ESG Assets Under Management and Bank Profitability

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Activos ESG sob gestão e rentabilidade dos bancos

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Abstrato

Esta tese tem como objetivo compreender a influência do enfoque de sustentabilidade das atividades operacionais de 40 grandes bancos da UE na sua rentabilidade. Enquanto fornecedores de capital e intermediários de meios financeiros, os bancos são centrais na estratégia da UE para aumentar o financiamento sustentável e tornar-se neutra em carbono.

Utilizando uma estimação do método dos momentos generalizado (GMM) e um modelagem de equações estruturais, foi avaliada a seguinte questão de investigação: *Como é que os activos ESG sob gestão dos bancos de importância sistémica na UE influenciam a sua rentabilidade?*

Controlando os factores específicos dos bancos e os macroeconómicos que determinam a rentabilidade dos bancos, foi encontrado um impacto negativo dos activos ESG sob gestão em percentagem dos activos totais na margem financeira líquida, mas não foi detectado qualquer impacto significativo na Return on Average Assets nem na Return on Average Equity. A relação encontrada é válida apenas no curto prazo e torna-se insignificante quando extrapolada para o longo prazo.

Os resultados devem ser entendidos como um ponto de partida para novas investigações neste domínio da banca sustentável, em especial devido às especificações GMM relativamente frágeis e ao curto período de tempo da amostra. Recomenda-se uma nova avaliação com as declarações obrigatórias e pormenorizadas sobre o Principal Adverse Impact do Sustainable Finance Disclosure Regulation, que lançará uma nova luz sobre o sector bancário sustentável para além das pontuações ESG.

Palavras-chave: ESG, banca sustentável, SFDR, GMM, SEM

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Abstract

This thesis aims to understand the influence of the sustainability focus of 40 large EU bank's operating activities on its profitability. As providers of capital and intermediary in the allocation of financial means, banks are central in the EU's strategy to increase sustainable finance and becoming carbon neutral.

Using both a System Generalized Method of Moments (GMM) estimation technique and a Structural Equation Model, the following research question was assessed: *How does the ESG Assets under Management ratio of systemically important banks in the EU influence their profitability?*

Controlling for commonly used bank-specific and macroeconomic factors determining the profitability of banks, a negative impact of the ESG Assets under Management as a percentage of total assets on the Net Interest Margin was found, however, no significant impact on neither the Return on Average Assets nor the Return on Average Equity was detected. The relation found is only valid in the short-run and becomes insignificant once it is extrapolated to the longer term.

The results should be understood as a starting point for further research in this area of sustainable banking in particular due to relatively fragile GMM specifications and the short time period of the sample. A renewed assessment with the mandatory, detailed Principal Adverse Impact (PAI) statements of the Sustainable Finance Disclosure Regulation is recommended and will shed new light on sustainable banking beyond ESG scores.

Keywords: ESG, sustainable banking, SFDR, GMM, SEM

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List of Abbreviations

Abbreviation	Description
AMECO	Annual Macroeconomic Database of the European Commission
AUM	Assets under Management
ECB	European Central Bank
ESG	Environmental, Social and Governance
ESG AUM ratio	ESG Assets under Management as a percentage of total assets
EU	European Union
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
NIM	Net Interest Margin
PAI	Principal Adverse Impact
RQ	Research Question
ROAA	Return on Average Assets
ROAE	Return on Average Equity
SEM	Structural Equation Modelling
SFAP	Sustainable Finance Action Plan
SFDR	Sustainable Finance Disclosure Regulation
SFF	Sustainable Finance Framework
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

1.1 Relevance

Sustainability has become an increasingly important topic in public discourse as governments, businesses, and individuals recognize the urgent need to take action to mitigate the environmental, social, and economic challenges the world is facing today.[1]

Simultaneously, the regulatory framework became more complex and stringent. Acting on the Paris Agreement, the European Union (henceforth EU) passed sets of new regulation in recent years to harmonize sustainability laws in the EU and ultimately becoming carbon-neutral by 2050 (European Commission, 2019).

The specific goals to achieve the target of carbon-neutrality are found in the European Green Deal. Further, among other objectives, the transformation program for a more sustainable EU economy endeavors to increase energy efficiency and to strive for sustainable economic growth by decoupling it from environmental pollution (European Commission, 2019).[2]

A key success factor to achieve the goals of the Green Deal is a common understanding of sustainability and collectively defined goals. Consequently, the European Commission introduced the EU Taxonomy Regulation (European Commission, 2022). It outlines the conditions for an activity or investment to be called sustainable, whereby it must work towards one of the six defined goals[3] