the steering of the economy, placing this aspect with central banks, financial intermediaries, and the real economy in the framework.

Following the argument that competition in the banking sector should be at a moderate level to achieve stability and stimulate economic growth, the topic of competition in the banking sector concerns primarily the state as a regulator as well as the financial intermediaries, and secondarily, it affects both capital providers, capital borrowers as well as the real economy. Finally, investments in IT can both stimulate competition in banking sectors and reduce the cost of banking services through screening and monitoring. Hence, investments in IT affect the whole financial market, the state from a regulatory perspective, and the real economy through the competition-stability effect.

3. Economic Analysis and International Comparison of the Euro area Banking Market

The previous chapter laid the theoretical groundwork for banking markets. This chapter aims to analyze and compare the Euro area banking market with other internationally relevant banking markets. The aim behind this journey through different banking markets is to identify the status quo of the Euro area banking market, to understand where it has optimization potential and to identify the fundamentals for future measures regarding the positioning of the Euro area banking market.

First, this chapter defines the Euro area banking market and analyzes which international banking markets can serve as comparable partners. Second, a macroeconomic analysis of the Euro area banking market and the comparable markets is conducted, focusing on key figures regarding productivity, demographics, inflation, interest rates, international trade, and foreign direct investments. Third, the banking sectors of the defined banking markets are researched, focusing on key figures regarding their organizational and financial structures.

3.1. Definition of the Euro area Banking Market and Internationally Comparable Markets

As the main topic of this work is the banking market of the Euro area, it is important to define this market. The banking market can be divided into two particular markets: the deposit and credit markets. The previous chapters showed that those two areas are the most important for value creation in the financial sector and for commercial banks in particular. The banking market of the Euro area consists of all countries that currently use the euro as currency and are member states of the European Union. The leading banks in this area are the supranational European Central Bank and the national central banks of

the member states. The ECB is responsible for the monetary policy of the Euro area, although responsibility for economic policy lies with the member states. However, the economic policies of the member states are aligned in order to achieve three common objectives: stability, growth, and employment. The euro was first introduced as book money in 1999 and was adapted by 11 countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, and Spain, as shown in Table 5. The Euro area was enlarged by Greece in 2001, and the introduction of the euro as cash money followed in 2002. Slovenia joined in 2007, Malta and Cyprus in 2008, Slovakia in 2009, Estonia in 2011, Latvia in 2014, and Lithuania in 2015, so that currently the Euro area consists of 19 member states. Although country-states such as Andorra, Monaco, San Marino, and the Vatican have also adopted the euro as their national currency, through special monetary agreements with the European Union, they are not considered part of the Euro area because they are non-European Union member states.[48]

As the Euro area banking market is defined through the euro as a currency with the ECB as the supervisory central bank, internationally comparable markets must be defined through the use of a single currency and a single central bank. Moreover, the international importance of a currency can be measured by its use as a reserve currency. Reserve currencies are foreign currencies held by a monetary authority, such as a central bank. A reserve currency serves several purposes: it is used to meet financial obligations from the balance of payments, to intervene in the exchange market to affect the exchange rate of the home currency, and for other related purposes such as providing confidence in the home currency or as a basis for foreign borrowing. Consequently, the usage or the share of a currency as a reserve can be used as a measure to identify internationally comparable markets with the Euro area.[49]

Year	Group	Countries
1999	Euro-11	Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain
2001	Euro-12	Euro-11, Greece
2007	Euro-13	Euro-12, Slovenia

[48] Cf. European Commission (2021)

[49] Cf. International Monetary Fund (2009), pp. 6 & 111

2008	Euro-15	Euro-13, Cyprus, Malta
2009	Euro-16	Euro-15, Slovakia
2011	Euro-17	Euro-16, Estonia
2014	Euro-18	Euro-17, Latvia
2015	Euro-19	Euro-18, Lithuania

Table 4: Overview of the Euro area Member States According to Year of Entry, Source: ECB

Figure 6 shows the amount of each currency used as a reserve currency by monetary authorities over the last 20 years. The US dollar is clearly the most used reserve currency over the last two decades, growing from one trillion US dollars in 1999 to approximately 7 trillion US dollars in 2020. The second most used reserve currency is the euro, with an amount of 0.25 trillion US dollars in 1999 and 2.5 trillion US dollars in 2020. The next two most used currencies are the Japanese yen and the British pound sterling, competing over the last 20 years for third place with a volume of 0.09 trillion US dollars in yen and 0.04 trillion US dollars in pounds sterling in 1999, rising to 0.7 trillion US dollars and 0.5 trillion US dollars in 2020, respectively.

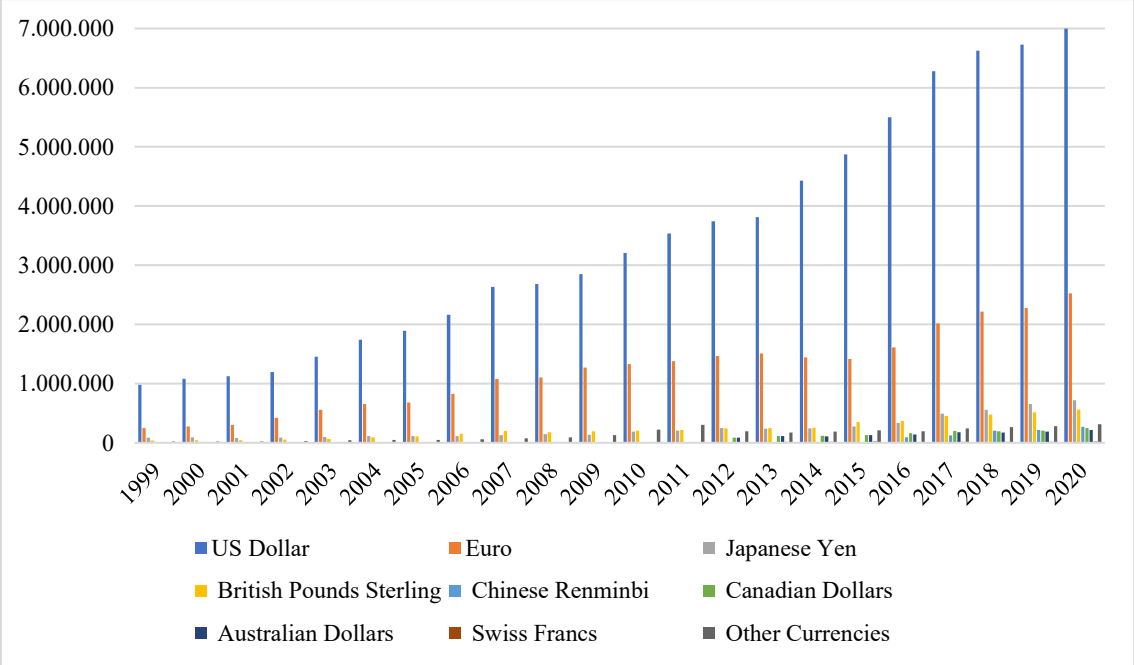

Figure 6: World Currency Composition of Official Foreign Exchange Reserves in Million USD for the Period 1999–2020, Based on Data of the International Monetary Fund

Figure 7 delves deeper into the topic and compares the relative numbers. Presenting the absolute share of currencies used as reserve currencies, it reveals that the usage of the US dollar has declined over the last 20 years by roughly 10 percentage points, whilst the use of the euro, the Japanese yen, and the British pounds sterling has been fairly consistent. In 2020, the US dollar, the euro, the Japanese yen, and the British pound sterling made up roughly 90% of the worldwide used reserve currencies. Significantly, while the usage of the Chinese renminbi has grown since 2016, it has not achieved the same share as the aforementioned currencies, which are clearly the leading reserve currencies in the world.

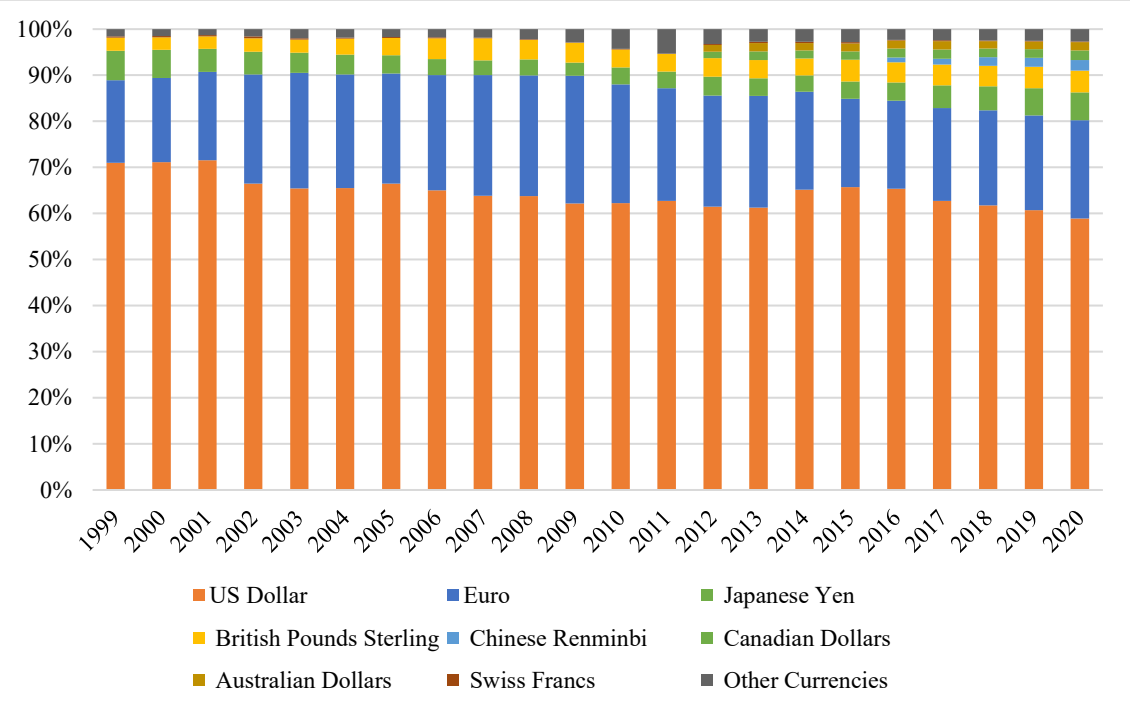

Figure 7: Absolute World Currency Composition of Official Foreign Exchange Reserves for the Period 1999–2020, Based on Data of the International Monetary Fund

Consequently, the United States of America with the US dollar and the Federal Reserve System (FED) as its central bank, the United Kingdom with the British pound sterling with the Bank of England as its central bank, and Japan with Japanese yen and Bank of Japan have been chosen as the internationally comparable markets to the Euro area banking market, as shown in Table 6.

Category	**Base Market**	**International Comparison Markets**		
Region	Euro area	USA	UK	Japan
Currency	EUR	USD	GPB	YEN
Central Bank	ECB	FED	Bank of England	Bank of Japan

State form	Part of *Staaten-verbund*	Federal State	Federal State	Centralized State
Languages	19 languages	English	English local languages	Japanese

Table 5: Euro area and Internationally Comparable Markets

However, there are several differences between the banking markets that need to be taken into consideration before comparing them. Politically, the Euro area countries do not constitute a single state, such as the United States, the United Kingdom and Japan. The countries of the Euro area are all part of the European *Staatenverbund*, which means they are sovereign states that unite to a certain degree under a supranational institution. Consequently, all member states of the Euro area retain a national economy and, culturally speaking, a national identity. Additionally, in the countries of the Euro area, there are 19 different languages, with some countries such as Germany and Austria using the same language and some countries such as Finland using several languages. This language factor promotes cultural heterogeneity. As such, many citizens of the individual countries of the European Union, of which the Euro area is a sub-group, see themselves firstly as citizens of their own countries and only secondly as citizens of the European Union. Over the period from 1992 to 2017, EU citizens were confronted with the so-called Moreno question and surveyed as to whether they identified themselves as national or European citizens. Overall, 90% of EU citizens identify primarily with their national identity. However, half of these additionally identify as EU citizens.[50]

It can be argued that this kind of heterogeneity is observed in the United States and the United Kingdom as well, as the United States consists of 50 states and the United Kingdom consists of three states and a province: England, Scotland, Wales and Northern Ireland. All these entities in the United States and the United Kingdom differ in geographic, demographic, and economic size as well as in local culture. Japan is different as it consists of prefectures and is administratively more centralized than the other banking markets. As English is the main language in the United States and the United Kingdom, however, it can be argued that cultural heterogeneity is not as strong as within the Euro area. The

[50] Cf. Ciaglia et al (2018), p. 5

following section compares the economic heterogeneity within the Euro area, the United States and the United Kingdom.

Figure 8 illustrates the relative deviation of GDP per capita from the median GDP per capita in the Euro area per member country, in the United States per state, excluding Washington D.C., and per country of the United Kingdom. It is observable that the normalized GDP per capita has the largest bandwidth in the Euro area, with a minimum value of 0.61, a maximum value of 1.67, and two outliers of 3.05 and 3.66. Additionally, the Euro area borders of the first and third quartiles, with 0.78 and 1.48, are further apart than the other two counties. Finally, the median of the normalized GDP per capita in the Euro area is1.68, way above the ideal outcome, contrary to the median of the United States at 1.03 and the United Kingdom at 1.00.

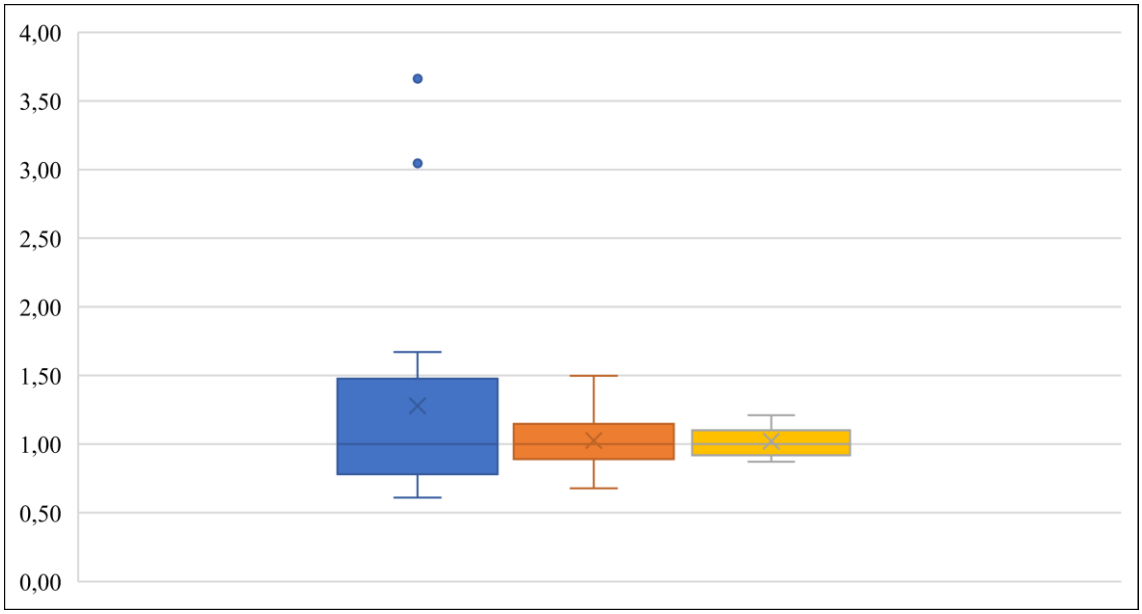

Figure 8: Relative Deviation of Countries / States from Median GDP per Capita in the Euro area (Blue, 2022), United States (Orange, 2022), and United Kingdom (Yellow, 2021). Own Calculation and Illustration Based on Data from World Bank, US Bureau of Economic Analysis and Office for National Statistics

The United States observes a slightly smaller bandwidth, with a minimum of 0.68 and a maximum of 1.50. Unlike the Euro area, the United States does not observe outliers. Furthermore, the normalized GDP per capita in the United States is much more concentrated as the borders of the first and third quantiles are 0.89 and 1.15 respectively, meaning that 50% of the states in the United States deviate between 11% and 15% from the median GDP per capita. The United Kingdom observes the smallest bandwidth. With a minimum of 0.87 and a maximum of 1.21, it lies within the borders of the first and third quartiles

of the Euro area. Consequently, it can be argued that the Euro area is both culturally and economically more heterogenous than the United States and the United Kingdom.

Bearing this heterogeneity in mind and the fact that the Euro area consists of several sovereign nations with disparate economies, it is beneficial to conduct an intra-Euro area comparison. In the following, GDP per capita is used to categorize the member states of the Euro area into different groups. Overall, the Euro area had, in 2020, a GDP per capita of 33,189.20 euros. If one looks at the GDP per capita in the individual countries in Table 7, it is observable that the range is considerable. In 2020, Greece, at the lowest end of the scale, had a GDP per capita of 15,475.62 euros, while Luxembourg, at the highest end, had a GDP per capita of 101,516.66 euros. Thus, the GDP per capita of Luxembourg exceeded the GDP per capita of Greece by roughly six times in 2020.

With this bandwidth in mind, the countries of the Euro area can be divided into three groups: high-income economies (HIE), mid-income economies (MIE) and low-income economies (LIE).

Group	**Country**	**GDP per Capita 2020**	**Deviation from Euro area Average**
High-Income Economies (HIE)	Luxembourg	101.516,66 €	+ 206%
	Ireland	74.518,16 €	+ 125%
	Netherlands	45.874,01 €	+ 38%
	Finland	42.701,32 €	+ 29%
	Austria	42.461,10 €	+ 28%
	Germany	40.367,65 €	+ 22%
Mid-Income Economies (MIE)	Belgium	39.042,67 €	+ 18%
	France	34.138,88 €	+ 3%
	Italy	27.744,33 €	- 16%
	Malta	24.852,98 €	- 25%
	Spain	23.694,00 €	- 29%
	Slovenia	22.240,82 €	- 33%
Low-Income Economies (LIE)	Estonia	20.160,29 €	- 39%
	Portugal	19.415,49 €	- 42%
	Cyprus	17.847,52 €	- 46%
	Lithuania	17.714,67 €	- 47%
	Slovakia	16.771,98 €	- 49%

	Latvia	15.519,46 €	- 53%
	Greece	15.475,62 €	- 53%

Table 6: Grouping of Euro area Countries According to GDP per Capita 2020, Based on Data from Federal Reserve Economic Data

3.2. Macroeconomic Analysis of the Banking Markets

To begin the comparison of the banking markets, it is important to gain a macroeconomic view of the banking markets and their differences. A macroeconomic perspective provides an overview of the financial market framework. The following macro-economic analysis concerns productivity, demography, interest rates, and trade. Regarding productivity and demography, GDP per capita, annual GDP growth, population, annual population growth, unemployment, annual growth of unemployment, and purchasing power parity (PPP), are reviewed and compared per banking market and the groups within the Euro area. The key figures regarding productivity and demography describe primarily the real economy and, secondarily, the financial economy. For a deeper understanding of the interest rate environment, the inflation rate, key interest rate, and short- and long-term interest rates of governmental bonds are reviewed. As the inflation and key interest rate are both dependent on the action of a central bank, these key figures are only reviewed in the banking markets, as a comparison within the Euro area is not possible. However, the interest rates paid on government bonds are reviewed at the national level. The key figures regarding interest rates can be reviewed within the states, central banks and, secondarily, the real economy, as they are all influenced by inflation and the interest rate environment. Finally, key figures regarding international trade and foreign direct investment are reviewed. These two key figures can be associated with the financial and the real economy in the financial framework, as the state has the ability to influence both of the key figures with corresponding measures, and, as such, the real economy is directly affected.

3.2.1. Productivity and Demography

An analysis of population size is a good starting point to assess the absolute and relative potential of the various banking markets.

As illustrated in Figure 9, the population size of the United States was similar to the population size of the Euro area in the period observed (2009–2020). In the United States, it grew from 304 million inhabitants to 329 million inhabitants (an average of 319 million). The population of the Euro area grew from 322 million to 342 million (an average of 336

million) in the same period. However, it is important to bear in mind that in 2009 the Euro area consisted only of 16 countries, admitting the Baltic states of Estonia, Latvia, and Lithuania later in the observation period. This means that their 6 million inhabitants cannot be considered when accounting for the organic population growth in the Euro area. Nevertheless, the total population of the 16 Euro area states in 2009 was 330 million, which is still the largest population among the banking markets.

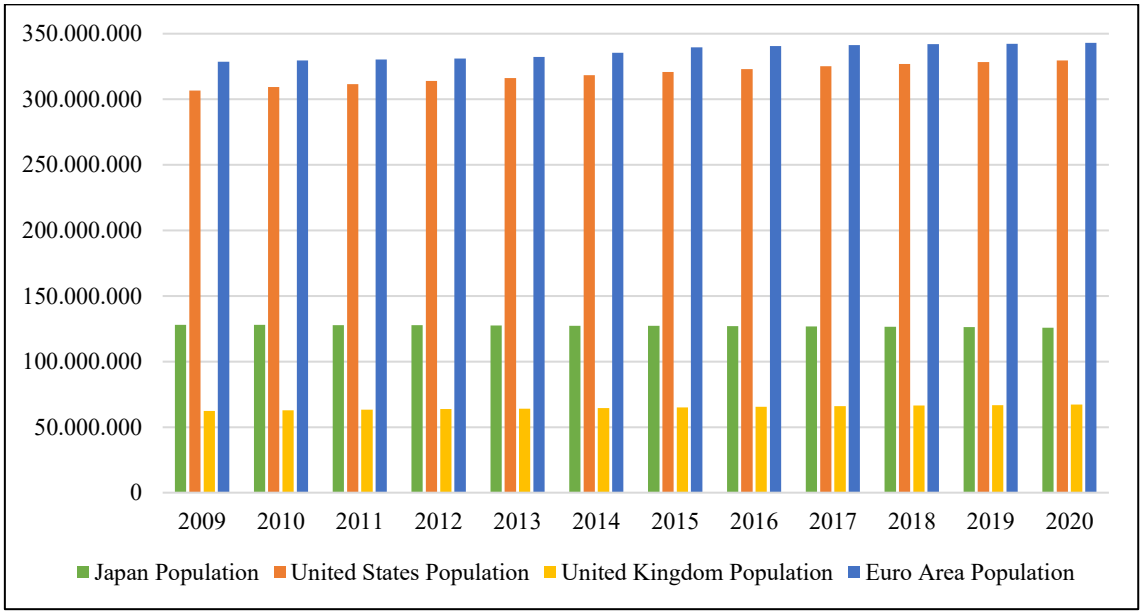

Figure 9: Total Population of the Banking Markets for the period 2009-2020, based on Data from World Bank

The third largest was the population of Japan, with an average population of 127 million during the observation period. Interestingly, the population of Japan decreased from 128 million inhabitants in 2009 to 125 million inhabitants in 2020, meaning that more people in Japan died or emigrated than were born or immigrated to the country. The United Kingdom had the smallest population base among the banking markets, with an average population of 65 million people during the observation period. However, the United Kingdom observed population growth in the reviewed period, from 62 million in 2009 to 67 million in 2020. Nevertheless, the population of Japan and the United Kingdom cannot be compared with the Euro area, which is considerably bigger.

Looking at the different groups within the Euro area, the MIE group was the biggest with an average of population of 187 million during the period. Starting with 182 million inhabitants in 2009, it grew to 189 million inhabitants in 2020, exceeding the population of Japan by roughly 50%. This is not surprising, as three of the five largest countries in the

Euro area – France, Italy, and Spain with a total of 175 million inhabitants in 2020 – are part of the group.

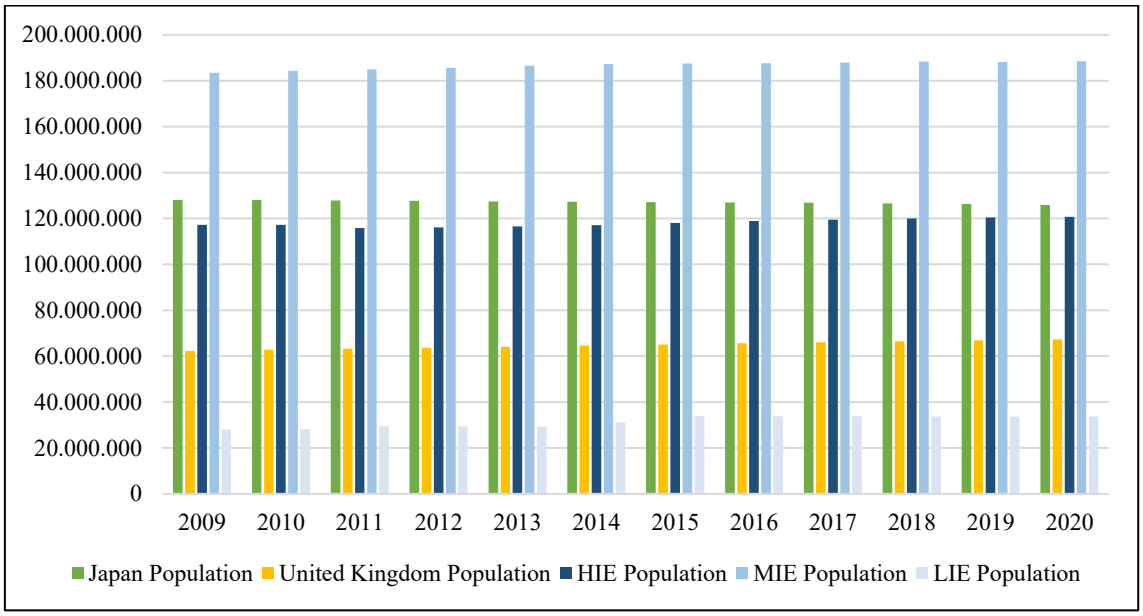

Figure 10: Population of Comparison Groups within the Euro area, United Kingdom, and Japan for the period 2009–2020, based on data of the World Bank

The HIE group is the second largest in the Euro area, with an average population of 118, with Germany as the largest country, contributing 83 million inhabitants. The HIE group is, therefore, similar in size to Japan, with a population of 117 million in 2009 that grew to 121 million in 2020. However, unlike Japan, the population of the HIE group is growing and not shrinking. The smallest group in the Euro area is the LIE group, with an average population of 32 million during the reviewed period – roughly half the size of the population of the United Kingdom. As the Baltic countries joined the Euro area at a later point, the 6 million inhabitants of Estonia, Latvia and Lithuania were only included after 2015.

Having assessed the absolute population base, it is interesting to take a closer look at the growth rates of the populations in the banking markets, as this sheds more light on the dynamics within the population base and underlines the findings of the previous section. As illustrated in Figure 11, the population of the Euro area grew as more countries joined. For example, in 2009, Slovakia, with a population of 5 million, joined resulting in a growth rate of 2%. This can be observed again in 2014 and 2015 with the memberships of Latvia and Lithuania, respectively. In both these years, the growth rate was around 1%, while in the periods 2010–2013 and 2016–2020, the growth rate was between 0.36 % and

0.09 %. Overall, however, the Euro area experienced a lower average annual population growth rate (0.52%) than the United Kingdom and the United States.

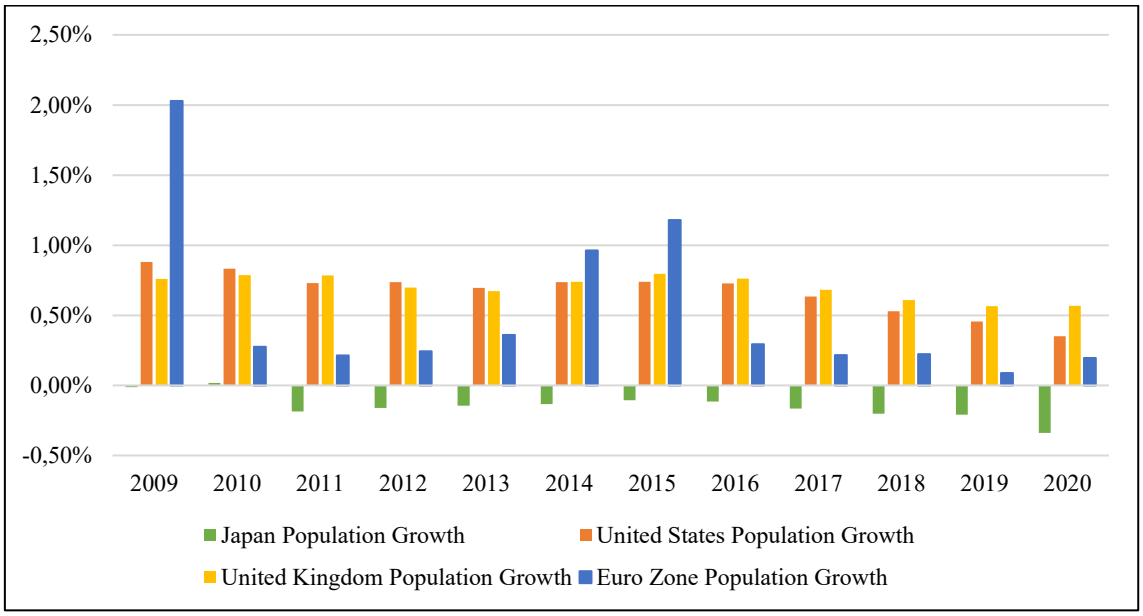

Figure 11: Population Growth Rate in the Banking Markets for the Period 2009–2020, Based on Data from the World Bank

The population growth rate of the United States and the United Kingdom was similar during this period, with the United States achieving an average of 0.67% and the United Kingdom an average of 0.70%. However, the population growth rate of the United States was 0.88% in 2009 and decreased to 0.35% in 2020, whilst the population growth rate of the United Kingdom was 0.80% in 2015 and 0.57% in 2020, surpassing the population growth rate of the United States. Unlike the Euro area, the United States, and the United Kingdom, the population growth rate in Japan was mostly negative. There was only a small positive growth of 0.02% in 2010, while a significant negative growth rate of -0.34% was recorded in 2020, resulting in a negative average population growth rate of -0.15% in the reviewed period.

Within the groups of the Euro area, the population growth rate is quite heterogeneous, as observable in Figure 12. Whilst the membership of Slovakia and the Baltic countries in 2009, 2011, 2014 and 2015 clearly spiked the population growth rate of the LIE group up to 23.96% in 2009, the population growth rate of the group in 2010 was only 0.14%, -0.43% in 2013, and negative again in the years 2012, and 2016 to 2019. Consequently, the population growth rate of this group was below the population growth rate of the Euro area, with an average of only -0.17% in the years without a new member country joining it.

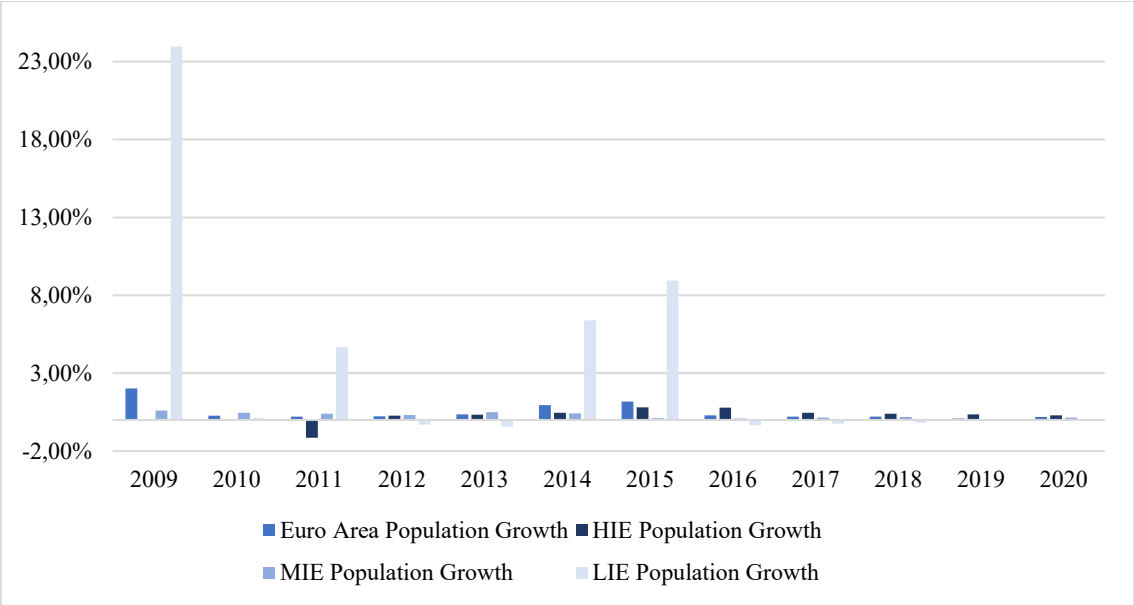

Figure 12: Population Growth Rate in the Comparison Groups for the Period 2009–2020, Based on Data from the World Bank

The population growth rate of the HIE group was also below the Euro area average during the period 2009–2015, being negative at -0.02% in 2009 and at -1.14% in 2011. However, the HIE group achieved higher population growth than the Euro area average in the period 2016–2020, and, overall, there was an average annual population growth rate of 0.25% in the HIE group during the period. The opposite pattern can be observed in the MIE group. In the period 2010–2013, the population growth rate was higher than the Euro area average – between 0.32% and 0.45%. However, in the period 2016–2020, the population growth of the MIE group was below the Euro area average, lying between -0.06% and 0.19%. With Italy being the main driver for the low population growth rates, with values between -1.15% in 2019 and -0.15% in 2016. However, the MIE group still achieved the highest average population growth rate of 0.28% for the whole period, excluding the effect of new member countries joining. If that effect is included, the LIE group achieved an average growth rate of 3.55%.

To conclude, in the given period, the Euro area and the United States had a similar population base, while the populations of Japan and the United Kingdom were notably smaller, although Japan's population was roughly twice the size as the United Kingdom's. Furthermore, the largest population group within the Euro area was the MIE group, followed by the HIE group, which had approximately the same population size as Japan. The LIE group was by far the smallest population in size, although new members – Slovakia, Estonia, Latvia, and Lithuania – significantly contributed to the population growth

within the LIE group. The United States and the United Kingdom had a similar population growth rate that was higher than the Euro area, with the United Kingdom surpassing the United States in the last few years. Unlike the Euro area, the United States and the United Kingdom, Japan's population shrank, having a negative population growth rate during the reviewed period.

After examining the population base and the demographic developments within the various banking markets, their economies need to be analyzed. To measure the overall output of the banking markets GDP is used, as it measures the aggregated output and consists of the value of all final goods and services produced in an economy within a given period. The used nominal GDP uses the prices of each measured period. For the conversion of the GDP of Japan, the United States, and the United Kingdom, the real exchange rate is used. The average nominal exchange rate of the financial markets per year is multiplied by the ratio between the price level of several goods in the Euro area and the price level of the same goods in the domestic market. This procedure aims to smooth out exchange rate fluctuations. The comparative price level, provided by Eurostat, is used to calculate the real exchange rate per period.[51]

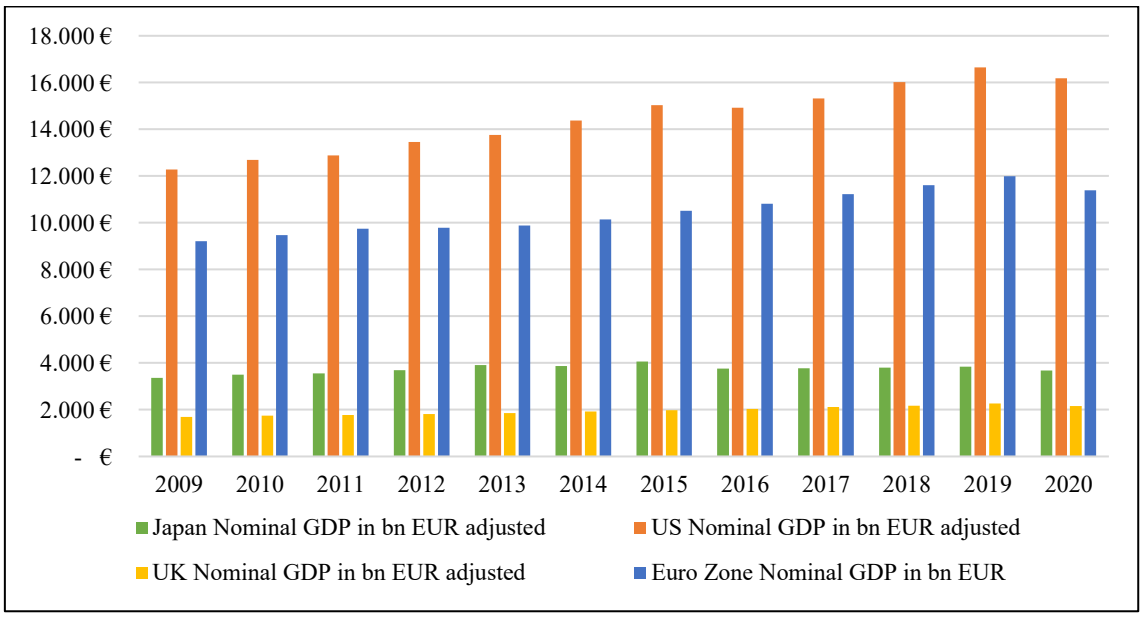

Figure 13: Nominal GDP in Euro of the Banking Markets for the Period 2009–2020, Based on Data from Federal Reserve Economic Data and Eurostat and Own Calculations

In Figure 13, it is observable that the United States had the highest GDP compared to the other banking markets in the period from 2009 to 2020, with an average GDP of 14,465

[51] Cf. Blanchard (2017), pp. 42-44, 375

billion euros. Furthermore, it enjoyed the highest growth rate, rising from 12,284 billion euros in 2009 to 16,654 billion euros in 2019. Ending at a value of 16,189 billion euros in 2020, the United States observed a total growth of its GDP of 31.79% with a compound annual growth rate, or short CAGR, of 2.65%. It is observable that the GDP of the Euro area was below the GDP of the United States, with an average GDP of 10,480 billion euros – 38% lower than the GDP of the United States. The GDP of the Euro area was between 9.214 billion euros in 2009 and 11.987 billion euros in 2019. With an end value of 11,382 billion euros, the Euro area observes a total growth in its nominal GDP of 23.54% with a CAGR of 1.96% in the observation period – the second lowest growth rate among the banking markets. The nominal GDP of Japan and the United Kingdom was much smaller than the GDP of the Euro area. Japan observed an average nominal GDP of 3,734 billion euros and the United Kingdom an average nominal GDP of 1,961 billion euros. The nominal GDP of Japan was between 3,369 billion euros in 2009 and 4,057 billion euros in 2015, which is lower than the GDP of the Euro area by roughly 60%. Moreover, with an end value of 3,671 billion euros in 2020, Japan observed a growth of its nominal GDP of 8.97% with a CAGR of 0.75%, the lowest growth rate among the banking markets. The GDP of the United Kingdom was even lower than the GDP of Japan, at 1,694 billion euros in 2009 and 2,262 billion euros in 2019. Thus, it was approximately 80% lower than the GDP of the Euro area. However, with an observed ending value of 2,163 billion euros, the United Kingdom observed a total growth of its nominal GDP of 27.67% with a CAGR of 2.31% – the second highest growth rate among the banking markets.

As far as the Euro area itself is concerned, it is observable that the MIE group had the highest nominal GDP among the comparison groups in Figure 14, with a nominal GDP of 5,412 billion euros in the period 2009–2020. The GDP of the MIE group was 4,971 billion euros in 2009 and 6,017 billion euros in 2019. With an end value of 5,586 billion euros, the MIE group achieved a growth in nominal GDP of 12.36% and a CAGR of 1.03%. However, despite having the largest nominal GDP, the MIE group observed the lowest growth rate within the Euro area. The MIE group was followed by the HIE group with an average nominal GDP of 4,538 billion euros during the observation period. Moreover, the nominal GDP of the HIE group was between 3,747 billion euros in 2009 and 5,349 billion euros in 2019, similar to the GDP of the MIE group in the observation period. However, this group enjoyed the strongest growth rate in the Euro area, with a

nominal GDP of 39.10% and a CAGR of 3.26%, even surpassing the growth rates of the United States and the United Kingdom.

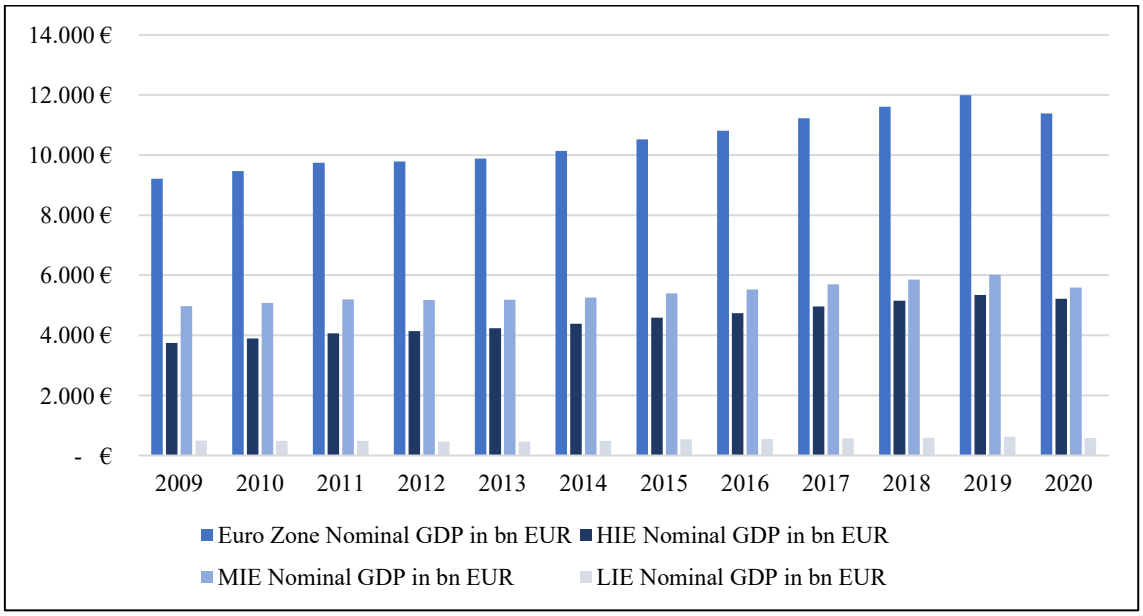

Figure 14: Nominal GDP in Euro of the Euro area and Comparison Groups for the Period 2009–2020, based on Data from Federal Reserve Economic Data and Eurostat

Both the nominal GDP of the HIE and MIE groups were above the GDP of Japan and the United Kingdom, although the difference between the GDP of the HIE group and Japan was, at the beginning of the observation period, only around 10%. Lastly, with an average nominal GDP of 529 billion euros, the LIE group was the smallest economy in the Euro area. The nominal GDP of the LIE group was 461 billion euros in 2013 and 622 billion euros in 2019. With a nominal GDP of 496 billion euros in 2009 and an end value of 585 billion euros in 2020, the LIE group observed a total growth of its nominal GDP of 5.18% with a CAGR of 0.43%. Hence, the economic growth of the LIE group was even below the economic growth of Japan. Because the banking markets are so heterogeneous concerning the size of their population and economies a more comparable key figure, such as the GDP per capita, is necessary.

As with the absolute measure of the nominal GDP, the United States also has the strongest economy in relative terms in the form of the nominal GDP per capita, as shown in Figure 15. The United States had an average nominal GDP per capita of 45,250 euros, with its lowest value being 40,042 euros in 2009, and the highest value being 50,725 euros in 2019. Although this decreased to 49,133 euros in 2020, it represented an overall growth of 22.7% and a CAGR of 1.89%, making it the banking market with the strongest economic growth in relative terms – far higher than the other banking markets. The Euro area

had an average nominal GDP per capita of 31,126 euros during the observation period. Its lowest value of 28,029 euros in 2009 reached a high of 33,189 euros in 2020, which meant a total growth of 18.41% with a CAGR of 1.53% – the second highest growth rate among the banking markets.

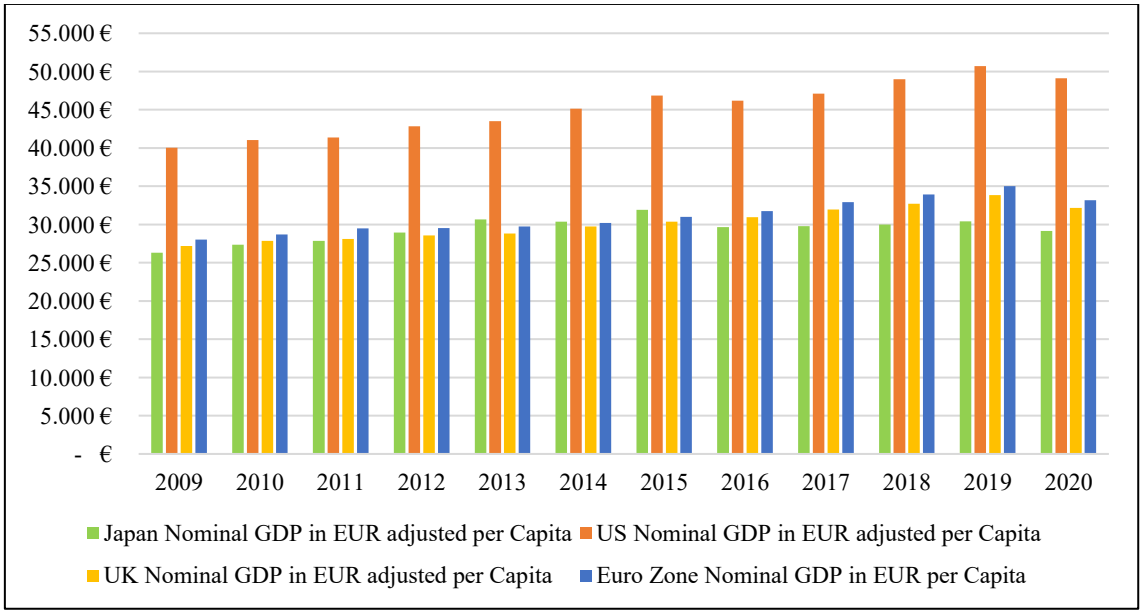

Figure 15: Nominal GDP per Capita in Euro of the Banking Markets for the Period 2009–2020. Own Calculation Based on Data from Federal Reserve Economic Data, Eurostat, and World Bank

With an average nominal GDP per capita of 30,198 euros in the observation period, the United Kingdom followed the Euro area in terms of relative economic power. The United Kingdom observed its lowest GDP per capita with 27,205 euros in 2009 and its highest with 33,849 euros in 2019, although this decreased to 32,181 euros in 2020. Nevertheless, this meant a total growth over the observation period of 18.29% with a CAGR of 1.52%. Japan had the lowest average nominal GDP per capita of 29,368 euros among the banking markets in the observation period. Japan observed its lowest nominal GDP per capita of 26,309 euros in 2009. However, Japan's nominal GDP per capita peaked at 31,908 euros in 2015 and not in 2019, as in the other banking markets. At the end of the observation period, Japan had a nominal GDP per capita of 29,173 euros, which meant a total growth of 10.88% with a CAGR of 0.91 %. Hence, Japan had the lowest growth of nominal GDP per capita amongst the banking markets in the period observed.

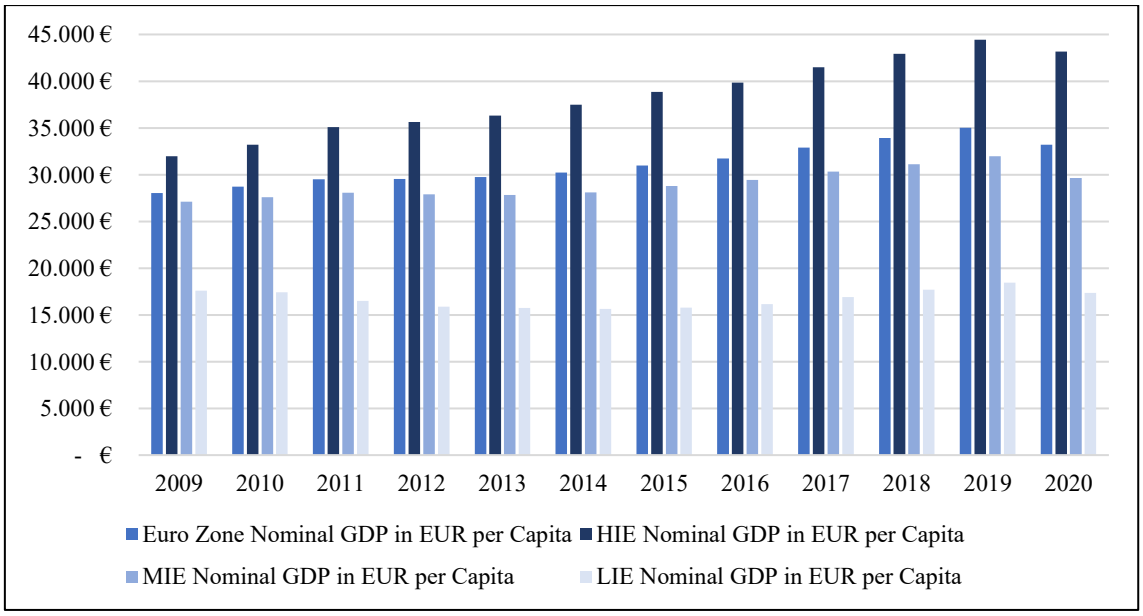

Figure 16: Nominal GDP per Capita in Euro of the Euro area and its Comparable Groups for the Period 2009–2020. Own calculation Based on Data from Federal Reserve Economic Data, Eurostat, and World Bank

Regarding the nominal GDP per capita of the Euro area, heterogeneity is observable within its groups, as displayed in Figure 16. Whilst the average GDP per capita for the Euro area, the HIE group and the MIE group were similar at the beginning of the period, differences became apparent at the end of observation period. Overall, the HIE group had the largest average nominal GDP per capita of 38,370 euros amongst the comparable groups. The nominal GDP per capita of the HIE group was 31.983 euros in 2009, rising to 44,425 euros in 2020 – closer the United States than to the Euro area. Moreover, the HIE group observed a growth rate of its nominal GDP per capita of 34.94% with a CAGR of 2.91%, surpassing the growth levels of the United States. The GDP per capita of the MIE group was similar to the GDP per capita of Japan and the United Kingdom, with an average of 28,983 euros during the observation period. However, the nominal GDP per capita of the MIE group was 27,104 euros in 2009, 31,971 euros in 2019, and 29,637 euros in 2020, which meant that it had a growth rate of its nominal GDP per capita of 9.34 % with a CAGR of 0.78% – below that of Japan. The LIE group had by far the lowest GDP per capita in the observation period, with an average of 16,764 euros, which was roughly 50% below the Euro area average. The nominal GDP per capita of the LIE group was 15,648 euros in 2014, 18,458 euros in 2019, and ended at 17,348 euros in 2020. The LIE group therefore saw growth of -1.45% with a CAGR of -0.12%, meaning that this group was the only market researched with a shrinking economy.

For a deeper understanding of the development of the GDP of the banking markets, it is necessary to analyze the annual growth rates as well as the total growth and CAGR. Figure 17 shows the annual GDP growth of the banking markets in the period 2009–2020, in their home currencies to avoid possible effects caused by using the real exchange rate. As shown, the United States, the Euro area, and the United Kingdom were all able to record positive growth rates over the whole period. Possible explanations for the negative *annual* growth rates in 2009 and 2020, however, could be the financial crisis of 2008 /2009, and the economic crisis and unrest following the outbreak of the Corona pandemic in 2020. The United States had the strongest annual growth rate, observing an average annual growth of 2.96% in the recognized period. With an average annual growth rate of 2.56%, the United States was followed by the United Kingdom.

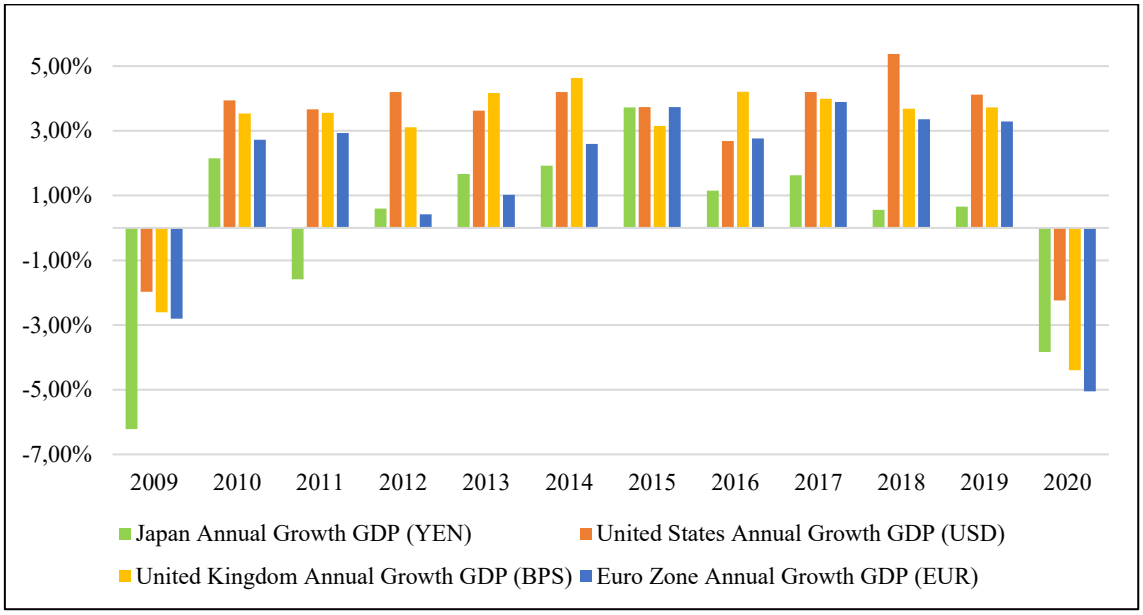

Figure 17: Annual Growth Nominal GDP of the Banking Markets for the Period 2009–2020. Own calculation Based on Data from the Federal Reserve Economic Data.

The Euro area had a relatively small average annual growth rate of 1.57%. This was especially affected by the 2011 euro debt crisis. Japan was the only banking market that experienced a decrease in three successive years: 2009, 2011, and 2020. Overall, the average annual GDP growth rate of Japan was 0.20%, the lowest amongst the banking markets. Moreover, Japan had quite a volatile annual GDP growth rate, as it was -6.22% in 2009 and 3.72% in 2015. However, for most of the time, Japan's annual GDP growth rate was between 0.5% and 1.6%.

Regarding the annual GDP growth rate within the Euro area as a whole and its groups, Figure 18 shows, once again, considerable heterogeneity. The peaks of the LIE group in

2009, 2014 and 2015 could be explained by the entry into the Euro area of Slovakia and the Baltics. However, the LIE group was the only market with a period of negative annual growth rates between 2010 and 2013, which could possibly be linked to the 2011 euro debt crisis since countries such as Portugal and Greece are a part of this group. Furthermore. However, both the HIE and MIE groups also recorded negative growth rates in the years 2009 and 2020.

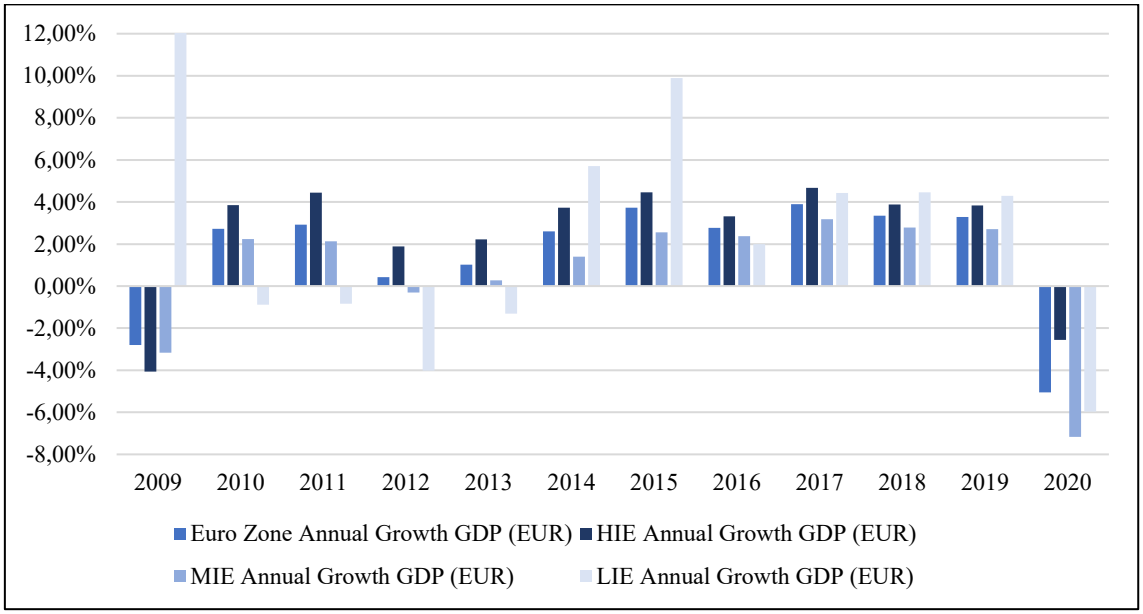

Figure 18: Annual Growth Nominal GDP for the Euro area and Comparison Groups for the Period 2009–2020. Own Calculation Based on Data from Federal Reserve Economic Data

The annual GDP growth of the HIE group was the strongest, with an average annual GDP growth rate of 2.47%, which was close to the average annual growth rate of the United Kingdom. Moreover, the annual GDP growth rate of the HIE group was -2.56% in 2020 and 4.67% in 2017. The MIE group had an average annual growth rate of 0.75%, the lowest among the comparable groups and even lower than Japan. The annual GDP growth rate of the MIE group was -7.16% in 2020 and 3.18% in 2017, meaning it experienced the most negative annual growth rate in 2020 of all researched subjects. If the years in which a new country joined the LIE group are excluded, it had an annual GDP growth rate of -5,96% in 2020 and 4,46% in 2018. However, if the years are not excluded, the LIE group experienced an average annual GDP growth rate of 2.53%, exceeding the HIE group. Lastly, it is noticeable that the LI group observed a consecutive annual GDP growth rate of over 4% in the period 2017–2019, which was close to the growth rate of the HIE group.

To conclude, the United States had the largest overall GDP in the observed period, followed by the Euro area, Japan and the United Kingdom, and the GDP of the Euro area was closer to the GDP of the United States than to the GDP of Japan or the United Kingdom. Regarding the comparable groups of the Euro area, the GDP of the MIE group was the highest, followed by the HIE and LIE groups, although the GDP of the HIE group grew closer to the GDP of the MIE group during the observation period. Regarding GDP per capita, the United States again recorded the highest level, while the GDP per capita of the Euro area, Japan and the United Kingdom were during the observation period. The HIE group had the highest GDP per capita in the Euro area, being closer to the United States than the Euro area itself. The GDP per capita of the MIE group was comparable to that of the United Kingdom and Japan. The GDP per capita of the LIE group was the smallest and was half of the Euro area average. A growth period was observable between the years 2010–2019 as all banking markets and the market groups within the Euro area realized an annual growth in GDP, the exceptions being Japan and the LIE group. The United States had the strongest annual GDP growth rate and Japan the weakest, with the Euro area lying between the two. The annual GDP growth rates of the HIE group were, most of the time, closer to the United States than to the Euro area as a whole. Overall, these findings reveal considerable economic heterogeneity within the Euro area.

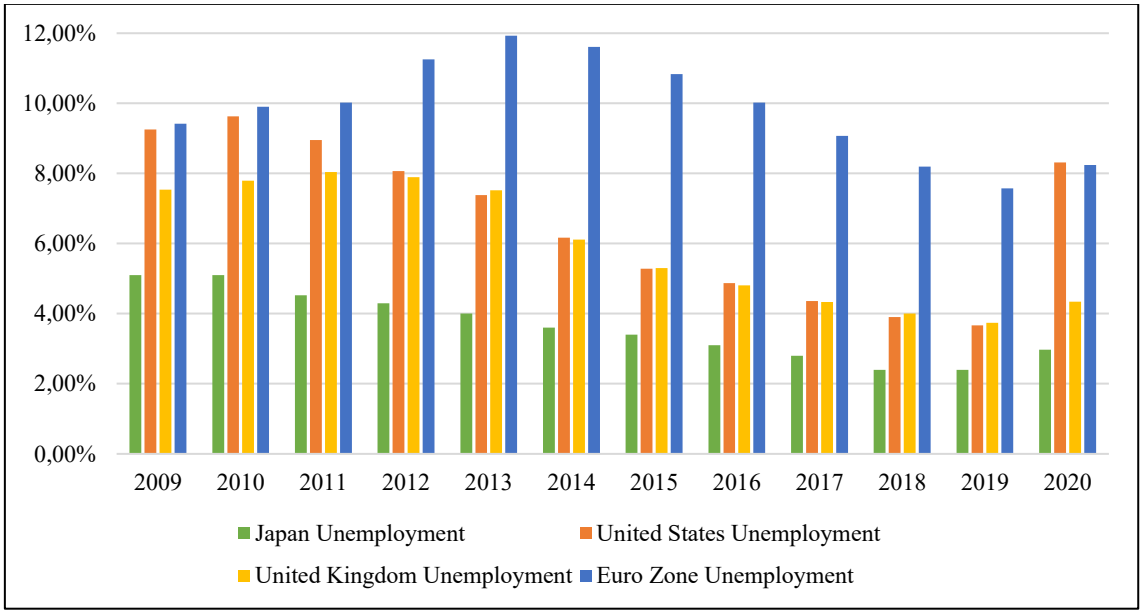

Figure 19: Annual Unemployment Rates of the Banking Markets During the Period 2009–2020, Based on Data from the World Bank

In addition to economic output, the productivity of the banking markets can also be measured by the unemployment rate. In Figure 19, it is noticeable that, for most of the time,

the Euro area had the highest rate of unemployment, while the Japan had by far the lowest. The United States and the United Kingdom observed similar unemployment rates in the middle of the period, although the unemployment rate in the United States spiked in 2020, surpassing the Euro area. The Euro area had an average unemployment rate of 9.84%, the highest rate among the banking markets in the observation period, peaking at 11.93% in 2014. With an average unemployment rate of 6.65%, the United States experienced the second highest unemployment rate among the banking markets, having an initial unemployment rate of 9.25% and an ending rate of 8.31%, meaning a total decrease of -10.16% with a CAGR of -0.78%, the lowest decrease amongst the banking markets. For most of the observation period, the United States and the United Kingdom experienced similar unemployment rates. However, the United Kingdom did not experience such a high increase in its unemployment rate in 2020. Moreover, the unemployment rate in the United Kingdom peaked in 2011 at only 8.04% and was the lowest in the observation period in 2019 at 3.74%. Additionally, with an initial unemployment rate of 7.54% and an ending rate of 4.34%, the United Kingdom observed a decrease in its unemployment rate of -42.44% with a CAGR of -3.26%, the highest decrease amongst the banking markets. Japan experienced the lowest average unemployment rate of 3.64%. With an ending rate of 2.97%, Japan experienced a decrease in its unemployment rate of -41.76%, with a CAGR of -3.21%.

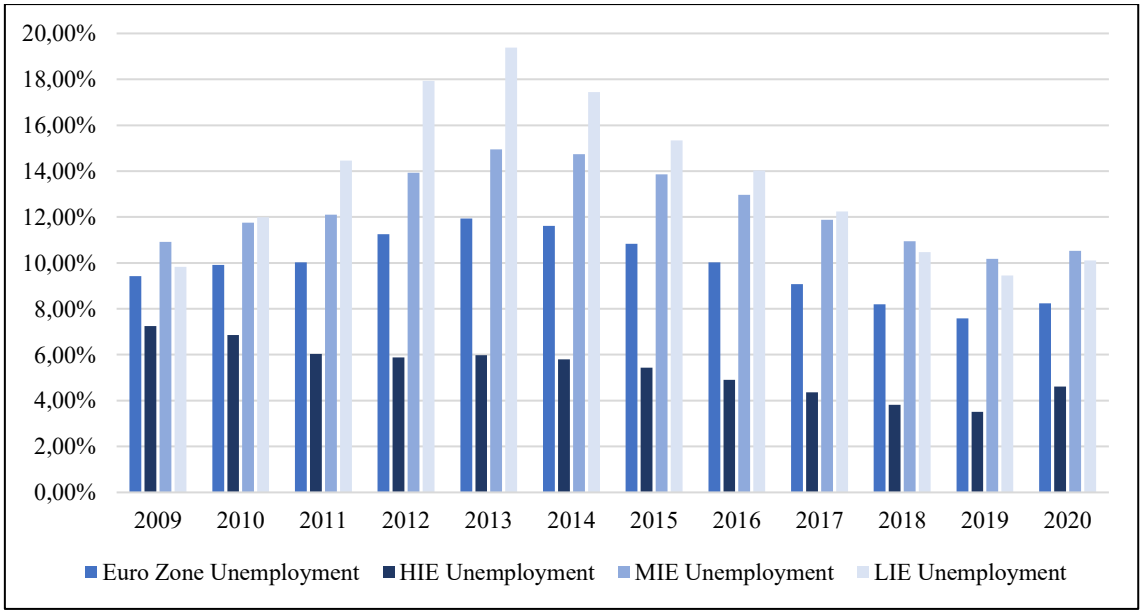

Figure 20: Annual Unemployment Rates of the Euro area and Comparison Groups for the Period 2009–2020, Based on Data from the World Bank

Figure 20 shows the unemployment rate of the Euro area as a whole and the groups within the area. It is observable that the MIE and LIE groups experienced a similar inversed u-shaped development. However, the HIE group experienced an almost consecutive decrease in the observed period. The LIE group experienced the highest average unemployment rate among the comparable groups at13.56%. Moreover, with an initial unemployment rate of 9.83% and an end rate of 10.11%, the LIE group was the only group that experienced an increase in its unemployment rate of 2.82% with a CAGR of 0.22%. The MIE group had an average unemployment rate of 12.39% in the observation period, which was quite close to the LIE group. However, the MIE group observed an unemployment rate of 10.91% at the start of the period and 10.53% at the end. Hence, the MIE group saw a decrease in its unemployment rate of -3.52% with a CAGR of -0.27%. Lastly, with an average unemployment rate of 5.37%, the HIE group had the lowest rate among the comparable groups, which was even lower than in the United States and the United Kingdom. The unemployment rate of the HIE group was 7.25% in 2009 and 3.5% in 2019. With a decrease of 4.61% in 2020, the HIE group saw a decrease in its unemployment rate of 36.49% with a CAGR of -2.81% during this period.

To understand the dynamics of the banking markets' unemployment rates, the annual growth rates need to be examined.

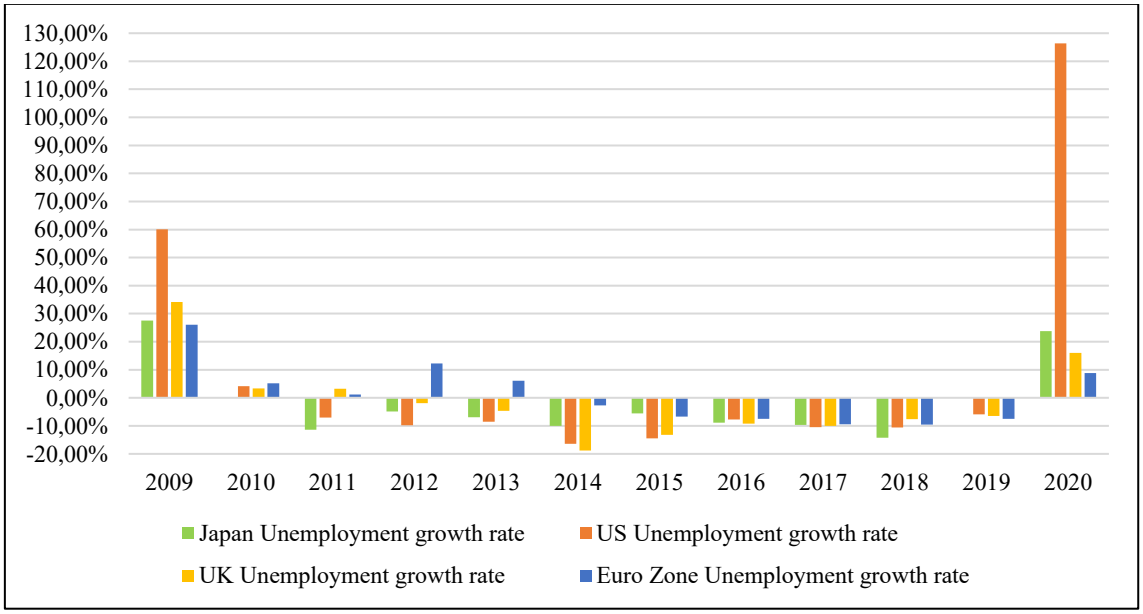

Figure 21: Annual Unemployment Growth Rates of the Banking Markets for the Period 2009–2020. Own calculation Based on Data from the World Bank.

As shown in Figure 21, the United States observed the highest annual unemployment growth rates among the banking markets, with 60.03% in 2009 rising to 126.43% in 2020.

Its lowest unemployment growth rate was -16.4% in 2014. Overall, this totals to an average annual growth rate of 8.3%, the highest average growth rate among the banking markets. Conversely, Japan nearly no change in its unemployment rate between 2010 and 2019, although it peaked at 27.5% in 2009 and reached its lowest value at -14.29% in 2018. It totaled an average annual unemployment growth rate of -1.69%, the lowest value amongst the banking markets. The Euro area had a slightly lower peak than Japan at 26.09% in 2009 and reached its lowest value at -9.61% in 2018. Totaling an average annual unemployment rate of 1.33%. Lastly, the United Kingdom had the second-lowest average annual unemployment growth of -1.26% in the observation period. All the banking markets observed a decrease in their annual unemployment for the period 2014–2019, and an increase in the years 2009 and 2020. Furthermore, the Euro area experienced growth in unemployment for the years 2012 and 2013, whereas the other banking markets observed a decrease in these years.

Figure 22 illustrates the unemployment growth rates of the Euro area and its groups. As can be seen, all the groups experienced a similar trend that was positive in the years 2009, 2014, and 2020 and negative in the period 2014–2019. In the period 2010–2013, the HIE group had a negative unemployment growth rate, unlike the MIE and LIE groups, and the Euro area average, more similar to the dynamic of the US labour market than the Euro area average.

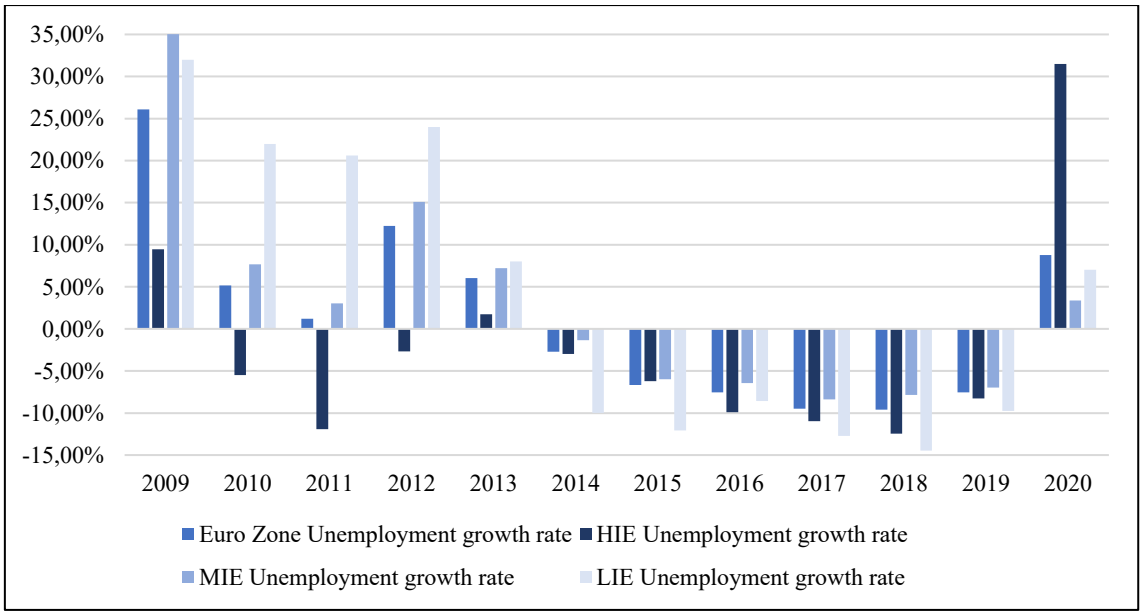

Figure 22: Annual Unemployment Growth Rate of the Euro area and its Comparable Groups for the Period 2009–2020. Own Calculation Based on Data from the World Bank

The unemployment growth rate of the HIE group peaked at 31.47% in 2020 but had the strongest decline at -12.44% in 2018. Totaling an average annual unemployment growth rate of -2.35%, the lowest value of all researched subjects. The MIE group observed the strongest growth in unemployment, with 35.03% in 2009, and the strongest decline, with -8.37% in 2017. This meant an average annual unemployment growth rate of 2.87%. Lastly, the LIE group saw, too, its strongest growth in unemployment at 31.98% in 2009, but observed the strongest decline of unemployment at -14.49% in 2018. Overall, the LIE group observed an average unemployment rate of 3.84%, the highest annual growth rate in the Euro area.

In summary, the unemployment rate in the Euro area was higher than in the other banking markets. Furthermore, unemployment in the Euro area peaked in 2013, while the other banking markets peaked in 2009. Within the Euro area itself, the HIE group had the lowest unemployment rate and was more similar to the unemployment rate of the United States and the United Kingdom than the Euro area average. The unemployment rate within the Euro area grew in the period 2010–2013 unlike in other banking markets. Again, the growth of the unemployment rate of the HIE group was more comparable to the growth rates of the United States and the United Kingdom than the Euro area average, again reflecting a degree of productivity heterogeneity in the Euro area.

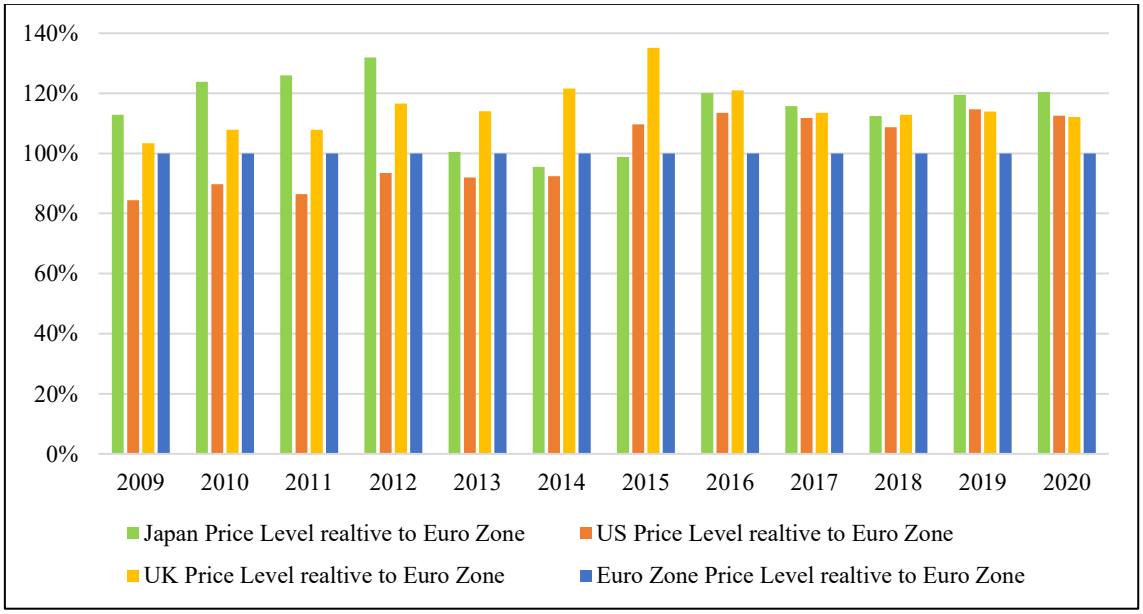

Figure 23: Price Level of Banking Markets Relative to the Euro area for the Period 2009–2020. Own Calculation Based on Data from Eurostat.

The last productivity key figure focusses on price differences in the banking markets. This key figure was already used above to calculate the nominal GDP in euros of the banking markets.

Figure 23 shows the different price levels of the banking markets relative to the Euro area for the observation period 2009–2020. For this calculation, the comparative price level released by Eurostat was used with the comparative price level of the Euro area as the base. Consequently, the price level in the Euro area was always 100%. Over the whole observation period, the United Kingdom had a higher price level than the Euro area, with an average price level of 115%, peaking in 2015 at 135% and falling to 108% in 2009 and 2010. Overall, the United Kingdom saw an increase in prices of 8.54%, with a CAGR of 0.71%. During the period 2009–2014, prices in the United States were lower than in the Euro area, although between 2015 and 2020 they were higher. The average price level was 100.8%. Prices in the United States peaked in 2015 at 115% and were at their lowest level in 2009 at 84%. In 2020, the United States observed a price level of 113%, meaning a total growth of 33.3% with a CAGR of 2.78%, the highest increase amongst the banking markets. Lastly, prices in Japan were higher than in the Euro area between the years 2009–2013 and 2016–2020, lying between 132% in 2017 and 96% in 2014. This was an average price level of 114.8%, similar to the United Kingdom, and a total growth rate of 6.74%, with a CAGR of 0.56%, the lowest growth rate amongst the banking markets.

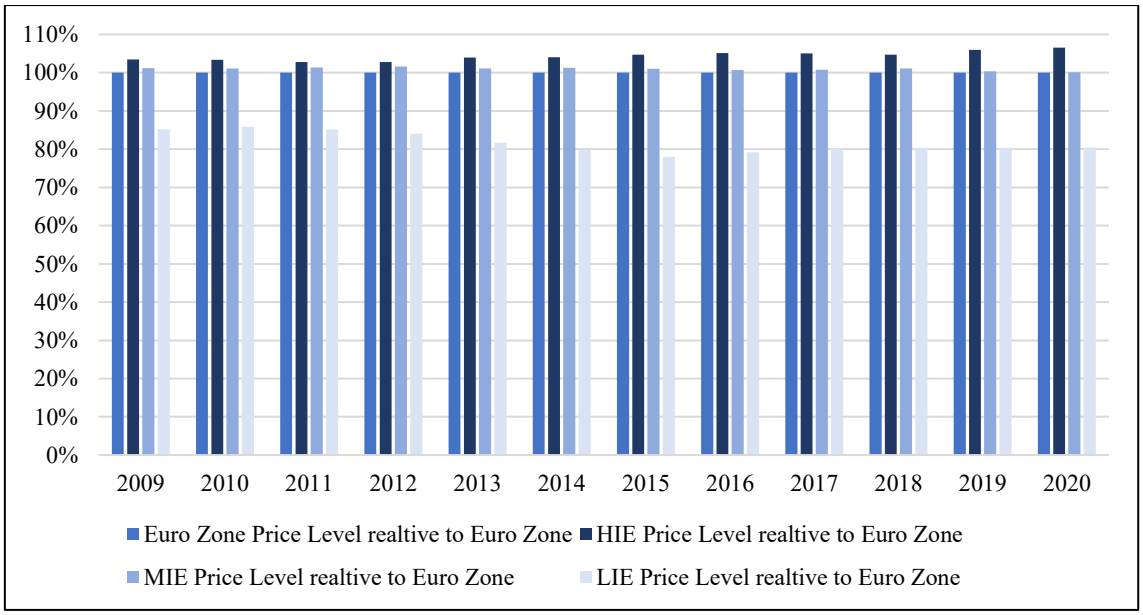

Figure 24: Price Level of Comparison Groups Relative to Euro area for the Period 2009–2020. Own Calculation Based on Data from Eurostat

Within the Euro area itself, the largest deviation regarding prices was experienced in the LIE group, as observable in Figure 24. Prices in the HIE group were at the level 103% in the years 2010–2013 and at 107% in 2020, with an average price level of 104.4% for the period as a whole. The price level of the MIE group was between 100% in 2019–2020 and 102% in 2012, with an average of 101%. The price level of the LIE group peaked at 86% in 2009 and reached its lowest value at 78% in 2015, averaging 81.7%. For the period 2009–2012, the price level of the LIE group was more comparable to the price level of the United States than the Euro area. The HIE group observed an increase in prices of 2.94% with a CAGR of 0.25%. The MIE group had a total growth rate of -1.01% with a CAGR of -0.08%, and the LIE group had a total growth rate of -5.56% with a CAGR of -0.46%. Again, this emphasizes the economic heterogeneity of the Euro area.
Overall, prices in the Euro area were below prices in the other banking markets during the observed period, with exceptions of the United States and Japan. Within the Euro area itself, prices in the HIE group were higher than the average price level in the Euro area, but not as high as in the other banking markets. Moreover, the price level of the MIE group was quite close to the Euro area average. Lastly, the price level of the LIE group was well below the Euro area average, being the lowest of all researched groups in the observation period.

3.2.2. Inflation and Interest Rates

The productivity of an economy is connected to prices, price stability, and interest rates. However, the central banks have different objectives for securing the stability of an economy. For example, the European Central Bank and the Bank of Japan target price stability, while the FED targets maximum employment, stable prices, and moderate long-term interest rates. The Bank of England's goal is to maintain monetary and financial stability by influencing interest rates. To reach these objectives, the central banks define a target inflation rate. The inflation rate is the price increase of a basket of goods in an economy over a defined period. Currently the target inflation rate set by the BoE, BoJ, ECB, and FED is 2%. Central banks influence the markets with the help of interest rates, as described in the previous chapter. Consequently, key figures like the inflation rate and base rates set by the central banks are important figures with regard to the economy. Furthermore, key figures for short-term and long-term debt in the financial markets and the real costs of indebtedness are also important for productivity and capital provision. Regarding short-term interest rates, the London Interbank Offered Rate (LIBOR) is used, and for

long-term interest rates, the interest rate paid on 10-year government bonds is used. Additionally, concerning the real cost of debts, the real interest rate based on the interest rate on 10-year governmental bonds is studied.[52]

Starting with the examination of the inflation rate, Figure 25 illustrates the harmonized consumer price index of the banking markets over the period 2009–2020. It is observable that Japan experienced a deflation, meaning a decrease in prices, in the years 2009–2012, 2016 and 2020, while the other banking markets observed a positive inflation rate throughout the whole period. For most of the time, Japan had quite a low inflation rate, between -0.8% and 0.8%, except for the years 2009 with a rate of -1.35% and 2014 with a rate of 2.76%, which is the lowest observed average inflation rate of 0.27% among the banking markets. However, Japan had the highest observed inflation rate for the period 2014–2015, with a rate of 2.76% and 2.79%, respectively, compared to the other banking markets.

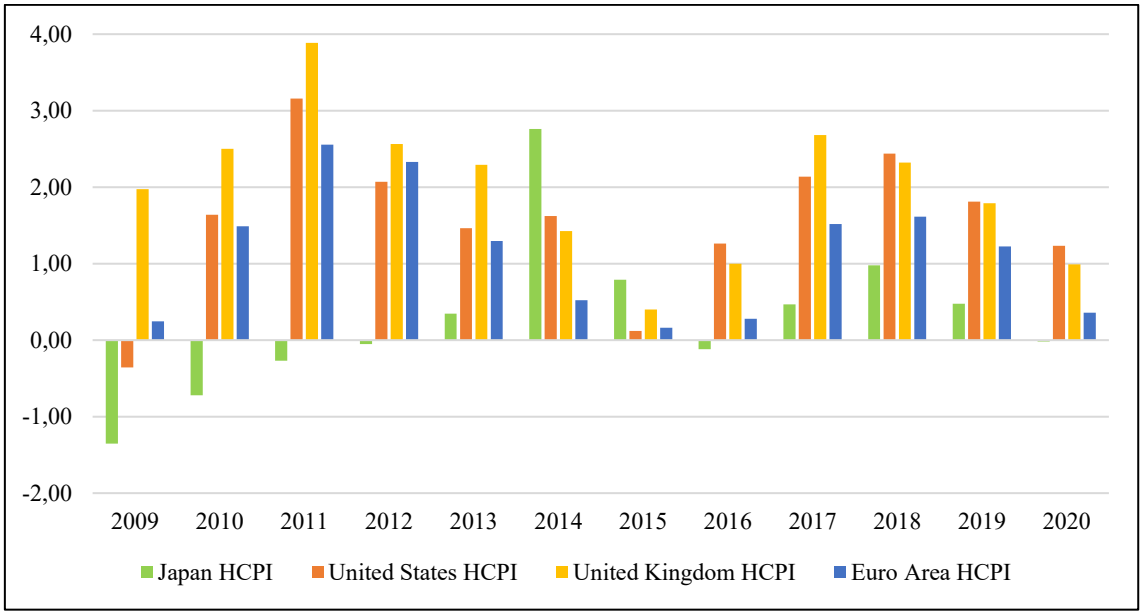

Figure 25: Harmonized Consumer Price Index of Banking Markets in Percentage Points for the Period 2009–2020, Based on Data from the World Bank

The United States also experienced a deflation rate of -0.36% in 2009, followed by an increase in inflation to 3.16% in 2011, which marked the smallest and largest inflation rate within the observation period for the United States. For the period 2012–2020, the inflation rate of the United States was between 1% and 2%, except in 2015, when it was

[52] Cf. Blanchard (2017) p. 23, BoE (2021a), BoJ (2022a), ECB (2021), FED (2020a), BoE (2021b), BoJ (2022b), ECB (2022a), FED (2020b)

0.12%. Overall, the United States experienced an average inflation rate of 1.55%, the second-closest inflation rate to the defined target interest rate. For the periods 2010–2017 and 2019–2020, the United Kingdom and the Euro area saw similar increases in inflation, with the United Kingdom having a higher inflation rate than the Euro area. The Euro area had the highest inflation at 2.55% in 2011 and the lowest at 0.16% in 2015. This was an average rate of 1.13% for the period as a whole, which was way below the target inflation rate. Furthermore, inflation in the United Kingdom peaked at 3.88% in 2011, the highest among the banking markets, although it fell to a low of 0.4% in 2015. However, with an average rate of 1.99% in the period as a whole, the United Kingdom was the only banking market that reached its defined target.

Before looking at the Euro area, it is important to note that all member countries of the euro are subject to the control of the ECB. This means that rates of inflation should be similar in these countries. However, there were observable differences regarding the interest rates within the Euro area, as can be seen in Figure 26.

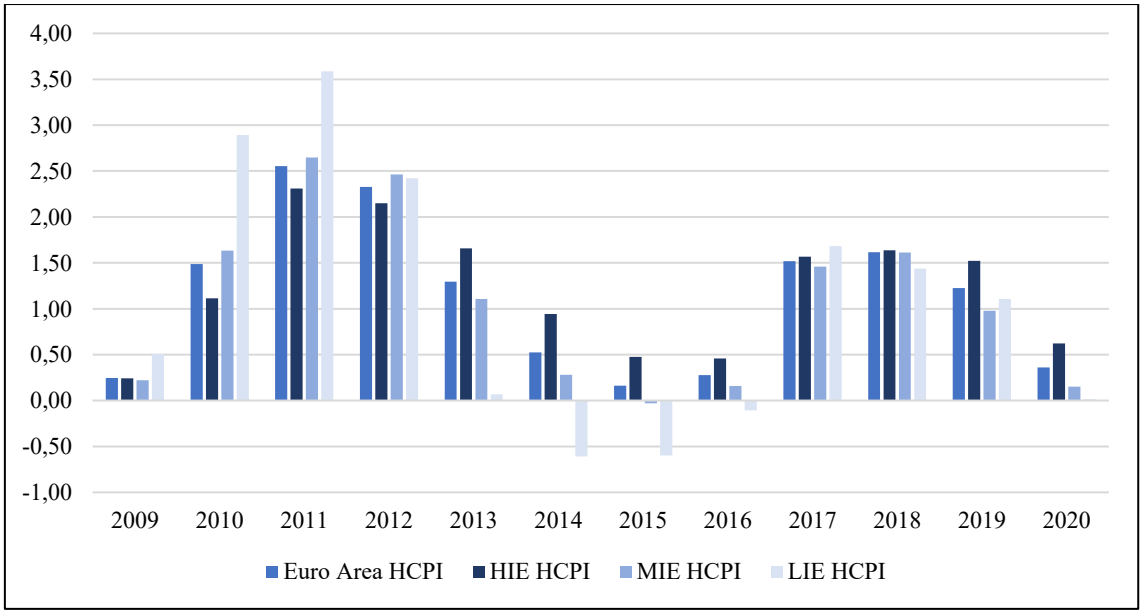

Figure 26: Harmonized Consumer Price Index of Euro area and its Comparable Groups in Percent Points for the Period 2009–2020, Based on Data from the World Bank

Within the Euro area, the LIE group has the strongest deviation in the inflation rate among the comparable groups, peaking at 3.599% in 2011, which was comparable to the United Kingdom, reaching its lowest value and deflation at -0.6% in 2014–2015. This meant an average inflation rate over the whole period of 1.03%, which was the strongest average deviation among the comparable groups. The HIE group had a positive inflation rate for the whole observation period reaching a high of 2.31% in 2011, and a low of 0.46% in

2015 – an average inflation rate of 1.22%. This deviation was a little less than that of the LIE group, but closer to the target inflation rate of 2%. Lastly, the MIE group had an inflation rate between -0.03%, being slightly deflationary, in 2015 and 2.65% in 2011. Overall, the MIE group had an average inflation rate of 1.06%. Hence, it was the closest to the Euro area average. Furthermore, for the period 2017–2018, all the groups within the Euro area had an inflation rate of around 1.5–1.6%. Overall, the HIE group achieved the highest stability, with a relative standard deviation of 56%, while the LIE group was the most volatile, with a relative standard deviation of 135%. Consequently, regarding the inflation rate, heterogeneity is once again observable in the Euro area.

One tool central banks use to achieve target inflation rates is to set key interest rates. More The key interest rate influences the commercial banks' lending rates and the cost of credit for borrowers. However, the central banks of the banking markets define key interest rates differently. Within the Euro area, the ECB has three different key interest rates: the interest rate on main refinancing operations, or the fixed rate in fixed rate tender, is the interest rate at which commercial banks can borrow money over the long term; the interest rate for marginal lending facility is the rate at which commercial banks can borrow money overnight; and then there is also the interest rate for deposit facilities. By contrast, the Bank of England uses the bank rate, which is the interest rate commercial banks get when they hold money at the Bank of England, to influence the inflation rate. In the United States, the FED charges commercial banks and other depository institutions the discount window primary credit rate. Lastly, the Bank of Japan sets the basic loan rate as the ceiling for commercial lending.[53]

Figure 27 shows the different key interest rates set by the central banks of the banking markets for the period 01.01.2009–31.12.2020. At the beginning of the period, the ECB set its highest key interest rate at 2% for the period January–February 2009. Afterwards the key interest rate was set at 1% for the period May 2009–March 2011. This was followed by a rise to 1.5% for the period July–November 2011. Afterwards, the ECB set lower key interest rates until the key interest rate reached 0% in March 2016. For the rest of the observation period, the key interest rate was set at 0%. Overall, the Euro area had an average key interest rate of 0.43%, the second-lowest interest rate environment among the banking markets.

[53] Cf. BoE (2021c), BoJ (2022c), ECB (2022b), FED (2022)

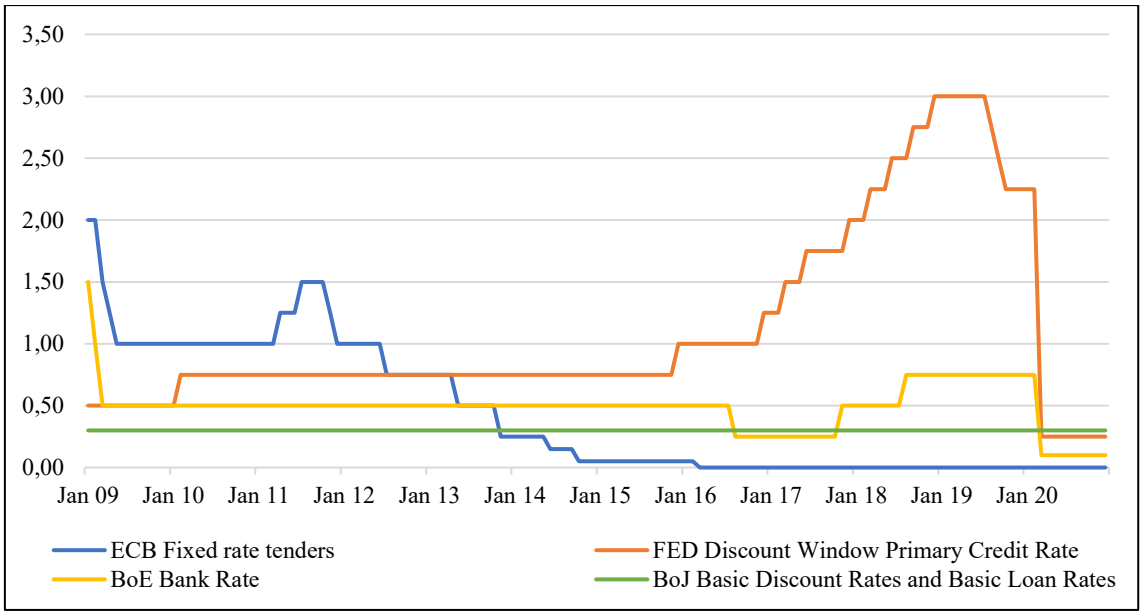

Figure 27: Key Interest Rates of the Banking Markets in Percent for the Period January 2009–December 2020, Based on Data from BoE, BoJ, ECB, FED

While the ECB lowered its key interest rate over the period November 2011–July 2019, the FED increased its key interest rate from 0.75% to 3%. This was followed by a sharp drop to 0.25% in March 2020. Therefore, the United States observed an average key interest rate of 1.12%, the highest interest rate among the banking markets. Like the ECB, the Bank of England decreased its key interest rate from 1.5% to 0.5% in 2009. A further decrease to 0.25% followed in 2016, and another to 0.75% in 2017. Like the FED, the Bank of England set a lower key interest rate of 0.1% in March 2020. Overall, the United Kingdom had an average key interest rate of 0.49% over the whole period, which was close to but higher than the key interest rate in the Euro area. Unlike the other central banks, the key interest rate of the Bank of Japan remained unchanged at 0.3% for the whole observation period. The lowest interest rate environment among the banking markets.

In addition to the key interest rates set by the central banks, commercial banks use other reference interest rates to determine their lending rates. For example, the use of the interest rate paid on the interbank market as a reference rate is usual for this procedure. Historically, LIBOR, lastly published by the Intercontinental Exchange Benchmark Administration, had been one of the most important reference interest rates. It was calculated with panel data from different banks to find an average representative rate used by large commercial banks for the interbank trade. However, after a market manipulation scandal, the publication of the original LIBOR was stopped in 2021, and national authorities urged

commercial banks to use other reference interest rates. However, for historical reasons, and to describe the interest rate environment during the period 2009–2020, the LIBOR is still used as key figure. Moreover, the LIBOR is calculated for different currencies and different maturities. [54]

To illustrate short-term interest rates, Figure 28 displays the LIBOR for contracts with a duration of three months for the dollar, euro, British pound, and yen over the period January 2009–December 2020. Interestingly, the curves of the LIBOR show similar movements to the key interest rates set by the central banks but is more dynamic level as the LIBOR is reported on a daily rate. The euro-LIBOR had its highest value at 2.45% in January 2009, followed by a decrease to 0.59 % in March 2010 and an increase to 1.51% in October 2011. After this, the euro-LIBOR decreased, reaching a negative value in May 2015 and hitting its lowest level at -0.56% in December 2020. From September 2014, the euro-LIBOR was the lowest LIBOR of the other banking markets and had an overall, average short-term interest rate of 0.19% for the period as a whole – the second lowest short-term interest environment among the banking markets. This was considerably lower than the key interest rate set by the ECB.

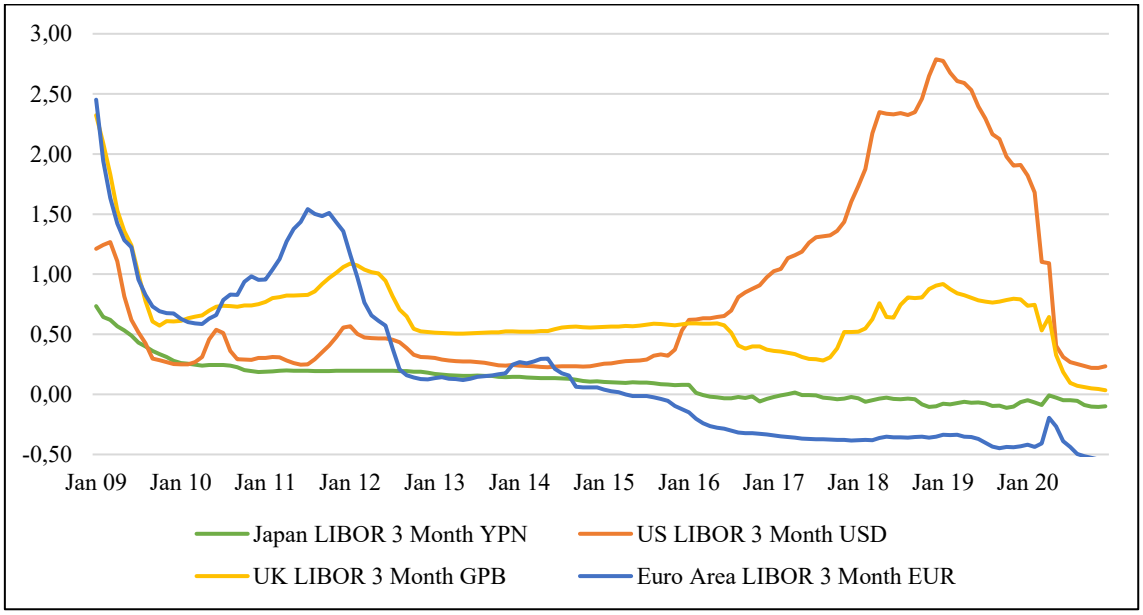

Figure 28: LIBOR 3 Month for Dollar, Euro, British Pound, and Yen in Percent for the Period January 2009–December 2020, Based on Data from FRED

The Yen-LIBOR was not as volatile as the Euro-LIBOR, as the Euro area saw a relative standard deviation of 339% and Japan a relative standard deviation of 157%. Moreover,

[54] Intercontinental Exchange Benchmark Administration (2022), Financial Stability Board (2021)

the Yen-LIBOR started with a value of 0.73% in January 2009 and constantly decreased to -0.1% in December 2020. With an average short-term interest rate of 0.1% calculated on the Yen-LIBOR, Japan had the lowest interest rate environment among the banking markets. At the beginning of the observation period, the GBP-LIBOR had a similar value to the Euro-LIBOR at 2.32% in January 2009, decreasing afterwards to 0.61% in December 2009, followed by an increase to 1.09% in January 2012. Afterwards, the GBP-LIBOR decreased to 0.28% in August 2017. Unlike the Euro-LIBOR, the GBP-LIBOR never fell to a negative value. The lowest value, at 0.03%, was in December 2020. Overall, the United Kingdom observed an average short-term interest rate based on the GBP-LIBOR of 0.66% over the period as a whole, the second highest short-term interest environment among the banking markets. As in the Euro area, the average short-term interest rate in the United Kingdom was below the average key interest rate set by the Bank of England. Lastly, the dollar-LIBOR reached its highest value at 2.79% in December 2018, and not, like the other banking markets, at the beginning of the observation period. In December 2020, the dollar-Libor fell to -0.10%, which was its lowest value in the observation period. Consequently, the United States observed an average short-term interest rate based on the Dollar-Libor of 0.83%, the highest short-term interest environment amongst the banking markets. Additionally, the United States observed a short-term interest rate environment below its key interest environment.

After examining the key interest rates and market short-term interest rates of the banking markets, a look into long-term interest rates is necessary. A reference for long-term interest rates are the interest rates paid on 10-year government bonds, as those are the conditions on which countries can finance themselves and conduct fiscal policies. For example, if one country has a deficit budget and thus emits more government bonds, the interest rate paid for the bonds increases as the supply of bonds increases. On the other hand, if the bonds of one country are considered safer than the bonds of another country, agents tend to demand more bonds from the safer country, and the interest rate decreases as the demand increases. Furthermore, a higher inflation rate increases the interest rate on government bonds. To visualize this, Figure 29 displays the interest rate paid on 10-year government bonds in the banking markets for the period January 2009–December 2020. The interest rate paid on 10-year government bonds in the Euro area showed a downward tendency, starting with 4.10% in January 2009, reaching a high of 4.32% in June 2009, and decreasing to its lowest value of -0.09% in December 2020. This meant an average long-term interest rate of 2.16% in the Euro area during the period as a whole, the second

highest level among the banking markets. For the period May 2009–August 2015, the interest paid on 10-year government bonds in the United States and the United Kingdom was quite similar and showed the same tendency. Until May 2014, the interest paid in the Euro area on 10-year government bonds was higher than in the United States and the United Kingdom. Later, however, the interest rate in the Euro area was lower than in the United States and the United Kingdom. From September 2014 on, the United States had the highest interest rate on 10-year government bonds among the banking markets.

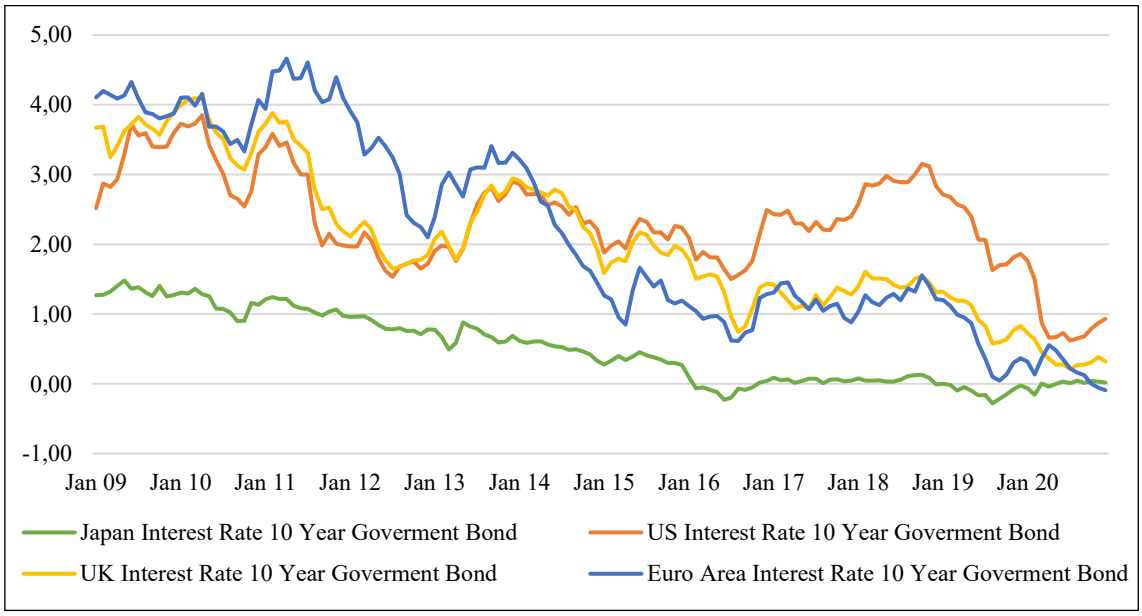

Figure 29: Interest for 10 Year Government Bonds of the Banking Markets in Percent for the Period January 2009–December 2020, Based on Data from FRED and OECD

The interest rate paid on 10-year government bonds in the United States was 0.62% in July 2020 and 3.72% in June 2009, and in the United Kingdom, 0.21% in July 2020 and 4.10% in April 2010. This meant an average long-term interest rate of 2.35% in the United States (the highest long-term interest environment among the banking markets) and 2.04% in the United Kingdom. For the period January 2009–September 2020, Japan had the lowest interest rate paid on 10-year government bonds among the banking markets, being only undercut by the Euro area during the period October 2020–December 2020. The interest rate paid on 10-year government bonds in Japan was -0.28% in August 2019 and 1.48% in May 2009. This meant that Japan experienced an average long-term interest rate of 0.49% in the observation period, the lowest long-term interest rate environment amongst the banking markets. Unlike the average short-term interest rates, all the long-term interest rates of the banking markets were above the respective average key interest rates of their central banks. In conclusion, all the banking markets showed a downward

tendency for the interest rate paid on 10-year government bonds for the observation period, with the highest value reached in the period 2009–2011 and the lowest value reached in the period 2019–2020.

Within the Euro area, the average interest rate paid on 10-year government bonds in the LIE group deviated the strongest from the Euro area average in the period March 2010–January 2014, as seen in Figure 30. In this period, the average highest interest rate paid on 10-year government bonds in the LIE group was 17.74% in February 2012, which deviated 13.72 percentage points from the Euro area average of 3.75%. Furthermore, it was the highest within the Euro area, lying between 0.11% in December 2020 and 17.47% in February 2012, converging to the Euro area average in the period January 2018–December 2020. With an average long-term interest rate of 5.31% in the observation period, the LIE group observed the highest long-term interest rate environment among the comparison groups.

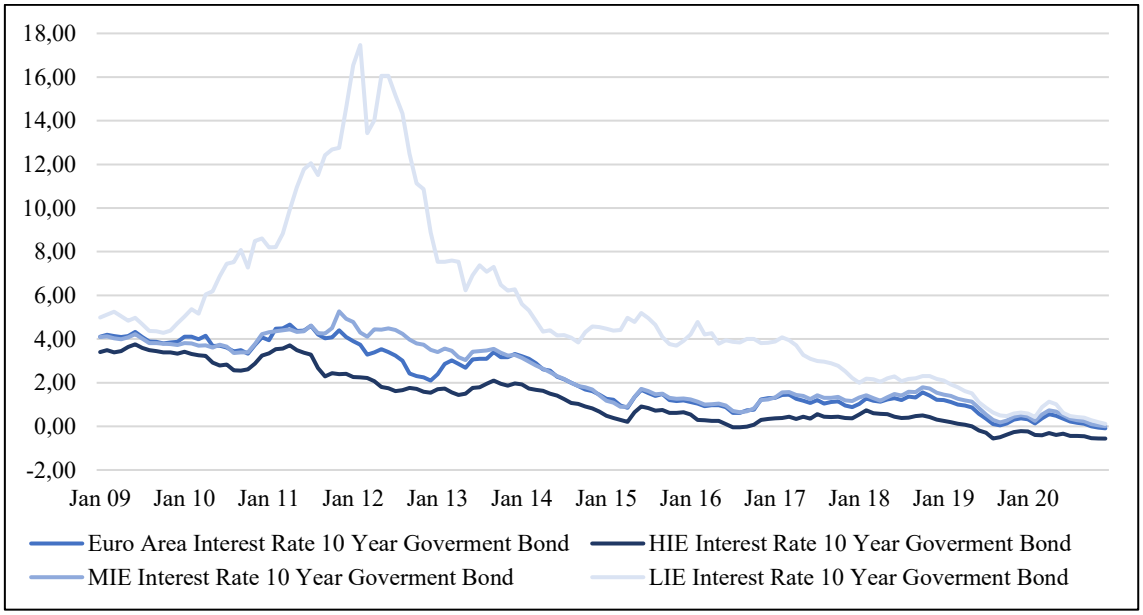

Figure 30: Interest for 10 Year Government Bonds in the Euro area and its Comparable Groups for the Period January 2009–December 2020. Own calculation Based on Data from ECB[55]

The average interest rate paid on 10-year government bonds in the MIE group was quite similar to the Euro area average, being slightly higher in the period October 2011–November 2013. Furthermore, the average interest rate for MIE group 10-year government

[55] Estonia is not considered, as the country does not emit 10-year governmental bonds within the observation period. Interest rate for Greece is estimated for July 2015, as data is missing.

bonds was 0.01% in December 2020 and 5.27% in November 2011. This meant an average long-term interest rate of 2.35% and was the closest to the Euro area average. Lastly, the average interest rate for 10-year government bonds in the HIE group showed the same tendencies as the Euro area average, although being slightly lower and even negative for the period May 2019–December 2020. The average interest rate for 10-year government bonds in the HIE group was -0.56% in December 2020 and 3.76% in June 2009. Therefore, the countries in the HIE group experienced an average long-term interest rate of 1.29%, which was 0.86 percent points below the Euro area average. Therefore, in all the groups, there was a downward tendency in the interest rate for 10-year government bonds during the observation period, as in the banking markets, with the LIE group deviating for the period January 2010–October 2012. However, these findings again underline the economic heterogeneity in the Euro area, in which the capital markets ranked the countries in the LIE group higher than the countries in the MIE and HIE groups.

As shown above, the banking markets had different levels of interest rates. Japan had low interest and inflation rates, while the United Kingdom had high interest and inflation rates. However, borrowing doesn't have to be cheaper in a low interest rate environment or more expensive in a high interest rate environment. Therefore, to describe the costs for the capital borrower and the yield of the capital provider, the real interest rate is an important key figure.

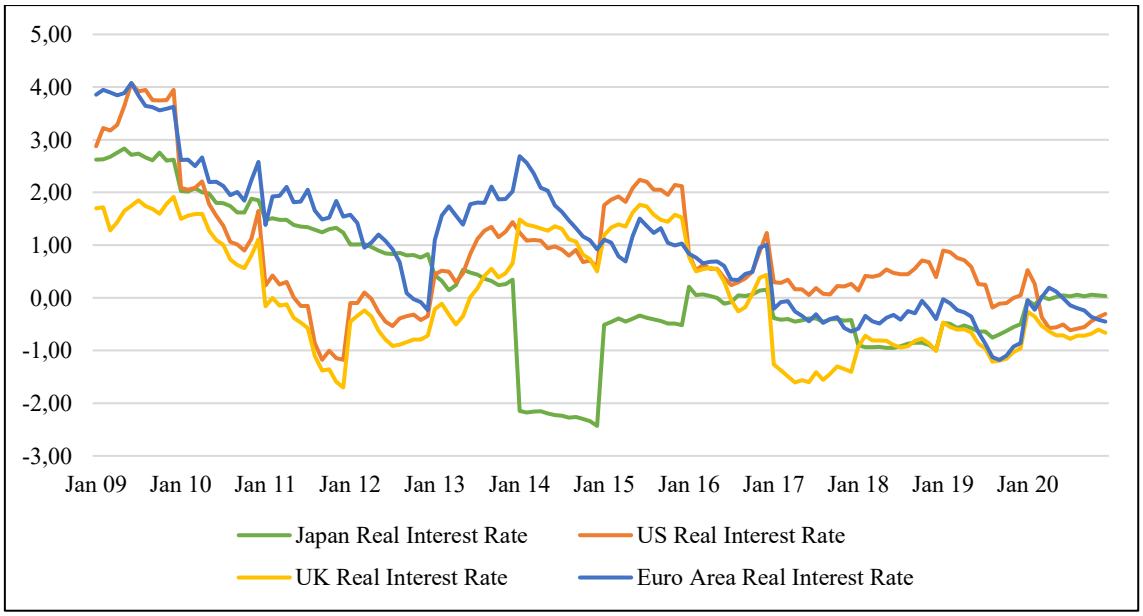

Figure 31: Real Interest Rate on 10-Year Governmental Bonds in Percent within the Banking Markets for the Period 2009–2020, Based on Data from ECB, OECD, and World Bank

The real interest rate is the interest rate paid minus the inflation rate. This means the increase in prices for goods over time is ruled out, and only the real costs – the real yield of borrowing is considered. For this, the interest rate on 10-year governmental bonds minus the Harmonized Index of Consumer Prices (HCPI) from the previous sections is used. As shown in Figure 31, all banking markets had a tendency to decrease the real interest rate within the observation period. On average, the Euro area had the highest real interest rate among the banking markets at 1.03%, with the highest point of 4.08% at the beginning of the observation period in June 2009 and the lowest point of -1.18% in September 2019. Additionally, for most of the first half of the observation period, the Euro area had the highest real interest rate, while for the second half, it was one of the lowest among the banking markets. For the period January 2015–February 2020, the Euro area, the United States, and the United Kingdom showed the same tendency regarding the real interest rate. The average interest rate in the United States was the second highest at 0.80%, peaking at 4.08% in June 2009 and reaching its lowest value at -1.18% in September 2011. Japan had the second lowest average real interest rate of 0.22%, reaching its highest level at 2.83% in May 2009 and its lowest level at -2.43% in December 2014. However, for the period June 2029–December 2020, Japan had the highest real interest rate amongst the banking markets. The sharp decline of the Japanese real interest rate in 2014 can be explained by a sharp increase in the inflation rate from 0.35% in 2013 to 2.76% in 2014. Among the banking markets, the United Kingdom had, for the largest part of the observation period, the lowest real interest rate, with an average interest rate of 0.22%, peaking at 1.91% in December 2009, and reaching its lowest value at -1.70% in December 2011. The data shows that all banking markets had a high real interest rate level at the beginning of the observation period, which decreased towards the end of the observation period. This was especially the case for the Euro area and the United States, as both banking markets observed their highest real interest rate in 2009 and their lowest real interest rate in 2019. Interestingly, in terms of real interest rates, the order of the market changes, revealing the Euro area as the costliest for capital.

Within the Euro area, the real interest rates of the HIE and MIE groups followed the trend of the real interest rate of the Euro area as a whole, as seen in Figure 32, although the HIE group's rate was slightly below and the MIE group's slightly above the real interest rate within the Euro area as a whole. However, the LIE group deviated from this trend for the period January 2010–December 2012, although from January 2017 on, the real interest rates of the comparable groups within the Euro area converged. Nevertheless, the LIE

group had the highest average real interest rate of 4.27%, peaking at 15.05% in February 2012 and reaching its lowest value at -0.63% in October 2019.

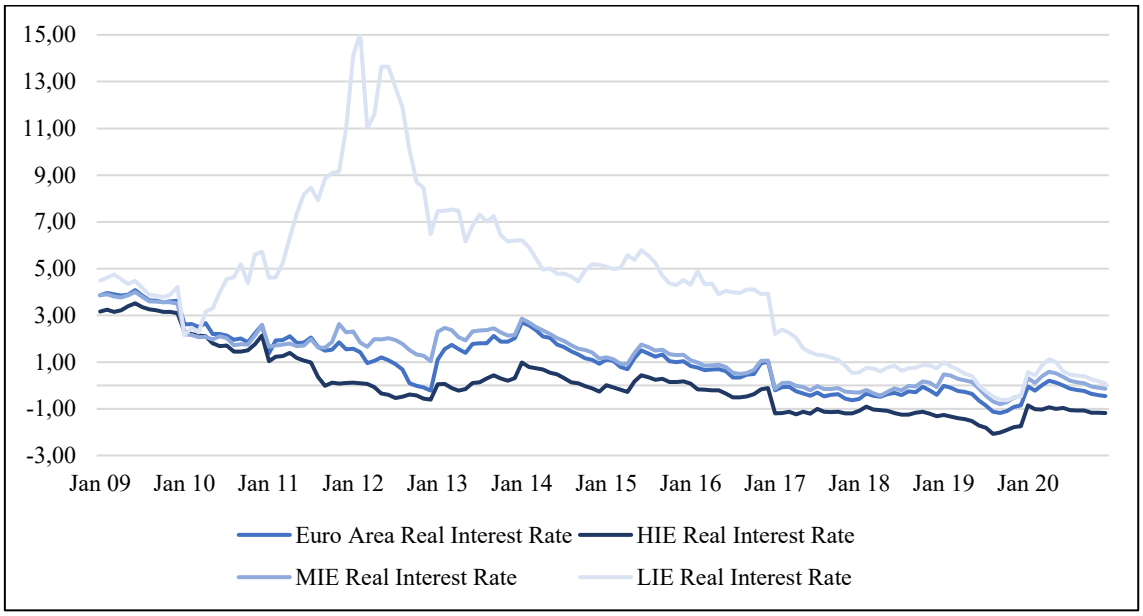

Figure 32: Real Interest Rate on 10-Year Governmental Bonds in Percent within the Euro area and Comparison Groups for the Period 2009–2020, Based on Data from ECB, OECD, and World Bank

The MIE group had the second highest average real interest rate of 1.29%, being close to the Euro area average of 1.07%. The highest real interest rate was 4% in June 2009, and the lowest was -0.81% in September 2019. Unlike the LIE and MIE groups, the HIE group had quite a low average real interest rate of 0.07% and was therefore more comparable to the average real interest rate in the United Kingdom of 0.06%. However, the highest real interest rate of the HIE group was 3.51% in June 2009, and the lowest was -2.07% in August 2019. Again, heterogeneity amongst the comparison groups with regard to real interest rates can be observed. However, convergence occurred at the end of the period.

To conclude, the inflation rate trend was similar in the Euro area, the Unites States and the United Kingdom, while Japan experienced low inflation or deflation most of the time. All banking markets had a defined target inflation of 2%, which only the United Kingdom exceeded on a regular basis, although it achieved the average target, while the United States, the Euro area, and Japan undercut the target. Within the Euro area, the LIE group deviated the most from the Euro area average inflation rate, either exceeding it or experiencing deflation. Regarding interest rates, the Euro area observed a decrease in all interest rates in the observation period, with the key interest rate being 0%, the Euro-LIBOR

being negative and the interest rate for 10-year government bonds being well below 2% from 2015 until the end of the observation period. Again, the LIE group deviated the strongest from the Euro area average. For example, the average LIE group's interest rate for 10-year government bonds exceeded the Euro area average in February 2012 by roughly 13%. Unlike the Euro area, the United States observed increasing interest rates, with values of the key interest rate reaching 3%, dollar-LIBOR 2.5%, and interest rates for 10-year government bonds of 3.12% until 2019. Interest rates in the United Kingdom were between the rates in the United States and the Euro area and were quite constant. The GBP-LIBOR was above the yen- and euro-LIBOR but below the dollar-Libor, and the interest rate for 10-year governmental bonds showed the same trend as the United States for the period 2009–2014 and the same trend as the Euro area for the period 2015–2020. Japan had a constantly low key interest rate and both a constantly decreasing yen-LIBOR and interest rate for 10-year governmental bonds, both around 0%. In 2020, the observed interest rates in all banking markets reached their lowest point in the period. Furthermore, the Euro area has the highest average real interest rate of 1.07% among the banking markets, while the lowest average real interest rate of 0.06% was observed in the United Kingdom. This meant that for the period as a whole, the real costs or yield of borrowing were the highest within the Euro area. High real interest rates mostly occurred in the LIE countries, with an average real interest rate of 4.27% and particularly high real interest rates in the period 2010–2017. The exception was the HIE group, which had a low average real interest rate of 0.07%, comparable to the average real interest rate in the United Kingdom and in the Euro area. Underscoring, once again, the heterogeneity of the Euro area economies.

3.2.3. International Trade and Foreign Direct Investment

International trade and interlinkage are important for an economy in a globalized world, as trade fuels national industries and markets. Consequently, it is necessary to look at and assess key figures regarding international trade and investment. The current account of an economy consists of all ingoing and outgoing transactions. This means that if the current account is positive, an economy exports more goods than it imports from other economies. Vice versa, if the current account is negative, the economy imports more than it exports. Furthermore, the flow of foreign direct investments (FDI) describes the value of cross-border transactions related to investments. If the FDI flow is positive, an economy attracts more investments than flow abroad, and vice versa. However, both figures display

an inflow or outflow of goods and investments in an economy. In the following chapter, both key figures are analyzed.[56]

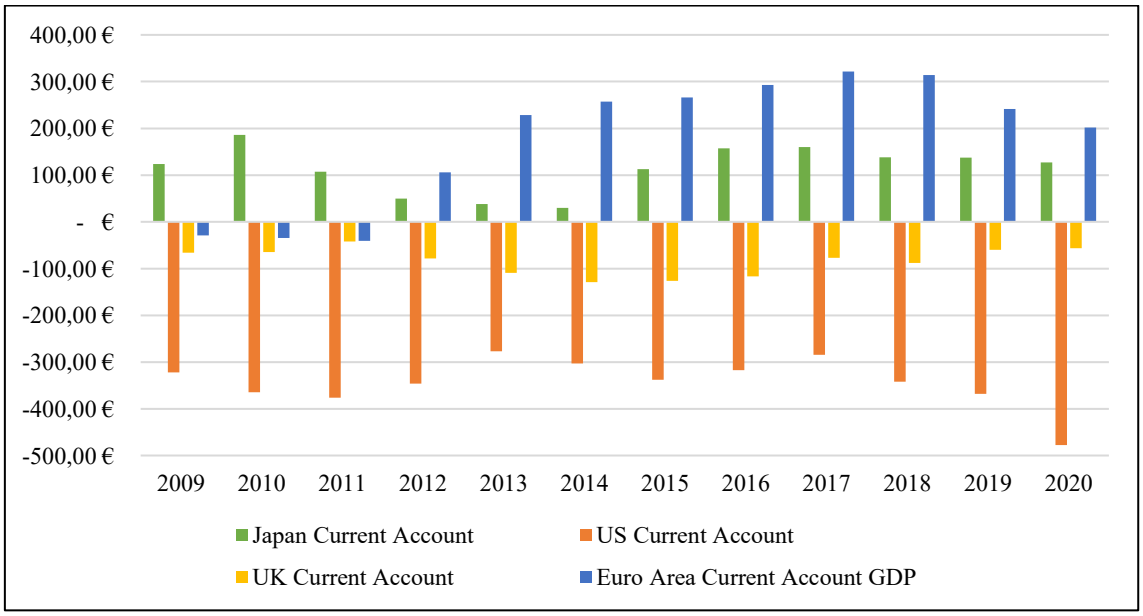

Figure 33: Current Account of the Banking Markets in Billion Euros for the Period 2009–2020, Based on Data from the World Bank

Figure 33 displays the annual current accounts for the banking markets in billions of euros for the period 2009–2020. As shown, the Euro area was a net exporter for the period, as it exported more than it imported. The average current account in the Euro area was 149 billion euros, the largest among the banking markets. Furthermore, the current account in the Euro area spanned from -41 billion euros in 2011 to 321 billion euros in 2017. Japan was a net exporter for the whole observation period, with the highest current account of 187 billion euros reached in 2010 and the lowest observed current account of 30 billion euros in 2014. With an average current account of 114 billion euros in the observation period, Japan had the second highest average current account compared to the other banking markets. Unlike the Euro area and Japan, the United States and the United Kingdom had a negative current account for the whole observation period; thus, both countries were net importers. The United States had its lowest level of -478 billion euros in 2020 and the highest level of -277 billion euros in 2013. Furthermore, with an average current account of -343 billion euros, the United States was the biggest net importer among the banking markets. Lastly, with an average current account of -84 billion euros, the United Kingdom had a higher current account than the United States. The lowest level of the United

[56] Cf. Blanchard (2017) p.379, OECD (2021)

Kingdom's current account was -129 billion euros in 2014, and the highest level was -42 billion euros in 2011.

Within the Euro area, heterogeneities are once again apparent, as shown in Figure 34. On average, the Euro area countries were net exporters, with an average current account per country ranging from 29 billion euros in 2010 to 81 billion euros in 2018. However, a deeper look into the comparable groups reveals that this positive current account was mostly driven by the countries within the HIE group, with an average current account of 119 billion euros in the period 2009–2010 and 173 billion euros in 2018. However, for the period 2009–2012, the MIE countries were, on average, net importers, although for the rest of the observation period, the average current account of the MIE countries was positive. The average current account of the MIE countries reached its highest level at 17 billion euros in 2019 and its lowest level at -35 billion euros in 2010.

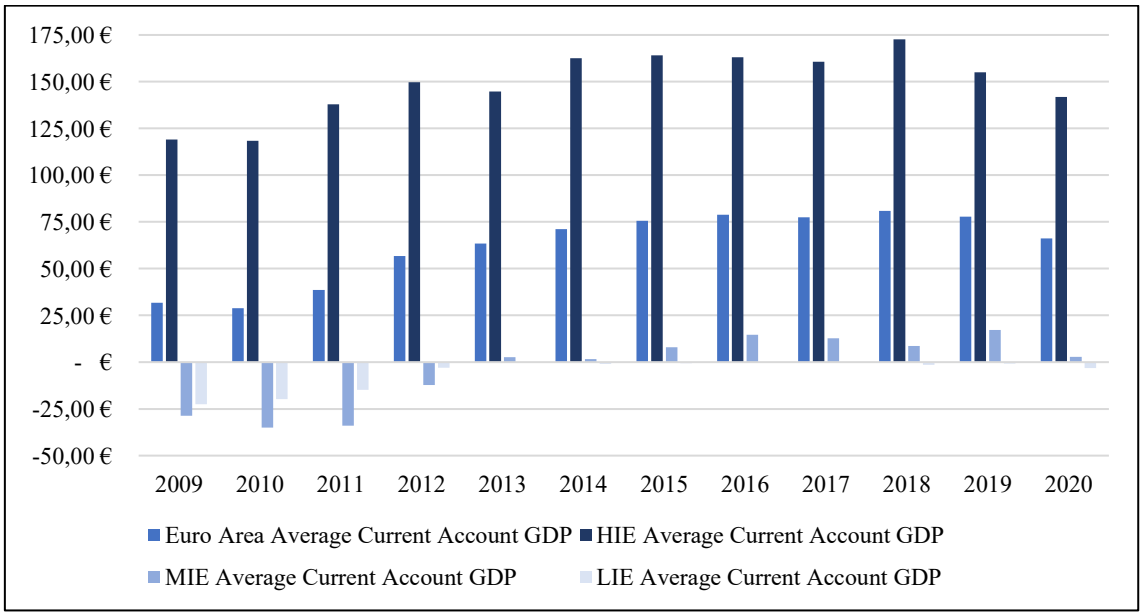

Figure 34: Average Current Account of the Euro area and its Comparable Groups in Billion Euros for the Period 2009–2020. Own calculation Based on Data from the World Bank

Unlike the HIE and MIE countries, the LIE countries were, on average, net importers for the whole observation period. The average current account of the LIE countries reached its lowest level at -23 billion euros in 2009 and its highest level at -0.33 billion euros in 2013. Overall, it can be seen that only the HIE countries were on average net exporters, with the average current account of the countries being 149 billion euros. The MIE and LIE countries, however, were net importers, with average current accounts of -3 billion euros and -6 billion euros, respectively.

After analyzing imports and exports, it is necessary to shed light on financial streams in the form of foreign direct investments. The Euro area observed the highest annual flow of foreign direct investment for most of the time within the observation period, as shown in Figure 35. Although for the period 2018–2019 the Euro area experienced a net outflow of foreign direct investments, for the period 2009–2017, the Euro area had the highest positive flow of foreign direct investment, thus having the highest value among the banking markets for this period. On average, the flow of foreign direct investments into the Euro area was 380 billion euros, with the highest level at 613 billion euros in 2011 and the lowest level at -18 billion euros in 2019. The United States observed a positive flow of foreign direct investments for the whole observation period, having the second highest flow for the period 2009–2017 and the highest for the period 2018–2019. On average, the annual flow of foreign direct investment was 248 billion euros with the highest level at 422 billion euros reached in 2015 and the lowest level at 137 billion euros reached in 2009.

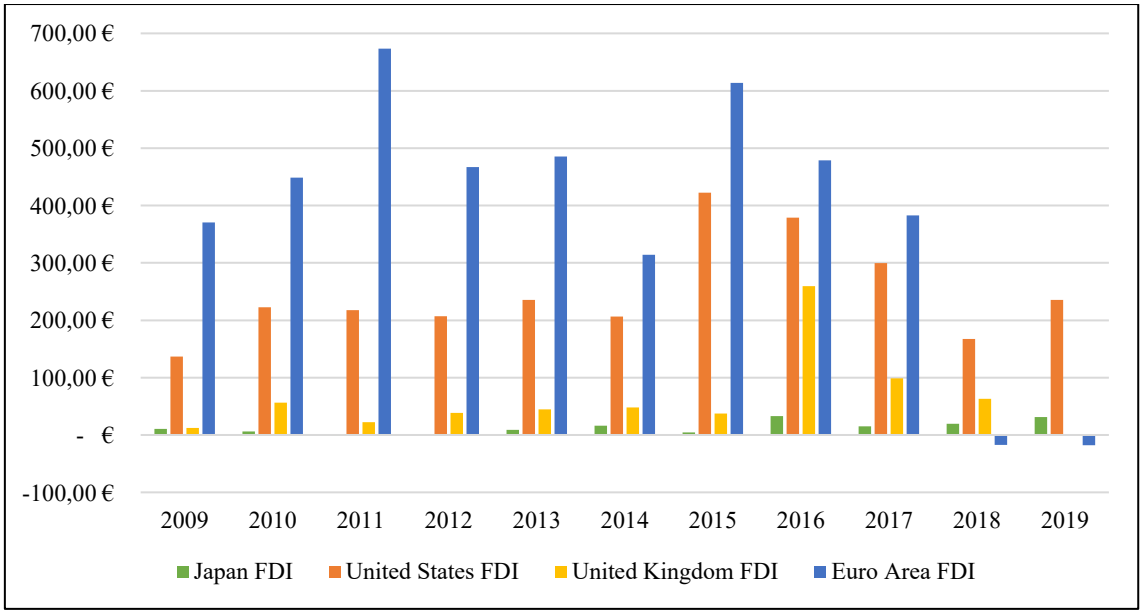

Figure 35: FDI Flow Within the Banking Markets in Billion Euros for the Period 2009–2019, Based on Data from the World Bank[57]

Like the United States, the United Kingdom experienced only positive annual flows of foreign direct investments in the observation period. On average, the flow of foreign direct investments was 62 billion euros for the United Kingdom, with its highest level at 259 billion euros reached in 2016 and the lowest value of 1.74 billion euros reached in

[57] Shortened observation period, through unavailability of data

2019. Unlike the other banking markets, the inflow of foreign direct investment into Japan was quite low, with an average of 13 billion euros and a high of 33 billion euros in 2016, and a low of 0.45 billion euros in 2012.

The main drivers of foreign direct investments within the Euro area were the countries within the HIE group, as shown in Figure 36. Despite experiencing a negative flow in 2018 and 2019, on average the

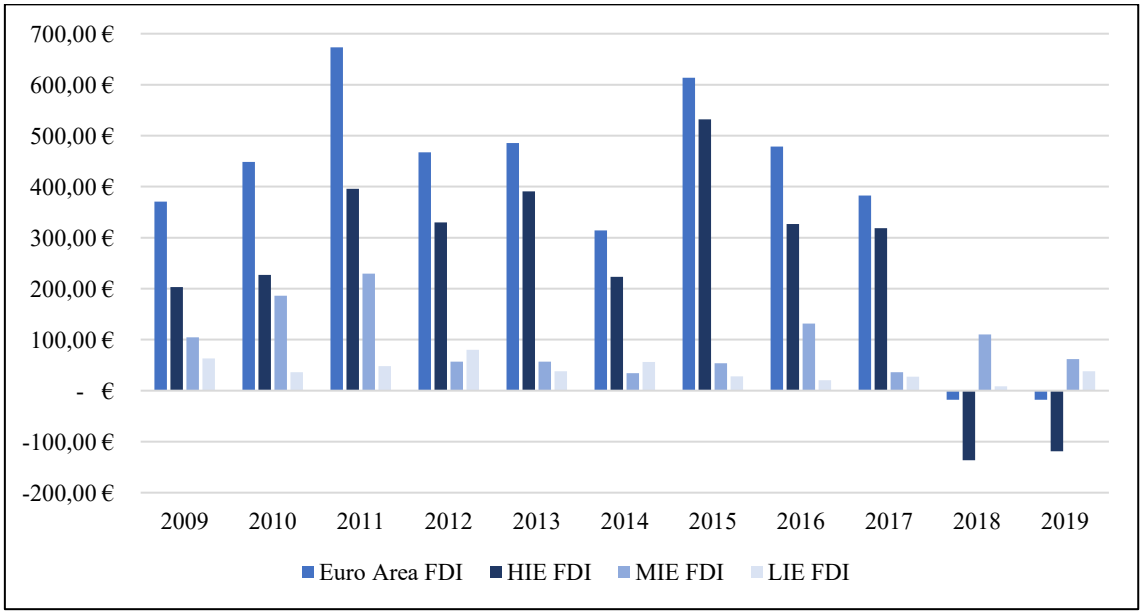

Figure 36: FDI Flow within Euro area and Comparison Groups in Billion € for the Period 2009-2019, based on data from World Bank

flow of foreign direct investments within the HIE group was 245 billion euros, peaking at 532 billion euros in 2015 and reaching its lowest level at -136 billion euros in 2018. For the years 2009–2011, 2016 and 2018–2019 the countries in the MIE group experienced a relatively high level of foreign direct investment, although this was quite low during the years 2012–2015 and 2017. The average flow of foreign direct investments within the MIE group was 97 billion euros, with a peak of 230 billion euros in 2011 and a trough of 34.2 billion euros in 2014. For the years 2009–2011, 2013 and 2015–2019 the countries in the LIE group attracted the lowest positive flow of foreign direct investments in the Euro area, with an average of 40 billion euros, a peak at 80 billion euros in 2012, and a trough of 8.37 billion euros in 2018. Overall, however, only the countries in the HIE group generated a negative flow of foreign direct investments, and only for a small part of the observation period.

To conclude, the Euro area and Japan were overall net exporters of goods, and the United States and the United Kingdom were net importers. The main drivers for exports within

the Euro area were, on average, the countries in the HIE group, although the countries in the MIE and LIE groups were on average net exporters for the period 2009–2012. Regarding foreign direct investments, the Euro area attracted foreign direct investment at a high level for the period 2009—2017, although in the last two years of the observation period it experienced a negative flow. The United States attracted a high level of foreign direct investment throughout the observation period. The United Kingdom and Japan also attracted a positive investment flow throughout the period, although this was lower than in the United States. The countries of the HIE group were the main drivers for foreign direct investments within the Euro area for most of the period, apart from the last two years. Consequently, the Euro area was the only market that experienced a negative flow of foreign direct investments among the banking markets, underscoring once again the heterogenicity within the Euro area.

3.2.4. Macroeconomic Comparison of the Banking Markets

To conduct an overall macroeconomic comparison and assessment of the banking markets, the average of the previous main key figures from the period 2009–2020 is displayed in Table 8. Regarding GDP per capita, only the United States with 45,250 euros achieved a higher value on average than the Euro area with a GDP per capita of 31,126 euros. This meant that the GDP per capita in the US was, on average, 1.5 times higher than in the Euro area. The GDP per capita of the UK and Japan was similar to the Euro area level. Within the Euro area, heterogeneity between the groups is again observable. The GDP per capita in the HIE group of 38,126 euros was roughly 2.3 times higher than in the LIE group with 16,764 euros. Hence, the difference between the GDP per capita of the United States and the HIE group was much smaller than between the United States and the Euro area as a whole. The average unemployment rate in the Euro area was10%, the highest among the banking markets, and 2.5 times higher than the average unemployment rate in Japan, at 4%, which the lowest value among the banking markets. Again, heterogeneity in the Euro area is observable, as the average unemployment of the HIE group, at 5%, was at a similar level as in Japan, while the average unemployment rates of the MIE and LIE groups exceeded the average of the Euro area by 2% and 4%, respectively.

Average for 2009-2020	**Euro area** *EA*	*HIE*	*MIE*	*LIE*	**US**	**UK**	**Japan**
GDP per Capita	31,126 €	38,370 €	28,983 €	16,764 €	45,250 €	30,198 €	29,369 €
Unemployment	10%	5%	12%	14%	7%	6%	4%
Price Level	100%	104%	101%	82%	101%	115%	115%
Inflation Rate	1.13%	1.22%	1.06%	1.03%	1.55%	1.99%	0.27%
Real Interest Rate	1.03%	0.07%	1.29%	4.27%	0.80%	0.06%	0.22%
Current Account[58]	177 bn €	*149 bn €*	*- 3 bn €*	*- 6 bn €*	- 343 bn €	- 84 bn €	114 bn €

Table 7: Overall Macroeconomic Comparison of the Banking Markets for the Period 2009–2020, Based on Data from ECB, Eurostat, FRED, OECD, World Bank

Furthermore, the average price level in the US was similar to the average price level in the Euro area, while Japan and the UK exceeded it by 15%. Within the Euro area, prices in the LIE group were, on average, 18% lower than in the Euro area as a whole. As described in the previous sections, all the central banks set an inflation target of 2% for the observed period. On average, this target was only reached by the United Kingdom, while the Euro area experienced an average of 1.13%. Deviation within the Euro area was between 0.09% in the HIE group and -0.1% in the LIE group. Thus, this deviation in the Euro area was not as great as with other key figures. In terms of real interest rates paid on 10-year governmental bonds, the Euro area had, on average, the highest rate at 1.03%, while the UK had the lowest at 0.06%. The main driver for the high interest rate within the Euro area itself was the LIE group, with an average real interest rate on 10-year governmental bonds of 4.27%, which was 4.20% higher than the average real interest rate on 10-year governmental bonds in the HIE group at 0.07%. This again indicates the economic heterogeneity of the countries within the Euro area. In terms of trade, the Euro area had, on average, the highest positive current account – 177 billion euros – among the banking markets. This meant that, together with Japan, it was a net exporter, while the other two banking markets were net importers. The average current account weighted by the GDP of the countries within the HIE group was 149 billion euros. Thus, the countries in this group were, on average, net exporters, while the countries in the MIE and LIE groups had a negative current account, on average -3 and -6 billion euros, respectively.

[58]Current Account for HIE, MIE and LIE group displays average current account of countries within comparison group, not total current account for comparison group.

Hence, heterogeneity among the countries in the Euro area can be observed in terms of trade as well.

The comparison shows that the Euro area is a leading banking market in terms of GDP per capita, price level, and current account, and that the countries in the HIE group are largely responsible for these positive figures. However, in terms of unemployment, inflation, and real interest rates, the Euro area lags behind the other banking markets, and these negative figures are mainly caused by countries in the MIE and LIE groups. Consequently, the question is: how can the banking sector of the Euro area help to ease this economic heterogeneity and support the economic performance of the MIE and LIE countries so that it converges with the economic performance of the HIE countries?

3.3. Analysis of the Banking Sectors

Besides macroeconomic key figures, the analysis of the banking sector using specific key figures is important to achieve an overarching picture and a comprehensive assessment. This analysis delves into the heart of the financial market framework, as it concerns capital providers, financial intermediaries / banks and capital providers. Firstly, key figures describing the organizational structure of the banking sectors are looked at. This is followed by key figures describing service delivery within the banking sectors. Regarding the organizational structure of the banking sectors, the total number of banks, the number of banks in relation to population size, the total number of employees, and the share of employees in the banking sector relative to the total labour force are reviewed. Then, the total number of bank branches and the number of branches in relation to the population as a whole, together with the total number of ATMs and their density, are analysed. Following this, the use of online banking is examined. The key figures regarding the organizational size of the bank sector can be assigned solely to the financial intermediaries / banks in the financial framework. Regarding financial structure, the total amount of deposits and credit, the bank asset to GDP ratio, and the bank asset to capital market ratio are analyzed. The key figures of bank assets to GDP ratio can be placed with financial intermediaries / banks in the financial market framework, while the amount of deposits can be placed with both capital providers and financial intermediaries / banks, and the amount of credit placed with capital borrowers and financial intermediaries / banks. Finally, to assess the financial stability of the banking sectors, the Z-scores are examined using the Herfindahl-Hirschman Index. The key figures regarding financial stability can be primarily placed with financial intermediaries / banks in the financial market

framework and secondarily with the state, as the state as regulator has an interest in a stable banking sector. However, taking a broader view, the following key figures affect all the surrounding entities in the financial market framework, as they are all connected to the financial market.

3.3.1. Organizational Structure of the Banking Sectors

To calculate the number of banks, different data sources and institutions are used. Regarding the Euro area and the United Kingdom, the reported number of credit institutes from the ECB is used, while for Japan and the United States, the number of insured institutes with the Deposit Insurance Company of Japan (DICJ) and the Federal Deposit Insurance Company (FDIC), respectively, are used. Figure 37 displays the total number of banks within the banking markets for the period 2009–2020.

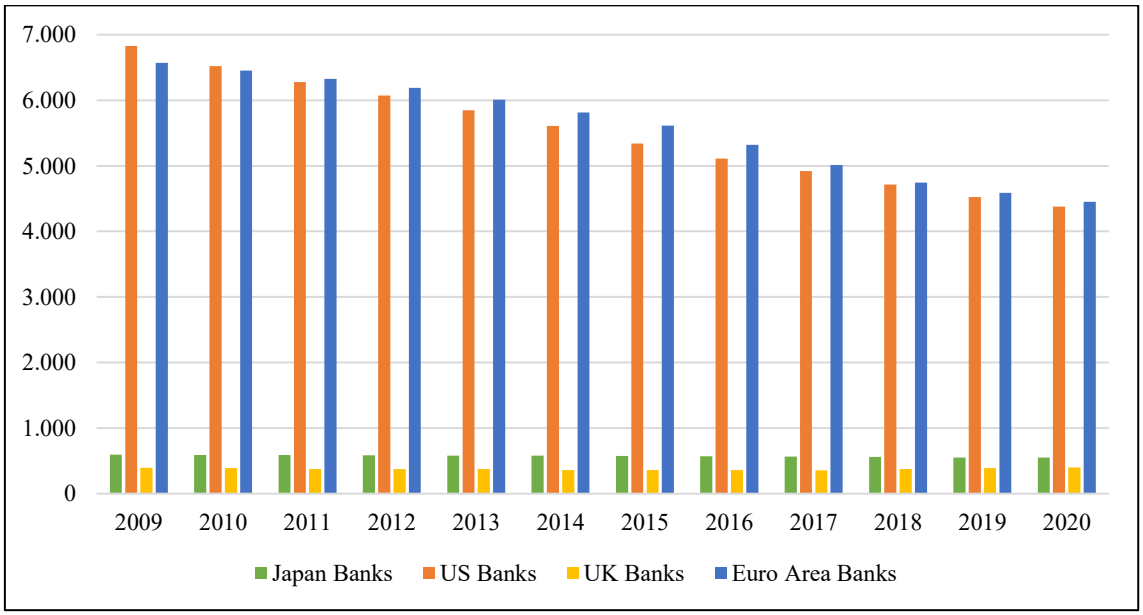

Figure 37: Number of Registered Banks Within the Banking Markets for the Period 2009–2020, Based on Data from the DICJ, ECB and FDIC

It is observable that the total number of banks declined in the Euro area and the United States, while the total number of banks in Japan and the United Kingdom was similar and stayed at a constant level. On average, the Euro area had 5,591 banks during the period observed, peaking at 6,568 in 2009 and falling to 4,452 in 2020. This meant a decrease in the number of banks in the Euro area of 32.2%, with a CAGR of -2.6%. Overall, the euro banking area, in terms of the total number of banks, was the largest in the banking sector. The United States followed the Euro area closely, with an average of 5,511 banks. The highest number of banks in the United States was reached with 6,829 institutes in

2009 and the lowest number with 4,377 in 2020 – a decrease 35.9%, with a CAGR of -3%. However, it could not be ascertained from the data whether this decrease was caused by mergers, acquisitions or insolvencies. Unlike the Euro area and the United States, the number of banks in Japan only slightly decreased, while the number in the United Kingdom remained constant throughout the observation period. Regarding both of the latter banking markets, Japan's banking sector was the biggest in terms of the total number of banks, with an average of 575 registered banks that peaked at 595 banks in 2009 and fell to 550 banks in 2020. Consequently, Japan observed a decrease in the number of banks of 7.6% with a CAGR of -0.6%. The United Kingdom had on average 376 banks during the period as a whole, with a high of 401 banks in 2020 and a low of 355 banks in 2017. Starting with 396 banks, the United Kingdom was the only banking market to see an increase in the number of banks of 1.3% with a CAGR of 0.1% in the observation period. Within the Euro area, the HIE group had the highest number of banks, while the LIE group of countries had the lowest number – having only a fraction of the total number of registered banks within the Euro area, as shown in Figure 38.

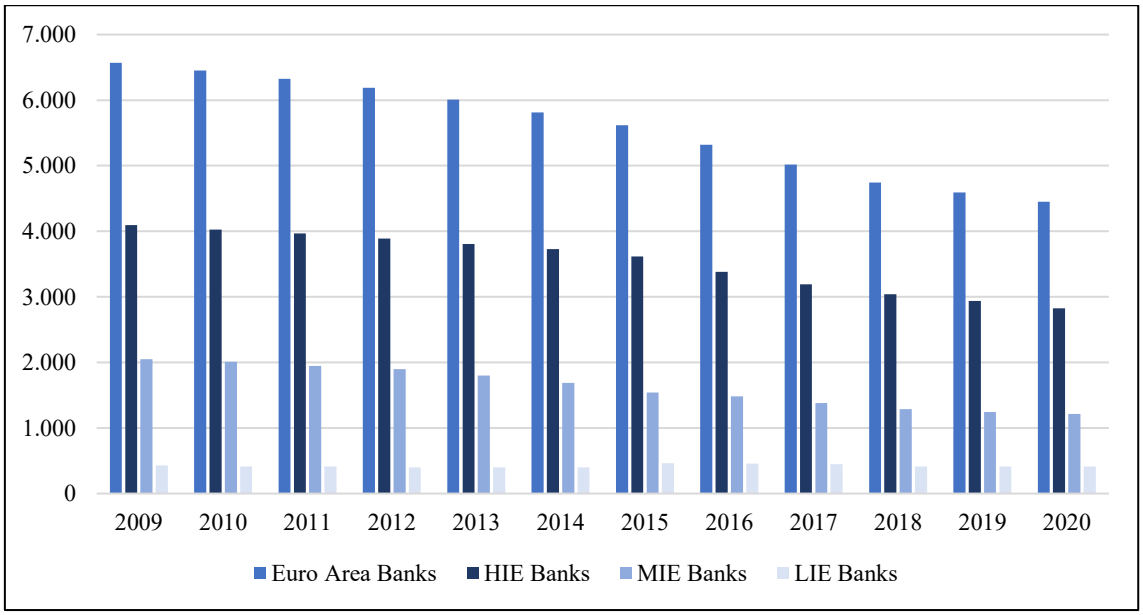

Figure 38: Number of Registered Banks Within Euro area and Comparison Groups for the Period 2009–2020, Based on Data from ECB

There were an average of 3,542 banks over the observation period in the countries of the HIE group, making up roughly two-thirds of the number of banks within the Euro area. The highest numbers occurred in Austria and Germany, with an average of 688 and 1,789, respectively. The highest number of banks (4,094) occurred in 2009 and the lowest (2,826) in 2020. Over the period, the HIE group saw a decrease of 30% with a CAGR of

2.6% in its total number of registered banks. The number of banks in the MIE countries was roughly half of the number in the countries of the HIE group, with an average of 1,628 banks during the observation period. Like the HIE group, the MIE group had the most banks (2,047) in 2009 and the fewest (1,213) in 2020. This was a decrease of 40.7% with a CAGR of 3.4%. Unlike the HIE and MIE groups, the number of banks in the LIE countries stayed at a constant level throughout the observation period – largely because the Baltic countries became a part of this group during this period. The average number of banks in the LIE during this period was 422. This peaked at 460 banks in 2015 and fell to a trough of 399 banks in 2013. Overall, the LIE group had 427 banks in 2009 and 413 banks in 2020, meaning a slight decrease of 3.3% with a CAGR of 0.3%, the lowest decrease in the comparable groups. In total, the HIE group of countries had 63% of the banks in the Euro area, the MIE group 29%, and the LIE group 8%.

The total number of banks, however, cannot be used as the only indicator of the size of a banking sector, as it does not incorporate the total size of the population and, thus, can lead to a misinterpretation. Hence, the number of banks needs to be measured in relation to the population as well. For this purpose, the number of banks per million capita is used, as shown in Figure 39.

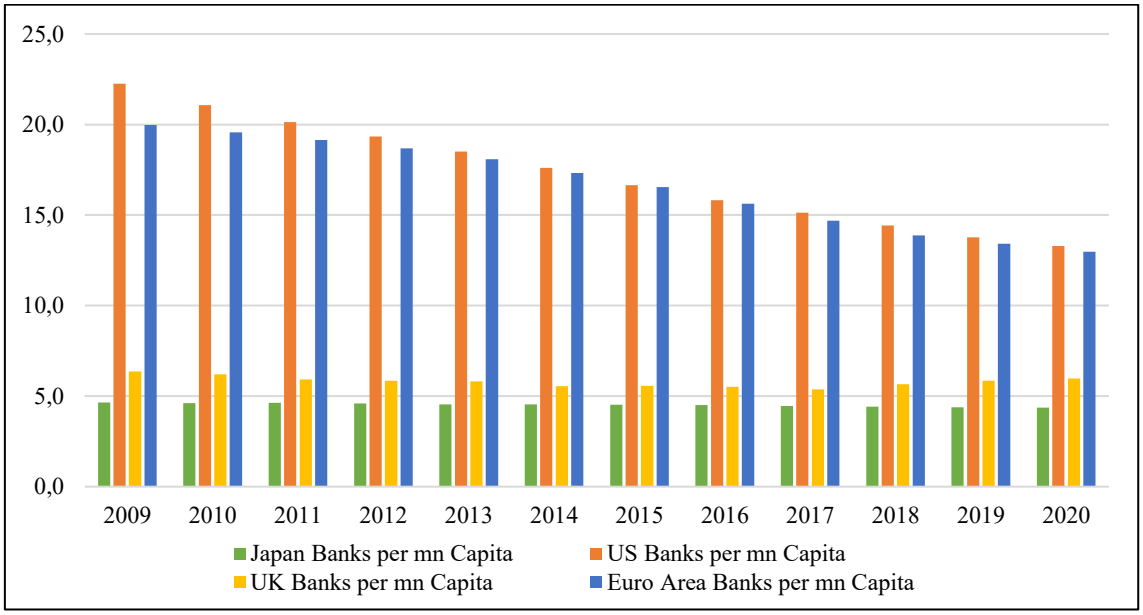

Figure 39: Number of Banks per Million Capita in the Banking Markets in the Period 2009–2020, Based on Data from the DICJ, FDIC, ECB, and World Bank

Again, the Euro area and the United States were the largest banking sectors regarding banks per million capita, and both banking sectors saw a decrease in the number of banks per capita within the observation period. Unlike Figure 38, which shows the total number

of banks, in Figure 39, the banking sector of the United States was slightly larger than the banking sector of the Euro area in terms of banks per million capita. On average, the United States had 17.3 banks per million capita, while the Euro area had an average of 16.7 banks per million capita. Furthermore, the number of banks per million capita in the United States decreased from 22.3 per mn capita in 2009 to 13.3 per mn capita in 2020, and in the Euro area, it decreased from 20 per mn capita in 2009 to 13 per mn capita in 2020. Thus, there was a decrease of 40.3% (CAGR of 3.4%) in the US and a decrease of 35% (CAGR of 2.9%) in the Euro area during the observation period.

In terms of the number of banks per capita, the banking sector of the United Kingdom was larger than the banking sector of Japan, which again presents a different picture than simply calculating the total number of banks within the sectors. On average, the number of banks per million capita in the United Kingdom was 5.8, peaking at 6.4 in 2009 and falling to a trough of 5.4 in 2017. Despite an increase of 6 banks per million capita in 2020, the United Kingdom observed an overall decrease of 6.2% (CAGR of 0.5%). The Japanese banking sector was the smallest among the banking markets, with an average of 4.5 banks per million capita in the observation period, ranging from 4.4 in the period 2018–2020 to 4.6 in the period 2009–2013. This meant a decrease of 5.9% (CAGR of 0.5%) throughout the period, meaning that both Japan and the United Kingdom observed a similar dynamic. Overall, the banking sectors of the United States and the Euro area were much bigger in terms of the number of banks than the banking sectors of the United Kingdom and Japan. However, the Euro area and the United States observed a larger decrease in the absolute and relative number of banks than the United Kingdom and Japan.

Within the Euro area, large differences between the countries in the various groups are once again apparent, as shown in Figure 40. The HIE group had by far the largest number of banks per million capita, with an average of 30, which was even higher than the number of banks per capita in the United States. Nevertheless, the number of banks per million capita decreased from 34.9 in 2009 to 23.4 in 2020 – a drop of 33% (CAGR of 2.8%). However, countries such as Luxembourg (256 banks per million capita), Ireland (90.8), and Austria (80.1) kept the numbers relatively high. Unlike when calculating the total number of banks, the banking sector of the LIE group was larger than the banking sector of the MIE group when calculating the number of banks per million capita. On average, the LIE group had 13.4 banks per million capita, peaking at 15.2 in 2009 and falling to a

trough of 12.2 in the period 2019–2020, meaning a decrease of 19.2% (CAGR of 1.6%) in the observation period.

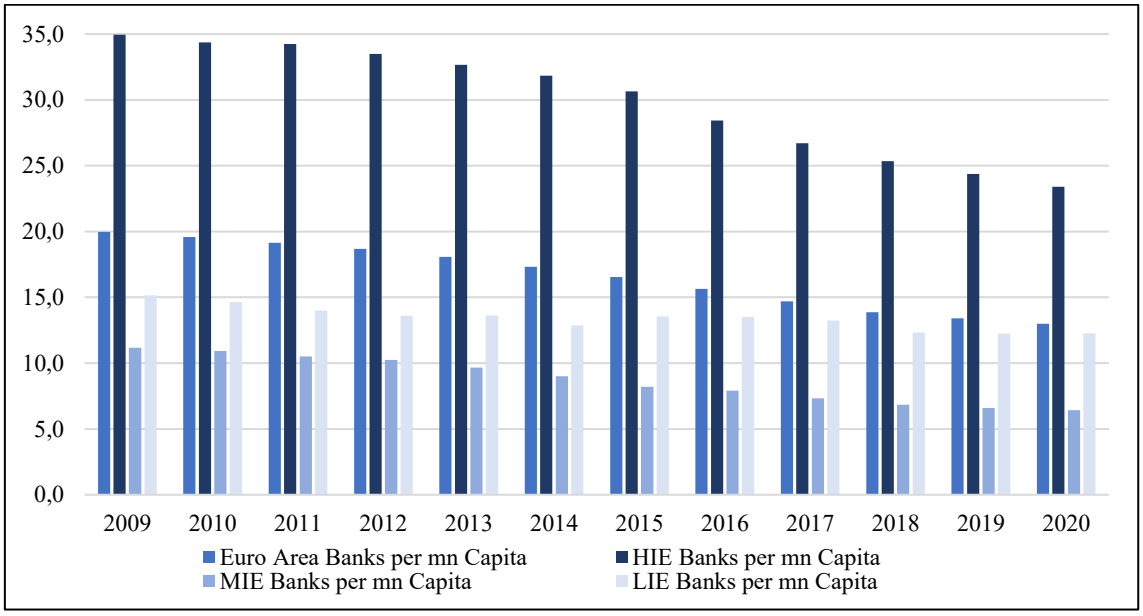

Figure 40: Number of Banks per Million Capita in the Euro area and its Comparable Groups in the Period 2009–2020, Based on Data from the ECB and World Bank

The MIE group had the smallest banking within the Euro area, with an average of 8.7 per mn capita, meaning it was closer in size to the banking sectors of the United Kingdom and Japan than the Euro area as a whole. Furthermore, the number of banks per million capita for the MIE group ranged from 6.4 in 2020 to 11.2 in 2009 – a decrease of 41% (CAGR of 3.5%), which was similar to the decrease in the United States.

In addition to calculating the number of banks in a banking sector, size can also be determined by the number of employees in a banking sector, as shown in Figure 41. The Euro area has the most employees in its banking sector, with an average of 2.01 million employees throughout the observation period. The number ranged from 1.82 million in 2020 to 2.20 million in 2009 – a decrease of 17% (CAGR of 1.4%). This decrease, however, was not as big as the decrease in the number of banks, supporting the hypothesis that the Euro area banking sector was consolidating. Unlike in the Euro area, the number of employees in the banking sector in the United States increased slightly, with an average of 1.93 million employees during this period. The number of employees fluctuated slightly, with 1.89 million in 2009, 1.96 million in 2012, and 1.94 million in 2020. Nevertheless, the number of employees in the banking sector of the US increased by 2.6% (CAGR of 0.2%), which paints a different picture than simply calculating the number of banks,

which decreased by 35.9% (CAGR of 3%). This also indicates consolidation activities within the banking sector of the United States.

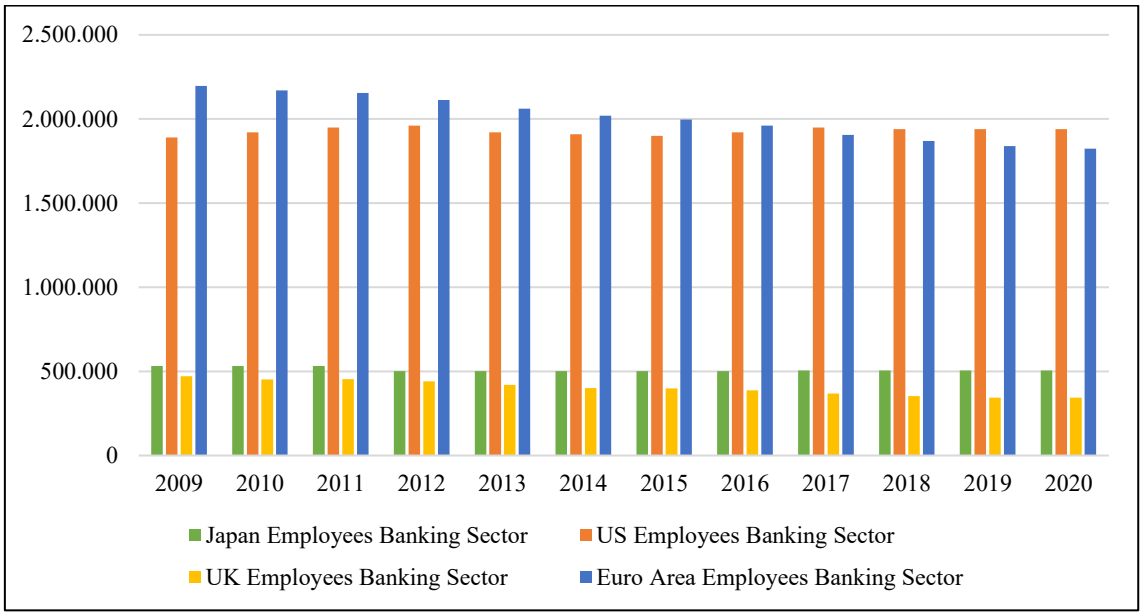

Figure 41: Number of Employees in the Banking Sector of the Banking Markets, based on data from ECB, FDIC, ONS and Statistic Bureau of Japan[59]

There were far fewer employees in the banking sectors of Japan and the United Kingdom than in the banking sectors of the Euro area and the United States throughout the period. The Japanese banking sector had an average of 509,000 employees throughout the period, peaking at 531,000 employees in the period 2009–2011, and falling to a low of 501,000 employees in the period 2012–2016. Ending the period with 506.00 employees, Japan saw an overall decrease of 4.7% (CAGR of 0.4%). In terms of total employees, the United Kingdom had the fewest among the banking markets, with an average of 402,000 throughout the observation period. The number fell from 471,000 in 2009 to 343,000 in 2020 – a decrease of 27.1% (CAGR of 0.4%). This trend was contrary to the small increase in the total number of banks in the United Kingdom, again indicating that the UK's banking sector was rationalized during the observation period.

[59] Estimation of number of employees for Japan in the period 2009-2020 based on data from Statistic Bureau of Japan and International Labor Office, as data for whole financial sector is only available for the years 2007, 2012 and 2017. Furthermore, the share of employees within the banking sector with 30,1% 2012 is assumed for all years, as it is only available for the year. The number of employees in the banking sector of the United Kingdom is estimated for the year 2020 based on data from ECB and ONS.

Within the Euro area, the largest banking sector in terms of number of employees was the banking sector of the MIE group, as displayed in Figure 42. On average, the MIE group of countries had 991,000 employees in the period 2009–2020, peaking at 1.09 million employees in 2009 and falling to a low of 911,000 employees in 2020. This was a decrease of 16.2% (CAGR of 1.3%), which was similar to the Euro area average.

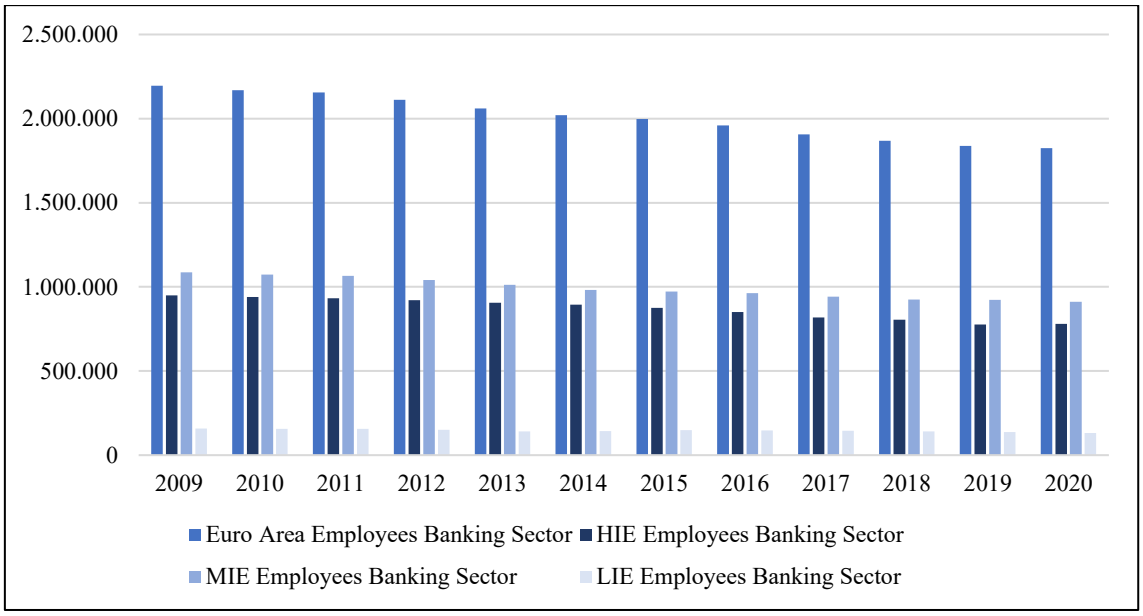

Figure 42: Number of Employees in the Banking Sector of the Euro area and its Comparable Groups, Based on Data from the ECB

The size of the banking sector of the HIE group, in terms of employees, was also close to the MIE group and the Euro area as a whole. The HIE group of countries had an average 871,000 employees, peaking at 950,000 employees in 2009 and falling to a low of 777,000 in 2019. Ending the period with 780,000 employees, the HIE group experienced a decrease in employee numbers in the banking sector of 17.9% (CAGR of 1.5%). The number of employees in the banking sector of the LIE group of countries was the smallest, with an average of 147,000, and fell from 159,000 in 2009 to 132,335 employees in 2020 – a decrease of 16.5% (CAGR of 1.4%), which was close to the Euro area average.

As the banking markets and the comparable groups in the Euro area differ in terms of population and labour force, a relative measure is necessary to compare the banking markets in terms of employment. For this purpose, it is interesting to consider the share of the total labour force that worked in banking in the period 2009–2020, as shown in Figure 43. At the beginning of the period, from 2009–2012, the United Kingdom had the highest share, while for the period 2013–2016, the Euro area had the highest, although this decreased, and, from 2017 on, the United States had the highest share. On average, however,

the Euro area had the highest share of banking sector employees relative to the labour force at 1.24%, lying between 1.11% in the period 2019–2020 and 1.39% in 2009 – an increase of 20% (CAGR of 1.7%), 3% higher than the total decrease of employees (17%).

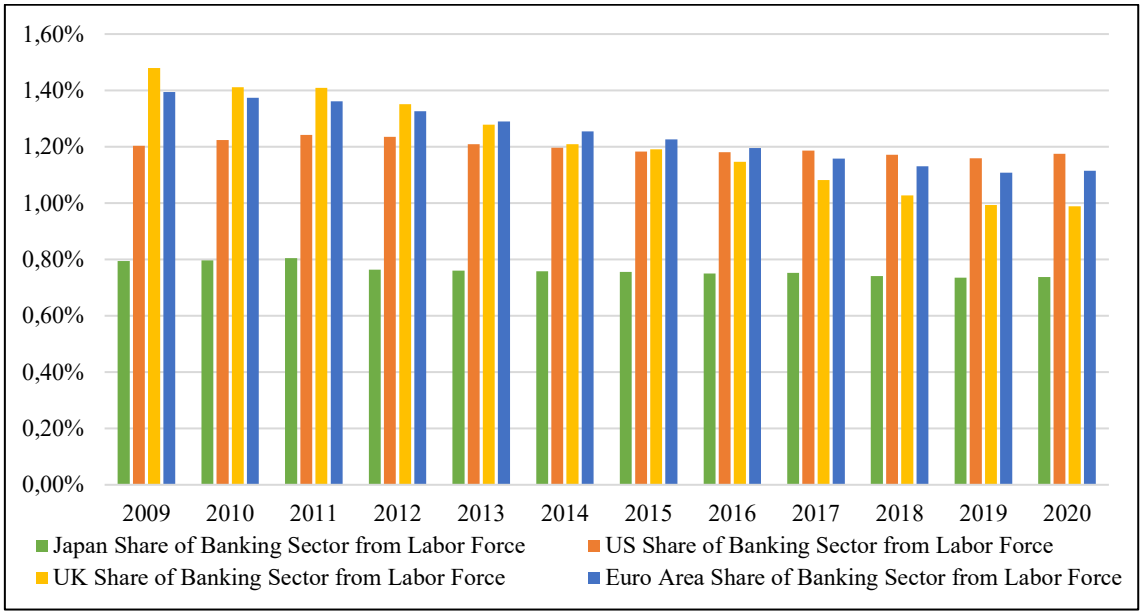

Figure 43: Share of Employees in the Banking Sector Relative to the Total Labour Force Based on Data from ECB, FDIC, ONS, Statistic Bureau of Japan and World Bank[60]

The Euro area was closely followed by the United Kingdom, with an average of 1.21%, and the United States with an average of 1.2%. The United Kingdom, observed the highest share at 1.48% in 2009, which, however, fell to 0.99% in the period 2019–2020, – a decrease of 33.2% (CAGR of 2.8%), the highest decrease among the banking markets. Unlike the Euro area and the United Kingdom, the United States only observed a decrease of 2.4% (CAGR of 0.2%) in its banking sector share, peaking at 1.24% in the period 2011–2012 and falling to a low of 1.16% in 2019. Japan observes the smallest banking sector share relative to its labour force, with an average of 0.76%, lying between 0.74% in the period 2018–2020 and 0.80% in the period 2010–2011. Within the observation period as a whole, the share decreased by 7.2% (CAGR of 0.6%). Interestingly, the decrease in the share of banking employees relative to the total work force in all the markets

[60] Estimation of share of employees for Japan in the period 2009-2020 based on data from Statistic Bureau of Japan and International Labor Office, as data for whole financial sector is only available for the years 2007, 2012 and 2017. Furthermore, the share of employees within the banking sector with 30,1% is assumed for all years, as it is only available for the year 2012. The share of employees in the banking sector of the United Kingdom is estimated for the year 2020 based on data from ECB and ONS.

was less than the decrease in the overall total number of employees within the banking sectors.

Within the Euro area, the HIE group had the highest share of employees working in the banking sector relative to its labour force, followed by the MIE and the LIE groups, as shown in Figure 44.

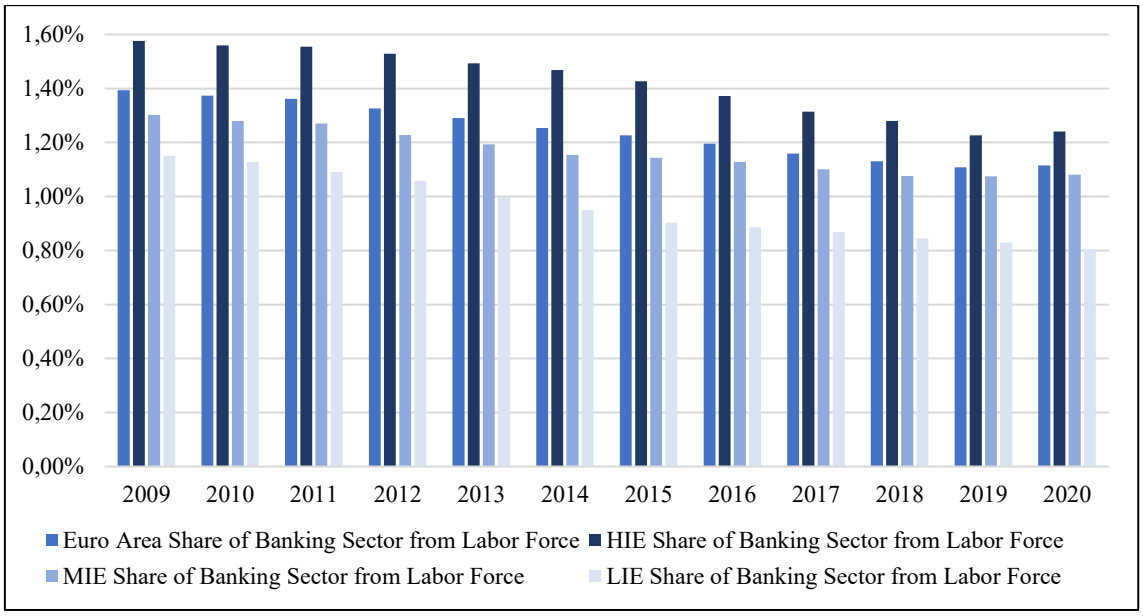

Figure 44: Share of Employees in the Banking Sector Relative to the Total Labour Force of the Euro area and its Comparable Groups, Based on Data from the ECB and World Bank

With an average share of 1.42%, the LIE group had the highest share, well above the Euro area average of 1.24%. The HIE group's banking sector was 1.58% in 2009 and 1.23% in 2019, ending at 1.24% in 2020 – a decrease of 21.2% (CAGR of 1.8%). The main drivers were Germany, with an average of 1.48%, Austria, with an average of 1.68%, and Luxembourg, with an average of 9.64%. Making the banking sector of the HIE group of countries the largest sector in terms of employees relative to the labour force as a whole. The average share of employees in the banking sector relative to the total labour force in the MIE group of countries was 1.17%, slightly below the Euro area average. This fell from 1.30% in 2009 to 1.08% in the period 2018–2020, – a decrease of -17% (CAGR of 1.4%) over the period as a whole. The LIE group had the smallest share of employees in the banking sector relative to the total labour force, with an average of 0.96%. Thus, it was closer to the average share of Japan than the average share of the Euro area. This share was 1.15% in 2009 and 0.80% in 2020 – a decrease of 30.1% (CAGR of 2.5%), similar to the decrease in the United Kingdom's share.

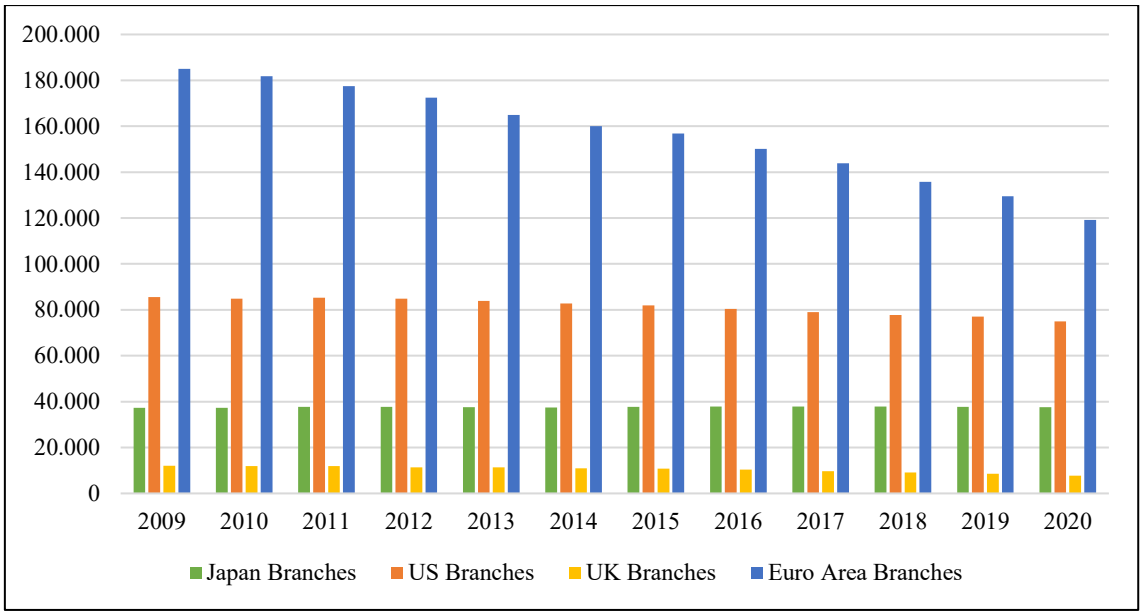

Figure 45: Number of Bank Branches in the Banking Markets for the Period 2009–2020, Based on Data from ECB, FDIC, IMF, Statistic Bureau of Japan and ONS[61]

In addition to the number of banks and the number of employees in the banking sectors, it is also interesting to consider the development of the number of bank branches in the banking sectors. This indicates how many places bank customers can interact directly with their bank and utilize financial services, such as withdrawing money, mandating transactions, or receiving advice on financial products, such as deposit accounts or loans. Figure 45 shows the total number of bank branches in the defined banking markets for the period 2009–2020. As can be seen, the Euro area had by far the largest number, with an average of 156,398 branches over the period as a whole, peaking at 184,952 in 2009 and falling to a low of 119,21 in 2020 – a decrease of 35.5% (CAGR of 3%). The United States had the second highest number of bank branches, with an average of 81,534 over the period, which was roughly half of the Euro area average. The number of branches win the United States fell from 85,566 in 2009 to 74,928 in 2020 – a decrease of 12.4% (CAGR of 1) – which was much lower than the decrease in the Euro area as a whole. Unlike the other banking markets, Japan saw a slight increase in the number of bank branches of 0.9% (CAGR of 0.1%), having 37,323 in 2009, reaching a high of 37,892 in 2016, with an average of 37,63 over the period as a whole. The United Kingdom had the fewest branches among the banking markets, with an average of only 10,476, having 12,099 in 2009 and 7,675 in 2020 – a decrease of 36.6% (CAGR of 3%). This was the

[61] Number of branches within Japan is estimated based on data from IMF and Statistic Bureau of Japan

biggest reduction in the number of banking branches among the banking markets within the observation period.

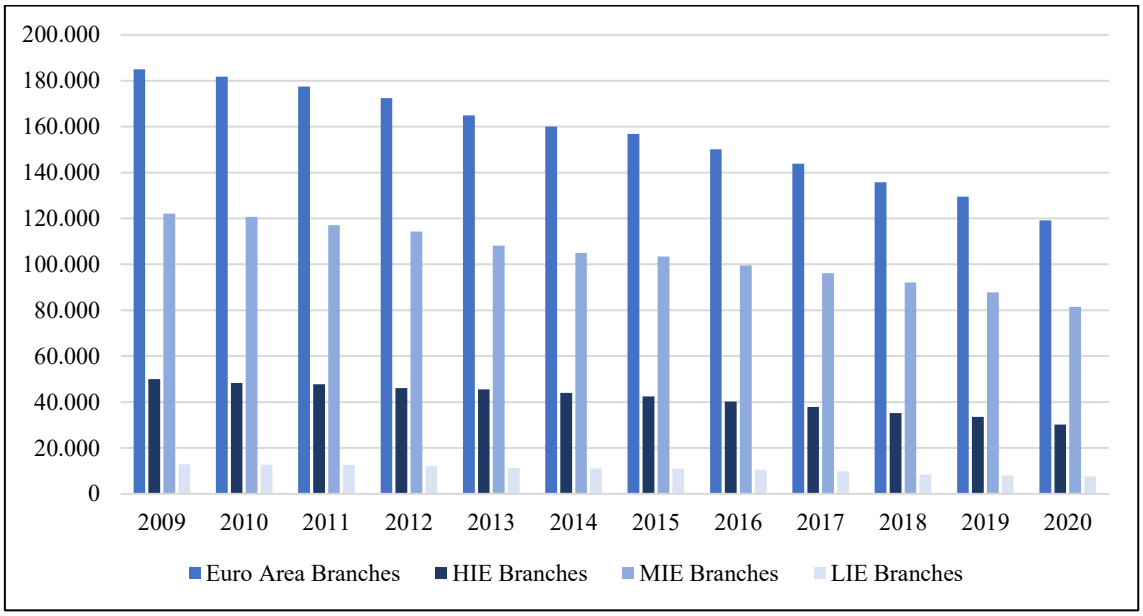

Figure 46: Number of Bank Branches within the Euro area and its Comparable Groups for the Period 2009–2020, Based on Data from the ECB

Regarding the Euro area, the MIE group of countries had the most branches, as shown in Figure 46. With an average of 81,473 branches, this was 66% of all branches in the Euro area. It had 122,123 in 2009 and 81,473 in 2020 – a decrease of 33.3% (CAGR of 2.8%) – the smallest decrease among the comparable groups. The main drivers were the territorially large countries of France, Italy, and Spain, with averages of 37,259, 29,793, and 32,708, respectively. The MIE group was followed by the HIE with an average of 41,760 branches over the period as a whole, which was similar to the number of branches in the Japanese banking sector. Germany had the most branches, with an average of 33,231 – 80% of the total number of branches within the HIE group. The number fell from 49,965 in 2009 to 30,192 in 2020 – a decrease of 39.6% (CAGR of 3.3%) and even more than the decrease observed in the United Kingdom. The LIE group had the fewest bank branches among the comparable groups, with an average of 10,653 over the period as a whole, which was similar to the number in the United Kingdom. The number of branches peaked at 12,864 in 2009 and fell to a low of 7,553 in 2020 – a decrease of 41.3% (CAGR of 3.4%) – the biggest drop among the researched subjects.

As the United Kingdom and Japan are much smaller in terms of territory and population than the United States and the Euro area, the number of branches needs to be put into relation to the population to ascertain the accessibility of banking services. Figure 47

shows the development of the number of banks per million capita in the banking markets for the period 2009–2020. It is observable that the Euro area still has by far the largest number of branches, with an average of 466 in the observation period. The number of branches per million capita in the Euro area was 563 in 2009 and 348 in 2020 – a decrease of 38.2% (CAGR of 3.2%), which was slightly higher than the decrease in the absolute number of branches.

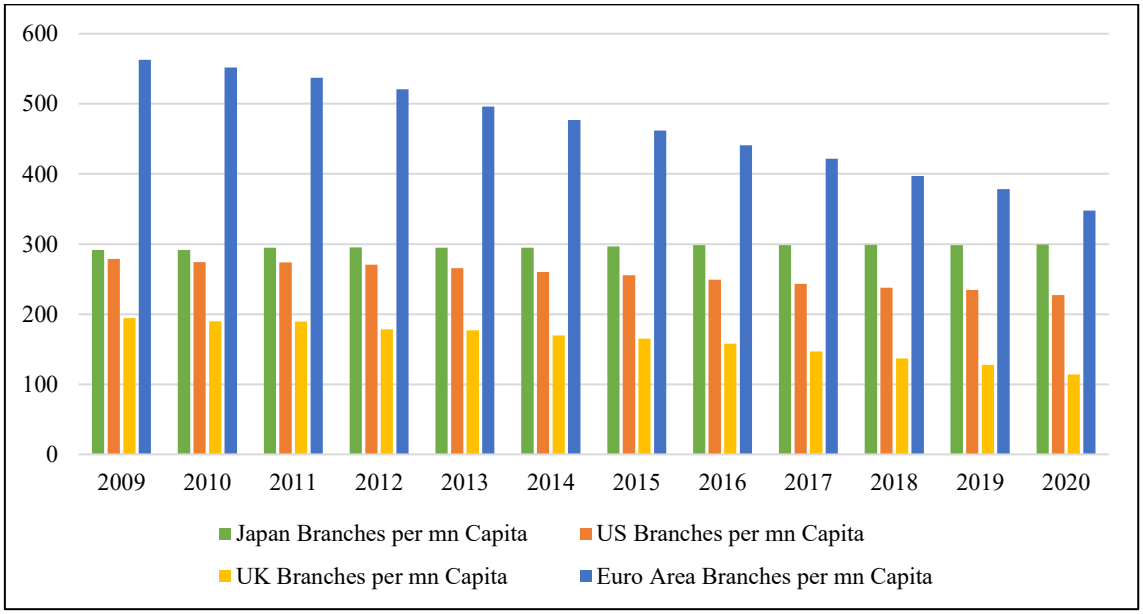

Figure 47: Number of Branches per Million Capita in the Banking Markets in the Period 2009–2020, Based on Data from ECB, FDIC, IMF, Statistic Bureau of Japan, ONS and World Bank[62]

Japan had the second highest number of branches per million capita among the banking markets, with an average of 296 branches in the observation period. This peaked at 299 branches in 2018 and 2020 and was at its lowest in the period 2009–2010, at 291. Thus, the Japanese banking sector observed an increase of 2.6% with a CAGR of 0.2% regarding branches per million capita in the observation period, while the remaining banking markets observed a two-digit decrease. Although the number of branches per million capita in the Euro area was 93% higher than in Japan in 2009, this decreased to 16% in 2020. At the beginning of the observation period, the number of branches per capita in the United States was 279, similar to the Japanese banking sector. However, over the observation period, the number of branches per million capita decreased, reaching a low of 227 branches in 2020 – a decrease of 18.5% (CAGR of 1.5%). The United States had an

[62] Number of branches within Japan is estimated based on data from IMF and Statistic Bureau of Japan

average of 256 branches per million capita over the period. In terms of branches per million capita, the United Kingdom had the fewest, with an average of 162 branches over the period. This meant that the number of branches per million capita in the Euro area was roughly three times higher than in the United Kingdom. The number of branches per million capita in the United Kingdom was 194 in 2009 and 114 in 2020. Hence, the United Kingdom observed a decrease in branches per million capita of 41.2% (CAGR of 3.4%) – the biggest decrease in the four banking markets.

Within the Euro area, the MIE group, in terms of branches per million capita, had the most branches, with an average of 558 over the period, as shown in Figure 48. This was roughly 1.5 times higher than the average number in the HIE and LIE groups. The main drivers were Spain, with an average of 701 branches, and France, with an average of 563 branches per million capita. The number of branches per million capita was 666 in 2009 and 432 in 2020 – a decrease of 35.1% (CAGR of 2.9%), which was lower than the average within the Euro area as a whole. Regarding branches per million capita, the HIE group had an average of 354 and thus followed the MIE group.

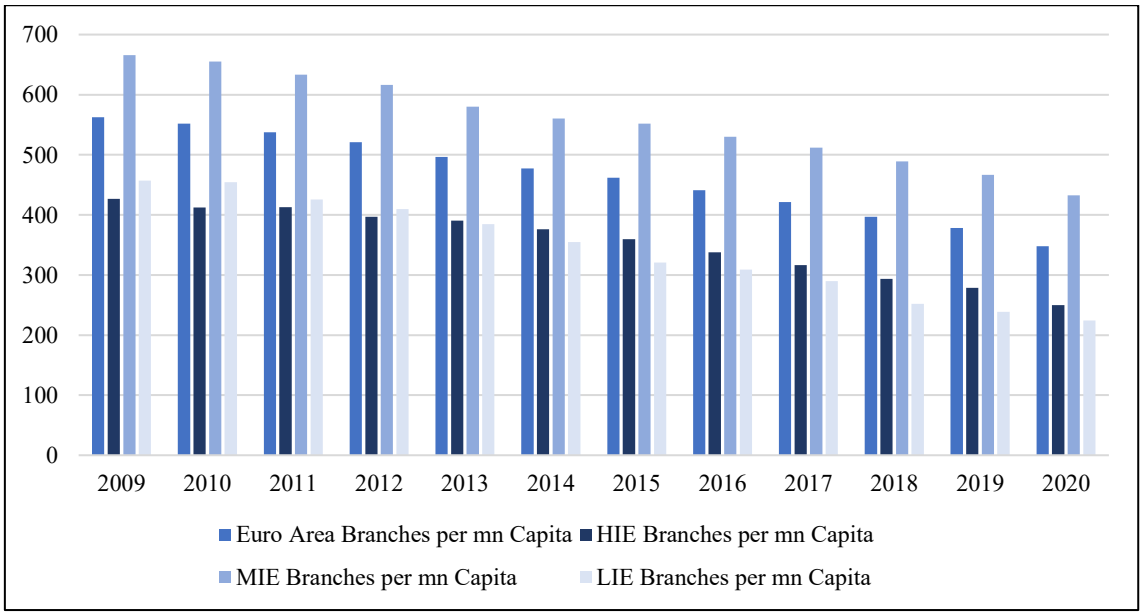

Figure 48: Number of Branches per Million Capita in the Euro area and its Comparable Groups in the Period 2009–2020, Based on Data from ECB and World Bank

The number was mainly driven by Germany, with an average of 407 branches; Luxembourg, with an average of 459 branches; and Austria, with an average of 468 branches per million capita. The number peaked at 427 branches in 2009 but decreased to 250 branches in 2020, a trend more similar to the United States than to the Euro area. This was a decrease of 41.4% (CAGR of 3.4%) over the period as a whole. In the Netherlands,

this was particularly notable, with a decrease in bank branches per million capita of 71.4% (CAGR of 6%). With an average of 343 branches per million capita over the observation period, the LIE group had the fewest branches among the comparable groups in the Euro area. Portugal and Cyprus were the main drivers in this group, with an average of 527 branches and 558 branches per million capita, respectively. The number of branches in the LIE group peaked at 457 in 2009 and was at its lowest at 224 branches in 2020, which was similar to the situation in the United States in 2020. Hence, the LIE group observed a decrease in branches per million capita of 51% (CAGR of 4.2%), which was the biggest decrease among the researched subjects. In terms of the decrease in the number of branches per million capita, Cyprus, with a decrease of 71.4%, was an extreme case, especially when compared with Slovakia, which only saw a decrease of 13.4%.

An alternative to branches in terms of providing certain financial services are automated teller machines (ATMs). ATMs are not as staff-intensive as branches and therefore tend to generate less expense. It is, nevertheless, important to describe the development of ATMs in the banking sectors as it is another important indicator. Figure 49 shows this development over the period 2009–2020. As can be seen, the United States had the most ATMs, with an average of 441,645 over the period as a whole. The numbers increased from 396,751 in 2009 to an estimated 486,877 in 2020 – an increase of 22.7% (CAGR of 1.9%).

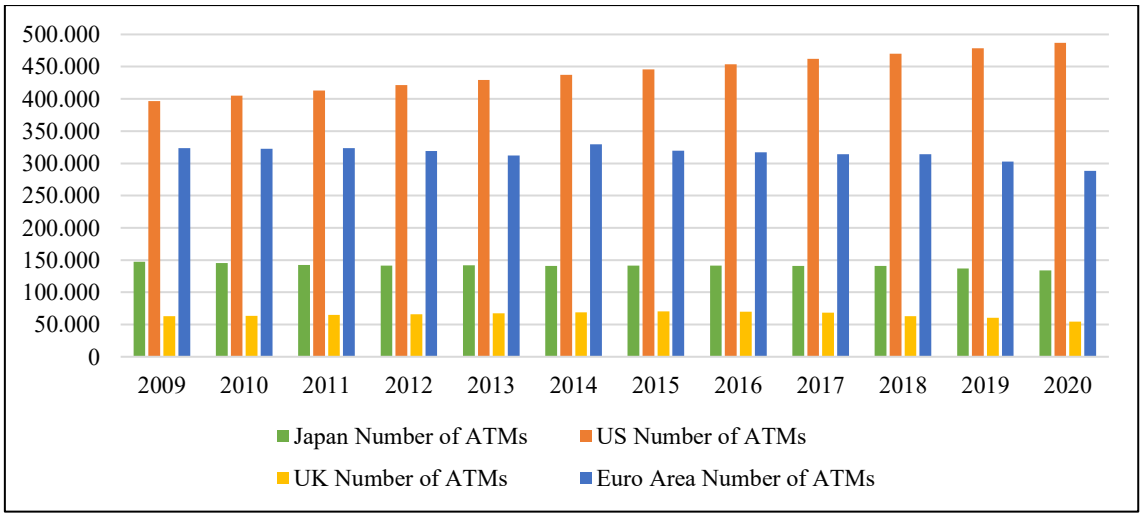

Figure 49: Number of ATMs in Banking Markets for the Period 2009–2020, Based on Data from An et al (2018), ECB, IMF, and LINK Scheme Holdings[63]

[63] Number of ATMs in the United States is estimated through extrapolation for the years 2010-2017 and 2019-2020, as data is only available for the years 2009 and 2018

Unlike the United States, the other banking markets observed a decrease in ATMs over the observation period. Nonetheless, the decrease in the number of ATMs in the Euro area and the United Kingdom was not as great as the decrease in the number of branches. The Euro area had an average of 315,536 ATMs in the observed period, peaking at 329,339 in 2014 and falling to a low of 288,266 in 2020. Overall, starting at 323.620 ATMs in 2009, the number of ATMs decreased over the period by 10.9% (a CAGR of 0.9%). There were roughly half the number of ATMs in Japan than in the Euro area, with an average of 141,26 over the observation period. During this time, the number of ATMs in Japan decreased by 8.9% with a CAGR of -0.7%, reaching a peak of 147,202 ATMs in 2009 and falling to 134,084 in 2020. The United Kingdom had the fewest ATMs, with an average of 65,131 over the observation period. Furthermore, the number decreased the most by 13.5% (a CAGR of 1.1%) – peaking at 70,588 in 2015 and falling to 54,574 in 2020 at the end of the observation period.

Figure 50 shows the development of the number of ATMs in the Euro area and its comparable groups for the period 2009–2020. The MIE group had the most ATMs among the comparable groups, with an average of 175,925 ATMs over the period as a whole, having 187,873 in 2009 and 154,365 in 2020 – a decrease of 17. 8% with a CAGR of 1.5%.

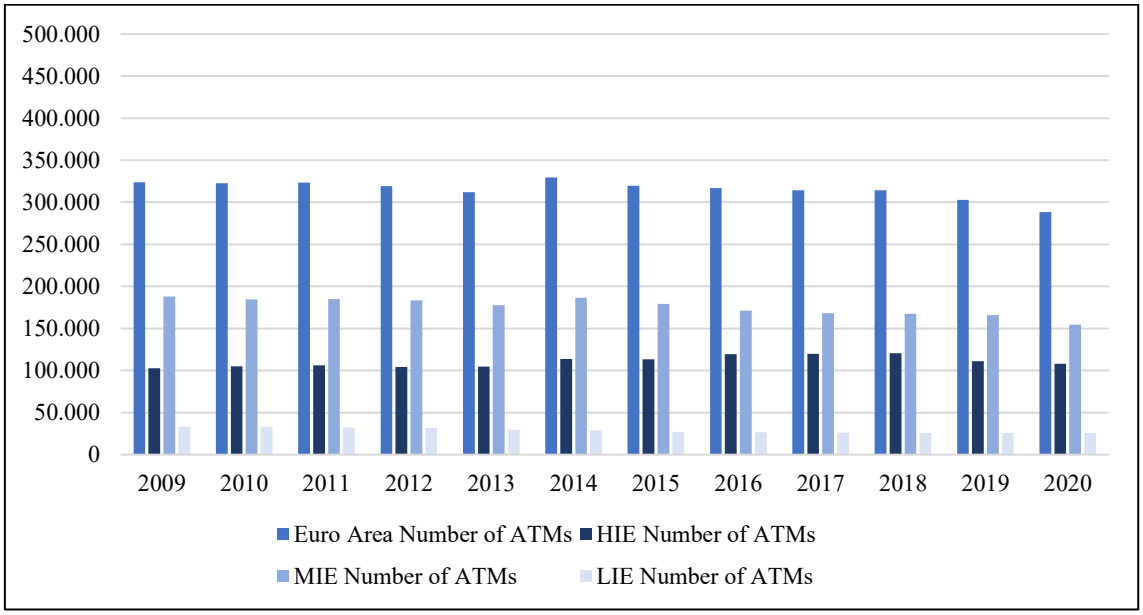

Figure 50: Number of ATMs in the Euro area and its Comparable Groups for the Period 2009–2020, Based on Data from the ECB

This was followed by the HIE group, with an average of 110,719 ATMs in the period 2009–2020, peaking at 120,673 ATMs in 2018 from a low of 102,627 in 2009. Unlike the other groups, the HIE group saw an increase in ATMs of 5.2% with a CAGR of 0.4%,

ending with 107,931 in 2020, to which Germany contributed with an increase of 10.6%, Luxembourg (30.6%), and Austria (60.8%). The LIE group had by far the fewest ATMs, with an average of 28,893 over the observation period, which is equal to 9% of ATMs within the Euro area. Over the observation period. The number decreased by 21.7% (a CAGR of 1.8%), which was the greatest drop in numbers among the researched subjects, falling from 33,144 in 2010 to 25,930 in 2020.

In terms of the number of ATMs per million capita, the United States still had the most ATMs, as shown in Figure 51. It had an average of 1,382 ATMs per million capita in the period 2009–2020. Starting at 1,293 in 2009, the numbers peaked at 1,478 in 2020 – an increase of ATMs per million capita of 14.3% with a CAGR of 1.2%, the only increase among the banking markets.

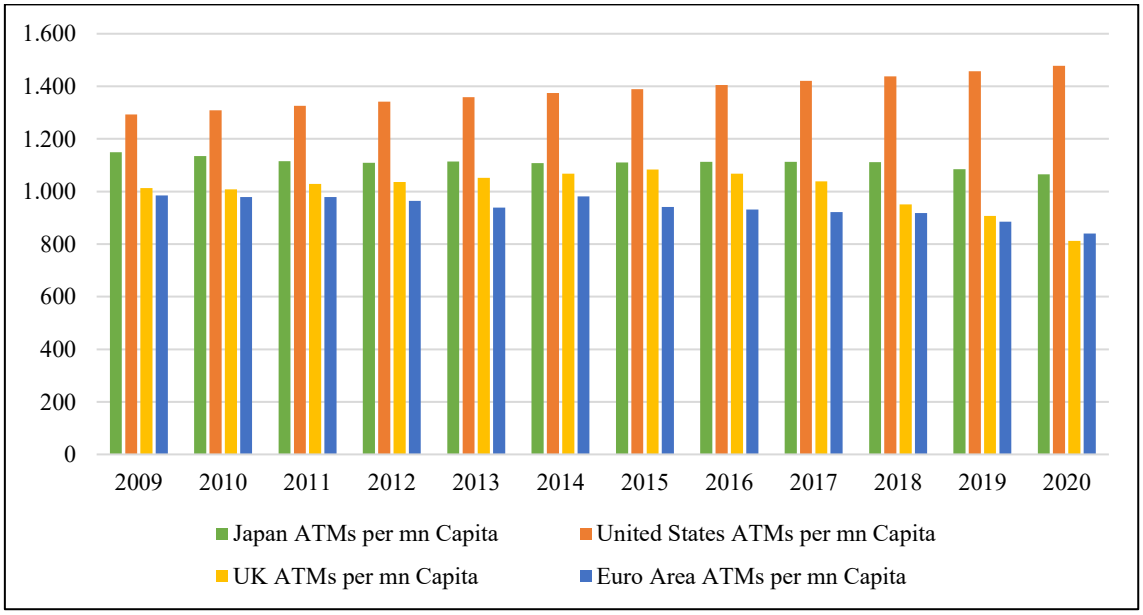

Figure 51: Number of ATMs per million Capita in Banking Markets for the Period 2009–2020, Based on Data from An et al (2018), ECB, IMF, LINK Scheme Holdings and World Banks[64]

Japan had the second highest density of ATMs, with an average of 1,111 ATMs per million capita. Nonetheless, the number decreases over the period by 7.3%, with a CAGR of 0.6%. in the observation period. Japan had the highest density of ATMs in 2009, with 1,150 ATMs per million capita, but this fell to 1,066 ATMs per million capita in 2020. The density of ATMs in the United Kingdom also decreased. There was an average of

[64] Number of ATMs in the United States is estimated through extrapolation for the years 2010-2017 and 2019-2020, as data is only available for the years 2009 and 2018

1,006 ATMs per million capita throughout the period as a whole. However, the numbers decreased from 1,084 ATMs per million capita in 2015 to 812 ATMs per million capita – a decrease of 19.9% (a CAGR of 1.7%), the biggest decrease among the banking markets. The Euro area as a whole had the lowest density of ATMs, with an average of 939 ATMs per million capita over the entire period. The numbers fell from 984 in 2009 to 840 in 2020 – a decrease of 14.6% (a CAGR of 1.2%).

At the beginning of the observation period, the LIE group had the highest density of ATMs, and the HIE group had the lowest in the Euro area. But this changed, and by the end of the period, the HIE group had the highest density of ATMs, and the LIE group had the lowest, as shown in Figure 52.

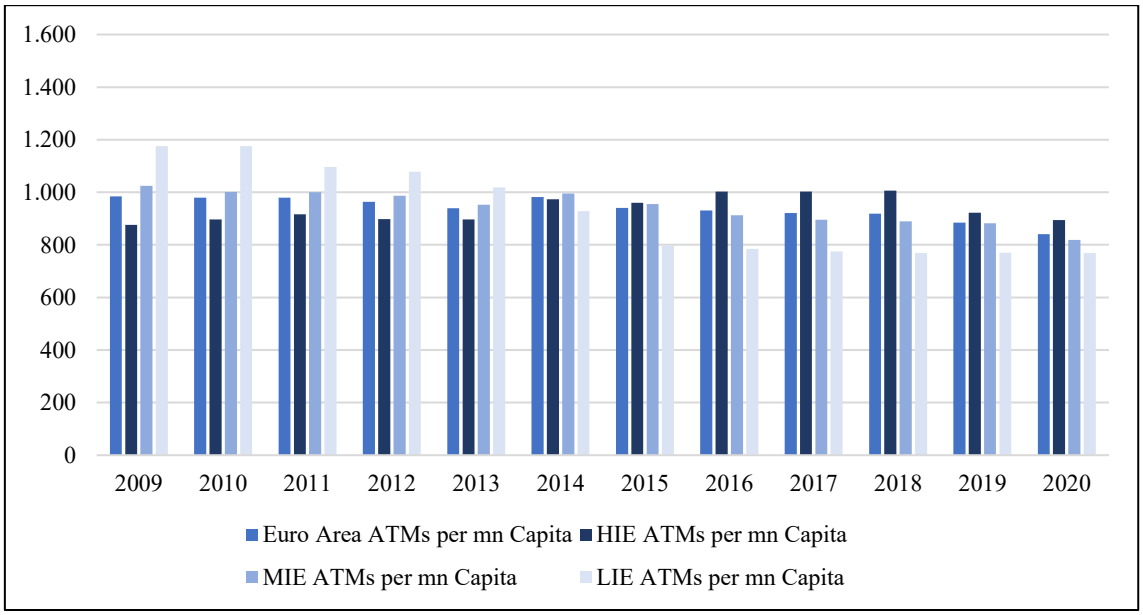

Figure 52: Number of ATMs per million Capita in the Euro area and its Comparable Groups for the Period 2009–2020, Based on Data from ECB

However, the MIE group had the highest density overall, with an average of 943 ATMs per million capita among the comparable groups. This number fell from 1,024 in 2009 to 819 in 2020 – a decrease of 20% (a CAGR of 1.7%). As such, the decrease in ATMs per million capita in the MIE group of countries was similar to the decrease in the United Kingdom. The HIE had the second highest density of ATMs among the comparable groups, with an average of 937 ATMs per million capita. The number of ATMs per million capita in this group fluctuated from 876 in 2009 to 1,006 in 2018, ending the period at 894 – an overall increase of 2% with a CAGR of 0.2%. However, it is noteworthy that the Netherlands observed a decrease in ATMs per million capita of 73%, from 515 ATMs per million capita in 2009 to 139 ATMs per million capita in 2020, which was the greatest

decrease and the lowest observed density among the countries in the banking markets and comparable groups. On average, the LIE group had the lowest density of ATMs, with 928 ATMs per million capita over the period as a whole. Portugal was the exception; with an average of 1,508 ATMs per million capita, it had the highest density of ATMs among the countries in the banking markets and comparable groups. However, the number of ATMs per million capita in the LIE group as a whole fell from 1,176 in 2009 to 769 in 2020 – a decrease of 34.6% with a CAGR of 2.9%, which was the greatest decrease in density among the researched subjects.

Another important key figure is the extent to which online banking is used. Figure 53 shows the development and usage of online banking as a percentage of the population in the banking markets that used online banking during the period 2013–2020 (2013 being the first year in which data became available in all banking markets).

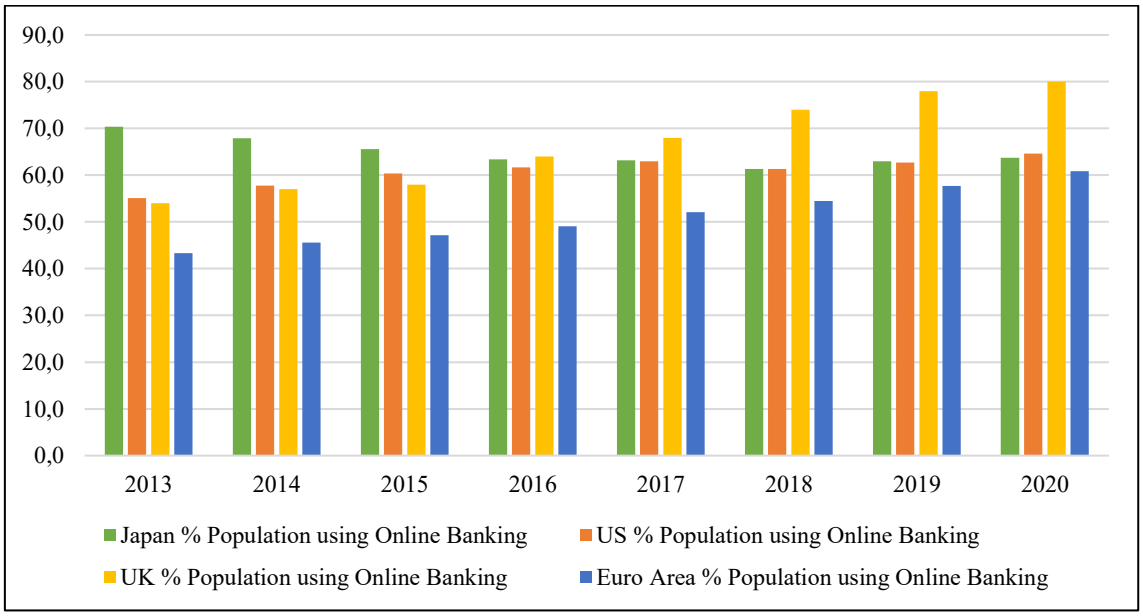

Figure 53: Percentage of Population Using Online Banking in the Banking Markets for the Period 2013–2020, Based on Data from Accenture, Eurostat, FDIC, and PR Times[65]

At the beginning of this period, Japan had the highest share of online banking users; however, this decreased, so that the United Kingdom had the highest share after 2016. Only 51.3% of the Euro area's population used online banking during this period – the smallest share in the banking markets. However, online banking in the euro increased from 43.3%

[65] For the United States, the FDIC is used as source for the period 2013-2017 and Accenture is used for the period 2018-2020. Values for the United States in the years 2014 and 2017 are estimated through extrapolation, as there is no data available.

in 2013 to 60.8% in 2020 – an increase of 40.4% and a CAGR of 5%. The United Kingdom had the highest average share, with 66.6% of its population using online banking services. Furthermore, this share steadily increased from 54% in 2013 to 80% in 2020 – an increase of 48.1% and a CAGR of 6%. This means that the United Kingdom observed the biggest increase in online banking usage among the banking markets. The United Kingdom was followed by Japan, with an average share of 64.8% of its population using online banking over the observation period as a whole. Japan had its highest share at 70.4% in 2013 but later experienced a decrease, with its lowest share of 61.3% occurring in 2018. However, by the end of the observation period, the share of online banking users in Japan increased again to 63.7%, so that the overall share only decreased by 9.5% (a CAGR of 1.2%). Nevertheless, it was the only banking market that experienced a decrease in online banking usage. An average of 60.8% of the population in the United States used online banking between 2009 and 2020. This increased as well, rising from 55.1% in 2013 to 63.7% in 20200 – an increase of 17.2% and a CAGR of 2.2%, which, however, was the smallest increase among the banking markets.

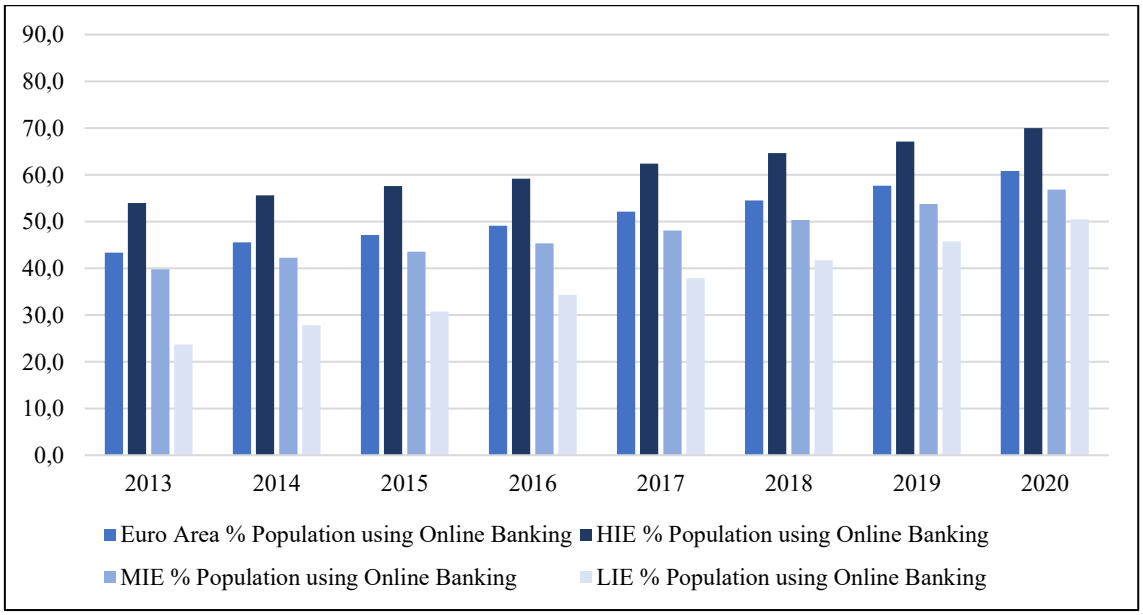

Figure 54: Percentage of Population Using Online Banking in the Euro area and its Comparable Groups for the Period 2013–2020, based on Data from Eurostat

Among the comparable groups within the Euro area, an average of 61.3% of the population of the HIE countries used online banking, as seen in Figure 54. This was the largest share among the comparable groups. Within the HIE group itself, 86.6% of the population of the Netherlands and 87.6% of the population in Finland used online banking. The total usage of online banking in the HIE group of countries was 54% in 2013 and 70% in 2020

– an increase of 29.7% with a CAGR of 3.7%. However, this was the smallest increase among the comparable groups in the Euro area. In the MIE group of counties, an average of 47.5% of its population used online banking throughout the period. However, in Italy this was only 30.6%. Nevertheless, the percentage of users overall rose from 39.8% in 2013 to 56.8% in 2020, which was an increase of 42.8% with a CAGR of 5.4%. Only an average of 36.5% of the population within the LIE group of countries used online banking between 2013 and 2020. However, this group was divided between countries with a high and low share of online banking users. For example, in Latvia and Estonia, an average of 64.1% and 78.6% of their respective populations used online banking, whereas in Cyprus and Greece, these averages were 31.1% and 22.1%, respectively. These values were among the highest and lowest values observed among the countries in the banking markets. Nevertheless, the overall share of online banking users in this group of countries increased from 23.7% in 2013 to 50.5% in 2020 – an increase of 113.2% (with a CAGR of 14.1%), the greatest increase among the researched subjects.

To conclude, in terms of organizational size, the banking markets either stagnated or shrank within the observation period. The Euro area and the United States observed both a decrease in the number of banks and the number of branches within the observation period. And while the number of employees in the banking sector in the United States changed only slightly, the number of employees in the banking sector in the Euro area decreased as well. Japan and the United Kingdom observed only minor changes in the number of banks in the observation period. However, the United Kingdom observed a strong decrease in terms of employees in the banking sector and the number of its branches, while Japan observed only minor changes in those two key figures. Furthermore, only the United States observed an increase in the number of ATMs. The other banking markets observed a reduction of these. Ultimately, the only key figure indicating high growth was the usage of online banking, especially in the Euro area, the United Kingdom, and the United States, although in Japan its usage decreased over the observation period.

3.3.2. Financial Structure of the Banking Sectors

The constituent parts of the banking sectors and how these are organized is only one side of the coin.

Additionally, it is important to examine the financial structure of the banking sectors. In terms of size, the total amount of deposits for liabilities and the total amount of loans for

assets are therefore analyzed. In addition, the ratio between the total assets of the banking sectors and the GDP of the banking market is used to describe the relative size of the banking sectors. The ratio is an indicator of the financing structure in the banking markets, as it indicates whether a banking sector is more market- or bank-based in terms of the financing of debt. The Z-score, which describes the stability of the banking sector at the level of single institutions in terms of solvency using buffers and risks, is used to examine financial stability. Lastly, the Herfindahl-Index (HHI) is used to describe competitiveness in the banking sectors, by comparing the squared market shares of the leading banks.

The customer-faced asset side of a bank balance sheet comprises the emitted loans to the customers. Figure 55 describes the development of the credit volume from the private non-financial sector in the banking markets, thereby excluding government and other banks, for the period 2009–2020.

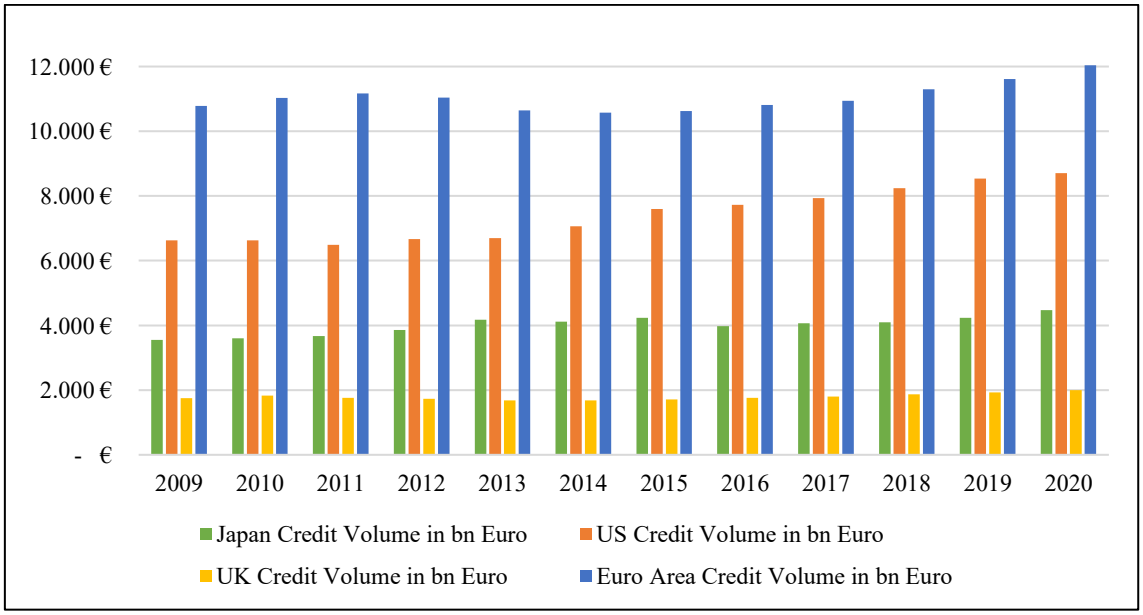

Figure 55: Credit Volume from the Private Non-Financial Sector of the Banking Markets in Billion Euro for the Period 2009-2020, Based on Data from Bank for International Settlements and ECB

In terms of credit volume, the Euro area had the largest banking sector with an average of 11,047 billion euros over the period 2009–2020. The Euro area had a credit volume of 10,784 billion euros at the beginning of the observation period, peaking with a credit volume of 12,038 billion euros in 2020, and falling to a low of 10,575 billion euros in 2015. So, overall, the Euro area achieved a growth in credit volume of 11.6% with a CAGR of 1% during the observation period, which was the smallest growth rate among

the banking markets. The Euro area was followed by the United States, with an average credit volume of 7,409 billion euros, rising from a low of 6,490 billion euros in 2011 to 8,708 euros in 2020. Overall, the United States observed an increase in credit volume of 31.4% and a CAGR of 2.6%, which was the highest growth rate among the banking markets. As such, the credit volume of the US and the Euro area converged over the observation period. The size of the banking sector in Japan in terms of credit was roughly half the size of the United States, with an average of 4,004 billion euros over the observation period. However, the total credit volume of the Japanese banking sector increased by 25.8% with a CAGR of 2.2%, with a low of 3,554 billion euros in 2009 rising to 4,472 billion euros in 2020. The United Kingdom was the smallest banking sector in terms of total credit volume, with an average of 1,792 billion Euros – 16 % of the size of the Euro area. The United Kingdom had a credit volume of 1,750 billion euros in 2009, which fell to a low of 1,678 billion euros in 2013 and peaked at 1.997 billion euros in 2020 – an increase in credit volume of 14.1% and a CAGR of 1.2%.

Regarding the constituent groups in the Euro area, the MIE group had the largest credit volume, as shown in Figure 56.

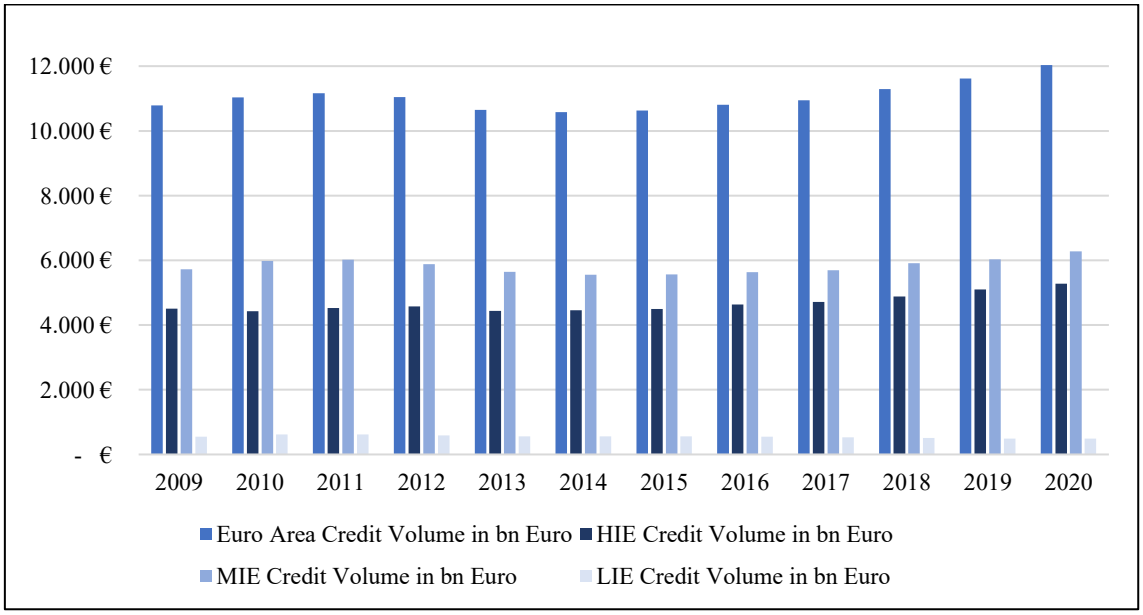

Figure 56: Credit Volume from the Private Non-Financial Sector of the Euro area and its Comparable Groups in Billion Euros for the Period 2009–2020, based on Data from ECB

The average credit volume of the MIE group was 5,826 billion euros over the observation period, which was roughly half of the whole credit volume in the Euro area. The MIE group had a credit volume of 5,725 billion euros at the beginning of the period, falling to

a low of 5,558 billion euros in 2014, and peaking at 6,227 billion euros in 2020 – an increase in credit volume of 9.6 % with a CAGR of 0.8% over the period, which was below the Euro area average. However, there were considerable differences between the countries within the MIE group. Belgium, for example, observed an increase of 47%, France an increase of 57%, while Italy experienced a decrease of -4%, and Spain a decrease of -33%. The MIE group was closely followed by the HIE group in terms of credit volume. Over the observation period, the HIE group had an average credit volume if 4,668 billion euros, which was still larger than the average credit volume in Japan. With 4,507 billion euros at the beginning of the period, it fell to 4,439 billion euros in 2013 before rising to its peak at 5,273 in 2020 – an increase in credit volume of 17% and a CAGR of 1.4%, which was above the Euro area average. Like the MIE group, however, there were considerable differences between the countries within the HIE group. Ireland, for example, saw a decrease in credit volume of -48%, while Finland achieved an increase of 56%. The LIE group, with an average of 552 billion euros, was the smallest banking sector in terms of credit volume amongst the comparable groups in the Euro area. This was roughly one-tenth of the size of the credit volume of the MIE group of countries. At the beginning of the observation period, the LIE group had a credit volume of 552 billion euros, peaking at 622 billion euros in 2011 before decreasing to a low of 488 billion euros in 2020 – an overall decrease of 11.7% with a CAGR of -1%. Again, deviation within the group was considerable, with Portugal, Greece and Cyprus experiencing a two-digit decrease, while Slovakia observed an increase in its credit volume of 111%, which was the largest increase amongst all researched subjects.

The classical counterpart to customer loans on the asset side are the deposits of customers on the liability side of a bank's balance sheet. Thus, after the analysis of the total amount of credit in the banking sectors of the banking markets, an analysis of the total amount of deposits follows.

Figure 57 shows the development of the total amount of deposits held by the private non-financial sector in the period 2009–2020. In total terms, the Euro area was the largest banking sector regarding deposits, with an average of 11,627 billion euros over the observation period. The level of deposits rose continuously, starting with the lowest level at 10,022 billion euros in 2009 and rising to 14,281 billion euros in 2020 – an increase of 42.5% with a CAGR of 3.5% in the observation period. The United States had the second highest level of private deposits, with an average of 8,715 billion euros over the period as a whole.

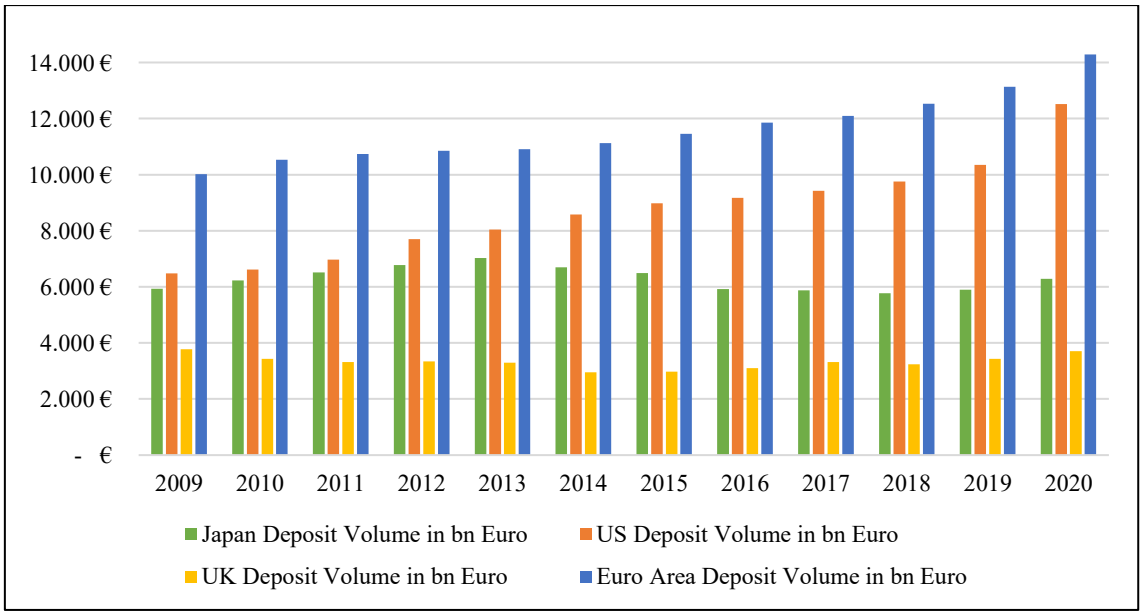

Figure 57: Total Amount of Deposits Held by the Private Non-Financial Sector in the Banking Markets for the Period 2009–2020, Based on Data from BoE, ECB, FRED, and World Bank

Interestingly, this figure was similar to Japan's at the beginning of the observation period. However, the US experienced strong growth over the period, so at the end it converged with the level in the Euro area. So, like the Euro area, the United States experienced continual growth in deposits, starting at the low of 6,485 billion euros in 2009 and ending with a high of 12,516 billion euros in 2020 – an increase of 93% with a CAGR of 7.7%. This was by far the biggest increase in the banking market, being twice as high as the growth in deposits in the Euro area. The Japanese banking sector observed an average of 6,285 billion euros in deposits over the period. However, unlike in the Euro area and the US, the deposit level did not continually increase but fluctuated around the average value. Thus, the lowest level of 5,766 billion euros occurred in 2018 and the highest of 7,028 billion euros in 2012, from a starting point of 6,485 billion euros in 2009 to an end point of 6,285 billion euros in 2020. This was an increase in the level of deposits of only 5.9% with a CAGR of 0.5%, significantly lower than the growth rates in the Euro area and the United States. The United Kingdom had the lowest level of deposits among the banking markets, with an average of 3,325 billion euros over the period, which was roughly half of the level in Japan. The United Kingdom's highest level of deposits at 3,778 billion euros was in 2009; afterwards, the level decreased to a low of 2,958 billion euros in 2014 before increasing again to 3,707 billion euros in 2020. Overall, the United Kingdom saw a decrease in the level of deposits held by the private sector of 1.9% with a CAGR of -

0.2%. Thus, the United Kingdom was the only banking market that experienced a decrease in deposits over the observation period.

Within the Euro area, the MIE group of countries had the largest level of deposits, as displayed in Figure 58. With an average of 5,875 billion euros over the observation period, the MIE group had around 51% of the total deposits held in the Euro area, which was similar to the level in Japan. Like the Euro area as a whole, the level of deposits in the MIE group grew continuously, with the lowest value of 4,967 billion euros occurring in 2009 and the highest at 7,311 in 2020. This was an increase of 47.2% with a CAGR of 3.9% – the highest increase among the comparable groups. France experienced the highest level of deposits, with an average of 2,172 billion euros and an increase of 92%. The MIE group was closely followed by the HIE group, with an average of 5,239 billion euros over the observation period, making up 45% of the total deposits held in the Euro area. Like in the MIE group of countries, the deposits held in the HIE group grew continuously, with its lowest level of 4,525 billion euros occurring in 2009 and its highest of 6,347 billion euros in 2020. Thus, the HIE group observed an increase in deposits of 40.3% with a CAGR of 3.4% over the observation period, which was below the average in the Euro area. Germany had the highest level of deposits in the HIE group, with an average of 3,333 billion euros over the period – which was over 50% of the deposits in the entire group of HIE countries.

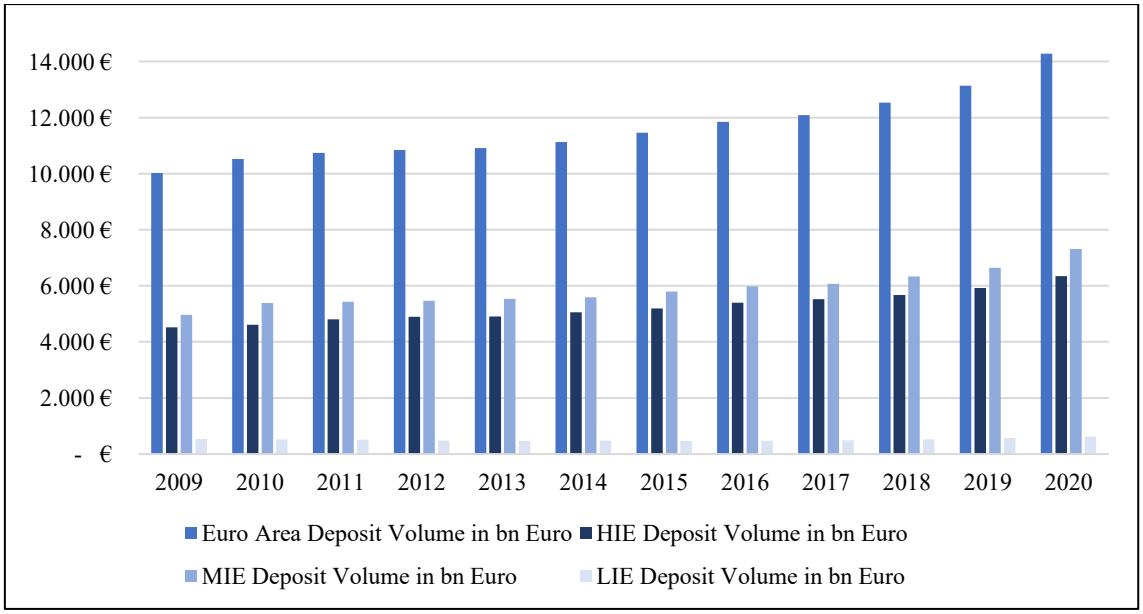

Figure 58: Total Amount of Deposits Held by the Private Non-Financial Sector in the Euro area and Comparison Groups for the Period 2009–2020, Based on Data from ECB

The LIE group of countries had the lowest level of deposits. With an average of 513 billion euros, the deposits held in the LIE group contributed to only around 4% of the total deposits held in the Euro area. At the beginning of the observation period, the LIE group had 531 billion euros held in deposits. This, however, fell to a low of 469 billion euros in 2015 before rising to a high of 623 billion euros in 2020. Overall, the LIE group saw an increase in the level of deposits held of 17.4%, with a CAGR of 1.5%. This was well below the average in the Euro area, but higher than in Japan and the United Kingdom. However, credit and deposit volumes are absolute measures. To assess the relative size of the various banking sectors, the ratio between the total bank assets held in a banking sector and the GDP of the country where the banking sector is located must be used. In this way, the economic performance and economic size of an individual country are considered, as, for example, the GDPs of the United States and the Euro area are much larger than the GDPs of the United Kingdom and Japan.

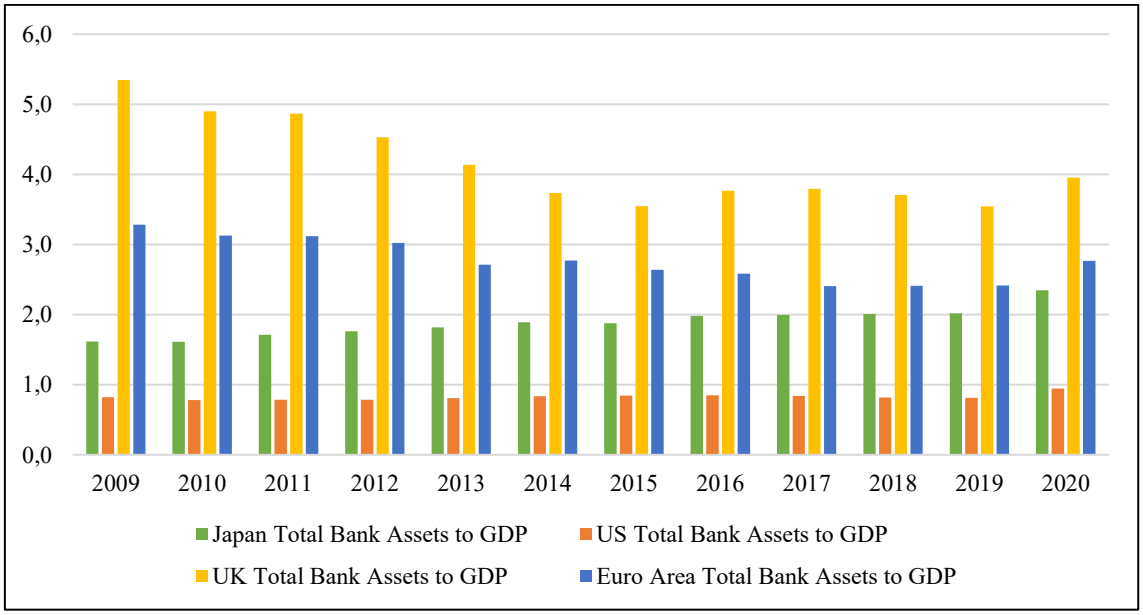

Figure 59: Total Bank Assets to GDP Ratio in Percent in the Banking Markets for the Period 2009–2020, Based on Data from BoE, BoJ, FRED, ECB, and World Bank

Figure 59 shows the development of the ratio between the total bank assets and the GDP of the banking markets for the period 2009–2020. The United Kingdom was the largest banking sector in terms of total bank assets to GDP ratio with an average value of 4.15, observing the highest ratio at 5.35 in 2009 and the lowest ratio at 3.54 in 2019. With a ratio of 3.95 in 2020, the total bank asset to GDP ratio of the United Kingdom decreased by -26.1% with a CAGR of -2.2% over the observation period. With an average total bank asset to GDP ratio of 2.77, the Euro area was the second largest banking sector among

the compared banking markets. Peaking at a ratio of 3.28 in 2009 and reaching its lowest level with a total bank asset to GDP ratio of 2.41 in the period 2017–2019. At the end of the observation period, the Euro area observed a ratio of 2.77, which was a decrease of -15.8% and a CAGR of -1.3%. Therefore, the banking sectors of the United Kingdom and the Euro area both decreased in size over the observation period. Conversely, Japan and the United States both experienced growth in their banking sectors in terms of the total bank asset to GDP ratio over the same period. Japan had the third largest banking sector with an average total bank assets to GDP ratio of 1.89, observing its lowest ratio of 1.61 in 2010 and its largest of 2.34 in 2020. With a starting ratio of 1.62 in 2009, Japan experienced growth of 45% and a CAGR of 3.8% in its banking sector over the period as a whole. Lastly, with an average total bank assets to GDP ratio of 0.83, the United States had the smallest banking sector among the compared markets in the observation period, with the banking sector in the United Kingdom being nearly five times larger and the banking sector in the Euro area being roughly three times larger in relative terms. The United States observed its lowest ratio of 0.78 in 2010 and its highest of 0.94 in 2020, which was a growth of 14.8% with a CAGR of 1.2%. All banking sectors observed an increase in the total bank asset to GDP ratio from 2019 to 2020; this can be partially explained by the economic crisis following the Corona pandemic of 2020, as the GDP of all compared banking markets, as previously shown, decreased in the aftermath of the Corona outbreak while the total assets of the banks did not decrease.

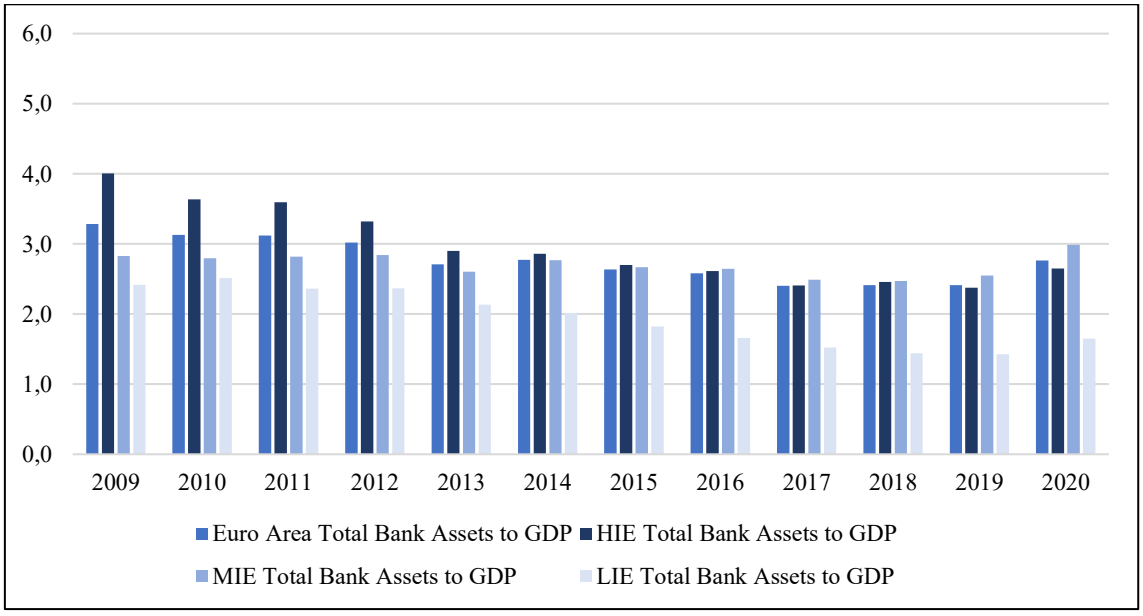

Figure 60: Total Bank Assets to GDP Ratio in Percent in the Euro area and its Comparable Groups for the Period 2009–2020, Based on Data from ECB and World Bank

Within the Euro area itself, the HIE group had an average total bank assets to GDP ratio of 2.96 and, as such, was the largest banking sector in the observation period. However, it was overtaken by the MIE group in the period 2016–2020, as shown in Figure 60. The total bank asset to GDP ratio of the HIE group peaked at 4.01 in 2009 and fell to a low of 2.38 in 2019. With a ratio of 2.65 at the end of the observation period, the HIE group observed a decrease in its banking sector of -33.9% and a CAGR of -2.8%. The size of the single banking sectors in the HIE group of countries and how these developed over the period were quite diverse. For example, Luxembourg observed an average ratio of 15.94 and a decrease of -38%; Germany observed an average ratio of 2.52 and a decrease of -35%; Ireland observed an average ratio of 3.67 and a decrease of -79%; while Finland observed an average ratio of 2.78 and an increase of 71%. On average, the MIE group observed a total bank asset to GDP ratio of 2.71 over the considered period. Thus, the group had the second-largest banking sector in the Euro area in relative terms. The largest (2.99) was observed in 2020, and the lowest ratio (2.47) in 2018. With a starting ratio of 2.83 in 2009, the MIE group observed an increase in its banking sectors of 5.8% with a CAGR of 0.5%, the only group in the Euro area to increase in relative size. While France, Spain and Belgium had large banking sectors, with averages of 3.22, 3.36, and 2.59, respectively, the banking sectors in Italy and Slovenia were smaller, with average ratios of 1.66 and 1.18, respectively, over the observation period. In comparison to the other groups in the Euro area, the LIE group had the smallest average ratio of 1.94. Peaking with a total bank asset to GDP ratio at 2.51 in 2010, it had its lowest value of 1.43 in 2019. With a starting ratio of 2.42 in 2009 and an ending ratio of 1.65 in 2020, the banking sector in the LIE group observed a decrease in relative size of -31.6% with a CAGR of -2.6%. Interestingly, countries such as Slovakia and Lithuania had similar average total bank assets to GDP ratios as the United States, with 0.85 and 0.66, respectively.

Until now, only the size of the banking sectors has been examined. To determine whether the banking sectors of the banking markets are market- or bank-based, the total deposits held need to be compared to the total market capitalization of the banking markets. For this, the bank to market ratio is used. This means that the higher the ratio, the more a financial system is bank oriented, and the lower the ratio, the more a financial system is market oriented.[66]

[66] Cf. Demirguc-Kunt, Levine (1999), p. 15

As shown in Figure 61, the financial system of the Euro area was clearly bank oriented, with an average bank to market ratio of 2.19 over the observation period.

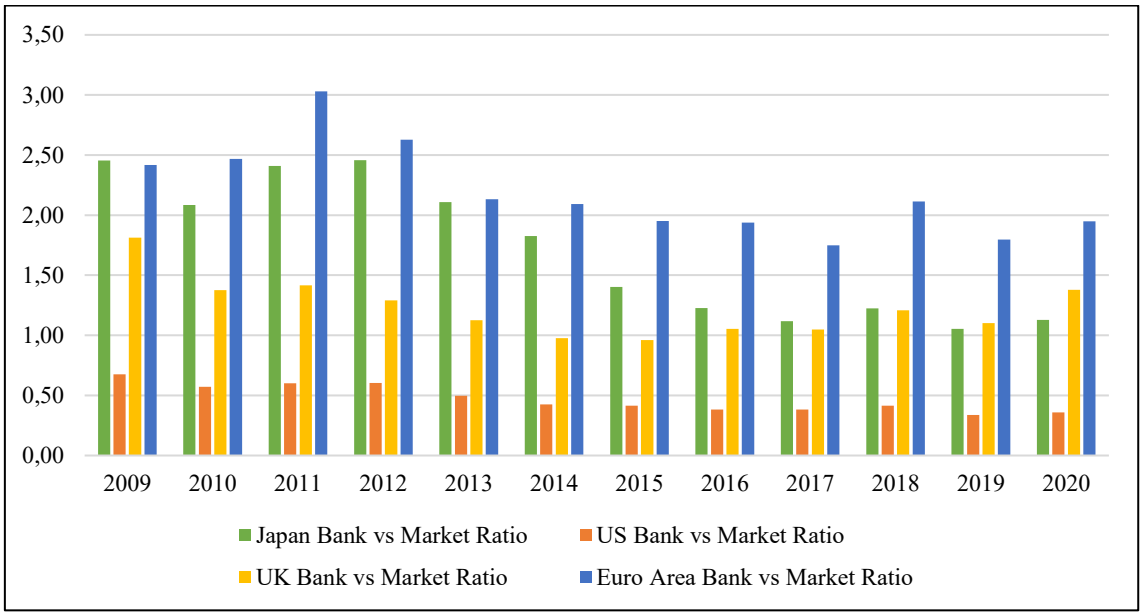

Figure 61: Bank vs. Market Ratio in the Banking Markets for the Period 2009–2020, Based on Data from World Bank, FRED, BoE, ECB, and Bloomberg

The highest bank vs. market ratio with a value of 3.36 was observed in 2011, while the lowest bank vs. market ratio with a value of 1.83 was observed in 2017. Overall, the bank vs. market ratio shrank from 2.42 in 2009 to 1.95 in 2020, which was a decrease of 19.3% with a CAGR of -1.6%. Meaning that the financial system in the Euro area moved towards a market concentration over the observation period but nevertheless remained a bank-oriented financial system. At the beginning of the observation period, the financial system of Japan was bank oriented, with a bank vs. market ratio of 2.45 in 2009, its highest value of 2.46 in 2012, and an average bank vs. market ratio of 1.71 over the observation period. Nevertheless, after peaking in 2012, the ratio decreased to its minimum of 1.06 in 2019, although the last recorded value was 1.13 in 2020. This was a decrease of 54% with a CAGR of -4.5% in the bank vs. market ratio in the Japanese financial system and meant that at the end of the observation period, the Japanese financial system lost its bank orientation and could be labelled as somewhere between a bank- and market-oriented system. The financial system of the United Kingdom observed its highest bank vs. market ratio with a value of 1.81 in 2009; afterwards, the ratio dropped to its lowest value of 0.96 in 2015. Although at the end of the observation period, the financial system of the United Kingdom observed a bank vs. market ratio of 1.38, this meant an overall decrease in the ratio of 23.8% and a CAGR of -2%. Overall, the United Kingdom observes an

average bank vs. market ratio of 1.23. This meant that the financial system of the United Kingdom was also somewhere between being bank- and market-oriented. Lastly, the financial system of the United States could be classified as market oriented during the whole observation period, with an average bank vs. market ratio of 0.47. The highest bank vs. market ratio with a value of 0.68 was observed in 2009, and the lowest value of 0.34 in 2019. At the end of the observation period, the United States had a bank vs. market ratio of 0.36, which meant a decrease in the ratio of 47% and a CAGR of -4.5%.

Within the Euro area, the LIE group observed the highest bank vs. market ratio, as shown in Figure 62. Over the period as a whole, the LIE group had an average bank vs. market ratio of 4.52, which was clearly above the average ratio in the Euro area. The bank vs. market ratio of the LIE group was between 3.26 in 2009 and 6.08 in 2012. With a bank vs. market ratio of 4.93, the LIE group observed an increase in its ratio of 51.3% and a CAGR of 4.3%. Thus, the financial systems of the LIE group could be considered bank oriented for the observation period. Especially Latvia, with an average bank vs. market ratio of 15.21, and Cyprus, with an average ratio of 16.01, had strongly bank-oriented financial systems.

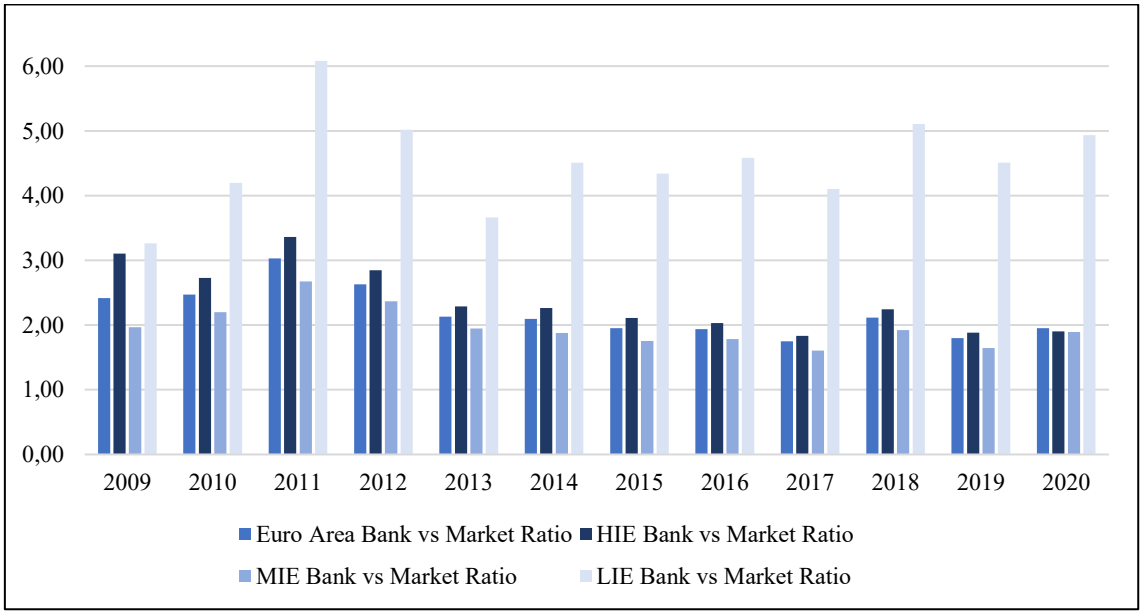

Figure 62: Bank vs. Market Ratio in the Euro area and its Comparable Groups for the Period 2009–2020, Based on Data from ECB and Bloomberg

With an average bank vs. market ratio of 2.38 in the observation period, the HIE group observed the second highest ratio within the Euro area. The bank vs. market ratio of the HIE group was between 3.36 in 2011 and 1.88 in 2019. Furthermore, the HIE group observed a decrease in its bank vs. market ratio of 38.8% and a CAGR of -3.2%, with a

starting ratio of 3.10 and an ending ratio of 1.90 over the observation period. Overall, the financial system of the HIE group could therefore be considered bank oriented, except for Finland. Finland observed an average bank vs. market ratio of 0.84 and thus could be considered market oriented. Lastly, the MIE group observed the lowest bank vs. market ratio in the Euro area, with an average ratio of 1.97 over the observation period. The bank vs. market ratio of the MIE group was between 1.61 in 2017 and 2.67 in 2011. With a starting ratio of 1.96 and an ending ratio of 1.89, the MIE group observed a decrease in its bank vs. market ratio of 3.6% and a CAGR of -0.3%. Therefore, the financial system of the MIE group could be considered bank oriented, with the exception of France. With an average bank vs. market ratio of 1.29 in the observation period, the financial system of France could be considered somewhere between a bank- and market-oriented system.

Regarding bank concentration, which is an indication of the level of competition in the banking markets, the Herfindahl-Hirschman-Index, or HHI, is used. It is comprised of the sum of the squared market shares of the market participants, between 0 for no concentration and 10,000 for a monopoly. Markets with an HHI below 1,500 are considered not concentrated; between 1,500 and 2,500, they are considered moderately concentrated; and above 2,500, highly concentrated.[67]

As shown in Figure 63, Japan had the highest concentration in its banking market based on total bank assets, with an average HHI of 1,680 over the considered period. Thus, the banking market in Japan could be classified as moderately concentrated. The highest HHI of 1,887 was observed in 2019 and the lowest HHI, with a value of 1,384, in 2014. For the years 2013–2014, the HHI of the Japanese banking market was below the HHI threshold of 1,500 and thus cannot be classified as moderately concentrated in those years. Furthermore, with a starting HHI of 1,571 in 2009 and an end HHI of 1,766 in 2020, the Japanese banking sector observed an increase in its HHI of 12.4% with a CAGR of 1% and thus an increase in concentration. With an average HHI of 758 in the observation period, the Euro area observed the second highest concentration among the banking markets. The HHI for the Euro area can be taken as an average value of the member countries as there is no shared market for financial services, and it is computed based on the share of total bank assets of the member countries. The lowest average HHI level of the Euro area, with 666, was observed in 2009 and the highest, with 837, in 2020, which meant an

[67] Cf. The United States Department of Justice (2018)

increase of 25.6% and a CAGR of 2.1%. Consequently, the average banking market in the Euro area can be classified as not concentrated.

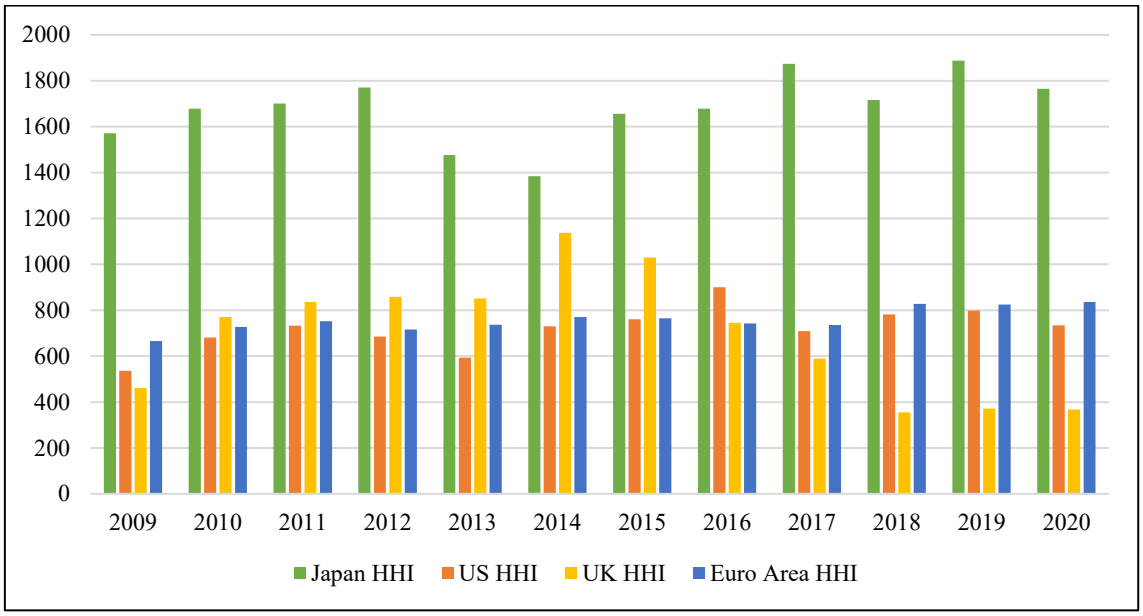

Figure 63: Herfindahl-Hirschman Index Regarding Total Bank Assets in the Banking Markets for the Period 2009–2020, Based on Data from BankFocus and ECB

The United States followed the Euro area with an average HHI of 720. The lowest concentration, with an HHI of 536, was observed in 2009 and the highest, with an HHI of 900, in 2016. Thus, for the observation period, the banking market in the United States could be considered not concentrated. Furthermore, the United States observed an HHI of 734 at the end of the observation period – an increase in concentration of 37% and a CAGR of 3.1%. The United Kingdom observed on average the smallest concentration with an HHI of 698 but experienced considerable volatility with a relative standard deviation of 38%, compared to the Euro area's relative standard deviation of 7%. At the beginning of the observation period, the United Kingdom had an HHI of 460. By 2014, this had increased to its highest value of 1,138. However, it later decreased to its lowest value of 355 in 2018. The United Kingdom never surpassed the threshold enabling it to be classified as concentrated but experienced sharp changes in concentration during the observation period. Furthermore, at the end of the observation period, the United Kingdom observed an HHI of 367, which meant a decrease of 20.2% with a CAGR of -1.7% compared to the beginning of the period.

Within the Euro area, the LIE group observed by far the largest average concentration with an average HHI of 1,528 in the observation period, as shown in Figure 64.

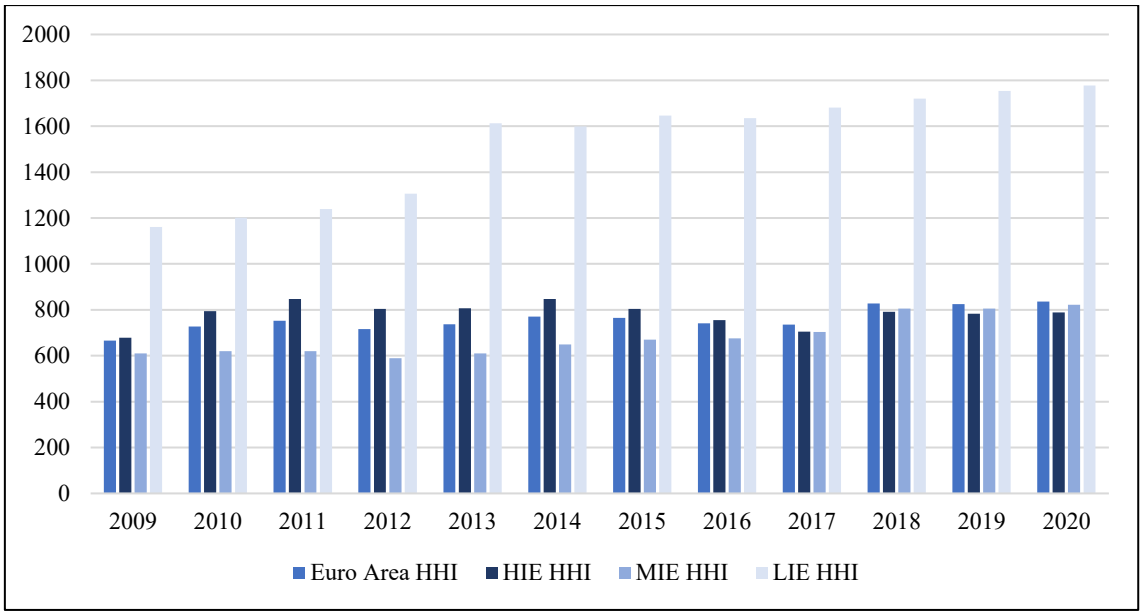

Figure 64: Herfindahl-Hirschman Index regarding Total Bank Assets in the Euro area and its Comparable Groups for the Period 2009–2020, Based on Data from ECB

The lowest average concentration, with an HHI of 1,161, was observed in 2009, and the highest, with an HHI of 1,777, in 2020, meaning an increase in average concentration of 53.1% and a CAGR of 4.4% over the observation period. For the period 2009–2012, the average HHI of the LIE group was below the concentration threshold of an HHI of 1,500. However, for the rest of the observation period, it was above, and thus, the banking markets of the LIE group could be considered, on average, moderately concentrated. Estonia, Lithuania and Greece had the highest concentrations in the group, with average HHIs of 2,592, 1,967 and 1,949, respectively. This meant that the banking market in Estonia could even be classified as highly concentrated. The countries in the HIE group observed the second-highest average concentration among the comparable groups, with an average HHI of 784 over the observation period. The lowest average concentration, with an HHI of 679, was observed in 2009 and the highest, with an HHI of 847, in 2014. Moreover, at the end of the observation period, the HIE group observed an average HHI of 789, meaning an increase in concentration of 16.2% and a CAGR of 1.4% over the observation period. On average, therefore, the banking markets of the countries within the HIE group could be classified as not concentrated, with Germany having the lowest concentration in its banking market, with an average HHI of 279 in the observation period – the lowest observed average HHI among all countries. As Germany weighted very heavily in the group, the banking markets of the Netherlands and Finland were not visible in the average. Both banking markets, however, observed an average HHI of over 2,000, with

Finland even experiencing an average HHI of 2,990 over the period. Thus, the banking market of the Netherlands could be classified as moderately concentrated and the banking market of Finland as heavily concentrated. Lastly, the countries in the MIE group observed the smallest average concentration in its member countries' banking markets, with an average HHI of 682 in the observation period. In 2009, the smallest average concentration with an HHI of 589 was observed, and in 2012, the highest, with an HHI of 822 in 2020. With an HHI of 610 at the beginning of the observation period, the countries of the MIE group experienced an increase in the average concentration of their banking markets of 34.6% and a CAGR of 2.9%. Furthermore, as the HHI did not surpass the threshold for concentration, the banking markets of the MIE group could be classified as not concentrated.

As far as assessing the stability of the banking markets is concerned, the so-called 'Z-score' is used. The Z-score was initially introduced by Altman (1968) with the aim of creating a ratio that calculates the bankruptcy risk of a company. For this purpose, a multiple discriminant analysis is employed, which factors in working capital / total assets, retained earnings / total assets, EBIT / total assets, market value of equity / book value of total debt and sales / total assets. The lower the calculated Z-score, the higher the probability of a company's bankruptcy. [68]

As the nature of banks differs from other types of companies, the Z-score was adapted by Boyd, Graham, and Hewitt (1993) to measure stability specifically in the banking sector. Bankruptcy is defined by a situation where equity is insufficient to offset losses. To compute the Z-score, the sum of the mean return on assets and capital-asset ratio is divided by the standard deviation of the return on assets. A higher Z-score indicates a lower probability of insolvency, as it reflects higher profitability (mean return on assets), better capitalization (capital-asset ratio), and lower volatility (standard deviation of the return on assets). Conversely, a lower Z-score indicates a higher risk of failure. Consequently, a high Z-score indicates that a bank possesses a large risk buffer and is thus financially stable.[69]

As shown in Figure 65, the United States observed the highest stability among the banking markets, with an average Z-score of 33.38 over the observation period. The highest Z-score of 35.09 was observed in 2019, directly followed by the lowest of 30.28 in 2020,

[68] Cf. Altman (1968), p. 589-609

[69] Cf. Boyd, Graham, and Hewitt (1993), p. 48,

which was possibly a result of the economic crisis following the Corona pandemic of 2020. With a Z-score of 30.71 in 2009, the United States experienced a decrease in its Z-score of 1.4% and a CAGR of -0.1% over the observation period as a whole. However, this decrease was a result of the low Z-score in 2020. Therefore, as the Z-score of the United States increased by nearly 14% between 2009 and 2019, with an average Z-score of 17.22, the Euro area took second place in terms of financial stability among the banking markets over the observation period. As can be seen, however, it had nearly half the value of the average Z-score observed in the United States. The Z-score of the Euro area was between 14.30 in 2011 and 21.82 in 2019. With a starting Z-score of 13.16 and a Z-score of 19.98 in 2020, the Euro area therefore observed an increase in its Z-score of 51.8% and a CAGR of 4.3% within the observation period.

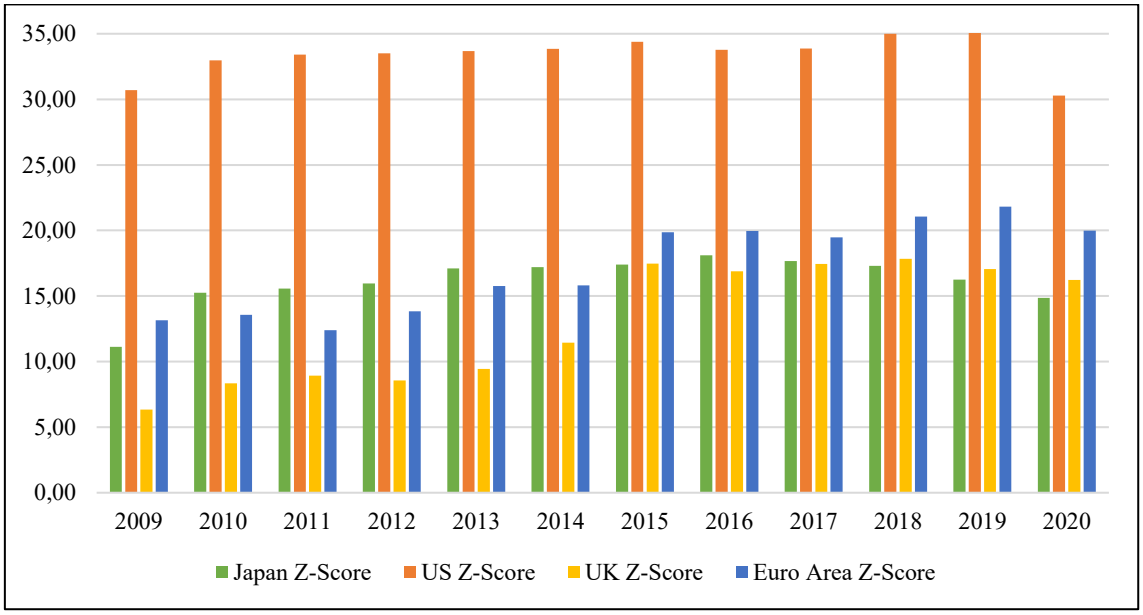

Figure 65: Z-score of the Banking Markets in the Period 2009-2020, Based on Data from the World Bank

In terms of financial stability, the Euro area was followed by the Japanese banking market, with an average Z-score of 16.15 over the observation period. The lowest Z-score of 11.12 was observed at the beginning of the observation period in 2009, and the highest of 18.10 in 2016. Moreover, at the end of the observation period, a Z-score of 14.87 was achieved, which meant an increase in the Z-score of 33.7% and a CAGR of 2.8% over the period as a whole. The United Kingdom had the least stable banking sector, with an average Z-score of 13 over the observation period. The lowest Z-score of 6.34 was observed in 2009, which was nearly a fifth of the Z-score achieved by the United States in that year, and in 2018, its highest Z-score, with a value of 17.83, was achieved. At the

end of the observation period, however, the United Kingdom had a Z-score of 16.24, a higher Z-score than Japan for that year, which meant an increase in the Z-score of 156% with a CAGR of 13% – the highest increase in stability among the banking markets.

Within the Euro area, the HIE group had the most stable banking sector for the whole observation period, as displayed in Figure 66. Overall, the HIE group achieved the highest average Z-score with a value of 20.17, which was well above the Euro area average for the period. The lowest Z-score of the HIE group, with a value of 14.30, was observed in 2011, and the highest, with a value of 26.60, in 2019. With a starting Z-score of 14.64 and an ending Z-score of 24.03, the HIE group saw an increase of 64.1% with a CAGR of 5.3%. The average Z-score of countries within the HIE group was quite diverse, ranging from 7.64 in Ireland to 31.02 in Luxembourg.

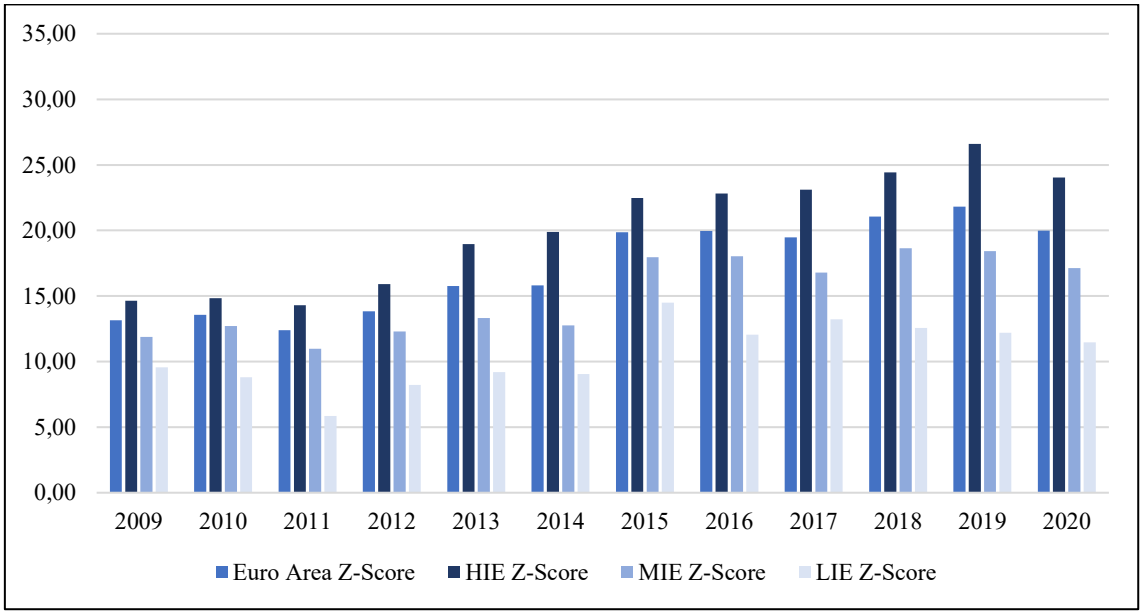

Figure 66: Z-score of the Euro area and its Comparable Groups in the Period 2009–2020, Based on Data from the World Bank

With an average Z-score of 15.08, the HIE group was followed by the MIE group. The average Z-score of the MIE group was below the Euro area average. The MIE group saw its lowest Z-score, with a value of 10.98, in 2011, and its highest Z-score, with a value of 18.64, in 2018. Overall, the MIE group achieved an increase in its Z-score of 44.1% and a CAGR of 3.7%, with a starting value of 11.89 and an ending value of 17.13. The individual countries within the MIE group achieved similar Z-scores, the exception being Slovenia, which had an average Z-score of 3.07 over the observation period, the lowest observed Z-score among the analyzed countries. Lastly, the LIE group had the least stable banking sector among the comparable groups, with an average Z-score of 10.56, which

was 38% below the Euro area average. In detail, the Z-score in the LIE group was between 5.84 in 2011 and 14.50 in 2015. With a starting Z-score of 9.57 and an ending Z-score of 11.47, the LIE group saw an increase in its Z-score of 19.8% and a CAGR of 1.7%. The individual countries of the LIE group, however, observed heterogeneous Z-score results, lying between 5.66 in Greece and 22.74 in Slovakia.

3.3.3. Comparison of the Banking Sectors

To finalize the comparison of the banking sectors and summarize the previous sections of the chapter, Table 9 condenses the most important key figures of the banking markets and the constituent groups within the Euro area, giving an average value for the period as a whole.

Average for 2009–2020	**Euro area** *EA*	*HIE*	*MIE*	*LIE*	**US**	**UK**	**Japan**
Banks per mn capita	16.7	30	8.7	13.4	17.3	5.8	4.5
Workforce (%)	1.24	1.42	1.17	0.96	1.20	1.21	0.76
Branches per mn capita	466	354	558	343	256	162	296
ATMs per mn capita	939	937	943	928	1,383	1,006	1,111
Usage online banking[70] (%)	51.3	61.3	47.5	36.5	60.8	66.6	64.8
Total bank asset to GDP ratio	2.77	2.96	2.71	1.94	0.83	4.15	1.89
Bank vs market ratio	2.19	2.38	1.97	4.52	0.47	1.23	1.71
HHI	758	784	682	1,528	720	698	1,680
Z-score	17.22	20.17	15.08	10.56	33.28	16.15	13

Table 8: Overall Comparison of the Banking Sectors for the Period 2009–2020, Based on Data from Accenture, BankFocus, Bloomberg, BoE, BoJ, DICJ, ECB, Eurostat, FDIC, FRED, IMF, ONS, PR Times, Statistic Bureau of Japan, World Bank

In terms of size, the United States had the largest banking sector with an average of 17.3 banks per million capita over the observation period, closely followed by the Euro area

[70] Average for 2013-2020

with an average of 16.7 banks per million capita, whereas the United Kingdom and Japan had only 5.8 and 4.5 banks per million capita, respectively. The HIE group with 30 banks per million capita stands out among the comparable groups within the Euro area, as the MIE group only had an average of 8.7 banks per million capita. However, the number of banks per million capita decreased by 35% in the Euro area over the observation period, which was reflected by a similar decrease of 40% in the United States, while Japan and the United Kingdom only observed a decrease of 6%. In terms of the share of banking sector employees in the overall workforce, the Euro area observed the largest share with an average of 1.24%, closely followed by the United Kingdom with a value of 1.21% and the United States with 1.20%, while Japan only observed an average share of 0.76%. Again, the HIE group observed the largest share within its banking sectors, with an average of 1.42% over the observation period.

Like the number of banks per million capita, the share of banking sector employees in the workforce decreased in all banking markets. The United Kingdom observed the biggest decrease of 33%, followed by the Euro area with a decrease of 20%. Japan only observed a decreasing e of 7%, while in the United States, the share of banking sector employees in its workforce remained nearly constant, with only a small decrease of 2% observed.

Regarding the number of branches per million capita, the Euro area was the largest banking sector, with an average of 466 over the recorded period. This was by far the most branches per million capita, as Japan had an average number of only 296 branches per capita, the United States 256, and the United Kingdom 162. Within the Euro area, the MIE group even had an average of 558 branches per million capita, the HIE group 354, and the LIE group 343. Over the observation period, the number of branches per million capita decreased by 41% in the Euro area and the United Kingdom and by 18% in the United States. Conversely, the number of branches per million capita increased by 3% in Japan within the same period.

The above comparison suggests that in the Euro area as a whole, and especially in the HIE group of countries, there is potential for consolidation, However, it needs to be considered that there is no homogenic banking sector in the Euro area, as there are in the national banking sectors. This could explain the high density of banks, raising the question of whether regulations are needed to adjust the level of the playing field to allow an environment that enables such consolidations or whether there are already enough incentives in place for banks to consolidate.

To measure digitization in the banking sectors the number of ATMs per million capita and the mobile banking usage were calculated. The Euro area had the lowest average number of ATMs per million capita, with a value of 939 over the observation period. The United States had the highest with 1,383 ATMs per million capita, followed by Japan with 1,111 and the United Kingdom, with 1,006. The numbers decreased in the Euro area by 15%, in the United Kingdom by 20%, and in Japan by 7%, while they increased in the United States by 14%. Within the Euro area, the HIE group observes an increase of ATMs per million capita of 2%, the MIE group observed a decrease of 20%, and the LIE group a decrease of 35%.

Among the banking markets, the Euro area had the smallest digital banking sector, with an average of 51.3% of its population using online banking in the period 2013–2020. In the United States, this was an average of 60.8%; in Japan, an average of 64.8%; and in the United Kingdom, an average of 66.6%. Between the comparable groups in the Euro area, there was a large spread. In the HIE group, an average of 61.3% of the population used online banking, whereas this figure was 47.5% in the MIE group and 36.5% in the LIE group. Japan was the only banking market where the usage of online banking declined, with a decrease of 10% in the period 2013–2020. The United Kingdom observed the highest increase in online banking usage of 48%, followed by the Euro area with an increase of 40% and the United States with an increase by 17%. Within the Euro area, the LIE group observed an increase of 113%, the MIE group of 43%, and the HIE group of 30%.

The above key figures show that, regarding levels of digitization, the banking sector in the Euro area lags behind the other banking markets, indicating potential for improvement especially in the LIE group of countries. However, digitization, like consolidation, requires a high investment that only large banks can provide. Hence, smaller banks are at a competitive disadvantage.

In financial terms, the United Kingdom had the largest banking sector, with an average total bank asset to GDP ratio of 4.15 over the observation period, followed by the Euro area, with an average ratio of 2.77, and Japan, with an average ratio of 1.89. The United States had by far the smallest banking sector among the banking markets, with an average total bank asset to GDP ratio of 0.83. However, while the total bank asset to GDP ratio decreased in the United Kingdom by 26% and in the Euro area by 16%, the United States was able to realize an increase in its ratio of 15% and Japan of 45%. Within the Euro area, the average total bank asset to GDP ratio of the HIE group, with 2.96, and the MIE group,

with 2.71, was quite similar, while the LIE group had an average total bank asset to GDP ratio of 1.94. Furthermore, the MIE group was able to realize an increase in its total bank asset to GDP ratio of 6%, while the HIE group saw a decrease of 34%, and the LIE group a decrease of 32%.

Among the banking markets, the Euro area had the strongest bank-oriented financial sector, with an average bank vs. market ratio of 2.19. With an average bank vs. market ratio of 1.71, the Japanese financial sector could also be classified as bank oriented. However, as shown in the previous section, the Japanese financial sector was positioned between the two at the end of the observation period, as was the financial sector in the United Kingdom, with an average bank vs. market ratio of 1.23. Therefore, the United States was the only bank market with a market-oriented financial system, with an average bank vs. market ratio of 0.47 in the observation period. Within the Euro area, the financial system of the LIE group had the strongest bank orientation, with an average bank vs. market ratio of 4.52, while the HIE group had a value of 2.38 and the MIE group a value of 1.97. As shown in the previous chapter, there were exceptions, as Finland was the only country in the Euro area with a market-oriented financial system with an average bank vs. market ratio of 0.84 and France's financial system with a value of 1.29. Over the observation period, the bank vs. market ratio decreased in all banking markets: in the Euro area, by 19%; in the United Kingdom, by 24%; in the United States, by 47%; and in Japan, by -54%. Conversely, within the Euro area, the LIE group saw an increase in its bank vs. market ratio of 51%, while the HIE group saw a decrease of 39%, and the MIE group a decrease of 4%.

The banking market in Japan was the most concentrated among the banking markets. With an average HHI of 1,680 in the observation period, it could be classified as moderately concentrated. The average HHI of the remaining banking markets was quite similar, as the Euro area had an average HHI of 758, the United States 720, and the United Kingdom 698. Thus, the banking markets of these countries were not concentrated. Within the Euro area, the banking sectors of the HIE group had an average HHI of 784 and the MIE group a value of 682 and thus were not concentrated, while the LIE group had an average HHI of 1,528 and was thus moderately concentrated. In all banking markets, except the United Kingdom, the HHI increased: by 10% in Japan, 26% in the Euro area, and 37% in the United States. The United Kingdom observed a decrease in its HHI of 10% in the observation period. Within the Euro area, all the comparable groups observed an increase in their HHI: the HIE group by 16%, the MIE group by 35%, and the LIE group by 53%.

In terms of stability, the United States was the most stable banking market, with an average Z-score of 33.28 in the observation period. The other banking markets observed smaller average Z-scores: the Euro area with 17.22, Japan with 16.15, and the United Kingdom with 13 – roughly half the value of the United States. Among the comparable groups in the Euro area, the HIE group has the highest average Z-score with a value of 20.17, followed by the MIE group with a value of 15.08 and the LIE group with 10.56. Thus, the average Z-score of the HIE group was nearly 100% higher than the average Z-score of the LIE group. Within the observation period, the United States observed a small decrease in its Z-score of 1%, while the other banking markets observed an increase: 156% in the UK, 52% in the Euro area, and 34% in Japan. Within the Euro area, all comparable groups observed an increase in their Z-scores: the HIE group of 64%, the MIE group of 44%, and the LIE group of 20%.

The above key figures show that, while overall the Euro area is in a good position, heterogeneity within the Euro area needs to be addressed. The banking sector in the LIE group of countries, in particular, is strongly bank oriented, moderately concentrated, and the least stable compared to the other parts in the Euro area and the other banking markets. Thus, it needs to be discussed whether, and if so, how, regulation can mitigate these findings and contribute to the convergence of these banks with those in the HIE and MIE groups.

4. Profitability Analysis of Relevant Banks in the Banking Markets

While the previous chapters analyzed the organizational structure of the banking sectors and their constituent parts from a macroeconomic perspective, this chapter takes a more granular approach. This chapter analyzes and compares the average profitability of the most relevant banks in the banking markets. In the first step, ‘buckets’ containing the most relevant banks per bank market are defined, as are their profitability key figures. Subsequently, the banking markets are analyzed regarding the defined key figures based on the average value of the banks in the bucket for the period 2009–2020. Lastly, the profitability of the relevant institutions in the banking markets is compared, and profitability benchmarks for institutions in the Euro area are determined. The profitability analysis of relevant banks in the banking markets directly concerns the financial intermediaries / banks in the financial market framework, as it describes the performance of these entities. However, on a broader view, the profitability analysis also concerns capital

providers, borrowers and their surrounding entities, as the whole framework is interconnected.

4.1. Definition of Relevant Banks and Key Figures

The approach to defining these relevant institutions involves two steps. First, a long list of the five largest banks according to their total assets in 2020 for the United States, the United Kingdom and Japan is created. In the Euro area, the five largest banks per comparable group are considered, as well as the largest bank per country if the country has no bank under the five largest banks within its group. With this procedure, every country is represented with at least one bank in the long list. In the second step, a short list is created based on the global systemically important banks (G-SIB) as defined by the Financial Stability Board (FSB). So basically, if an institution is among the largest banks in its bank market and considered globally systematically important, it is considered suitable for placement in the bucket of relevant banks in its bank market and can be used for profitability analysis. Table 10 shows the long list of potentially relevant institutes. Interestingly, the largest banks, JP Morgan Chase, BNP Paribas, and MUFG Bank, are similar in size regarding their total assets, with all institutes having a value of over 2,000 billion euros in 2020. Furthermore, the spread of total assets is quite large, with the smallest bank on the list being Swedbank in Lithuania, with total assets of 7.71 billion euros in 2020, thus only 2% of the size of the largest bank, JP Morgan Chase. The short list is given in bold and italics in Table 10 and comprises 17 institutes classified as relevant. As can be seen, the Euro area bucket contains the most banks (7 institutes), with two institutes from the HIE group – Deutsche Bank from Germany and the ING Bank in the Netherlands – and five institutes from the MIE group – BNP Paribas, Credit Agricole, Societe General from France, the Spanish Banco Santander, and Italy's Unicredit. With three banks in the bucket, France has both the most and largest banks according to total assets in the Euro area. Although Germany is the largest economy in the Euro area, it has only one institute classified as relevant. This is because the German financial sector has a uniquely decentralized structure in which small state-owned saving banks and cooperative banks have a large market share. Thus, the Deutsche Bank is the only globally systematically important bank in Germany. BNP Paribas Fortis and BGL BNP Paribas, respectively, are the largest banks in Belgium and Luxembourg. There are no relevant banks in the countries of the LIE group, as no institute from these countries is considered systematically important globally. Moreover, the banks in the LIE group are significantly smaller in terms of total

assets than the banks in the other comparable groups. For example, the total assets from the largest bank in the LIE group, the Portuguese Caixa Geral De Depositos, has only a tenth of the volume of the total assets of the smallest bank in the Euro area bucket – the Italian bank, Unicredit – underscoring, once again, the heterogeneity of the Euro area's banking sector.

Bank Market	**Group**	**Country**	**Bank**	**Total Assets bn €**	**G-SIB**
US	***US***	***US***	***JP Morgan Chase Bank***	***2,759.41 €***	***Yes***
EA	***MIE***	***France***	***BNP Paribas***	***2,488.49 €***	***Yes***
Japan	***Japan***	***Japan***	***MUFG Bank***	***2,236.36 €***	***Yes***
EA	***MIE***	***France***	***Credit Agricole***	***1,961.06 €***	***Yes***
US	***US***	***US***	***Citibank***	***1,841.82 €***	***Yes***
US	***US***	***US***	***Bank Of America***	***1,840.79 €***	***Yes***
Japan	Japan	Japan	Japan Post Bank	1,724.79 €	No
Japan	***Japan***	***Japan***	***Mizuho Bank***	***1,626.78 €***	***Yes***
US	***US***	***US***	***Wells Fargo Bank***	***1,593.32 €***	***Yes***
Japan	***Japan***	***Japan***	***Sumitomo Mitsui Banking Corporation***	***1,590.63 €***	***Yes***
EA	***MIE***	***Spain***	***Banco Santander***	***1,508.25 €***	***Yes***
EA	***MIE***	***France***	***Societe Generale***	***1,461.95 €***	***Yes***
EA	***HIE***	***Germany***	***Deutsche Bank***	***1,323.99 €***	***Yes***
UK	***UK***	***UK***	***Barclays Bank***	***1,182.82 €***	***Yes***
EA	***HIE***	***Netherlands***	***ING Bank***	***937.38 €***	***Yes***
EA	***MIE***	***Italy***	***Unicredit***	***931.46 €***	***Yes***
Japan	Japan	Japan	The Norinchukin Bank	829.36 €	No
UK	***UK***	***UK***	***HSBC UK Bank***	***744.93 €***	***Yes***
EA	HIE	Netherlands	Cooperatieve Rabobank	659.79 €	No
UK	UK	UK	Lloyds	656.12 €	No
EA	HIE	Germany	DZ Bank	594.57 €	No
EA	HIE	Finland	Nordea Bank	552.16 €	No
US	US	US	U.S. Bank National Association	437.04 €	No
UK	UK	UK	National Westminster Bank	426.01 €	No
UK	***UK***	***UK***	***Standard Chartered Bank***	***418.54 €***	***Yes***
EA	MIE	Belgium	BNP Paribas Fortis	335.14 €	No
EA	HIE	Austria	Erste Group Bank	277.39 €	No
EA	HIE	Ireland	Bank Of Ireland	133.79 €	No
EA	LIE	Portugal	Caixa Geral De Depositos	91.38 €	No
EA	LIE	Portugal	Banco Comercial Portugues	85.81 €	No
EA	LIE	Greece	National Bank of Greece	77.49 €	No
EA	LIE	Greece	Piraeus Financial Holdings	71.58 €	No
EA	LIE	Greece	Alpha Services & Holdings	70.06 €	No
EA	HIE	Luxembourg	BGL BNP Paribas	56.54 €	No
EA	LIE	Cyprus	Bank Of Cyprus Public	21.51 €	No
EA	LIE	Slovakia	Slovenska Sporitel'na	20.75 €	No
EA	MIE	Slovenia	Nova Ljubljanska Banka D.D.	19.57 €	No
EA	LIE	Estonia	Luminor Bank	14.92 €	No
EA	LIE	Lithuania	Swedbank	14.01 €	No
EA	MIE	Malta	Bank Of Valletta	12.91 €	No
EA	LIE	Latvia	Swedbank	7.71 €	No

Table 9: Long List of Potentially Relevant Institutes. Short List, in Bold and Italics, Based on Data from BankFocus and FSB

Consequently, a comparison of the institutes within the Euro area is not possible, as there are no banks from the LIE group in the relevant bank bucket. Furthermore, all banks in the Euro area's bank bucket are supervised by the ECB; thus, an internal comparison is not as interesting as a cross-border comparison with banking markets that have different supervisory banks. Moreover, the largest bank according to total assets in Lithuania and Latvia is the Swedish-based Swedbank. The United States' bucket of relevant banks consists of JP Morgan Chase, the Citibank, Bank of America, and Wells Fargo, all large banks with total assets of over 1,500 billion euros in 2020. Japan has three institutes in its relevant bank bucket: the MUFG Bank, Sumitomo Mitsui Banking Corporation, and the Mizuho Bank – all of which also had over 1,500 billion euros in 2020. Lastly, the United Kingdom's bank bucket also consists of three banks: Barclays Bank, Standard Chartered Bank, and the HSBC UK Bank as part of the HSBC Holding. However, as the HSBC Holding has significant operations in Asia, only the HSBC UK Bank is considered in the banking market of the United Kingdom. According to total assets, the banks in the UK are the smallest, having assets between 418 billion euros and 1,182 billion euros in 2020. Using this procedure, a representative relevant bank in each banking market can be computed using the average key figures of the banks in the respective buckets. For the sake of simplicity, the buckets are labelled the Euro area banks, the Japanese banks, the UK banks, and the US banks.

To analyze the average profitability and structural differences in the balance sheets of the relevant banks in the banking markets, the size in terms of total assets, and share of liquid assets is firstly considered. Subsequently, the development of the share of deposits and loans of the total assets and share of non-performing loans is considered to determine the overall size of the banks. To analyize the stability of the relevant banks, the equity is examined, as well as the TIER 1 capital ratio, and the capital adequacy ratio. For the average profitability regarding the interest business, the net interest income before taxes and the net interest margin based on total assets are analyzed. For the overall average profitability, the net income, the return on equity, and total expenses and efficiency ratios are analyzed. Finally, to see how the capital markets rate the profitability of the relevant banks in the banking markets, the total market capitalization and the price-to-book value ratio are examined.

4.2. Analysis of the Average Profitability of Relevant Banks in the Banking Markets

To begin the profitability analysis, a foundation needs to be laid by determining the financial size of the relevant banks in the banking markets in terms of total assets. With a total asset average of 1,570 billion euros in the observation period, the US banks were the largest. Their assets were between 1,145 billion euros in 2009 and 2,009 billion euros in 2020 – an increase of 75.5% with a CAGR of 6.3%, as shown in Figure 66. Although the Euro area banks were the largest in terms of average total assets between 2009 and 2013, they were overtaken by the US banks after this period. Nevertheless, with average total assets of 1,408 billion euros in the observation period as a whole, the Euro area banks had the second-highest average total assets among the compared banking buckets, with a low of 1,312 billion euros in 2013 and a high of 1,530 billion euros in 2020 – an increase of 14.7% with a CAGR of 1.2%. Consequently, the increase in total assets of the Euro area banks was much smaller than that of the US banks and the Japanese banks.

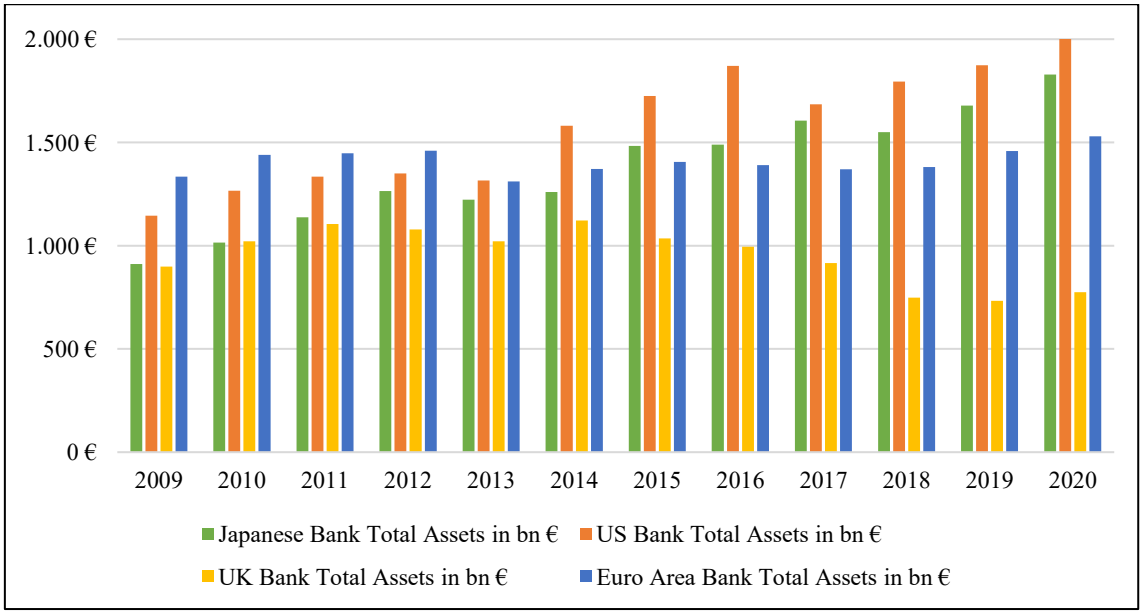

Figure 67: Total Assets in Billion Euros of the Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from BankFocus and Eikon

As shown in Figure 67, the Japanese banks overtook the Euro area banks in terms of total assets in the period 2015–2020. However, the average total assets of the Japanese banks over the whole observation period was only 1,371 billion euros, which places them third among the banking markets. The lowest value of 912 billion euros of total assets in the Japanese banks was in 2009 and the highest value was 1,829 billion euros in 2020 – an

increase of 100.6% with a CAGR of 8.4%, by far the highest increase among the banking markets. Lastly, the UK banks had the lowest amount of total assets, with an average value of 954 billion euros in the observation period. Thus, the UK banks were the smallest among the relevant banks in the banking markets. The lowest value of total assets of the UK banks was 733 billion euros in 2019 and the highest, 1,123 billion euros, in 2014. However, with a starting value of 900 billion euros in 2009 and an ending value of 774 billion euros, the UK banks observed a decrease in total assets of 13.9% with a CAGR of -1.2% in the observation period. Hence, the UK banks were the only banks with a decrease in total assets in the observation period.

To understand to what degree a bank can meet its liabilities, it is important to analyze how many liquid assets, meaning cash or cash equivalent assets, a bank holds. To equal out the difference in the size of total assets and analyze structural differences among the relevant banks in the banking markets, the share of liquid assets from the total assets is considered.

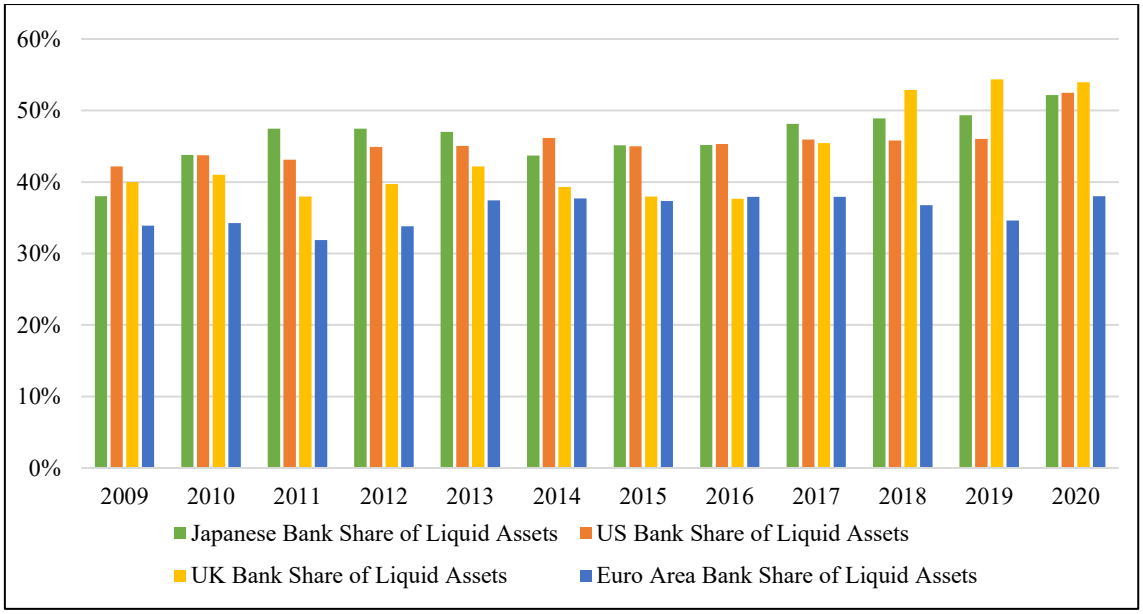

Figure 68: Share of Liquid Assets from Total Assets of Relevant Banks in Banking Markets for the Period 2009–2020, Based on Data from BankFocus and Eikon

It is observable from Figure 68 that the Japanese banks had the largest share of liquid assets among the relevant banks for the periods 2010–2013 and 2017. Overall, with an average share of liquid assets of 46.3%, the Japanese banks had the largest share of liquid assets among the banking markets, being between 38% in 2009 and 52.2% in 2020 – an increase in the share of liquid assets of 37.2% with a CAGR of 3.1%, the largest increase among the banking markets. In the years 2009, 2014, and 2016, the total share of liquid

assets in the US banks was the largest. However, the US banks had an average share of liquid assets of only 45.5% over the period as a whole, making them banks in the banking market with the second largest share of liquid assets. The smallest share of liquid assets of 42.2% occurred in 2009, while the largest, 52.5%, occurred in 2020. Thus, the US banks saw an increase in their share of liquid assets of 24.5% with a CAGR of 2%. In terms of the average share of liquid assets in the observation period, the UK banks were third in size, with an average value of 43.5%, which was quite close to the average share of liquid assets observed in the US banks. The UK banks had the smallest share of liquid assets with a value of 37.3% in 2016 and the largest at 54.3% in 2019, the largest observed share in this year. With a starting value of 40% in 2009 and an end value of 54%, the UK banks experienced an increase in their share of liquid assets of 34.9% and a CAGR of 2.9%. Moreover, with a relative standard deviation of 15%, the UK banks observed the greatest volatility in their share of liquid assets among the banking markets in the observation period. Interestingly, the UK banks started to increase their share of liquid assets after the year 2016, which was the same year the Brexit referendum took place. Lastly, the Euro area banks had the smallest share of liquid assets for the whole observation period, as seen in Figure 68. The Euro area banks had an average share of liquid assets of 36% over the observation period, which was significantly smaller than the share of liquid assets of the other banking markets. The Euro area banks had their smallest share of liquid assets at 31.9% in 2011 and its largest at 38% in 2020. Thus, with a starting share of liquid assets of 33.9% in 2009, they observed an increase in their share of liquid assets of 12.1% with a CAGR of 1%, the smallest increase among the banking markets. However, with a relative standard deviation of 5.9%, this was quite constant.

As discussed in previous chapters, the main function of a bank is to use the money collected from its depositors to issue loans. Although loans are placed on the asset side of a bank's balance sheet, they are not classified as liquid or cash equivalences because loans are borrowers' obligations to banks. Hence, loans are not directly available to satisfy the liabilities of their depositors. Consequently, it is important to understand which share of the total assets of a bank are loans. Figure 69 shows the share of loans in the total assets of the relevant banks in the respective banking markets for the period 2009–2020.

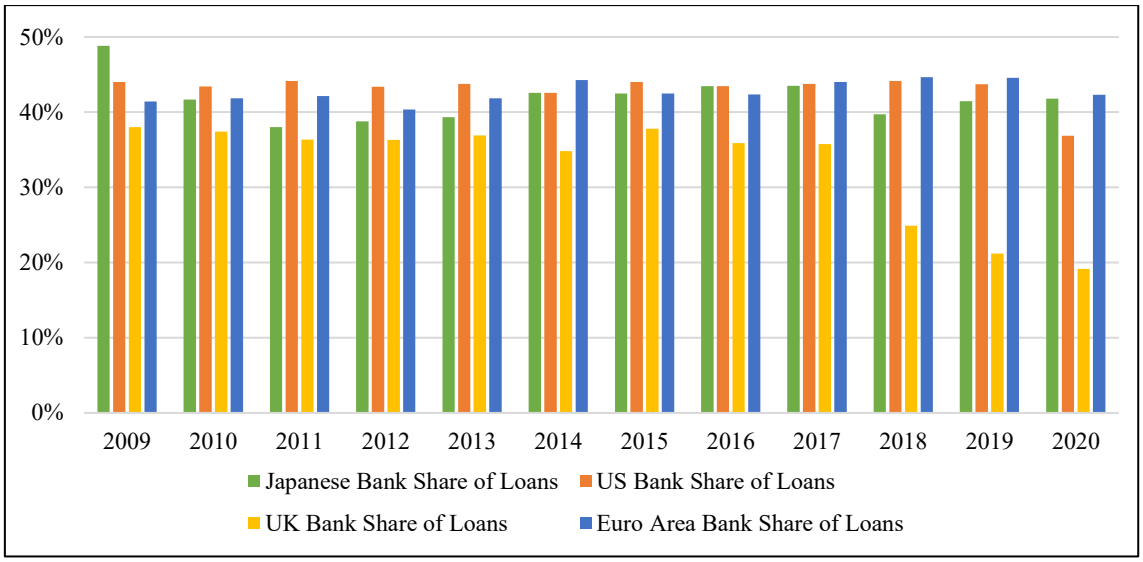

Figure 69: Share of Loans from Total Assets of Relevant Bank in Banking Markets for the Period 2009-2020, Based on Data from BankFocus and Eikon

The US banks had the largest share of loans in the period 2010–2016 and an average over the whole period of 43.1%. The US banks therefore had the largest share of loans among the banking markets in the considered period. Its share of loans was 36.9% in 2020, and 44.1% in 2011 and 2018, which was quite close to the starting share of 44% in 2009. This was an overall decrease in the share of 16.2% with a CAGR of -1.3% in the observation period as a whole. However, for the period 2009–2019, the share of loans in the US banks was quite constant, lying between 42.6% and 44.1%. Consequently, the decrease was mostly caused by the share of loans in 2020, explaining the increase in the share of liquid assets of the US banks in 2020. For the period 2017–2020, the Euro area banks had the largest share of loans among the banking markets, as seen in Figure 69. Furthermore, the Euro area banks had the second-largest average share of loans, with a value of 42.7% over the observation period. The share of loans was quite constant, lying between 40.4% in 2012 and 44.7% in 2017–2018; this was evident in the small relative standard deviation of 3.2% as well. With a starting share of loans of 41.4% in 2009 and an end value of 42.3%, the Euro area banks observed a small increase in the share of loans of 2.2% with a CAGR of 0.2%, the only relevant banks in the banking markets with an increase in the observation period. With a share of loans of 48.8% in 2009, the Japanese banks had the largest share in this year and was the highest for the Japanese bank in the observation period. Afterwards, the share of their loans decreased, and thus, for most of the period, they was placed third after the banks of the Euro area and the US banks. The lowest share of loans of the Japanese bank was observed two years after the highest share, with a value

of 38% in 2011. However, the Japanese banks had a share of loans of 41.8% at the end of the observation period, which was an overall decrease in the share of loans of 14.4% with a CAGR of -1.2%. This decrease mostly occurred between 2009 and 2010, as in the period 2010–2020, the share of loans of the Japanese banks was quite consistent, lying between 38% and 43.5%. With an average share of loans of 32.9% in the observation period, the UK banks had by far the smallest share of loans among the relevant banks in the banking markets. The share of loans of the UK banks was 38% in 2009 and 19.1% in 2020 – a decrease of 49.7% with a CAGR of -4.1%, the biggest observed decrease. Interestingly, the share of loans dropped sharply in the period 2018–2020, as the liquid assets of the UK banks rose in this period.

As loans are the borrowers' obligations to a bank, there is a possibility that the borrower is not able to service the debt. If a loan is not serviced by its borrower within three months or 90 days, it is classified as a non-performing loan. Naturally, a bank wants to minimize the share of non-performing loans, as those loans have a negative impact on the bank's net interest income. Thus, it is important to analyze the share of a bank's loan portfolio that is classified as non-performing loans.[71]

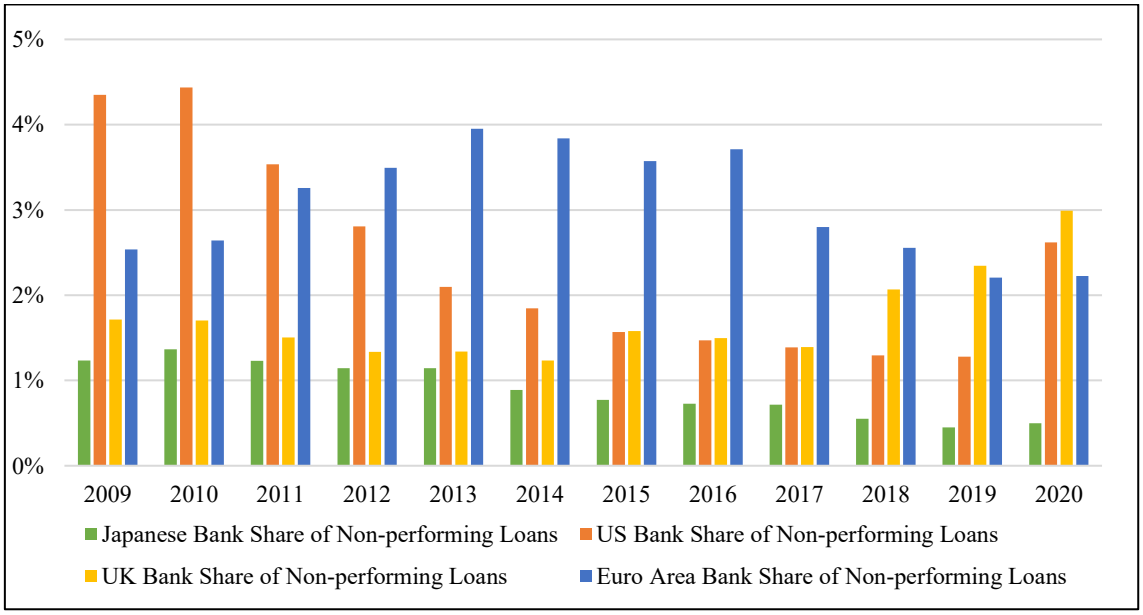

Figure 70: Share of Non-Performing Loans of Relevant Banks in Banking Markets for the Period 2009–2020, Based on Data from BankFocus

In Figure 70, it can be seen that the Euro area banks had the largest share of non-performing loans in their loan portfolios for the period 2012–2018, and the largest average share

[71] Bank for International Settlement (2016), p. 27

of non-performing loans (3.07%) over the whole observation period. The trend was inverted, with the highest share of non-performing loans with a value of 3.95% in 2013 and the lowest share of 2.21% in 2019. With a starting share of non-performing loans of 2.54% in 2009 and ending at 2.23% in 2020, the Euro area banks saw an overall decrease in their share of non-performing loans of 12.3% with a CAGR of -1%. Over the whole period, the US banks had the largest share of non-performing loans in their loan portfolios, with the second-largest average share of non-performing loans at 2.39%. The non-performing loans of the US banks peaked with a share of 4.43% in 2010 and fell to a low of 1.28% in 2019. Overall, the US banks saw a decrease in their share of non-performing loans of 39.8% and a CAGR of -3.3%, with a starting share of 4.35% in 2009 and an ending share of 2.62% in 2020. Again, the US banks experienced a significant change in 2020, with the share of non-performing loans doubling from 1.28% in 2019 to 2.62% in 2020. At the end of the observation period, 2019–2020, the UK banks had the largest share of non-performing loans among the relevant banks in the banking markets. However, the UK banks were third in terms of the average share of non-performing loans, with a value of 1.73% over the observation period. The UK banks experienced their smallest share of non-performing loans, with a value of 1.24%, in 2014 and the biggest share of 2.99% in 2020. With a starting share of 1.72%, the UK banks experienced an increase in their share of non-performing loans of 74.4% with a CAGR of 6.2% in the observation period, the highest and only increase among the relevant banks in the banking markets. However, most of the increase occurred in the period 2018–2020, the period in which the UK banks reduced the share of loans from their total assets significantly, as shown in the previous section. Lastly, the Japanese banks had the smallest share of non-performing loans for the whole observation period, as seen in Figure 70. The share of non-performing loans of the Japanese banks was between 1.37% in 2010 and 0.45% in 2019. With a decrease of 59.6% and a CAGR of -5%, the Japanese bank had the largest decrease in the share of non-performing loans among the bank markets in the observation period, with a starting share of 1.23% in 2009 and ending with 0.50% in 2020.

The counterpart of a bank's assets are its liabilities. One of the most important positions on the balance sheet are the deposits, which are the obligation of a bank to its depositors and one of the core financial services a bank provides. Thus, it is important to examine which share of the liabilities are deposits. As total assets equal total liabilities in a balance sheet, the deposits can be analyzed as a share of total assets.

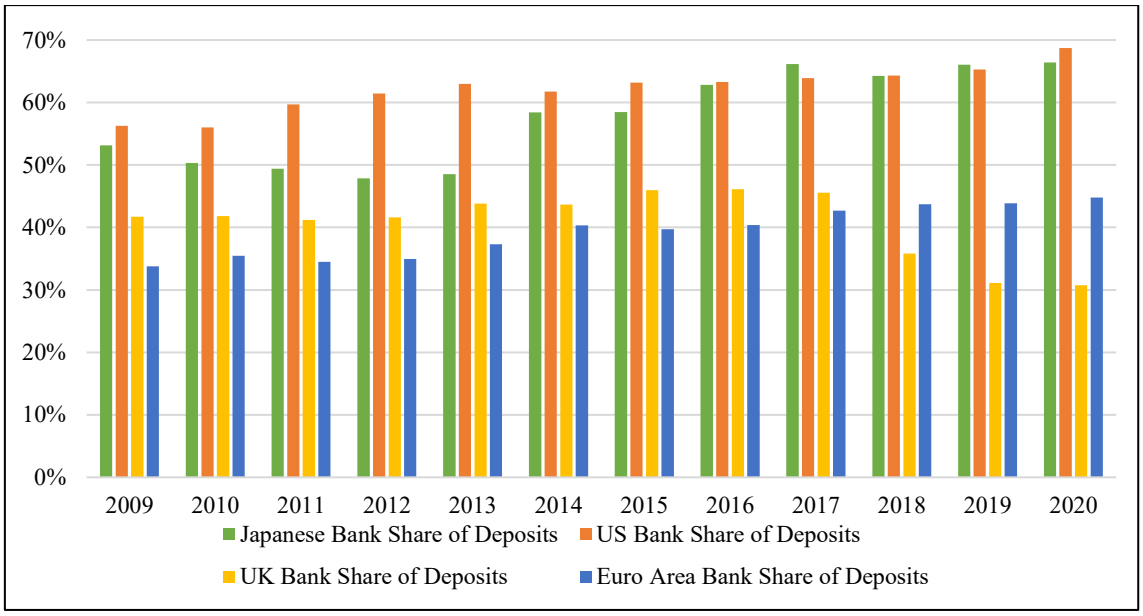

Figure 71: Share of Deposits from Total Assets of Relevant Banks in Banking Markets for the Period 2009–2020, Based on Data from BankFocus and Eikon

As shown in Figure 71, the US banks had the largest share of deposits for the years 2009–2016, 2018 and 2020. Moreover, with an average share of deposits of 62.2%, the US banks had the largest average share over the period as a whole. The share of deposits of the US banks peaked at 68.7% in 2020, with a low of 56% in 2010, which was quite close to the starting share of 56.2% in 2009. Overall, the US banks saw an increase in their share of deposits of 22.2% with a CAGR of 1.9% in the observation period. In the years when the US banks did not have the largest share of deposits, the Japanese banks did. Consequently, in the years 2017 and 2019, the Japanese bank had the largest share of deposits among the relevant banks in the banking markets. As the share of deposits of the Japanese banks was similar to the share of the US banks in the period 2014–2020, it is not surprising that the Japanese banks had a similar average share of deposits of 57.7%. The share of deposits of the Japanese banks was between 47.9% in 2012 and 66.4% in 2020. With a starting share of deposits of 53.1%, the Japanese bank saw an increase of their share of deposits of 25% with a CAGR of 2.1% – the largest increase among the relevant banks in the banking markets. Unlike the US and Japanese banks, the banks on the European continent had smaller shares of deposits in their balance sheets. The UK banks had an average share of deposits of 40.8% over the period and thus were third among the relevant banks in the banking markets. The lowest value of the UK banks share of deposits was observed with 30.8% in 2020, the lowest value among the relevant banks of the banking markets, and the highest value, with a share of 46.1%, in 2016. With a

starting value of 41.7% in 2009, there was a decrease over the period of 26.2% with a CAGR of -2.2%, which meant that the UK banks were the only relevant banks in the banking markets that experienced a decrease in their share of deposits. Again, the main decrease occurred between 2018–2020, as the share of deposits of the UK banks was between 41.7% and 46.1% in the previous years of the observation period. Lastly, the Euro area banks had the smallest share of deposits, with an average share of deposits of 39.3%. More The share peaked with a value of 44.8% in 2020, up from its low of 33.8% in 2009. Hence, the Euro area banks experienced an increase in their share of deposits of 32.5% with a CAGR of 2.7% in the observation period. It is interesting to note that the maximum observed share of deposits in the UK and Euro area banks was still smaller than the minimum share of deposits in the US and Japanese banks.

The collection of deposits and the provision of loans are the core intermediary functions of a bank. To understand to what degree the provided loans are covered by the collected deposits, it is necessary to analyze the loan-to-deposit ratio. The ratio is calculated by dividing the provided loans by the collected deposits, so if the loan-to-deposit ratio equals 1, every collected deposit is provided as a loan. As shown in Figure 72, the Euro area banks had the highest loan-to-deposit ratio among the relevant banks from the banking markets in the observation period, with an average total loan-to-deposit ratio of 106%, by far the highest average ratio among the relevant banks in the banking markets.

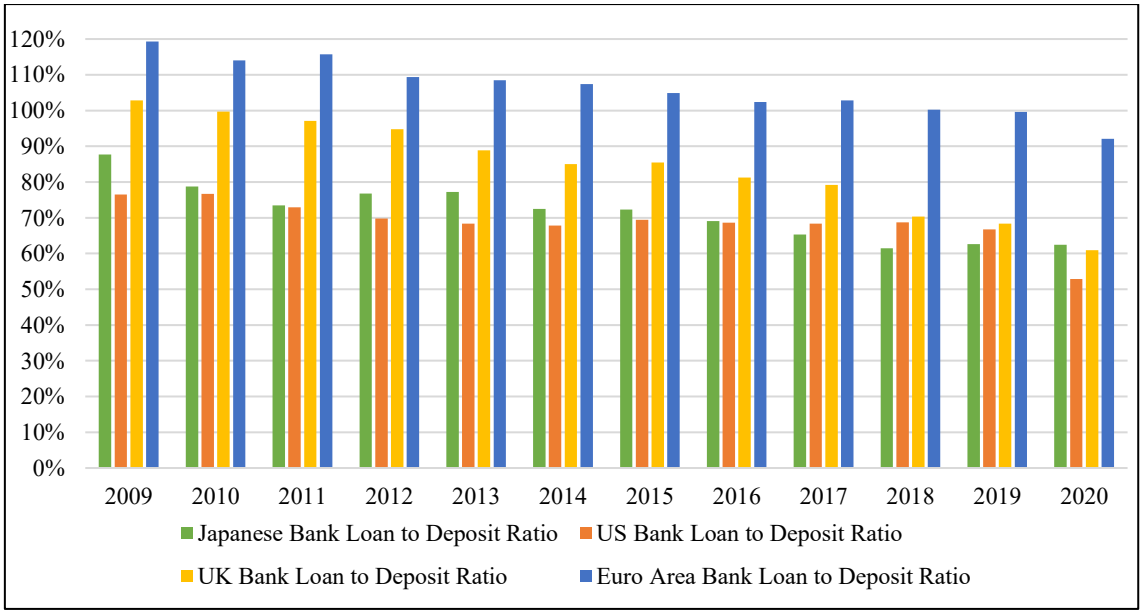

Figure 72: Loan-to-Deposit Ratio of Relevant Banks in Banking Markets for the Period 2009–2020, Based on Data from BankFocus

The Euro area banks had a loan-to-deposit ratio of 119% in 2009; subsequently, this decreased to a ratio of 92% in 2020. Therefore, the Euro area banks saw a decrease in their loan-to-deposit ratios of 22.8% with a CAGR of -1.9% over the period as a whole. However, a large part of the decrease occurred in 2020, as between 2015 and 2019 the Euro area banks' loan-to-deposits ratio was between 100% and 105%. With an average loan-to-deposit ratio of 84% over the observation period, the UK banks followed the Euro area banks. Unlike the banks in the Euro area, however, the UK banks saw a consecutive decrease in their loan-to-deposit ratios, with the highest ratio of 103% occurring in 2009 and the lowest, 61%, in 2020 – a decrease of 40.7% with a CAGR of 3.4%, the biggest decrease among the relevant banks in the bank market in the observation period. The Japanese banks had an average loan-to-deposit ratio of 72%, which was substantially lower than the average loan-to-deposit ratio of the Euro area and UK banks. The Japanese banks also observed a decrease over the period, with the highest ratio of 88% occurring in 2009 and the lowest, 61%, in 2018. In the period 2018–2020, the Japanese banks' loan-to-deposit ratio was quite constant but increased slightly to 62% in 2020. Overall, however, there was a decrease of 28.8% with a CAGR of -2.4% over the observation period as a whole. Lastly, with an average of 69%, the US banks had the lowest average loan-to-deposit ratio among the relevant banks in the observation period. Like the UK and Japanese banks, the US banks' loan-to-deposit ratio decreased in the observation period. The highest ratio of 77% was observed in 2009, and the lowest of 53% in 2020 – a decrease of 30.9% with a CAGR of -2.6%. Like the Euro area banks, the sharpest decrease in the US banks' loan-to-deposit ratio occurred from 2019 (67%) to 2020 (53%), as it was quite constant between 2012 and 2019, as seen in Figure 72.

Another important position on the liability side of a bank's balance sheet is the bank's equity. As shown in previous chapters, a bank's equity is important to signal its depositors the willingness to screen loans effectively and is therefore an important indicator of a bank's stability. Thus, comparing the total equity of banks is an interesting way of examining structural differences between the relevant banks in the banking markets.

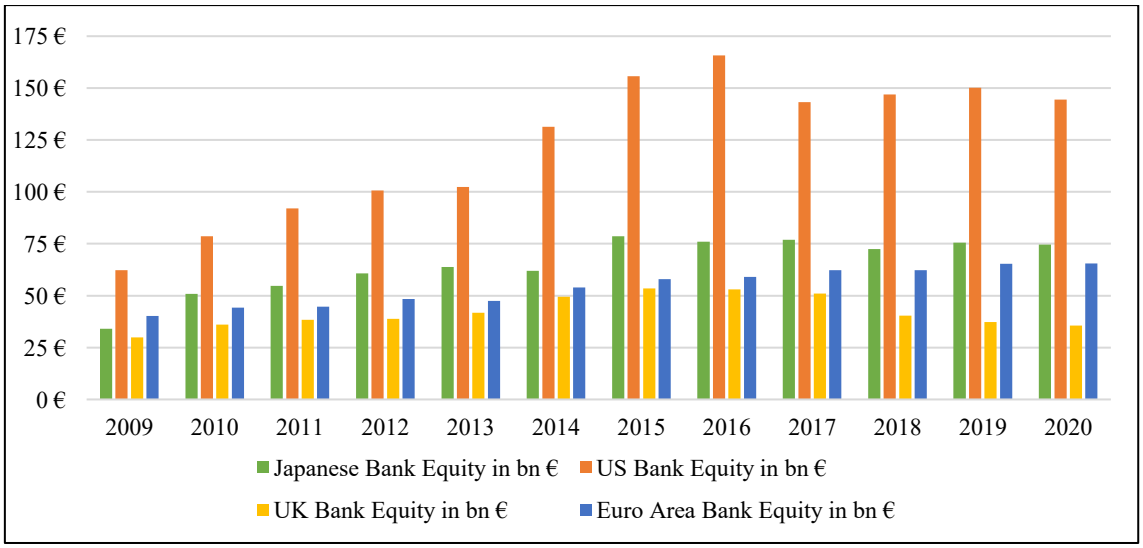

Figure 73: Equity in Billion Euros of Relevant Banks in Banking Markets for the Period 2009-2020, Based on Data from BankFocus

As shown in Figure 73, the US banks had by far the largest amount of equity among the relevant banks in the banking markets for the whole observation period. Overall, the US banks had an average equity of 122.8 billion euros, which was nearly twice the average amount of equity of the Euro area and Japanese banks and three times the average amount of the UK banks. Nevertheless, the US banks had the lowest level of equity, with a value of 62.3 billion euros in 2009. However, subsequently, this rose dramatically to its highest value of 165.7 billion euros in 2016, although it decreased to 144.5 billion euros in 2020. This was an overall increase of 132% with a CAGR of 11% over the observation period, the biggest increase among the relevant banks in the banking markets. The US banks were followed by the Japanese banks, with an average equity of 65 billion euros over the period. The Japanese banks had their lowest level of equity at 34 billion euros in 2009. Subsequently, this increased to 78.6 billion € in 2015. However, between 2015 and 2020, the Japanese banks' equity was quite constant, although it decreased slightly to 74.6 billion euros in 2020, which was nevertheless an increase of 119.7% with a CAGR of 10%, the second largest increase among the relevant banks in the banking markets. The average equity of the Euro area banks (54.3 billion euros) was quite similar to the level of equity held by the Japanese banks over the observation period. However, the Euro area banks had their lowest level of equity (40.1 billion euros) in 2009. Subsequently, this rose to a high of 65.4 billion euros in 2020. Overall, the Euro area banks increased their total equity by 63% with a CAGR of 5.3% during the observation period. Lastly, the UK banks had the lowest average level of equity, with 42.1billion euros over the observation period.

The lowest level of equity (30 billion euros) occurred in 2009; it then increased to 53.5 billion euros in 2015 before decreasing again afterwards to a level of 35.6 billion euros in 2020. Hence, the UK banks increased their equity by 18.9% with a CAGR of 1.6%, which was the smallest increase among the relevant banks in the bank markets in the observation period

Because there are differences in the total assets and size of the banks, a relative comparison of the equity is necessary as well. In Figure 74, it can be seen that the US bank had the highest share of equity for the whole period among the relevant banks in the banking markets. This is also reflected in the US banks' average share of equity of 7.66% in the observation period, the highest value among the relevant bank in the banking markets. The US banks' share of equity peaked with a share of 9.03% in 2015, had its lowest share of 3.73% in 2009, and ended with a value of 4.08% in 2020 – an increase of the US banks' share of equity of 32.2% with a CAGR of 2.7% in the observation period. In terms of average share of equity, the US banks were followed by the Japanese banks with an average share of equity of 4.75%. The Japanese banks' share of equity was 3.73% in 2009 and 5.3% in 2015; afterwards, this decreased to 4.08% in 2020 – an increase of 9.5% with a CAGR of 0.8%, the lowest increase among the relevant banks in the banking market.

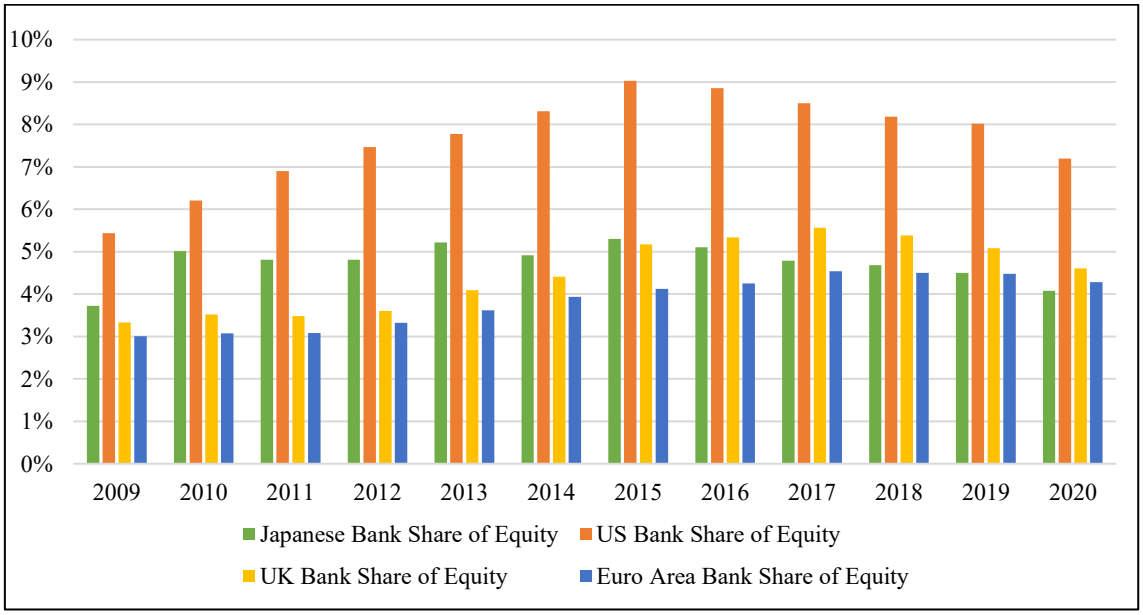

Figure 74: Share of Equity from Total Assets of Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from BankFocus and Eikon

The UK banks had the third highest average share of equity at 4.6%. The lowest value of 3.33% occurred in 2009, but this increased to a high of 5.57% in 2017, only to decrease to a share of equity of 4.6% in 2020 – an overall increase of its share of equity of 38.2%

with a CAGR of 3.2% in the observation period. Interestingly, the UK banks' share of equity also decreased in the period 2018–2020 as did the other previously analyzed key figures. In the period 2009–2019, the Euro area banks observed the smallest average share of equity of 3.85%, as seen in Figure 74. The trend over the period was similar to the UK banks', as the lowest value of 3.01% occurred in 2009, which later increased to 4.54% in 2017 before decreasing to 4.28% in 2020 – the only year in which the Euro area banks did not have the smallest share of equity. Ultimately, the Euro area banks had an overall increase in share of equity of 42.2% with a CAGR of 3.5%, the largest increase among the relevant banks in the banking markets.

The share of equity to total assets is only a first indication of the stability of a bank, as it does not consider the individual risks of different assets and different types of equity. For example, a liquid asset such as cash is not as risky as a loan. To take these risk differences into account, the Basel Committee on Banking Supervision defined, on the one hand, risk weights for different assets to determine with how much equity these assets need to be backed and, on the other hand, categorized the equity into core capital, or TIER 1 capital, and supplementary capital, or TIER 2 capital. Hence, two different capital ratios can be analyzed regarding risk-weighted assets: the capital adequacy ratio, which consists of the sum of TIER 1 and TIER 2 capital divided by risk-weighted assets; and the TIER 1 capital ratio, which is computed by dividing the TIER 1 capital with the risk-weighted assets. In the following, both ratios are analyzed for the different relevant banks in the banking markets.[72]

Figure 75 shows that the UK banks had the largest capital adequacy ratio for the period 2017–2020. Which can be explained by the decrease in loans and the increase in liquid assets by the UK banks in this period. The UK banks also observed the largest capital adequacy ratio in 2009, 2013, and 2016. Overall, the UK banks also had the largest average capital adequacy ratio, with a value of 18.02%. The lowest capital adequacy ratio, with a value of 14.66%, occurred in 2009; afterwards, the ratio increased to its highest value of 23.37% in 2019 before decreasing to 22.48% in 2020. Hence, the UK banks observed an increase in capital adequacy ratio of 53.4% with a CAGR of 4.4%. Consequently, the UK banks became financially more stable and saw the largest increase in capital adequacy ratio among the relevant banks in the banking markets. For the periods

[72] Cf. Bank for International Settlement (1988), p. 17-23

2010–2012 and 2015–2016, the US banks had the largest capital adequacy ratio, and, with an average capital adequacy ratio of 17.24%, the second-highest among the relevant banks. The US banks observed their lowest capital adequacy ratio with a value of 14.24% at the beginning of the observation period in 2009. Afterwards, this increased to its highest level of 19.67% in 2012, only to decrease to a value of 15.3% in 2013. In the period 2013–2020 the US banks' capital adequacy ratio increased to 17.87% – an overall increase of 25.5% with a CAGR of 2.1% in the observation period, the lowest increase among the relevant banks in the bank market. However, the US bank also became more financially stable during the observation period.

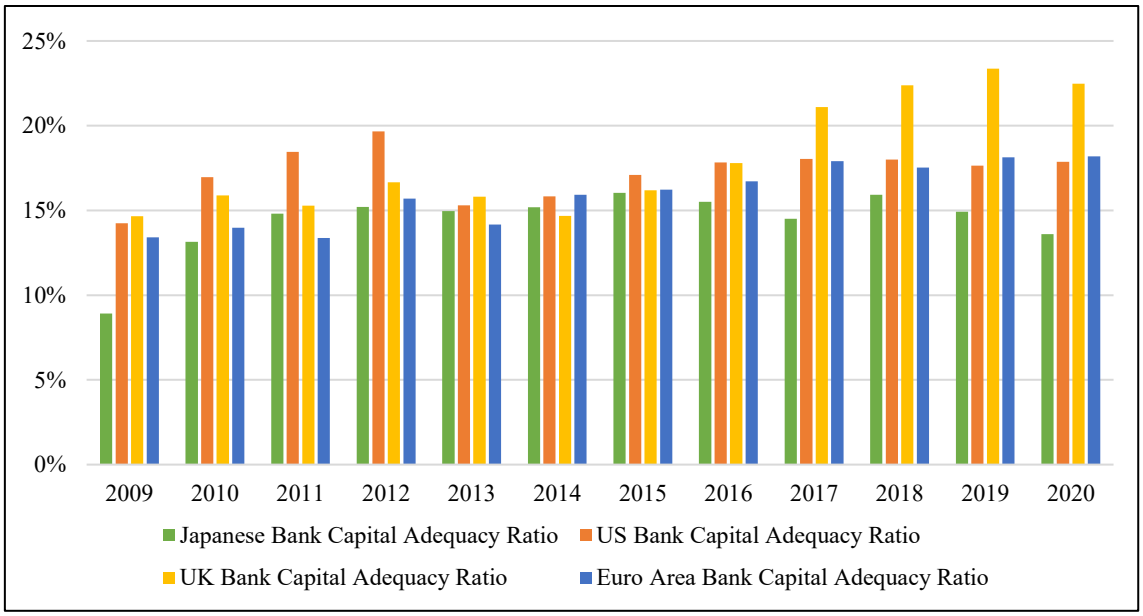

Figure 75: Capital Adequacy Ratio of Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from BankFocus

The Euro area banks had the largest capital adequacy ratio among the relevant banks in the banking markets in 2014 and had the third-highest average capital adequacy ratio of 15.93% among the relevant banks in the banking markets. At the beginning of the observation period, the Euro area banks had a capital adequacy ratio of 13.41%. After an increase in 2010, this dropped to the lowest value of 13.37% in 2011. In the period 2012–2020, however, the capital adequacy ratio of the Euro area banks increased to a high of 18.18% in 2020 – a larger capital adequacy ratio than the US banks had in 2019–2020. Overall, the Euro area banks saw an increase in capital adequacy ratio of 35.5% with a CAGR of 3%, which meant they also increased their financial stability in the observation period. Lastly, the Japanese banks had the lowest average capital adequacy ratio, with a value of 14.39%. The lowest capital adequacy ratio, with a value of 8.92%, occurred

2009. Afterwards, this almost doubled to a high of 16.03% in 2015 before dropping to 13.60% in 2020. Hence, the Japanese banks saw an increase in their capital adequacy ratio of 52.4% with a CAGR of 4.4% in the observation period and thus also became more financially stable.

As the capital adequacy ratio includes TIER 2 capital, which consists of undisclosed reserves, revaluations, hybrid capital instruments, subordinated term debt, and other items, it is not as clear as TIER 1 capital ratio. The core capital definition is much clearer, as the TIER 1 capital consists only of the permanent shareholders equity and disclosed reserves – the original fund of the bank to run its business. Furthermore, according to the Basel III regulation framework, banks are obliged to hold a certain amount of TIER 1 capital: 4.5% in 2013; 5.5% in 2014; and 6.0% from 2015 on. Consequently, in addition to the capital adequacy ratio, it is important to analyze the TIER 1 capital ratio of the relevant banks in the banking markets.[73]

In Figure 76, it can be seen that all the relevant banks in the banking markets complied with the mandatory TIER 1 capital ratio, as the ratio of all the relevant banks was well above the defined minimums in the relevant years.

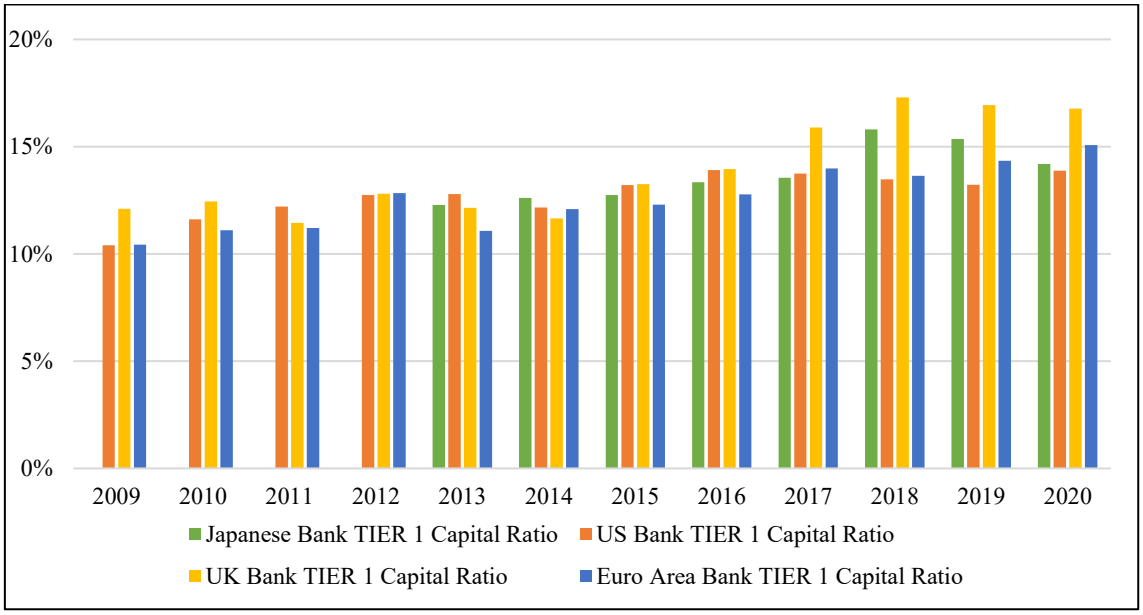

Figure 76: TIER 1 Capital Ratio of Relevant Banks in the Banking Markets for the Period 2009–2020, Excluding Japan, for the Period 2009–2012, based on Data from BankFocus

At the beginning of the observation period 2009–2010, and at the end of the observation period 2015–2020, the UK banks observed the largest TIER 1 capital ratio among the

[73] Cf. Bank for International Settlement (1988), p. 18f.; Bank for International Settlement (2010), p. 69

relevant banks in the banking markets. With an average TIER 1 capital ratio of 13.89%, the UK banks observed the largest average TIER 1 capital ratio among the relevant banks in the banking markets. Furthermore, over the observation period, the TIER 1 capital ratio of the UK banks grew, with, however, some volatility. In 2009, the UK banks observed a TIER 1 capital ratio of 12.10%, which increased in 2010, decreased to its lowest value of 11.45% in 2011, increased again to a high of 17.30% in 2018 before decreasing once more to a ratio of 16.77% in 2020. Consequently, the UK banks saw an increase in their TIER 1 capital ratio of 38.6% with a CAGR of 3.2% over the observation period. With an average TIER 1 capital ratio of 13.74% in the period 2013–2020, the Japanese banks had the second highest TIER 1 capital ratio. The observation period for the Japanese bank was limited because there was no data available for the period 2009–2012. Nonetheless, the average TIER 1 capital ratio of the Japanese banks was still higher than the average TIER 1 ratio of the Euro area and US banks in the same period. Additionally, the Japanese banks observed the highest TIER 1 capital ratio among the relevant banks in the bank market in 2014. Like the UK banks, the Japanese banks saw an increase in their TIER 1 capital ratio within the considered period. The lowest TIER 1 capital ratio of 12.28% was observed in 2013 and increased to its highest value of 15.81% in 2018, before decreasing to a value of 14.20% in 2020. Thus, the Japanese banks saw an overall increase in their TIER 1 capital ratio of 15.6% with a CAGR of 2%. For half of the time in the observation period, the TIER 1 capital ratio of the Euro area and the US banks was quite similar. However, with an average TIER 1 capital ratio of 12.78% in the observation period, the US banks observed a slightly higher TIER 1 capital ratio than the Euro area banks. The US banks observed their lowest TIER 1 capital ratio of 10.41% in 200. Afterwards, this increased to its highest value of 13.91% in 2016 before decreasing slightly to a TIER 1 capital ratio of 13.88% in 2020. Additionally, the US bank observed the highest TIER 1 capital ratio among the relevant banks in the banking markets in 2011 and 2013. Overall, therefore, the US banks observed an increase in their TIER 1 capital ratio of 33.3% with a CAGR of 2.8% in the considered period. Lastly, with an average TIER 1 capital ratio of 12.57%, the Euro area banks observed the lowest TIER 1 capital ratio among the relevant banks in the banking markets. However, the Euro area banks saw an overall increase in their TIER 1 capital ratio over the observation, period. The lowest ratio of 10.44% was observed in 2009. Afterwards, however, this increased with some volatility to its highest value of 13.88% in 2020 – an increase in TIER 1 capital ratio of 44.4% with a CAGR of 3.7%, the highest increase among the relevant banks in the banking markets.

Another measure to analyze the riskiness of a bank's portfolio is to look at its risk-weighted asset (RWA) density. The Basel regulations set risk weights on different assets for the calculation of the risk-weighted capital. For example, cash, with basically no default possibility, has a risk weight of 0%, while claims on the private sector have a risk weight of 100%. Thus, the RWA density is the ratio between risk-weighted assets and total assets. The higher a bank's RWA is, the riskier its portfolio.[74]

For the period 2011–2020, the US banks had the highest RWA density and thus had the riskiest portfolio amongst the compared banks in this period, as seen in Figure 77. Furthermore, the US banks' average RWA density was 48% over the entire observation period and hence, the riskiest average portfolio among the compared banks.

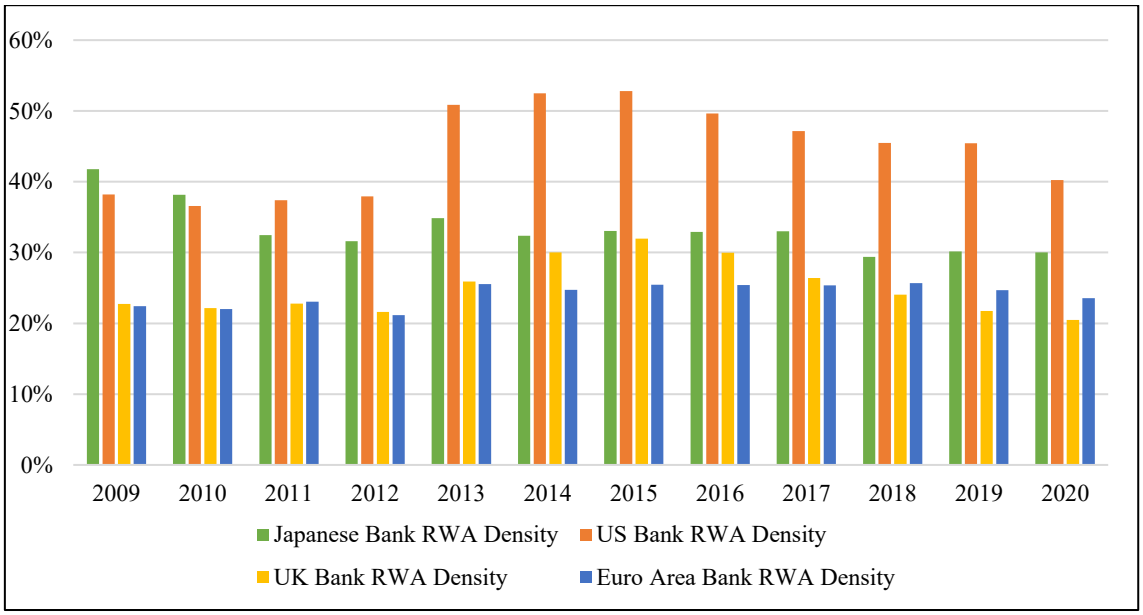

Figure 77: RWA Density of Relevant Banks in Banking Markets for the Period 2009–2020. Own Calculation Based on Data from BankFocus and Eikon[75]

The US banks had their lowest RWA density in the period 2009–2012, when it was between 36.6% and 38.2%. In the following period, 2013–2019, this was much higher, with values between 45.4% and 52.8%. At the end of the observation period, however, this decreased again to an RWA density of 40.3%. Overall, however, the US banks observed an increase in their RWA density of 5.4% with a CAGR of 0.4%. If 2020 is excluded, the US banks even experienced an increase of 19%. Thus, the portfolio of the US banks became riskier during the observation period. In the years 2009–2011, the Japanese banks

[74] Cf. Bank for International Settlement (1988), p. 21-22

[75] Calculated by dividing the capital ratio through the capital adequacy ratio.

had the highest RWA density among the compared banks, as seen in Figure 77. Additionally, the Japanese banks observed the second highest average RWA density over the observation period of 32%. The Japanese banks had their highest RWA density of 41.8% at the beginning of the observation period. Afterwards, this decreased with some volatility to its lowest value of 30% in 2020. Thus, the Japanese banks saw a decrease in their RWA density of 28.2% with a CAGR of -2.3%. Thus, the Japanese banks' portfolios became less risky over the period. The UK banks had, with 26.3%, the second lowest average RWA density among the compared banks. At the beginning of the observation period, the UK banks had a RWA density of 22.7%. This rose to its highest value of 32% in 2016, before falling to its lowest value of 20.5% in 2020 – an overall decrease in RWA density of 9.9% with a CAGR of -0.8% over the observation period. Hence, the portfolio of the UK banks became less risky. Again, the UK banks experienced considerable change in the post-Brexit period of 2017–2020, as is apparent with other key figures. Lastly, the Euro area banks had, with 25%, the lowest average RWA density among the relevant banks in the banking markets. The trend over the period was quite constant, which was reflected by a relative standard deviation of 6%. The Euro area banks' RWA density was between 21.1% in 2012 and 25.7% in 2018. With a starting RWA density of 22.2% in 2009 and an ending value of 23.5% in 2020, the Euro area banks saw an increase in their RWA density of 4.9% with a CAGR of 0.4%. Thus, the portfolio of the Euro area banks became slightly riskier over the observation period.

After examining the structure and risk of a bank's balance sheet, it is necessary to look at the profit and loss statements. The net interest income is the difference between a bank's income from interest rates and the expenses needed to generate them. Thus, it can be interpreted as revenue from a bank's function as a financial intermediary. In the following, the net interest income, as an absolute key figure, as well as the net interest margin based on total assets and loans, as a relative a key figure, are analyzed to understand the profitability of the relevant banks in the banking markets regarding their function as financial intermediaries.

The US banks observed by far the largest net interest income among the relevant banks in the banking markets for the whole observation period, as shown in Figure 78. With an average net interest income of 37.4 billion euros, it was nearly four times larger than the Japanese and UK banks. The US banks had a net interest income of 31.5 billion euros in 2009, which increased in 2010, before decreasing to its lowest value of 30.2 billion euros in 2013. In the period 2014–2019, it rose to its highest value of 45.2 billion euros,

before falling to 37.2 billion euros in 2020. Overall, the US bank observed an increase in its net interest income of 17.9% with a CAGR of 1.5% over the observation period, the largest increase observed among the relevant banks in the banking markets.

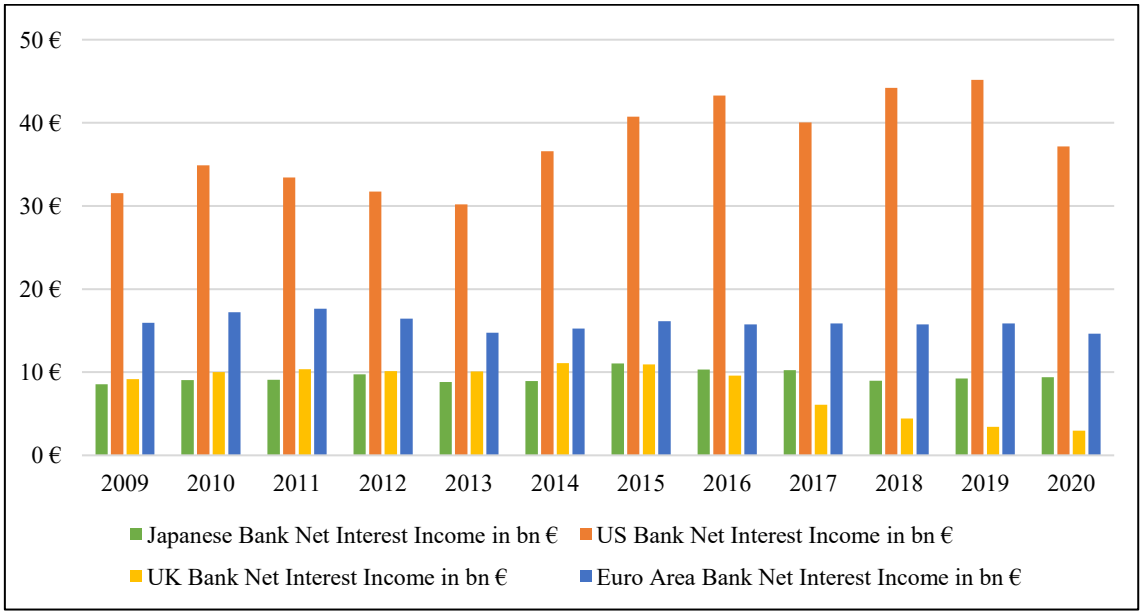

Figure 78: Net Interest Income in Billion Euros of Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from BankFocus

The US bank was followed by the Euro area banks, with an average net interest income of 15.9 billion euros. The Euro area banks observed a net interest income of 15.9 billion euros at the beginning of the observation period. Afterwards, this rose to its highest value of 17.6 billion euros in 2011 but decreased in the two following years. In the period 2014–2019, the Euro area banks' net interest income was quite stable but decreased to 14.6 billion euros in 2020 – an overall decrease in net interest income of 8.3% with a CAGR of -0.7%. Therefore, this decrease mainly occurred in 2020, as the Euro area banks' net interest income in 2019 was at the same level as in 2009. For the period 2009–2016, the net interest income of the Japanese and UK banks was quite similar, as seen in Figure 78. However, the average net interest income of the Japanese banks was 9.5 billion euros in the observation period and is thus, higher than the average net interest income of the UK banks of 8.2 billion euros. The Japanese banks observed their lowest net interest income of 8.5 billion euros in 2009. Afterwards, this increased to its highest value of 11.1 billion euros in 2015 before decreasing to 9.4 billion euros in 2020. Overall, this was an increase of 10.2% with a CAGR of 0.9%. Unlike the Japanese banks, the UK banks did not see an increase in their net interest income over the observation period. The UK banks had a net interest income of 9.2 billion euros at the beginning of the observation period, which

increased to its highest value of 11.1 billion euros in 2014. However, this was followed by a strong decrease to a low of 3 billion euros in the period 2017–2020. This was an overall decrease in net interest income of 67.8% with a CAGR of -5.6%, by far the largest change among the relevant banks in the banking markets.

To take the analysis from an absolute to a relative level and compare how efficiently the relevant banks in the banking markets earned their net interest income, the net interest margin based on the total assets, or NIMTA, needs to be analyzed.

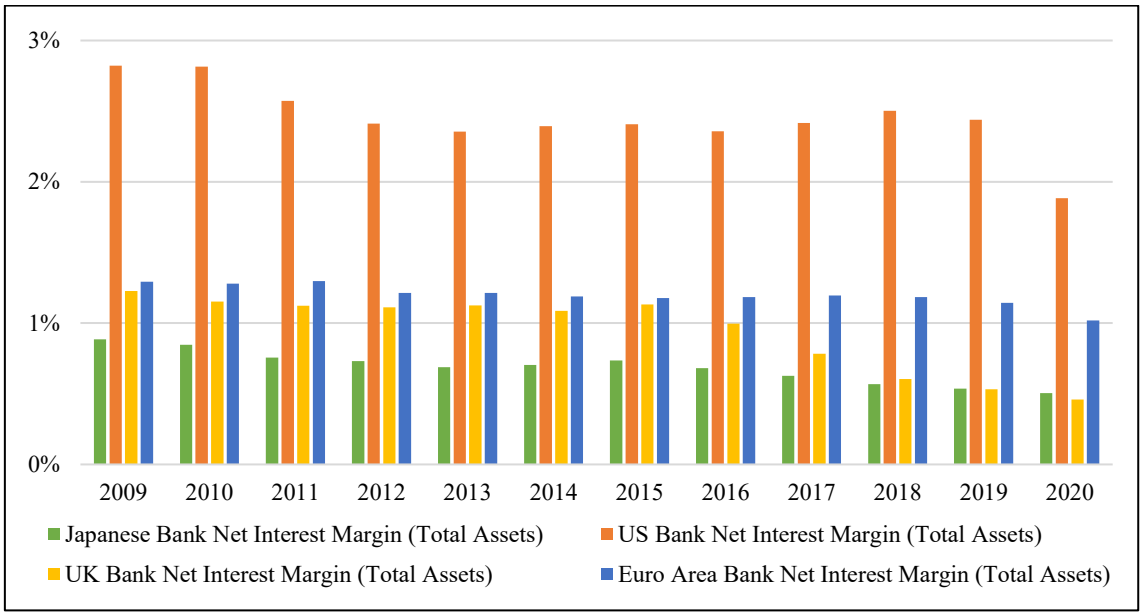

Figure 79: Net Interest Margin Based on Total Assets of Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from BankFocus and Eikon

As shown in Figure 79, the US bank observed the highest NIMTA for every year of the observation period. Furthermore, the US bank observes an average NIMTA of 2.45%, the highest among the relevant banks in the banking markets. The US bank observed its highest NIMTA, with a value of 2.82%, in the period 2009–2010. Afterwards, the US banks' NIMTA decreased with some volatility to its lowest value of 1.88% in 2020. Hence, the US bank saw a decrease in its NIMTA of 33.2% with a CAGR of -2.8%, which is contrary to the increase of its net interest income of 17.9%. However, the largest part of the decrease can be explained by the US banks' NIMTA decrease in 2020, as seen in Figure 79. The Euro area banks followed the US banks in terms of average NIMTA, with a value of 1.20%. In 2009, the Euro area banks had a NIMTA of 1.29%, which increased to its highest value of 1.30% in 2011. In the following period, 2012–2018, the Euro area banks' NIMTA decreased slightly but remained fairly constant between 1.18% and 1.21%. Afterwards, the NIMTA decreased to 1.02% in 2020. Overall, the Euro area banks saw a

decrease in their NIMTA of 21.2% with a CAGR of -1.8%, which was larger than the decrease in their net interest income of 8.3%. The UK banks had the third highest average NIMTA of 0.94% in the observation period. The UK banks observed their highest NIMTA of 1.23% in 2009. Afterwards, this decreased to its lowest value of 0.46% in 2020. This was a decrease of 62.6% with a CAGR of -5.2%, which was comparable to the decrease in net interest income of 68% over the observation period. Lastly, the Japanese banks observed the lowest average NIMTA, with a value of 0.69%. The Japanese banks' NIMTA was between 0.50% in 2020 and 0.89% in 2009. Hence, the Japanese banks observed a decrease in their NIMTA of 43% with a CAGR of -3.6% in the observation period, which was contrary to the increase in their net interest income of 10%. Overall, the profitability of all relevant banks in the banking markets decreased in terms of NIMTA during the observation period.

Total assets include non-interest-bearing assets, such as, for example, cash, in addition to interest-bearing assets. Thus, it is necessary to narrow the base of the net interest margin to get a better understanding of the profitability of the relevant banks in the banking markets. As loans are mostly the largest contributor to net interest income, the net interest margin based on the sum of loans, or NIML, can be used as an indication of the margin banks earn through their interest business. As seen in Figure 80, the US banks had both the highest NIML and the highest average NIML of 5.74% during the observation period as a whole. This was by far larger than the average NIML of the other relevant banks in the banking markets. The US banks had a NIML of 6.61% in 2009, which increased to its highest value of 6.68% in 2010. Following a decrease in 2011 and 2012, the US bank had quite a stable NIML for the period 2012–2019, although this decreased to its lowest value of 5.14% in 2020. Overall, the US bank saw a decrease in its NIML of 22.3% with a CAGR of -1.9%, which was not as large as the decrease in the NIMTA of 33.2%. Figure 80 shows that the Euro area banks had the second highest NIML for every year of the observation period. This was an average NIML of 2.93% over the considered period, the second highest average NIML among the relevant banks in the banking markets. The Euro area banks' highest NIML was in the period 2009–2012, with a NIML of 3.22% in 2009 and 3.24% in 2011. Afterwards, this decreased to 2.46% in 2020. This was a decrease in NIML of 23.74% with a CAGR of -2% and was therefore comparable to the decrease in its NIMTA of 21.2% in the same period.

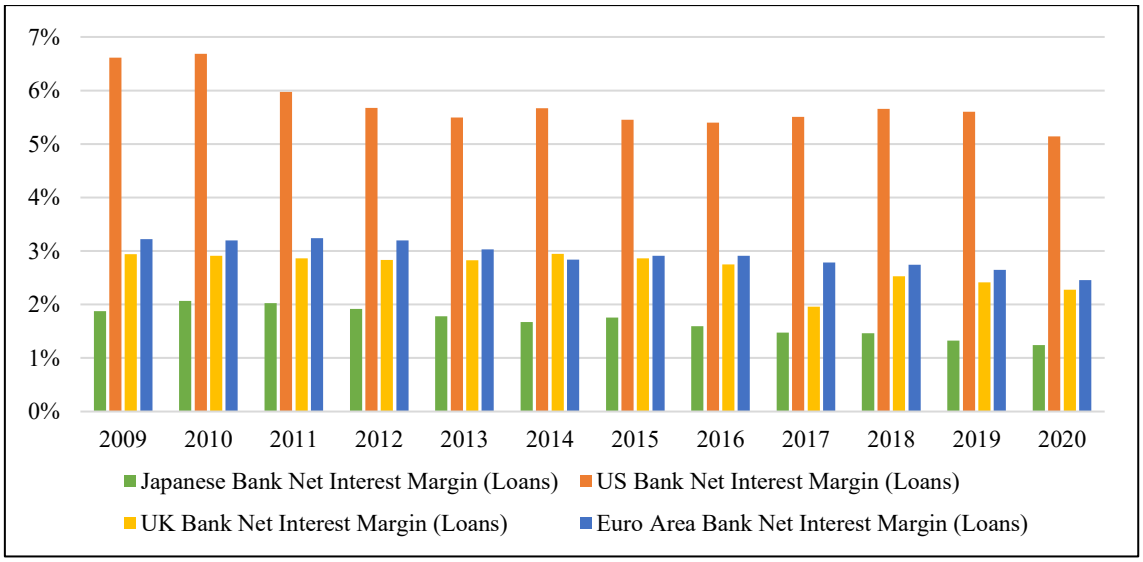

Figure 80: Net Interest Margin based on Loans of Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from BankFocus

In terms of average NIML, the Euro area banks were followed by the UK banks with a value of 2.68%. For the period 2009–2015, the UK banks' NIML was quite constant, with a starting value of 2.94% in 2009 and the highest observed value of 2.95% in 2014. Afterwards, the UK banks' NIML decreased to its lowest value of 1.96% in 2017, only to increase to 2.28% in 2020. Overall, the UK bank saw a decrease in their NIML of 22.5% with a CAGR of -1.9% over the observation period, which was considerably lower than the decrease in their NIMTA of 62.6%. Lastly, the Japanese banks had an average NIML of 1.68% over the period, the lowest NIML among the relevant banks in the banking markets. The Japanese banks had an NIML of 1.88% in 2009, which increased to its highest value of 2.07% in 2010. In the following years, however, this decreased to its lowest value of 1.24% in 2020. Thus, the Japanese banks saw a decrease in their NIML of 33.8% with a CAGR of -2.8%, the strongest decrease among the relevant banks in the banking markets. However, this decrease was not as great as the decrease in the NIMTA of 43%. Again, all the relevant banks in the banking markets observed a decrease in profitability expressed by their NIML. However, this decrease was not as extreme as the decrease in their NIMTA.

The net interest income considers the revenue and expenses from interest-bearing assets. However, it does not consider other revenue streams, or the operational and other costs of a bank. Thus, to analyze the profitability of the whole bank, the net income needs to be analyzed as well. Furthermore, in addition to the absolute value of net income, the relative return on assets and return on equity also have to be considered to enable a

comparison, besides the absolute size of the relevant banks in the banking markets. As seen in Figure 81, the US bank had both the highest net income for every year and the highest average net income of 20 billion euros among the relevant banks in the banking markets. The US banks' lowest net income of 5.6 billion euros was in 2009, although this increased to 27 billion euros in 2015. Afterwards, in the period 2015–2019, the US banks' net income was quite stable, lying between 24.8 billion euros in 2017 and 28.3 billion euros in 2018. However, this halved to 13.7 billion euros in 2020. Thus, while the US bank saw an overall increase in its net income of 145.1% with a CAGR of 12.1%, this would have been much larger if the US banks had not experienced such a strong decrease in 2020, caused by the impact of the Corona pandemic.

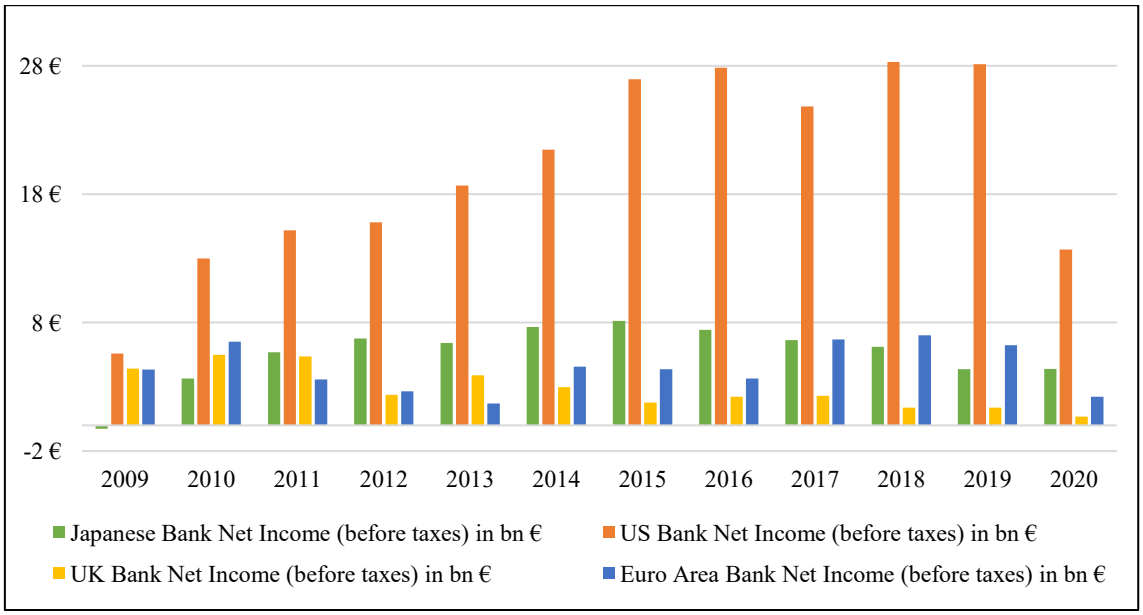

Figure 81: Net Income (before Taxes) in Billion Euros of Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from BankFocus

The Japanese banks had the second highest average net income of 5.6 billion euros over the observation period, although they were the only banks to have a negative net income of -0.3 billion euros in 2009. However, afterwards, this increased continually to a high of 8.1 billion euros in 2015, although it decreased again slightly to 4.4 billion euros in the period 2019–2020. Thus, after the losses in 2009, the Japanese banks saw an increase in their net income of 20.6% with a CAGR of 1.9%. Furthermore, the Japanese banks were the only banks that did not experience a decrease in net income in 2020. The Euro area banks had the third highest average net income of 4.5 billion euros over the observation period. Their net income experienced two periods of increase and two periods of decrease. In 2009, the Euro area banks had a net income of 4.4 billion, which increased in 2010.

Afterwards, however, it decreased to its lowest value of 1.7 billion euros in 2013, to increase to its highest value of 7 billion euros in 2018, only to decrease again to 2.2 billion euros in 2020. Hence, the Euro area bank experienced an overall decrease in net income of 48.7% with a CAGR of -4.1%. However, most of this decrease was caused once again by the aftermath of the impacts of the outbreak of the Corona pandemic in 2020, as well as Lastly, the UK banks had the smallest average net income of 2.9 billion euros. The UK banks saw their highest net income in the period 2009–2011, lying between 4.4 billion euros in 2009 and 5.5 billion euros in 2010. In the following years, the UK banks' net income decreased with some volatility until it reached its lowest value of 0.7 billion euros in 2020. Hence, the UK bank experienced a decrease in net income of 84.6% with a CAGR of -7.1%. Arguably, this decrease was again the result of the Corona pandemic. However, there was also a decrease in average net income of 75% in the years before 2020.

The analysis of the absolute net income does not take the financial size of the relevant banks in the banking markets into account. Hence, a relative measure for the comparison is necessary. To do this, the return on assets is calculated by dividing the total net income by the total assets of a bank.

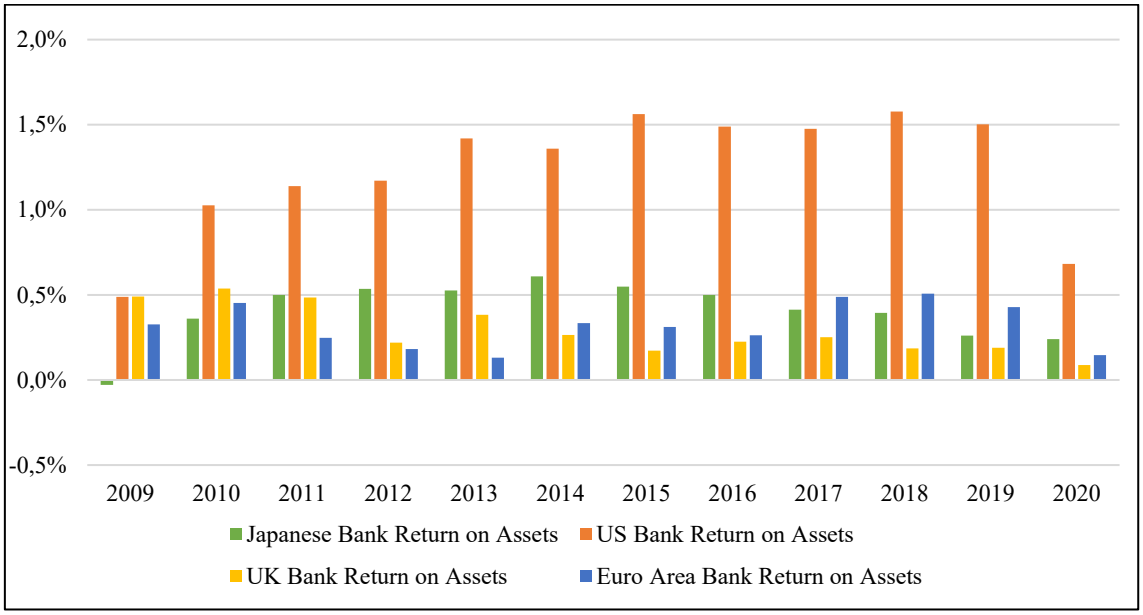

Figure 82: Return on Assets Based on Net Income (before Taxes) of Relevant Banks in Banking Markets for the Period 2009–2020, Based on Data from BankFocus and Eikon

As shown in Figure 82, the US banks had by far the largest return on assets in the period 2010–2020, although the level was the same as the UK banks in 2009. With an average return on assets of 1.24%, however, the US banks had by far the largest return on assets

among the relevant banks in the banking markets. The US banks had their lowest return on assets of 0.49% in 2009, but this increased in the following years. For the period 2013–2019, the return on assets was quite constant, lying between 1.36% in 2014 and the highest observed value of 1.58% in 2018. In the last year of the observation period, however, the US banks saw a large decrease in their return on assets from 1.50% in 2010 to 0.68% in 2020. Nevertheless, the US bank experienced an increase in their return on assets of 39.7% with a CAGR of 3.3% in the period as a whole. If only the period 2009–2019 is considered, thus excluding the influences of the outbreak of the Corona pandemic in 2020, the US banks had an increase in their return on assets of 208%. Moreover, the US banks were the only institutes among the relevant banks in the banking markets with an increase in their return on assets in the observation period. The US banks were followed by the Japanese banks, with an average return on assets of 0.40% – a third of the average return on assets of the US banks. Although the period started with a loss in return of assets of -0.03% in 2009, this increased to its highest value of 0.61% in 2014. In the period 2015–2020, however, the Japanese banks experienced a constant decrease in their return on assets, dropping to the lowest observed value of 0.24% in 2020. If the loss observed in 2009 is excluded, the Japanese bank saw a decrease in its return on assets of 33.1% in the period 2010–2020. Unlike the other relevant banks, the Japanese banks did not experience a strong decrease in the year 2020, as seen in Figure 82. Thus, the Japanese banks were not affected by the outbreak of the Corona pandemic in 2020, as all the other relevant banks were. The Euro area banks had an average return on assets of 0.32% in the observation period – the third highest among relevant banks in the banking markets. Again, its development was quite volatile, as there were several periods of increase and decrease. At the beginning of the observation period, the Euro area banks had a return on assets of 0.33%, which increased in 2010, only to decrease to its lowest value of 0.13% in 2013. In the period 2014–2018, however, there was a sharp increase to the highest value of 0.51% in 2018, which was followed by an equally sharp decrease at the end of the observation period to 0.15% – an overall decrease over the whole period of 55.3% with a CAGR of -4.6%. However, if the influences of the outbreak of the Corona pandemic 2020 are excluded, the Euro area banks saw an increase in their return on assets of 31% in the period 2009–2019. Lastly, with an average of 0.29% in the observation period, the UK banks had the lowest return on assets. At the beginning of the observation period, the UK banks observed a return on assets of 0.49%, the same value as the US bank. In 2010, this increased to the highest observed value of 0.54%. In the following period

(2011–2020) the UK banks experienced a volatile decrease in their return on assets, dropping to the lowest observed value of 0.09% in 2020. This was an overall decrease in return on assets of 82.2% with a CAGR of -6.8% over the period, the largest decrease among the relevant banks in the banking markets. Like the US and euro banks, the UK banks were a strongly affected by the Corona pandemic outbreak in 2020. However, if the influences of the Corona outbreak in 2020 are excluded and only the period 2009–2019 is used, the UK banks still experienced a decrease in return on assets of 62%.

A narrower comparison of profitability and efficiency is the analysis of the return on equity, calculated by dividing the net income by a firm's equity. As a firm's equity reflects its stockholders' money, the return on equity shows how a firm uses this money efficiently to gain profits.

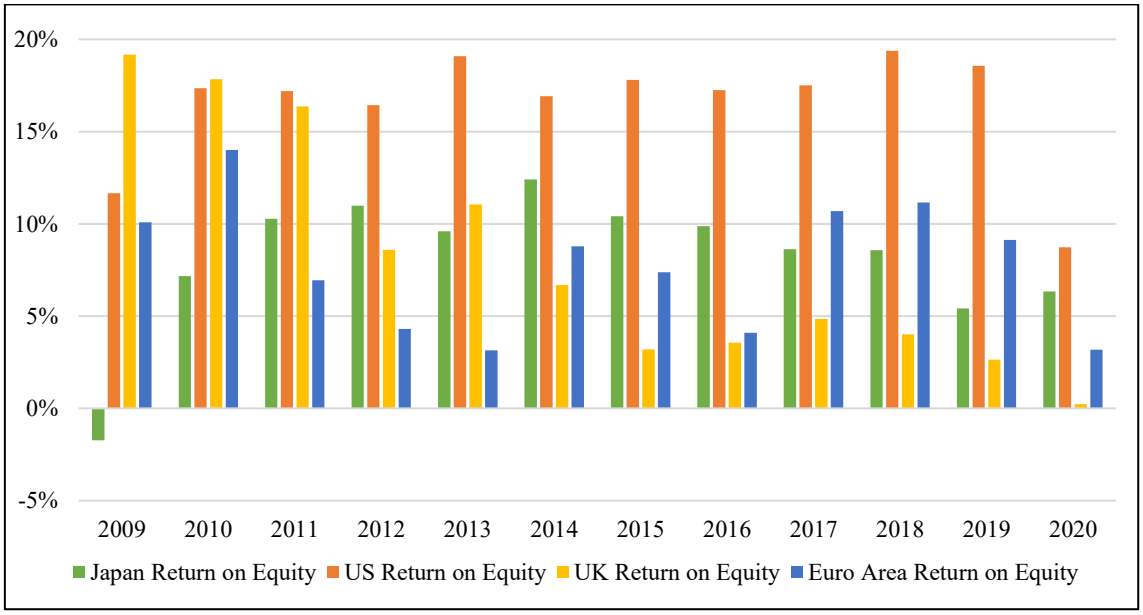

Figure 83: Return on Equity Based on Net Income (before Taxes) of Relevant Banks in Banking Markets for the Period 2009–2020, Based on Data from BankFocus

As seen in Figure 83, the US banks observed both the highest return on equity for the period 2011–2020 and the highest overall average return for the whole period of 16.49%. The US banks saw a return on equity of 11.67% in 2009, which increased steadily in the following years from 16.44% in 2012 to the highest observed value of 19.39% in 2018. At the end of the observation period, the US banks, however, experienced a sharp decrease in their return on equity, down to 8.72%, which can be linked to the outbreak of the Corona pandemic in 2020. Overall, the US banks saw a decrease in their return on equity of 25.2% with a CAGR of -2.1% over the whole period. However, if the Corona year of 2020 is excluded, the US bank saw an increase in their return on equity of 59%.

In the period 2009–2010, the UK banks observed the highest return on equity among the relevant banks in the bank market, and with an average return on equity of 8.18% over the period as a whole, the UK banks had the second highest return on equity. The highest value of 19.17% occurred in 2009. Afterwards, however, this decreased with some volatility down to the value of 0.22% in 2020. Thus, the UK banks saw an overall decrease of 98.8% with a CAGR of -8.2%, the highest decrease observed among the compared banks. Even if the Corona-year 2020 is excluded, the UK bank still saw a decrease of 86%. The UK banks were closely followed by the Japanese banks, with an average return on equity of 8.16% in the observation period. Although the Japanese banks observed a negative return on equity of -1.74% in 2009, this increased later, with some volatility, to its highest value of 12.42% in 2014. In the period 2015–2020, the Japanese banks' return on equity decreased to its lowest value of 5.41% in 2019 before increasing again to 6.34% in 2020. Thus, the Japanese banks were the only banks that experienced an increase in return on equity in 2020. If the loss of 2009 is excluded, they saw a decrease in return on equity of 11.5% with a CAGR of 1%. Lastly, the Euro area banks experienced the lowest average return on equity of 7.69% among the compared banks in the considered period. As with net income and return on assets, the trend was volatile. In 2009, the Euro area banks observed a return on equity of 10.07%, which increased in 2010 to its highest observed value of 13.83%. In the three following years, this decreased to its lowest value of 3.06% in 2013, only to increase again to 4.03% in 2017 and 11.16% in 2018. At the end of the observation period, however, the Euro area banks saw a return on equity of 3.19%. Hence, they observed a decrease in return on equity of 68.4% with a CAGR of -5.7% over the period as a whole, and even with 2020 excluded, this was still a decrease of 10%.

In addition to the net income or the net interest income, the expenses of a bank are also an important measure of efficiency. Hence, in the following, the total expenses of the relevant banks from the banking markets as an absolute measure and the efficiency ratio, calculated by dividing the revenue with the expenses, as a relative measure are analyzed. In Figure 84, it can be seen that the US banks had the highest expenses in the periods 2009–2011 and 2016–2020. Moreover, at 63.4 billion euros, they had the highest average total expenses among the compared banks in the overall period. In 2009, the level of expenses was the highest at 78 billion euros, but this decreased to its lowest value of 52.1 billion euros in 2013. In the period 2014–2019, it increased again to 75.3 billion euros before falling to 62.8 billion euros in 2020.

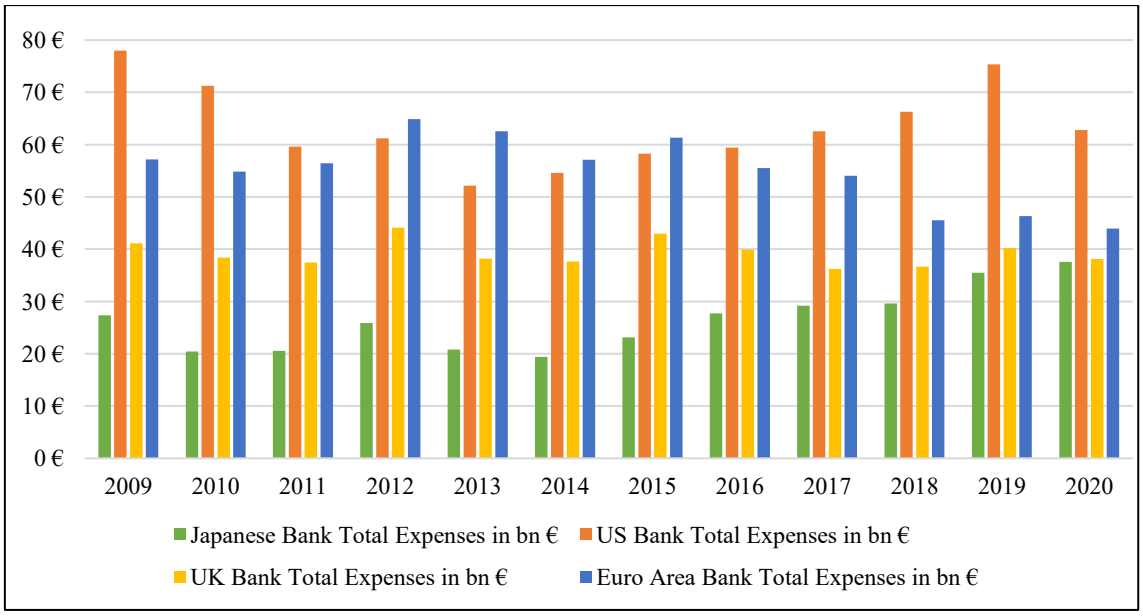

Figure 84: Total Expenses in Billion Euros of Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from Eikon

This was an overall decrease in expenses of 19.5% with a CAGR of -1.6% over the period as a whole. With an average level of expenses of 55 billion euros, the Euro area banks followed the US bank, observing the highest level in the period 2012–2015. In 2009, the Euro area banks' total expenses were 57.2 billion euros, which increased to their highest level of 64.9 billion euros in 2012. In the period 2013–2020, however, the level of expenses gradually decreased to 43.9 billion euros in 2020. Hence, the Euro area banks saw an overall decrease in total expenses of 23.2% with a CAGR of -1.9%, the largest decrease among the compared banks. The UK banks followed the Euro area banks with average total expenses of 39.3 billion euros over the period. With expenses at 41.1 billion euros at the beginning of the observation period, these increased to a level of 44.1 billion euros in 2012. Afterwards, the UK banks' total expenses decreased to their lowest value of 36.3 billion € in 2017, only to rise again to 38.1 billion euros in 2020. Overall, the UK banks saw a decrease in total expenses of 7.2% with a CAGR of -0.6%. Lastly, the Japanese bank observed, with 26.4 billion euros, the lowest average level of expenses among the compared banks in the observation period. The Japanese banks had total expenses of 27.3 billion euros in 2009. Afterwards, these decreased to a level of 19.4 billion euros in 2014. In the period 2015–2020, the expenses increased to their highest value of 37.5 billion euros in 2020. Thus, the Japanese bank observed an increase in expenses of 37.4% with a CAGR of 3.1%. Consequently, the Japanese banks were the only institutes among the compared banks that observed an increase in total expenses.

The volume of total expenses alone is not enough to describe whether a bank is working efficiently or not. For this, revenue needs to be compared with expenses to understand how much money is spent to earn a certain amount of money. As the efficiency ratio is computed by dividing the revenue with the expenses, a higher efficiency ratio indicates a higher efficiency, and an efficiency ratio smaller than one indicates a negative profit. For the period 2012–2020, the US banks observed both the highest efficiency ratio and the highest average efficiency ratio of 1.32 for the whole period. The US banks, therefore, were the most efficient institutes among the compared banks over the observation period. The US banks saw their lowest efficiency ratio of 1.07 in 2009, but then observed an increase up to their highest value of 1.47 in 2016. Afterwards, the efficiency ratio decreased to 1.22 in 2020. Overall, the US banks achieved an increase in efficiency ratio of 13.7% with a CAGR of 1.1% over the period as a whole. Thus, the US banks became more efficient. In the period 2010–2011, the Japanese banks observed the highest efficiency ratio among the compared banks. Moreover, with an average efficiency ratio of 1.23 over the whole observation period, the Japanese banks were the second most efficient institutes among the compared banks. They observed their lowest efficiency ratio of 0.99 in 2009, but then saw an increase to a high of 1.39 in 2014. In the period 2015–2020, however, this decreased to 1.12. Nevertheless, the Japanese banks saw an increase in efficiency ratio of 12.9% with a CAGR of 1.1% in the observation period.

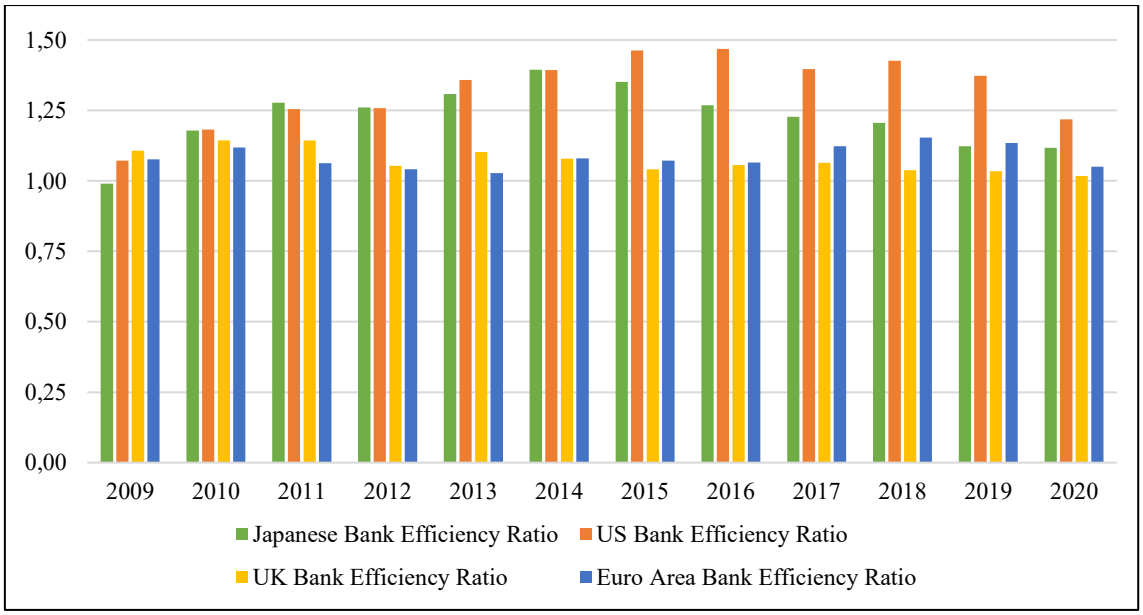

Figure 85: Efficiency Ratio of Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from BankFocus and Eikon

With an average efficiency ratio of 1.08 in the observation period, the Euro area banks were the third highest in terms of efficiency. The Euro area banks had an efficiency ratio of 1.08 in 2009, but after an increase in 2010, the banks' efficiency ratio fell to the lowest observed value of 1.03 in 2014. Afterwards, however, it increases to its highest value of 1.15 in 2018, only to decrease again to 1.05 in 2020. Hence, the Euro area banks experienced a decrease in efficiency ratio of 2.4% with a CAGR of -0.2% over the observation period. Lastly, with an average efficiency ratio of 1.07, the UK banks were the least efficient among the compared institutes. The UK banks saw an efficiency ratio of 1.11 in 2009, which increased to a high of 1.14 in the period 2010–2011. Subsequently, however, the UK banks saw a decrease in efficiency ratio to the lowest observed value of 1.02 in 2020. Overall, therefore, the UK banks saw a decrease in efficiency ratio of 8.1% with a CAGR of -0.7% over the observation period, the largest decrease among the compared banks. Again, the effects of the Brexit referendum were evident, as the UK banks became less efficient in the post-Brexit years 2017–2020.

The last set of key figures necessary to consider are key figures from the capital markets. Actors on the capital markets trade shares of the banks in the expectation of earning a profit. If the efficient market hypothesis holds, the price paid on the capital market for a share of a bank reflects all available information regarding its profitability. Thus, in the following, the market capitalization as an absolute key figure and the price-to-book value (PBR) as a relative measure, are analyzed to assess the profitability of the relevant banks in the banking markets. The market capitalization reflects the total value of a bank's traded shares. As seen in Figure 86, the US banks had the largest market capitalization over the whole observation period, with an average market capitalization of 162 billion euros. They had a market capitalization of 112 billion euros in 2009, which increased in 2010, but then decreased to a low of 84 billion euros in 2011. Afterwards, however, this increased again to a high of 228 billion euros in 2017, only to decrease to 175 billion euros in 2020. Nevertheless, the US banks saw an increase in market capitalization of 56% with a CAGR of 4.7% over the considered period.

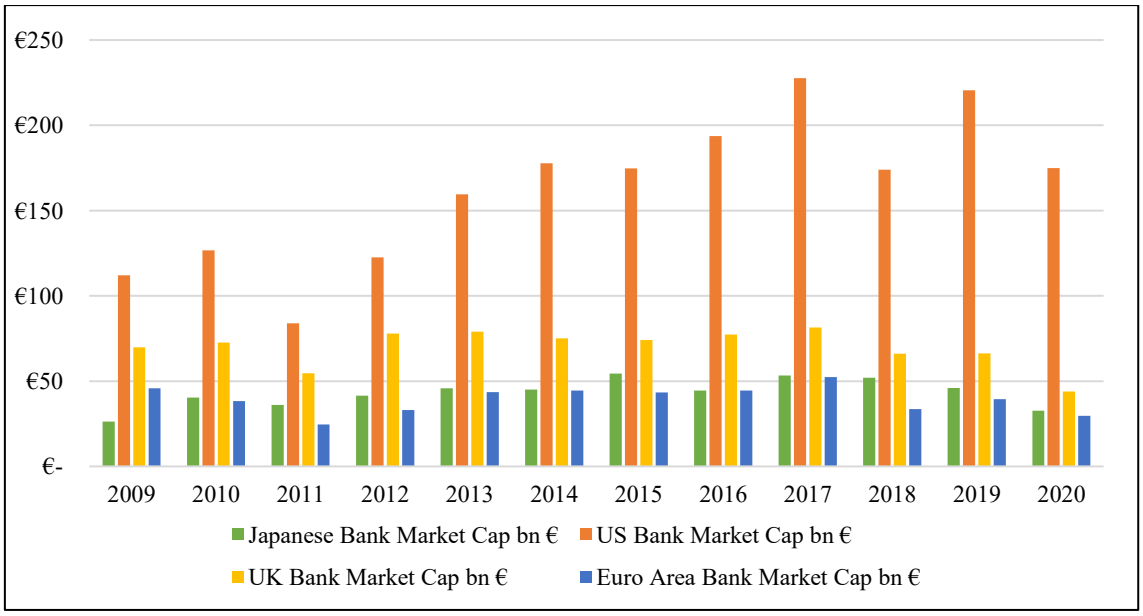

Figure 86: Market Capitalization in Billion Euros of Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from Eikon

The US banks were followed with some distance by the UK banks, with an average market capitalization of 70 billion euros, which was less than half of the market capitalization of the US banks. At the beginning of the observation period, the UK bank saw a market capitalization of 70 billion euros, which decreased in 2011. However, it remained fairly stable for the period 2012–2017, lying between 74 billion euros in 2015 and 81 billion euros in 2017, before decreasing to a low of 44 billion euros in 2020. Thus, the UK banks observed a decrease in market capitalization of 36.9% with a CAGR of -3.1%, the largest decrease among the compared banks. Even if the Corona year of 2020 is excluded, the UK banks still saw a decrease in market capitalization by 5%, which again reflects the negative impact of the post-Brexit referendum years between 2018 and 2019. Furthermore, the high market capitalization of the UK banks was mostly driven by the HSBC, which included in its key figures the Asian operation because the HSBC UK bank is not traded on the capital markets, which must also be considered. With an average market capitalization of 43 billion euros in the observation period, the Japanese banks were the third highest. They observed their lowest level of market capitalization with 26 billion euros at the beginning of the observation period. In the period 2010–2015, however, this increased to a high of 54 billion euros in 2015. Although in the period 2016–2019, the Japanese banks' market capitalization was quite constant, it fell to 33 billion euros in 2020. This resulted in an increase in market capitalization of 23.9% with a CAGR of 2% over the observation period. Unlike the other key figures in this chapter, the influences of

the outbreak of the Corona pandemic of 2020 are visible in this data, as the Japanese banks experienced a decrease in market capitalization from 46 billion euros in 2019 to 33 billion euros in 2020. Lastly, the Euro area bank observed, with 39 billion euros, the smallest average market capitalization among the compared banks in the considered period. They had a market capitalization of 46 billion euros in 2009, which decreased to its lowest value of 25 billion euros in 2011, before increasing to a high of 52 billion euros in 2017. However, in the period 2018–2020, the Euro area banks' market capitalization decreased to 30 billion euros in 2020. This resulted in a decrease in market capitalization of 35.3% with a CAGR of -2.9% over the whole observation period. Even if 2020 is excluded from the analysis, the Euro area banks still experienced a decrease in market capitalization of 13.9% over the period 2009–2019.

The PBR is calculated by dividing the market value of a bank's share by its book value. Hence, it can be used to measure the expectations of investors regarding the ability of a bank to generate profit. It is also an indicator of the healthiness of a bank and its ability to support economic growth. The two main drivers of a bank's PBR are the share of its non-performing loans and its non-interest related costs. Thus, a higher PBR implies a higher level of profitability expected by investors.[76]

For the period 2009–2014, the US banks observed the second highest and, for the period 2015–2020, the highest PBR among the compared banks, as seen in Figure 87. Furthermore, the US banks had an average PBR of 1.00, which was the highest value among the compared banks over the observation period. At the beginning of the observation period, the US banks had a PBR of 1.04, which decreased to a low of 0.59 in 2012 before increasing to its highest value of 1.32 in 2018. In 2019, however, it decreased to 0.99 before increasing again to 1.31 at the end of the observation period. Over the period as a whole, the US banks saw an increase in PBR of 25.8% with a CAGR of 2.1%.

[76] Cf. Bogdanova et al (2018), pp.89-90

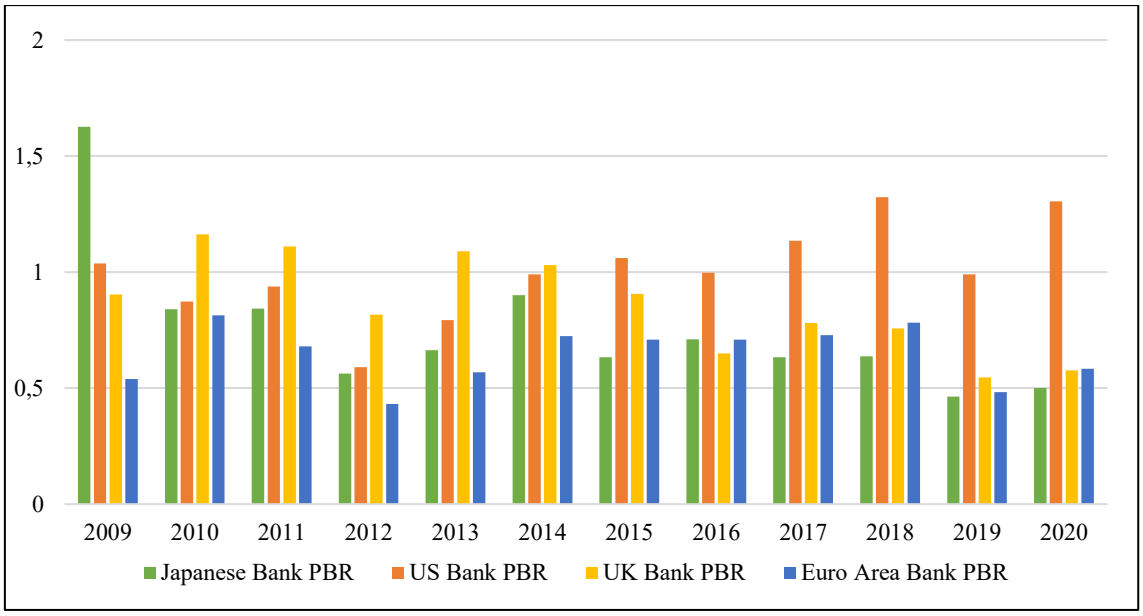

Figure 87: Price-to-Book Value Ratio of Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from Eikon

The UK banks achieved an average PBR of 0.86 over the observation period, which was the second highest value among the compared banks. In 2009, the UK banks' PBR was 0.90, which increased to its highest level of 1.16 in 2010. In the following years, however, this decreased to lows of 0.55 in 2019 and 0.58 in 2020 – an overall decrease of 36.2% with a CAGR of -3 % in the period 2009–2020. With an average PBR of 0.75, the Japanese banks followed the UK banks. The Japanese banks saw their highest PBR of 1.63 at the beginning of the observation period. In the following years, this decreased with some volatility to its lowest value of 0.46 in 2019, before increasing again to 0.50 in 2020. Hence, the Japanese bank saw a decrease in PBR of 69.3% with a CAGR of -5.8% over the observation period, the largest decrease observed among the compared banks. The Euro area banks observed, with 0.65, the smallest average PBR among the compared banks. In 2009, the PBR was 0.54, which increased to a high of 0.81 in the following year, only to decrease to the lowest observed value of 0.43 in 2012. Although in the period 2014–2018, the Euro area banks' PBR remained fairly stable, lying between 0.71 and 0.78, at the end of the observation period it decreased to 0.58 in 2020. Thus, the Euro area banks saw an increase in PBR of 8.2% with a CAGR of 0.7% over the observation period as a whole.

4.3. Comparison of the Relevant Banks in the Banking Markets

In order to summarize the most important key figures of the relevant banks in the banking markets from the previous chapter, the average value and the change of the key figures are displayed in Table 11. In terms of total assets, the Euro area banks with 1,498 billion euros, the US banks with 1,579 billion euros, and the Japanese banks with 1,371 billion euros were similar in size, while the UK banks total assets of 954 billion were notably smaller. As such, the US banks observed an increase in total assets of 75% and the Japanese banks of 101%, while the Euro area banks only saw an increase of 15% and the UK banks observed a decrease of 14%. This meant that the US and Japanese banks experienced stronger growth than the Euro area banks. This is especially observable in Figure 67, which clearly shows that the US and Japanese banks' total assets grew significantly more than the Euro area banks' total assets in the period 2017–2020. Regarding the average share of loans from the total assets, the Euro area banks with 42.7%, the US banks with 41.3%, and the Japanese banks with 41.8% all observed similar values, meaning they had similar conditions in terms of earning interest from customer loans. Only the UK banks observed a much smaller average share of loans of 32.9% – a decrease of 50%, which can be explained by the post-Brexit referendum years 2017–2020, as shown in Figure 68. One explanation could be that the UK banks tried to reduce the share of loans on their balance sheets as they expected economic difficulties following Brexit. However, the Euro area banks observed with 3.07% a larger average share of non-performing loans than the US banks with 2.39%, the Japanese banks with 0.89%, and the UK banks with 1.73%. Meaning that although the Euro area bank had a similar share of loans in its balance sheet, it had the largest share of loans not serviced by the loanee, which had a negative impact on the net interest income. Interestingly, the UK banks were the only banks with an increased share of non-performing loans of 75% in the observation period. In Figure 70, it can be seen that, especially in the post-Brexit referendum years, this share increased. This meant that the UK banks sold or shifted serviced loans, needing to keep the non-serviced loans on the balance sheets, which had a negative impact on net interest income.

Average / Change for 2009–2020	Euro area Banks	US Banks	UK Banks	Japanese Banks
Total Assets in bn €	1,408 € / +15%	1,579 € / +75%	954 € / -14%	1,371 € / +101%
% Loans	42.7% / +2%	41.3% / -16%	32.9% / -50%	41.8% / -14%
% NPL	3.07% / -12%	2.39% / -40%	1.73% / +75%	0,89% / -60%
% Deposits	39.3% / +33%	62.2% / +22%	40.8% / -26%	57.7% / +25%
Loan to Deposit Ratio	106.4% / -23%	68.9% / -31%	84.5% / -41%	71.6% / -29%
% Equity	3.01% / +42%	7.66% / +32%	4.46% / 38%	4.75% / +9%
RWA Density	24.1% / +5%	44.5% / +5%	25.0% / -10%	33.3% / 14%
NIML	2.93% / -24%	5.74% / -34%	2.68% / -22%	1.68% / -34%
Return on Equity	7.69% / -68%	16.49% / -25%	8.18% / -99%	8.16% / -11%[77]
Efficiency Ratio	92% / +2%	76% / -12%	93% / +9%	82% / -11%
Market Cap in bn €	39.4 € / -35%	162.3 € / +56%	69.8 € / -37%	43.2 € / +24%
PBR	0.65 / +8%	1.00 / +26%	0.86 / -36%	0.75 / -69%

Table 10: Overall Comparison of the Relevant Banks in the Banking Markets for the Period 2009–2020, Based on Data from BankFocus and Eikon

The structure of the liability side of the bank balance sheets of the Euro area and the UK banks differed from the US and Japanese banks, as the Euro area banks observed an average share of deposits of 39.3% and the UK banks 40.8%, while the US banks observed 62.2% and the Japanese banks 57.7%. Thus, the US and Japanese banks had different financing structures than the two European banks. Furthermore, while the US, Japanese, and Euro area banks all had roughly the same size of total assets, they had different amounts of deposits. One explanation could be that the US banks had the possibility to collect deposits from a much larger market than the Euro area banks, as the banks in the bucket of the Euro area mostly rely on their respective home markets. Furthermore, the Japanese banking sector had a much larger concentration than the Euro area banking sector, as stated in a previous chapter. Hence, there was less competition in the Japanese banking sector, which enabled the Japanese banks to collect a larger share of deposits than the Euro area banks. This smaller average share of deposits in the Euro area banks

[77] Growth expressed for 2010-2020

translated directly to a higher average loan-to-deposit ratio of 106.4%, which was significantly higher than the loan-to-deposit ratio of the UK banks with 84.5%, the Japanese banks with 71.6%, and the US banks with 68.9%. This meant that the Euro area banks, as the only relevant banks, could not solely finance their issued loans with the collected deposits. This could have had a direct impact on the Euro area banks' ability to earn profits. Another important part of a bank's balance sheet on the liability side is equity. The Euro area banks had the smallest average share of equity with 3.01% amongst the compared relevant banks. While the UK banks with 4.46% and the Japanese banks with 4.75%, had a similar average share of equity, the US banks had by far the largest average at 7.66%. A larger share of equity enables a bank to invest in riskier assets with larger profit opportunities, as these assets need to be underlined by more equity or capital. Consequently, the Euro area banks observed the smallest average share RWA density of 24.01%, followed by the UK banks with a RWA density of 25%. Figure 77 shows that the UK banks decreased their RWA density in the post-Brexit referendum years, underscoring the previous findings. The Japanese banks observed an average RWA density of 33.3% and the US banks 44.5%. As shown, the risk structure of the Euro area banks was smaller than the risk structure of the other compared banks. Consequently, the Euro area banks were not able to generate profits as high as the other banks. However, the Euro area banks had an overall lower risk in their asset portfolios, which is a more conservative approach. Nevertheless, the Euro area banks observed an average net interest margin based on loans of 2.93% in the observation period, which was the second highest NIML among the compared banks, after US banks' level of 5.74%, while the UK banks with 2.68% and the Japanese banks with 1.68% see a smaller average NIML. Interestingly, all relevant banks saw a decrease in their NIML of between 22% and 34% over the observation period, meaning that in terms of core financial intermediary services, the US banks were the most profitable among the compared banks. This perspective, however, changes if the total income is considered and the return on equity analyzed. Nevertheless, the US banks were still the most profitable institutes among the compared banks, with an average return on equity of 16.49% over the observation period. However, the Euro area banks observed with 7.69% the smallest return on equity, while the UK banks had an average of 8.18% and the Japanese banks of 8.16%. This meant that the Euro area banks had the highest negative outflow of money in relation to their size among the compared banks. Moreover, the US, UK and Euro area banks all saw a decrease in their return on equity over the whole observation period of between 25% and 99%, while the Japanese banks

saw a decrease of 11% in the period 2010–2020, after observing a negative return on equity in 2009. With an average efficiency ratio of 1.32, the US banks were the most efficient banks among the relevant banks. The Japanese banks were quite close, with an average efficiency ratio of 1.23, while the Euro area banks with 1.08 and the UK banks with 1.07 were the least efficient institutes. Furthermore, the US and Japanese banks became more efficient over the observation period, with increases in their efficiency ratios of 14% and 13%, respectively, while the Euro area and UK banks became less efficient with decreases of 2% and 8%, respectively. The capital markets shared this perspective. With an average market capitalization of 39.4 billion euros, the Euro area banks were valued the least among the compared banks, while the US banks, with an average market capitalization of 162.3 billion euros, were valued the highest. Furthermore, the UK banks, with an average market capitalization of 69.8 billion euros, and the Japanese banks, with 43.2 billion euros, were valued between the Euro area and the US banks but closer to the Euro area banks. While the Euro area banks saw a decrease in market capitalization of 35% and the UK banks of 37%, the US banks saw an increase of 56% and the Japanese banks of 24%. This means that, as far as the investors were concerned, the US and Japanese banks became more attractive, while the Euro area and UK banks became less attractive. This was also reflected by the price-to-book ratios of the relevant banks. The Euro area banks again observed with 0.65 the lowest average PBR among the compared banks in the observation period and the US banks with 1.00 the highest, with the UK banks having an average PBR of 0.86% and the Japanese banks of 0.75%. However, the Euro area banks did observe an increase in PBR of 8% and the US banks by 26%, while the UK and Japanese banks experienced decreases of 36% and 69%, respectively. As the PBR is mostly driven by the share of non-performing loans and non-interest-related costs, this is a further indicator that the Euro area banks observed the highest outflow of money in the form of non-interest-related costs among the compared banks.[78]

Overall, it can be concluded that the US banks were the most profitable banks among the relevant banks in the banking markets in the period 2009–2020, based on profitability and capital market key figures. The Euro area banks can be classified as the least profitable based on the return on equity and the capital market key figures. However, in terms of net interest income, the Euro area banks were the second most profitable among the

[78] Cf. Bogdanova et al (2018), pp.89-90

compared banks. Most notably, the Euro area banks observed a smaller share of deposits than the other banks while having the largest share of loans, leading to a loan-to-deposit ratio larger than 100%. Furthermore, the Euro area bank observed, in terms of risks, the most conservative approach in its asset portfolios.

The question that arises from this comparison is: how can the internationally relevant banks in the Euro area become as profitable as their counterparts in the US? Furthermore, the comparison indicates that if a country breaks away from a larger economic area, as was the case with the UK, it has negative implications for the financial intermediaries within that country, as the profitability of the UK banks decreased in all key figures after the Brexit referendum. Lastly, although the Japanese banks had a similar financial structure to the US banks, they were not as profitable. The question is whether this is related to the size of the banking market and the corresponding concentration in the banking sector, as the US banks had a larger banking market and a lower concentration than the Japanese. If so, it would suggest that access to a larger deposit and loan market could increase the profitability of the Euro area banks based on the concept of economies of scale.

5. Future Positioning of the Euro area Banking Market

The preceding chapters provided an overview of the economic reasoning of banks, the state of European banking regulation, as well as an economic analysis of the Euro area banking market, comparing it with the banking markets of Japan, the United States, and the United Kingdom. Additionally, a profitability analysis was conducted on the relevant banks in the Euro area and compared with their counterparts in the above-mentioned markets.

Current European banking regulation can be primarily viewed as a facilitator of risk sharing among member states, with the ECB and the EBA serving as supranational European supervision and regulation agencies, in addition to the national supervision, and regulation agencies. However, the absence of a European deposit insurance scheme indicates that the European Banking Union remains incomplete. The macroeconomic analysis revealed a mixed positioning of the Euro area banking market, with certain indicators placing it ahead of the comparable markets while others lagged behind. This disparity is largely attributed to the economic heterogeneity within the Euro area, raising the question of how to promote economic convergence among the Euro area countries. Concerning the banking sectors, the question arose about how to create a level playing field within

the Euro area to enable possible consolidations and investments in digital banking. Furthermore, the banking sectors of the LIE group differ from those of the HIE group and MIE group in terms of higher concentration and lower stability, prompting consideration of measures to mitigate these disparities and enhance banking service accessibility for LIE group countries. Regarding profitability, the analysis indicated that US banks generally outperform Euro area banks. One possible explanation for this could be the larger deposit and loan markets accessible to US banks, raising the question of how to provide Euro area banks with similar access to deposit and loan markets to enable economies of scale.

One possible approach to addressing the findings and emerging questions is the implementation of an integrated Euro area banking market, analogous to domestic markets for goods within the European Union. In the following, the concept of an integrated banking market is defined, how this concept can address the findings of the previous chapters, and what the practical design of an integrated Euro area banking market would entail. Subsequently, the current state of banking market integration is analyzed, and the gaps between the current state and the proposed practical design are identified. Finally, based on the identified gaps, recommendations are made on how to close these gaps for the future positioning of the Euro area banking market.

5.1. Concept of an Integrated Banking Market

The foundation of an integrated banking market rests on the concept of economic integration. This integration can be defined as both a process and a state of affairs. The process abolishes discrimination based on nationality among economies, while the state of affairs signifies the absence of discrimination between national economies. It's crucial to distinguish between economic cooperation and economic integration. While economic cooperation aims to reduce discrimination, integration aims to eliminate it. More specifically, economic integration is characterized by a unified consumer base from the integrated economies. It involves the reduction or elimination of barriers to trade, investment, and the flow of resources or services. Additionally, it encompasses the unrestricted movement of production factors such as labour, capital, and technology. This integration also includes standardized regulations with aligned standards, policies, market rules, and

political alignment. Interconnected infrastructure is essential, as is collaboration at a political level among participating economies.[79]

The ultimate objective of economic activities is to enhance overall welfare, guided by the Pareto principle. This principle dictates that an increase in individual welfare results only in an overall welfare increase if it doesn't diminish the welfare of another individual. Economic integration influences welfare on two fronts: economic efficiency and economic equity. Economic efficiency is shaped by alterations in production quantity and the change in discrimination between national and foreign goods. These changes enhance overall welfare through efficiency gains, which include improved production efficiency and consumer freedom in product choice. This leads to the conclusion that economic efficiency means efficiency in production and efficiency in exchange. Economic equity is influenced by income redistribution among individuals from different nations, along with overall income redistribution within a nation. If economic integration leads to decreased personal income for individuals within a nation, assistance is needed to mitigate these effects. Only this approach ensures an overall increase in welfare, according to the Pareto principle. Finally, the benefits of economic integration become more apparent when the participating nations exhibit competitive structures in their economies. Furthermore, the effect is particularly improved when there's a greater disparity in commodity costs before integration, a larger size of the integrated economies' union, a shorter economic distance between them, a higher pre-union tariff, and increased pre-union intercourse among the participating countries. [80]

The idea of integrated economies, as discussed above, is a longstanding concept that came to the forefront after the Second World War and laid the groundwork for the European Union. In the context of the concept of an integrated banking market, these findings must be tailored to the unique characteristics of the banking sector and combined with more recent research.

Building on the definition provided above, the concept of an integrated banking market can be seen as an aspired state of affairs within an integrated economy. This understanding requires identifying the contrast between the current situation and the desired outcome, leading to a process towards an integrated banking market. At its core, the overarching objective of an integrated banking market is to eliminate discrimination in the

[79] Cf. Balassa (1961), p. 1-7

[80] Cf. Balassa (1961), pp. 10-14; 68

provision of financial services among the participating economies. Consequently, it's important to recognize that the concept of an integrated banking market cannot be understood as mere cooperation, as its intended state surpasses the definition of pure economic cooperation. Specifically, the envisioned concept of an integrated banking market revolves around the concept of a unified consumer base for financial services derived from all participating economies. This entails the unhindered movement and seamless flow of input and output factors associated with financial services among the members of this integrated banking market. For example, a bank in country A could effortlessly gather deposits from an individual in country B and provide a loan to another individual in country C under identical conditions. This perspective is underscored by the critical role of unrestricted capital flow within the integrated economies, which stands as one of its fundamental principles.[81]

To enable a shared consumer base and the unhindered flow of input and output factors related to financial services, a pivotal prerequisite is the establishment of a unified legal framework within the integrated banking market. This framework would find expression through the standardization of regulations, market rules, and policies concerning financial services across the member countries in this integrated banking market. This standardization would be further emphasized by the presence of a singular supervisory agency and a unified regulatory body overseeing banks situated within the member countries of the integrated banking market. Achieving this demands a high degree of political collaboration among the participating nations. Moreover, the realization of an integrated banking market requires the development of a shared infrastructure for financial services. This infrastructure would serve to streamline the cross-border provision of financial services within the integrated banking market, fostering smoother interactions and operations.

The impact of an integrated economy on welfare is marked by shifts in efficiency and equity. To examine more closely the efficiency changes, especially through economies of scale brought about by an integrated banking market, it's essential to briefly revisit the significance of IT in the banking sector. For example, in 2021, banks spent six times more on IT than in 2001 and three times more than in 2011, despite the decrease in computing costs based on Moor’s law. Given the increasing importance of IT in the delivery of

[81] Cf. Balassa (1961), pp. 92-96

financial services, it can serve as an example of how an integrated banking market can enhance overall welfare by boosting efficiency and economies of scale. [82]

As previously elaborated in earlier chapters, the Vives/Ye model, based on the Hotelling model, highlights two factors that influence a bank's monitoring costs. On one hand, there are basic monitoring costs that remain consistent for all potential customers. On the other hand, there are distance monitoring costs, which vary based on the geographical and informational distances of the customer. Accordingly, investments in IT can be categorized into two distinct types: IT basic, which enhances the bank's efficiency and reduces overall monitoring costs, and IT distance, which enables the bank to decrease monitoring costs associated with the customer's location and information disparities. When a bank invests in IT basic, it accomplishes two significant outcomes. Firstly, it enhances its own welfare by lowering monitoring costs. Secondly, it stimulates the economy as it issues more highly monitored loans, thereby increasing overall welfare and stability. The same rationale applies to investments in IT distance, but primarily for customers situated farther from the bank and in areas with a high concentration of customers. [83]

Investments in both types of IT always come with a cost, and larger banks have a significant advantage over smaller ones. As both types of investments heavily rely on improvements in data processing, larger firms with larger databases are known to gain more benefit from such investments. This is supported by findings indicating that, following the 2008 financial crisis, larger banks allocated a higher percentage of their budget to IT compared to smaller banks. Furthermore, empirical studies show that, companies gain economies of scale from IT services as they grow in revenue and tend to emphasize the importance of increasing the IT budget to the same level as the growth in revenue. This demonstrates how economies of scale favour IT investments and, consequently, the increase the benefits bring, and the overall increase in welfare of an integrated banking market. Specifically, with a larger standardized consumer base, a bank can choose to consolidate and collaborate on technological improvements within associations or develop IT solutions through joint ventures using the larger data base gained from the increased consumer base. However, the latter two options likely apply primarily to investments in IT basic rather than IT distance, as banks would prefer to avoid increasing competition.[84]

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[82] Cf. FSB (2019), pp. 1, 17ff.Modi et al (2022), pp. 2f.

[83] Cf. Vives/Ye (2023), pp. 1-5; pp. 47f.

[84] Cf. Modi et al (2022), pp. 2f, 27f; Mithas et al (2018), p. 5229

The second way to enhance welfare through efficiency is by enabling customers and banks to freely choose within the integrated banking market. If the member countries create an integrated banking market, individuals can freely select financial services from any bank within the integrated banking market, not just those from their home country. Likewise, banks can attract deposits and issue loans throughout this integrated market. This would be particularly beneficial for consumers in underdeveloped banking markets that experience lower competition and stability compared to economies with stable and desiredly competitive banking markets. Individuals from such underdeveloped markets would gain access to more advanced financial services from banks outside their original market, promoting economic stability and growth in these countries. Furthermore, the banking markets of these countries would benefit from increased competition, which contributes to stability and economic growth.

Not only would individuals within the participating economies of an integrated banking market benefit from the efficiency gain through free selection, but banks would as well. This effect can be understood in terms of wage differences among the participating economies within an integrated banking market. With the freedom to operate across all economies, banks could allocate their operational processes to the economies where the ratio between wages and required skills was most favorable. In essence, by freely selecting production opportunities, banks could enhance their efficiency, ultimately contributing to an overall increase in welfare.

Moreover, banks could reduce their ‘home bias’. This refers to the strong link between a sovereign debt crisis and a banking crisis within an economy. The home bias means that banks often hold a significant amount of government bonds from their home country on their balance sheets as assets. Analyses of European banks have revealed a robust connection between the occurrence of a sovereign debt crisis and a subsequent banking crisis due to this home bias effect. Consequently, a sovereign debt crisis is highly likely to trigger a banking crisis, which can be damaging to the economy. This interconnection can be further strengthened if a bank has a significant focus on loans and deposits in its home country as well. Meaning that banks with a more geographically diversified portfolio would be more robust regarding shocks and crises. Therefore, adopting a differentiation approach within the integrated banking market, particularly concerning assets and

liabilities, could increase the stability of the banking sectors and economic growth, and, hence, contribute to an overall increase in welfare. [85]

The effect of efficiency consistently has a positive impact on welfare in the concept of an integrated banking market, while the effects related to equity are more complex. In other words, if changes in equity negatively affect the overall welfare of the participating economies, measures should be taken to mitigate these negative effects. Changes in equity can impact both individuals within an economy and the economy as a whole. Furthermore, according to the Pareto principle, an increase in equity is only beneficial for overall welfare if it doesn't decrease the welfare of any other individual. However, the negative effect on other individuals' welfare can be treated with targeted measures. With this in mind, two scenarios must be considered when analyzing the impact of an integrated banking market on equity and welfare: changes in equity among participating economies; and changes in equity for individuals within these economies.

Firstly, changes in equity among the participating economies are considered in the context of an integrated banking market. In detail, this would entail shifts in income between the banking sectors of the participating economies within an integrated banking market. For example, banks operating in economies with a high degree of competition in the banking sector could start to operate in economies with highly concentrated banking sectors. Subsequently, the banks in the economy with a highly concentrated banking sector would experience an increase in competition and potentially a decrease in income because of the entry of banks from economies with a competitive banking sector into the market and the connected gain in market shares of these banks. Normally, an increase in competition is always favourable within a market, as the offered quantity of goods increases while the price decreases, and thus the overall welfare increases. However, as elaborated in earlier chapters, the banking market is unique in terms of competition, as stability needs to be considered as well. Meaning that a mid-degree of competition is considered optimal for the banking market, as stability is essential to supporting economic growth. Consequently, changes in equity among the participating economies of an integrated banking market in terms of shifts in income within the participating banking sectors are favourable if these changes do not lead to ruinous competition within the banking sector and thus affect the overall welfare negatively.

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[85] Cf. Gomez Puig et al (2019), pp. 3f, 23f.; Roncoroni et al (2019) pp. 33f.

Another aspect to consider regarding changes in income in the banking sector are the potential impacts on the asset side of the balance sheet, especially regarding loans and government bonds, specifically related to the effects of potential economic crises in new countries the banks are invested in. The home bias tendency described above could mean that, potentially, the banking sector of country A could suffer from an economic crisis in country B. With increased stability and resilience, however, the banks would be incentivized to diversify their portfolios, as described above. However, an effective measure to ensure this could be a policy or proactive regulation from a supervisory agency insisting on sufficient diversification within a bank's portfolio.

The second aspect of changes in equity with influence on the overall welfare through an integrated banking market is changes in income of individuals within the participating economies. Two different effects can be considered: the influence on income through the consumption of financial services and the influence on income based on employment within the banking sectors.

The effect on the income of individuals through the consumption of financial services can be positive or negative. If an individual gets access to better financial services through an integrated banking market, for example, better conditions on deposits or loans, the effect on income and, thus, welfare is positive. On the other hand, if an individual from country A deposits her money with a bank from country B and the bank declares bankruptcy, she loses the deposited money and, hence, decreases her income and overall welfare. One can argue that the first effect is more likely, as the probability of a bank defaulting is quite low. However, the loss of all deposited money can outweigh the gains from access to better financial services. Hence, without measures, the effect can be ambiguous. One measure could be deposit insurance, as described in an earlier chapter, as this measure not only hinders bank runs but also compensates potential losses in case of a bank defaulting. However, in terms of an integrated banking market, deposit insurance needs to cover all participating economies to enable standardized market conditions. With the implementation of deposit insurance covering the whole integrated banking market, the negative effect on income changes related to the consumption of financial services by individuals could be mitigated, and thus, the overall effect on equity and overall welfare would be positive and desirable.

Lastly, alterations in equity in terms of income changes for individuals regarding employment are assessed. The negative effects of such changes can ironically be a result of a bank's effort to increase efficiency by freely selecting where to produce or create value

for their services. For example, when a bank based in country A, characterized by higher wage levels, shifts a segment of its operations to country B, marked by comparatively lower wage levels, it entails a negative income change for the employees in country A who face termination of employment. On the other hand, employees in country B, where the bank shifted parts of its operation, can realize a positive change in income. However, as the wage level in country B is lower than in country A, the overall change in equity is negative, and thus, there is a decrease in overall welfare. To mitigate this effect, different measures can be applied. The bank can implement socially acceptable redundancies by either only shifting jobs to another country if an individual retires or quits a job or by training and upskilling employees, facilitating the procurement of alternative employment. Additionally, the government can contribute to the job market integration of freed-up labor resources, for example through job training and reskilling programs that equip workers with in-demand skills, offering subsidies for employers to incentivize the hiring and training of unemployed workers, and establishing job placement services to match job seekers with available positions and provide career counselling. Through these measures, the negative effect on equity and overall welfare following income changes related to employment can be mitigated. Thus, the overall positive impact of an integrated banking market can be realized.

Consequently, it can be concluded that an integrated banking market would improve the overall welfare within the participating economies through both improvements in efficiency and equity, and negative effects can be mitigated through dedicated measures. This addresses the findings of the previous chapters in that an integrated banking market would contribute to mitigating the economic heterogeneity within the Euro area, as countries with less powerful economies could converge on the leading economies through better provision of financial services, boosting their economies. Additionally, countries with weaker banking sectors, especially in terms of stability and competition, would benefit from markets from countries with stable banking sectors. Individuals in the participating economies would not be limited to their native banking sectors but could choose other sectors freely, which would also provide stability and economic growth, improving the banking sector's provision and the individual's consumption of financial services, leading to a more prosperous economic development. Lastly, the European banks could collect deposits from a larger customer base, thus improving their financing opportunities. Additionally, with an integrated banking market, a level playing field for potential consolidation would be created. Regarding efficiency, the European banks could use economies

of scale, especially regarding IT investment, and have the opportunity to move their operations to economies where ratio between wages and required skills was optimal. The European banks would then have the opportunity to improve their profitability and compete with their American counterparts.

Before looking at the practical design of such an integrated banking market, it is important to understand which prerequisites need to be applied. As stated at the beginning of the chapter, an integrated economy is more successful if the economies experience a high degree of competition, have considerable disparity in commodity prices, should be of a certain size but be geographically and economically integrable, and should promote pre-union tariffs. Competition in the banking sector should be targeted at a moderate level, meaning that the first prerequisite is not relevant – although a moderate level of competition is necessary. The second prerequisite is also not relevant, as service delivery for financial products doesn't involve commodities. The prerequisites concerning size and geographic and economic compatibility are relevant to facilitate economies of scale. Lastly, the prerequisite regarding pre-union tariffs can be ignored as well, as it is not relevant to the banking market.

5.2. Practical Design of an Integrated Euro area Banking Market

Having defined the concept of an integrated banking market and discussed its beneficial effects for the euro banking area, this chapter proposes a practical design to implement an integrated Euro area banking market.

Before designing this, the prerequisites elaborated in the previous chapter – in particular, competition within the integrated Euro area banking market, its size, and the geographic and economic closeness between the member states – need to be discussed further. All these prerequisites target the potential member countries of the integrated Euro area banking market. Hence, a discussion is necessary to weigh the possible options.

The first and most obvious option is to create an integrated Euro area banking market consisting of all Euro area member states. Secondly, to optimize geographical closeness, two integrated Euro area banking markets could be envisaged, dividing the Euro area into two equally economically sized markets consisting of a northern Euro area banking market, with the German banking sector as the front runner, and a southern Euro area banking market, with the French banking sector as the front runner. Thirdly, several local integrated banking markets could be considered, with the condition that they match the size of the banking sectors in Germany or France. The three options are a tradeoff between

the size of the integrated Euro area banking market and geographical and hypothetically economic closeness. Hence, all three options need to be discussed, bearing in mind the defined prerequisites for an integrated banking market.

The ideal amount of competition within a banking market is targeted a moderate level, and, as already discussed in a previous chapter, the Euro area as a whole observed an average HHI of 758 between 2009–2020, which can be interpreted as a moderate level of competition. Consequently, the option of one integrated Euro area banking market is favourable in terms of competition. In a theoretical north/south divide with two integrated Euro area banking markets, the north had an observed average HHI of 822 and the south of 693 in the period 2009–2020. Hence, this option, having a moderate level of competition, could also be considered. Lastly, the option for several smaller, locally integrated banking markets needs to be assessed. As this option targets the creation of several banking markets in the Euro area with roughly the size of the current German or French banking market, they would not benefit from the competition from these banking markets. Germany observed an average HHI of 279 and France an average of 604 between 2009 and 2020. As the smaller banking markets, such as the Baltics, had a high-level concentration with average HHIs of between 1,219 and 2,592 between 2009 and 2020 and the LIE group with an average HHI of 1,528 in the same period, they would not be able to benefit from the competition of the German and French banking markets. Hence, in terms of competition, the options of one integrated Euro area banking market or a north and south integrated Euro area banking market outweigh the option of several local integrated banking markets.[86]

Subsequently, the prerequisite concerning size is analyzed. As discussed in the previous chapter, the larger the integrated banking market is, the greater the resulting economic benefits are. Consequently, the first option of one integrated euro banking area is clearly the most preferable, with the second option being more preferable than the third.

Average Intra Euro area Trade Volume 2009–2020	**1st Trading Partner**	**2nd Trading Partner**	**3rd Trading Partner**
Austria	*Germany (60.40%)*	*Italy (10.84%)*	*France (5.81%)*
Belgium	*Germany (27.05%)*	*Netherlands (26.60%)*	*France (23.16%)*
Cyprus	*Greece (34.99%)*	*Germany (14.59%)*	*Italy (12.89%)*
Estonia	*Finland (24.92%)*	*Latvia (17.58%)*	*Germany (16.85%)*

[86] HHI based on data from ECB and own calculations see annex for complete table.

Finland	*Germany (35.07%)*	*Netherlands (18.85%)*	*Belgium (8.96%)*
France	*Germany (31.84%)*	*Belgium (17.03%)*	*Italy (14.58%)*
Germany	*Netherlands (23.11%)*	*France (19.39%)*	*Italy (12.98%)*
Greece	*Germany (24.65%)*	*Italy (23.29%)*	*France (11%)*
Ireland	*Belgium (26.05%)*	*Germany (24.65%)*	*Netherlands (15.34%)*
Italy	*Germany (32.62%)*	*France (21.77%)*	*Spain (11.21%)*
Latvia	*Lithuania (31.91%)*	*Estonia (18.02%)*	*Germany (17.39%)*
Lithuania	*Germany (22.99%)*	*Latvia (21.18%)*	*Netherlands (10.24%)*
Luxembourg	*Germany (33.41%)*	*Belgium (28.80%)*	*France (16.47%)*
Malta	*Italy (36.00%)*	*Germany (18.47%)*	*France (14.70%)*
Netherlands	*Germany (44.10%)*	*Belgium (22.52%)*	*France (12.31%)*
Portugal	*Spain (42.35%)*	*Germany (19.08%)*	*France (14.59%)*
Slovakia	*Germany (45.06%)*	*Austria (16.24%)*	*France (10.39%)*
Slovenia	*Germany (33.50%)*	*Italy (23.14%)*	*Austria 16.49%)*
Spain	*France (26.08%)*	*Germany (24.40%)*	*Italy 14.89%)*

Table 11: Top Three Intra EU Trade Partners Based on Average Trade Volume 2009–2020 per Member Country. Own Calculation Based on Data from Eurostat

The third prerequisite, regarding geographical and economic closeness, is ambiguous. From a geographical point of view, the idea of locally, integrated Euro area banking market is more favourable than the other two options, with one integrated Euro area banking market being the least favourable option. In one integrated Euro area banking market, the German and French banking sectors would be dominant, and countries located further apart would not have a comparably high impact. Conversely, with a locally integrated Euro area banking market, geographical and regional features can be considered. When considering economic closeness, however, the perspective changes again. With intra-Euro area trade taken as a proxy for economic closeness, it is evident that Germany is one of the three largest trading partners for every country in the Euro area, as seen in Table 12. Furthermore, France and Germany are close trading partners. Consequently, dividing of the Euro area into two integrated banking markets, with Germany and France as front-runners, makes no sense in terms of promoting economic closeness. With this in mind, the argument for one integrated Euro area banking market outweighs the other two options.

Consequently, the most favourable option for the Euro area is to create one integrated Euro area banking market that includes all member countries. This not only makes sense when considering competition, size, and economic closeness but also when one considers that an artificial divide of the Euro area into several fragmented markets would involve considerable replication of processes necessitating increased effort and expense.

Having decided in favour of one integrated Euro area banking market, the practical design of this market can now be addressed. For this procedure, the conditions for an integrated banking market from the previous chapter need to be recalled: a shared consumer base, the unhindered flow of input and output factors, a unified legal framework, and a shared infrastructure for financial services.

Concerning a shared consumer base, an integrated Euro area banking market can be understood as a market in which individuals from every Euro area country can consume financial services from every bank located and licensed within the Euro area. It follows that every bank located and licensed in the Euro area can collect deposits, issue loans, and conduct other financial services across the whole Euro area. This design aspect fulfils the condition of free output and input flow as well. Especially regarding human capital, banks need to be able to run operations related to the provision of financial services in every country of the Euro area with one license issued by one central institution.

Central institutions would also play a pivotal role in a unified legal framework. For a functioning market, a central supervisory agency and a regulatory agency are required, to which all banks in the Euro area would be subject. The role of a central supervisory agency could be fulfilled by the European Banking Authority, and the role of a central regulatory agency by the European Central Bank. All the banks in the Euro area would need to be subjected to the same rules, laws, and policies, clearly formulated to avoid differences in interpretation. These rules, laws, and policies would need to be decided by one political body, for which the European Union and a subset of the member countries of the Euro area could be responsible. With a possibly more intense intertwining of the banks in the Euro area and more diverse bank asset sheets regarding the origin of assets and liabilities, the member states need to agree on a unified procedure in the case of bankruptcy and failure, with one institution to monitor systematic risk. To protect the shared customer base of the Euro area, market-wide deposit insurance would be necessary. Banks also need certainty if borrowers' default on their loans. Hence, the insolvency laws for individuals and enterprises need to be standardized within the Euro area. Furthermore, a unified legal framework would enable the banks within an integrated Euro

area banking market to invest efficiently in IT, as cross-country consolidations and cooperation would be possible and banks would have the opportunity to create digital branches in different markets. Additionally, a unified legal framework would facilitate the potential consolidation of banks. Lastly, taxation needs to be targeted, both at the bank and the consumer level. To ensure fair competition between the banks in the Euro area, taxation needs to be standardized to create a level playing field and prevent possible tax evasion within the Euro area. The taxation of the financial gains of individuals from financial services within the Euro area would also need to be standardized to ensure the smooth operation of banks across the whole Euro area.

The last condition to be taken into consideration is a shared financial, technical, legal, and knowledge-based infrastructure for an integrated Euro area banking market. A shared financial infrastructure enables participants in an integrated Euro area banking market to carry out transactions connected to financial services delivered by banks and, in particular, the transfer of money. This is achieved as a first step through the implementation of a common currency. In a second step, a shared financial infrastructure allows the participants to conduct transactions without the use of cash or the necessity of personal interaction. This results in a transaction system that is useable for all relevant participants in an integrated Euro area banking market. A shared technical infrastructure enables not only the technical requirements of the above-mentioned transaction system but also access to extensive channels of communication and data exchange. A shared legal infrastructure ensures the execution of a unified legal framework through supervisory authorities and legal courts. It is crucial that every participating country in an integrated Euro area banking market enforces this unified legal framework and accepts court decisions from either central Euro area institutions or national courts. A shared knowledge-based infrastructure provides, firstly, a training system to ensure adequately educated bank employees and, secondly, support and a knowledge base for consumers regarding the provision of financial services. The training system could be conducted by both banks and institutions of higher education, such as universities. Providing customer support entails not only ensuring that customers have sufficient knowledge to understand how to utilize the available financial services but also offering the possibility for customers to compare and select the financial services provided by different banks. This customer knowledge platform could be hosted either by the member states of the Euro area, through a bank association, a private company, or a joint venture between two or more of the above.

The above prerequisites for an integrated Euro area banking market and the conditions for its practical implementation are summarized in Table 13.

Prerequisite	
P.1	The integrated banking market includes all Euro area member states
Conditions	
C.1	The integrated Euro area banking market has a shared consumer base and enables a free flow of input and output factors for financial services
C.1.1	*Individuals can consume financial services regardless of the origin of the bank within the Euro area*
C.1.2	*Banks can operate across the Euro area with one license issued by one central institution*
C.2	The integrated Euro area banking market has a unified legal framework regarding financial services
C.2.1	*Harmonized rules, laws, and policies regarding financial services within the Euro area*
C.2.2	*Banks are subjected to one Euro area supervisory and regulatory agency*
C.2.3	*The Euro area agency to monitor risks emerging from the interconnection of banks*
C.2.4	*A Euro area deposit insurance*
C.2.5	*Standardized Euro area insolvency laws*
C.2.6	*Stimulation of IT investments through a regulator*
C.2.7	*Standardized taxation of profits from financial services for banks*
C.2.8	*Standardized taxation of profits from financial services for consumers*
C.3	The integrated Euro area banking market has a shared market infrastructure
C.3.1	*Shared financial infrastructure*
C.3.2	*Shared technical infrastructure*
C.3.3	*Shared legal infrastructure*
C.3.4	*Shared knowledge infrastructure*

Table 12: Prerequisite and Conditions for an Integrated Euro area Banking Market

With the foundation of an integrated Euro area banking market and the implementation of the above-defined practical design, it could be argued that the economies of the LIE countries would be stimulated and would therefore initiate a possible convergence to the economies in the HIE and MIE groups. Furthermore, the competition in the banking

sector of the LIE group would increase, and hence, their HHI would decrease to a favourable level. Furthermore, the stability within these banking sectors would also increase in terms of a higher Z-score. Overall, all countries within the Euro area would have the potential to realize a positive influence on their GDP through an integrated Euro area banking market. Additionally, a level playing field in the Euro area would be created that would facilitate potential consolidation activities. Finally, the relevant banks located within the Euro area could increase their profitability both as a result of increased opportunities to receive funding in terms of deposits and through increased efficiency achieved through economies of scale and larger IT investments. Thus, their international competitiveness, especially regarding the relevant banks in the USA, would be improved.

The conditions for an integrated Euro area banking market can also be placed within the defined Financial Market Framework. Condition C.1, regarding a shared consumer base and the enablement of a free flow of input and output factors for financial services, concerns every aspect of the Financial Market Framework. Condition C.1.1, regarding consumers, concerns capital providers and capital borrowers primarily and, secondarily, financial intermediaries / banks. Condition C.1.2 concerns the state, the central bank, and financial intermediaries / banks. As mentioned in Chapter 2, Diamond (1984) argues that the provision of financial services is improved if financial intermediaries have a well-diversified credit portfolio. Furthermore, Freixas / Rochet (2008) also argue that well-diversified credit portfolios and lending relationships improve the stability of the banking market. Consequently, if a bank is able to provide loans all across the Euro area, it can diversify its credit portfolio and its lending relationships, fulfilling condition C.1.2. Holmstrom / Tirole (1984) argue that several competing banks are beneficial for capital borrowers. Hence, if condition C.1 is fulfilled, capital borrowers can choose between competing banks in a euro-wide area, improving the outcome of their projects. Taking this argument further, condition C.1 would facilitate the correct level of competition in the Euro area banking market. As ascertained in Chapter 2, a moderate level of competition in the banking sector is favourable and beneficial for stability. Furthermore, according to Greenwood / Jovanovic (1990), a stable banking sector is beneficial for the economy. Hence, condition C.1 concerns the real economy and the state and central bank in the Financial Market Framework, as they are responsible for its enablement.

Condition C.2 concerns the state, the central bank, financial intermediaries / banks and the real economy. This condition, with its respective sub-conditions, describes a unified legal framework for the Euro area banking market with unified supervision from institutes

within the market. Condition C.2.4, a Euro area deposit insurance, as proposed by Diamond / Dybvig (1983) would prevent bank runs and thus improve the stability of the banking market, as would condition C.2.6, which would stimulate investments in IT. According to Greenwood / Jovanovic (1990), a stable banking market is beneficial for economic growth; as such, condition C.2 also concerns the real economy.
Condition C.3, regarding a shared market infrastructure, concerns both the financial market, as well as the state. Condition C.3.1, regarding a shared financial infrastructure, concerns primarily financial intermediaries and the state and, secondarily, capital providers and borrowers. This is because the base of a financial infrastructure is the currency, which is defined by the state, and the transaction system is defined and used by financial intermediaries, capital providers and borrowers. The technical infrastructure (condition C.3.2) to implement the transaction system as well as the technological standards concerns financial intermediaries / banks. The legal framework (condition C.3.3) concerns the state in the financial framework. Lastly, the knowledge infrastructure (condition C.3.4) concerns the state, financial intermediaries / banks, capital providers and capital borrowers.
Overall, the creation of an integrated Euro area banking market would stimulate economic growth within the Euro area, make its banking sector more resilient and stable, and enable the relevant banks to operate more efficiently and compete on an international level. Thus, a well-designed integrated Euro area banking market is a desirable target for the member countries of the Euro area.

5.3. Current State of Euro area Banking Market Integration

In the previous chapters, it was argued how one integrated Euro area banking market could mitigate the unfavorable findings resulting from a comparison between the Euro area and the other relevant banking markets and what a possible practical design of an integrated Euro area banking market might look like. However, the current state of banking market integration in the Euro area has not yet been discussed. It is, therefore, necessary to understand what degree of integration has already been achieved within the Euro area regarding its banking markets.
The introduction of the euro as the currency within the European Union can, of course, be perceived as a fundamental steppingstone towards integration of the banking markets in the member countries that adapted it, as a single currency eases the provision and consumption of financial services in contrast to several different currencies and conversion rates. In the following, the supervisory and regulatory aspects of banking market

integration and subsequent policies are discussed. In the aftermath of the 2008 financial crisis, the European Union decided to move towards integrated financial supervision regarding coordination, cooperation, and the application of European Union laws. Consequently, the European Union established the European System of Financial Supervisors, consisting of the European Systemic Risk Board, the European Banking Authority, the European Insurance and Occupational Pensions Authority, the European Securities and Markets Authority, a Joint Committee of the European Supervisory Authorities, and the local supervisory agencies of the member states. This system of financial supervision aimed to mitigate the shortcomings observed during the financial crisis in 2008 and hence increase the quality and consistency of financial supervision within the European Union, foster cross-border cooperation and supervision, and create a single rule book applicable to all financial market participants within the European Union.[87]

Regarding integration efforts within the Euro area banking markets, the European Systemic Risk Board and the European Banking Authority need to be particularly addressed, as the other two authorities are mainly concerned with the insurance and securities markets, and the Joint Committee of the European Supervisory Authorities aims to facilitate communication between the single authorities. The sole purpose of the European Systemic Risk Board is to monitor for systematic risk in the financial sector of the European Union. Additionally, if the board detects systematic risk, it also has the duty to suggest mitigating possibilities and monitor the subsequent actions. The second relevant banking authority, the European Banking Authority, serves as a supranational regulatory agency in addition to the national supervisory agencies of the Euro area member states. The European Banking Authority is dedicated to improving the functioning of the internal market within the Euro area. This involves establishing a robust, efficient, and consistent regulatory and supervisory framework to ensure sound and effective financial governance. It also entails ensuring the integrity, transparency, efficiency, and orderly operation of financial markets to maintain trust and stability. Additionally, the European Banking Authority focuses on strengthening international supervisory coordination efforts to foster consistency and cooperation on a global scale. Furthermore, the European Banking Authority works to prevent regulatory arbitrage and cultivate a level playing field for competition, ensuring fair conditions across the financial sector. It enforces

[87] Cf. European Union (2010c), pp. 84-86

comprehensive regulations and supervision to effectively manage credit and other associated risks in a prudent manner. Lastly, the European Banking Authority is committed to enhancing customer protection measures to safeguard the interests and rights of financial consumers.[88]

Banks can operate in more than one member state within the European Union under two conditions. Firstly, the bank needs to be licensed by an authority of a member state of the European Union. Secondly, the bank needs to notify the authority in the country where it wants to open a branch or offer cross-border financial services. Based on the notification, the European Banking Authority is informed regarding the cross-border operation as well. However, the notified authority can pose financial requirements to the bank that are specific to the member country. Overall, this procedure is called passporting and allows banks to operate and deliver financial services across the European Union and, thus, the Euro area.[89]

Besides supervisory integration, two other endeavours have been important towards the integration of the banking market within the Euro area: the Banking Union and the Capital Markets Union. As the Banking Union has already been discussed in a previous chapter, it is only briefly recalled here. The European Banking Union revolves around the European Central Bank, which serves as a supervisory agency for larger banks in the Euro area. Its supervisory function is based on three pillars: the single supervisory mechanism; the single resolution mechanism, which defines the resolution process of illiquid banks; and, as yet unfished, the European deposit insurance scheme. Although the European requirements and rules for the national deposit insurance systems have been standardized, they have not been consolidated into one Euro area-wide deposit insurance system. Lastly, the European Banking Union is built on a single rule book, which can be understood as the legal framework for banking within the Euro area.

Complementary to the European Banking Union, the European Commission published two communications regarding the establishment of a Capital Markets Union connected with action plans in 2015 and 2020. The European Commission's case for the integration of the financial market within the European Union is similar to the arguments proposed in previous chapters of this dissertation. In their communications, the Commission argued that the European capital markets are still underdeveloped and fragmented, especially

[88] Cf. European Union (2010a), pp. 5f.; European Union (2010b), pp. 21f.

[89] Cf. European Union (2006), pp. 19-36

compared to their American counterparts, although free flow of capital is one of the ground principles of the European Union. The reports further maintained that in integrated capital markets, individuals have more options for the consumption of financial services and entrepreneurs have more abilities to finance their projects. With these effects, economic growth in Europe is stimulated, and economic convergence between the member countries can be achieved together with and a more stable and resilient financial system. The Capital Markets Union is seen as part of a bank-oriented European financial system that fosters more investment within the European Union, helps to connect investments opportunities within the European Union, especially in smaller economies, increases the stability and resilience of the financial system, and creates more liquid and competitive financial markets. Additionally, the Capital Markets Union aims to enable efficiency gains for the banks within the Union using economies of scale.[90]

The first communication regarding the Capital Markets Union included an action plan with several measures: to establish more funding options for European companies, especially small and medium enterprises; to create a legal framework for sustainable investments and funding of European infrastructure; to increase investment options for private and institutional investors; to increase the credit capacities of European banks; and to remove barriers between the capital markets of the member states. As only the last two measures target banking market integration in the Euro area, they will be discussed in more detail. Increasing the credit capacities of European banks involves firstly the creation of transparent and standardized European securitization, with the aim of enabling investment opportunities for long-term investors based in the banking market. Secondly, it examines whether all member countries can benefit from an organized form of credit union. Lastly, it evaluates whether a European framework for covered bonds based on the national regulations of the member states can be created. The second measure – removing barriers between the capital markets of the member states – targets disparate insolvency laws between the member states and proposes the creation of a European legal framework for corporate insolvencies. Furthermore, it aims to abolish insecurities regarding the ownership of securities and the development of the capital markets in the member states. Lastly, it aims to converge the various European supervisory authorities, to be

[90] Cf. European Commission (2015), pp. 3f.

implemented through the earlier described European Banking Authority and the European Systemic Risk Board.[91]

Based on the first communication and action plan regarding a Capital Markets Union, the European Commission published a second communication in 2020, stating that most of the defined measures had been implemented but that significant barriers were still observable, especially regarding supervision, taxation, and insolvency laws. Furthermore, the reasoning behind and the vision for a Capital Markets Union was outlined. The Capital Markets Union intends to create a competitive and transparent market which allows all participants to access information and infrastructure. Furthermore, consumers should be able to select financial services and products based on competitive choice rather than market tradition or market power. In addition to the measures in the first communication, the European Commission added a digital finance strategy, aiming to profit from the benefits of digital financial products relating to innovation, competition, and risk mitigation. Specifically, the digital finance strategy aims to tackle the fragmentation of digitally single markets, enable cross-border delivery in digital financial services, create a regulatory framework that facilitates digital innovation of financial services, create a European digital financial data space, and address digital risk arising from new technologies. Overall, three key objectives are defined in the communication: to increase the accessibility of funding for European companies; to increase the security of long-term investments; and to integrate national capital markets into one single European capital market. These three key objectives are subdivided into 16 actions. In the following, only the relevant actions regarding banking market integration are elaborated on. The first key objective – increased accessibility – includes two relevant actions: the setting-up of an EU-wide platform with company information for investors, and a review of the legal framework for securities. The second key objective – to increase the security of long-term investments – includes one action that aims to assess a European financial competence framework to promote financial education. Lastly, the key objective integrating the national capital markets into one European market contains four actions. The first targets the taxation of profits from financial services, introducing a standardized European-wide system for withholding tax reliefs. The second aims to standardize or converge the non-bank insolvency laws within the European Union. The third proposes a strengthening of cross-

[91] Cf. European Commission (2015), pp. 5-7

border investment protection, and the fourth commits to standardizing European Union rules for capital markets under one supervisory body.[92]

In addition to organizational, regulatory, and supervisory integration, a technical integration of the Euro area banking markets has also taken place. With the single euro payment area, or SEPA, the member states of the Euro area have a common European Union wide payment system, which defines a regulatory and technical framework for payments, as well as clearing and software selection. [93]

Overall, a certain degree of integration in the Euro area banking market can be observed, mainly as a consequence of the European Union and its legislation. However, the division of power between national and European authorities is crucial when assessing the current state of integration. The European Banking Union can be understood as the regulatory foundation of an integrated Euro area banking market with common laws and the European Central Bank as a supervisory agency for a defined group of banks, while other banks are still supervised by national authorities. The Banking Union is complemented by the European Banking Authority, which serves as a regulatory agency within the European Union and the European Systematic Risk Board. However, these two authorities aim to converge the legislation of national authorities and do not pose as supranational authorities. Bearing all this in mind, banks can only operate in the whole Euro area if they notify every national authority of the member country in which they want to conduct business. This is a somewhat watered-down version of an integrated banking market. Further progress regarding the integration of the Euro area banking market has been targeted through the two communications and action plans regarding the Capital Markets Union by the European Commission. However, despite the overall goal of one single integrated capital market, of which the banking market is a part, the vision of an integrated Euro area banking market and a Capital Market Union have large overlaps. However, the Capital Market Union is still under development and has not yet been fully implemented, as a lot of fundamental work such as assessing options and standardization is still in progress. Nevertheless, a common infrastructure for banking market integration has been implemented through SEPA. However, this includes all member states of the European Union and not exclusively, as does the Banking Union, the members of the Euro area.

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[92] Cf. European Commission (2020a), pp. 2-14; Cf. European Commission (2020b), pp. 4f.

[93] Cf. European Union (2012), pp. 22ff.

5.4. Recommendations for Positioning of the Euro area Banking Market

Having proposed a practical design for an integrated Euro area banking market and having analyzed the current state of Euro area banking market integration, a foundation for recommendations regarding the future positioning of the Euro area banking market can be laid. In the following, the discrepancies between the status quo and the envisioned integrated Euro area banking market are identified. Subsequently, recommendations for the future positioning of the Euro area banking market are proposed.

To identify the discrepancies between the status quo and the envisioned integrated Euro area banking market, the prerequisites and conditions from Table 13 are reviewed. Firstly, the prerequisite P.1 that an integrated Euro area banking market needs to be as large as possible and include all member states of the Euro area can be interpreted as having been fulfilled. The Banking Union includes the Euro area member states, while the Capital Markets Union and the European System of Financial Supervisors address all member states of the European Union. Thus, all integration efforts have included the whole Euro area. However, one reservation is that these integration efforts have not been consistently applied as they switch between the Euro area and the European Union.

According to condition C.1, an integrated Euro area banking market should have a shared consumer base that enables a free flow of input and output factors for financial services. This condition can be classified as having been partially fulfilled as a result of the two sub-conditions C.1.1 and C.1.2. The first sub-condition, that individuals should be able to consume financial services regardless of the origin of the bank within the Euro area, has been partially fulfilled. Banks have the opportunity to offer their services through passporting within the European Union and, thus, within the Euro area. However, passporting involves several national supervisory agencies. Hence, the free consumption of financial services within the Euro area can be hindered to a certain degree. However, the Capital Markets Union addresses this topic through the targeted integration of all capital markets in the European Union. The sub-condition C.1.2, that banks should be able to operate across the Euro area with one license issued by one central institution, has not been fulfilled, bearing in mind the limitations of the passporting system mentioned above. Furthermore, there is no central institution in the Euro area that is responsible for the licensing of banks, as this is still under national responsibility.

According to condition C.2, the integrated Euro area banking market should have a unified legal framework regarding financial services. This has been partially fulfilled when

one considers its sub-conditions. Firstly, sub-condition C.2.1, which proposes the standardization of rules, laws, and policies regarding financial services within the Euro area, has been fulfilled. The Banking Union has a single rule book, and the European Banking Authority is responsible for the convergence of the national supervision agencies within the member states of the Euro area. Consequently, sub-condition C.2.2, that banks should be subjected to one Euro area-wide supervisory and regulatory agency has been partially fulfilled as the banks in the Euro area are subjected to a certain degree to the ECB following the Banking Union and the EBA through the European System of Financial Supervisors. However, only certain large banks are subject to the ECB, while smaller banks are still subject to national supervisory authorities. Additionally, the EBA aims to consolidate the underlying national authorities, not replace them, thus leaving national regulatory and supervisory authorities in place in addition to the supranational authorities in the Euro area. The European System of Financial Supervisors and sub-condition C.2.3 propose a Euro area-wide agency responsible for monitoring risks emerging from the interconnection of banks. This has been fulfilled with the creation of the European Systemic Risk Board. Conversely, however, sub-condition C.2.4, that there should be Euro area-wide deposit insurance, has not been fulfilled. Although a deposit insurance scheme is part of the European Banking Union, a Euro area-wide deposit insurance does not exist. Despite the actions from the Banking Union, the deposit insurance schemes of the member states have only been standardized, not consolidated. The standardization of the insolvency laws within the Euro area, as set down in sub-condition C.2.5, can be classified as having been partially fulfilled. Through the Banking Union, the insolvency and resolution mechanism within the Euro area has been finalized, and insolvency laws regarding non-banks have been targeted in the Capital Markets Union. However, this standardization although initiated, has not been implemented. Focusing on the Capital Markets Union, sub-condition C.2.6, which aims to stimulate IT investments through regulators, has been fulfilled. The digital finance strategy of the European Commission, included in the Capital Markets Union, specifically targets this topic. The two sub-conditions regarding the taxation of profits from financial services on consumers and on banks (C.2.7 and C.2.8) have not been fulfilled and are not included in any actions of the Capital Markets Union or the Banking Union.

The last condition C.3, that there should be a shared market infrastructure, can be assessed as fulfilled when one considers its sub-conditions. Sub-condition C.3.1, proposing a shared financial infrastructure, has been fulfilled. As mentioned above, the Euro area has,

with the euro, a single currency, which serves the basis for this sub-condition. Furthermore, with the SEPA system, following the Payment Service Directive I, a supranational European payment and settlement system has been implemented. With the fulfilment of sub-condition 3.1, it can be argued that regarding a shared technical infrastructure, the technical implementation of the transaction system has been fulfilled. Additionally, with the internet as a worldwide standard for communication. and the standardization of application programming interfaces regarding payments through the payment service directive II, sub-condition C.3.2 can be seen as fulfilled. As the potential member states of the integrated Euro area banking market are all member states of the European Union, sub-condition 3.3, a shared legal infrastructure, has also been fulfilled, as through membership of the European Union, the execution of unified legal frameworks has been regulated. Lastly, sub-condition C.3.4, proposing a shared knowledge infrastructure, has been partially fulfilled. The European University and its training system have been sufficiently developed to train people to work in the banking industry. Additionally, the European Union encourages students to study abroad through the ERASMUS programme. Furthermore, the implementation of European-wide knowledge infrastructure regarding financial knowledge, financial services, and financial data has been initiated through the Capital Markets Union and the Digital Finance strategy. However, as this implementation has only been initiated and not completed, the sub-condition has only partly been fulfilled. Nevertheless, as sub-conditions C.3.1, C.3.2, and C3.3 outweigh sub-condition C.3.4 regarding their impact, C.3 has to a great extent been fulfilled.

Overall, the discrepancy analysis reveals that most of the conditions for the practical design of an integrated Euro area banking market have at least been partially fulfilled, as shown in Table 14. The largest discrepancy concerns the supervision and regulatory authorities, as currently this is organized nationally, not supranationally. The situation is similar regarding deposit insurance systems, as the scheme has only been standardized, not implemented across the Euro area. Lastly, taxation standardization regarding profits from financial services has not been addressed. The partially fulfilled conditions also need to be addressed further.

Prerequisite		
P.1	The integrated banking market includes all Euro area member states	Fulfilled
Conditions		
C.1	The integrated Euro area banking market has a shared consumer base and enables a free flow of input and output factors for financial services	Partially fulfilled
C.1.1	*Individuals can consume financial services regardless of the origin of the bank within the Euro area*	*Partially fulfilled*
C.1.2	*Banks can operate across the Euro area with one license issued by one central institution*	*Not fulfilled*
C.2	The integrated Euro area banking market has a unified legal framework regarding financial services	Partially fulfilled
C.2.1	*Standardized rules, laws, and policies regarding financial services within the Euro area*	*Fulfilled*
C.2.2	*Banks are subjected to one Euro area wide supervisory and regulatory agency*	*Partially fulfilled*
C.2.3	*Euro area wide agency subjected to monitor risk emerging from interconnection of banks*	*Fulfilled*
C.2.4	*Euro area wide deposit insurance*	*Not fulfilled*
C.2.5	*Standardized Euro area wide insolvency laws*	*Partially fulfilled*
C.2.6	*Stimulation of IT investments through regulator*	*Fulfilled*
C.2.7	*Standardized taxation of profits from financial services for banks*	*Not fulfilled*
C.2.8	*Standardized taxation of profits from financial services for consumers*	*Not fulfilled*
C.3	The integrated Euro area banking market has a shared market infrastructure	Fulfilled
C.3.1	*Shared financial infrastructure*	*Fulfilled*
C.3.2	*Shared technological infrastructure*	*Fulfilled*
C.3.3	*Shared legal infrastructure*	*Fulfilled*
C.3.4	*Shared knowledge infrastructure*	*Partially fulfilled*

Table 13: Discrepancy Analysis of the Practical Design of an Integrated Euro area Banking Market and the Current Integration Status

With the discrepancies between the practical design of an integrated Euro area banking market and the current state of banking market integration in the Euro area having been identified, four recommendations for the future positioning of the Euro area banking market can be defined: to create a dedicated integrated Euro area banking market including all member states of the Euro area; to stringently implement the Capital Markets Union

envisioned by the European Commission and expand it; to finalize the current Banking Union; and to expand the Banking Union regarding the consolidation of supervisory and regulatory authorities.

The recommendation to create an integrated Euro area banking market is the foundation for the other recommendations. However, it can only be achieved if those recommendations are thoroughly implemented. Hence, it addresses the fulfilment of all partially and not fulfilled conditions and sub-conditions. To coordinate the efforts towards the creation of an integrated Euro area banking market, the member states of the Euro area should install a legal body that plans, oversees, and tracks all actions required to implement it.

The second recommendation to stringently implement the Capital Markets Union envisioned by the European Commission and expand it targets, in particular, the creation of one European capital market and, in consequence, an integrated Euro area banking market. This recommendation addresses the fulfilment of condition C.1, the sub-conditions C.1.2, condition C.2, sub-condition, C.2.5 and sub-condition C.3.4. To address sub-conditions C.2.7 and C.2.8, the standardization of taxation on profits from financial services, the current concept of the Capital Markets Union needs to be adapted, as it only envisions a standardized European-wide system for withholding tax reliefs.

With the finalization of the Banking Union, a Euro area-wide deposit insurance scheme will be introduced to replace the current national deposit insurance schemes. With this recommendation in place, a level playing field for the integrated Euro area banking market will be created, especially regarding consumer protection and overall system stability. As such, it addresses the fulfilment of condition C.2 and sub-condition C.2.4.

Finally, the current concept of the Banking Union needs to be expanded. Regulatory and supervisory authorities should shift from the national level to a European level. With this recommendation in place, a truly unified framework regarding rules, laws, and policies can be implemented. Furthermore, shifting the supervisory responsibilities of the ECB to a single, dedicated European supervisory authority would allow the central bank to focus on its core responsibilities. Furthermore, with this shift away from the ECB, there would be the possibility to expand an integrated Euro area banking market further to encompass an integrated European Union banking market, as, at the moment, the ECB only has a mandate for the Euro area member states. With an expanded Banking Union, the condition C.1, sub-condition C.1.2, condition C.2, and sub-condition C.2.2 would be fulfilled.

If all recommendations are implemented thoroughly, an integrated Euro area banking market can be established. An integrated Euro area banking market would stimulate the

economies of the Euro area member states, increase competition to an optimal level, and create a stable as well as resilient Euro area banking sector. Thus, the implementation of these recommendations would be beneficial for both the Euro area and its constituent countries.

6. Conclusion

This dissertation addresses two fundamental questions: Firstly, how does the Euro area banking market compare internationally in terms of economic and profitability ratios at the institutional level? Secondly, how should the Euro area banking market position itself in the future, taking into account its performance and the forthcoming economic policy challenges?

It is evident that the main issue in the Euro area revolves around its economic heterogeneity, which impacts both the economies and banking sectors of its member states. Additionally, internationally relevant banks within the Euro area tend to be less profitable compared to their counterparts in defined international banking markets. To address these issues, the establishment of an integrated Euro area banking market is proposed. Such an integrated Euro area banking market would stimulate economic convergence, enhance the stability of the banking sectors, and level the playing field for international banks to regain profitability.

In more detail, Chapter 2 demonstrates that banks exhibit greater efficiency in delivering transformation functions, including information transformation, risk transformation, and liquidity transformation, compared to the financial market. This is substantiated by various microeconomic models focusing on loan issuance and deposit collection. However, the delivery of transformation functions can also trigger bank runs and bank panics, potentially leading to economic crises. To avert such events, regulators can implement measures like deposit insurance. From a macroeconomic perspective, banks, as financial intermediaries, play a pivotal role in efficiently providing capital to an economy. Additionally, commercial banks assist central banks in money creation, and a well-developed, stable banking and financial system significantly contributes to economic growth.

Moreover, the banking market deviates from conventional markets regarding competition, with divergent viewpoints on its impact on stability and economic development. Some argue that heightened competition increases bank default rates due to higher risk-taking, while others contend that reduced competition elevates the default probability for both capital borrowers and banks. Both effects are relevant, and each can become

dominant depending on the prevailing level of competition in the observed banking market. Consequently, a moderate level of competition in the banking market is preferred for stability and the support of economic growth. The utilization of IT in banks can also influence competition by reducing costs and improving efficiency, though it may lead to undesirable levels of competition.

Lastly, Chapter 2 indicates that state intervention is justifiable only in the presence of market failure, such as potential bank runs, bank panics, or undesirable competition levels, necessitating market regulation. As such, it provides an overview of the current level of bank regulation in the Euro area.

Building on these foundations, Chapter 3 defines the Euro area banking market as one comprising countries that use the euro as their currency and are part of the European Union. For the purposes of comparison, the United States, the United Kingdom, and Japan are categorized as international banking markets due to the use of their currencies as reserve currencies. An internal comparison divides the Euro area into high-income economies (HIE), mid-income economies (MIE), and low-income economies (LIE) based on GDP per capita. In the subsequent analysis, the Euro area emerges as a leading banking market in terms of macroeconomic key figures. However, the presence of economic heterogeneity within the Euro area, particularly between the HIE, MIE, and LIE groups, presents a significant challenge. The economic weakness of the LIE group compared to the HIE and MIE groups raises questions about how the banking market can contribute to economic convergence in the Euro area. After analyzing macroeconomic key figures, the banking sectors of the Euro area and international banking markets are evaluated and compared, both in terms of organizational structures and financial key figures. The findings indicate that all banking sectors are either stagnating or decreasing organizationally, with consolidation potential in the HIE group, while the MIE and LIE groups experienced consolidation during the period observed. Furthermore, the Euro area is lagging in terms of digitization. Overall, considering the analysis of the financial key figures of the banking sectors, the Euro area's banking market is in a favourable position. However, the issue of heterogeneity within the Euro area remains a concern, especially in relation to the less stable and more concentrated banking sectors of the LIE group, as opposed to the banking sectors of the HIE and MIE groups, which display the opposite trend. This prompts the question of how countries in the LIE group can benefit from the competition and stability offered by other banking markets.

Following the analysis and comparison of economies and banking sectors in Chapter 4 a profitability analysis is conducted on internationally relevant proxy banks in each respective banking market. These proxy banks were created using average balance sheet and profit and loss statement figures from the largest banks classified as internationally relevant in their respective banking markets. The analysis reveals that Euro area banks lag behind in profitability, particularly when compared to the proxy banks of the United States. This raises the question of how regulators can establish a level playing field in the Euro area to enhance bank profitability and maintain international competitiveness, especially in competition with banks in the United States.

Building on the findings from the previous chapters, Chapter 5 proposes an integrated Euro area banking market, encompassing all Euro area member states. This integrated market features a shared consumer base, facilitates the free flow of input and output factors for financial services, has a unified legal framework for financial services, and shares a market infrastructure. A delta analysis reveals that integration in the current Euro area banking market has been partially achieved, but not to the extent required to optimally address the findings from the previous chapters. Based on this identified delta, four measures for the future positioning of the Euro area banking market are suggested: The creation of a dedicated integrated Euro area banking market encompassing all member states; the implementation of the Capital Markets Union envisioned by the European Commission and expanding it with regard to the taxation of financial services and banks; finalizing the current European Banking Union to establish a unified Euro area deposit insurance scheme; and expanding it to consolidate supervisory and regulatory authorities in the Euro area. These measures are designed to stimulate the economies of Euro area member states, increase competition in the Euro area banking market to a sufficient level, and establish a stable and resilient Euro area-wide banking sector.

Bearing these results in mind, this dissertation makes a significant contribution to European Union policymaking, offering measures concerning the existing European Banking Union and a potential future Capital Markets Union. While the analysis of the Euro area banking market from 2009 to 2020 sheds light on the impact of measures taken following the financial crisis in 2008 and the European debt crisis, it also provides a foundation for further research into correlations. However, it's important to note that this work relies on descriptive statistics and does not include regression analysis, limiting its ability to draw in-depth conclusions about correlation. Overall, this dissertation provides a comprehensive contribution to banking theory, offers insights into the development of the Euro area

banking market during a unique economic era, and presents practical measures that can significantly contribute to economic convergence in the Euro area and the creation of a fully integrated Euro area banking market, fulfilling the idea of a European Banking Union and a Capital Markets Union.

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Statutory Declaration

Statutory Declaration

I, M.Sc. Philipp Oliver Dingenotto, hereby declare under oath that the present dissertation was written independently and without unauthorized assistance, in compliance with the "Principles for Safeguarding Good Scientific Practice at Heinrich Heine University Düsseldorf."

Philipp Dingenotto, Düsseldorf, 21.08.2024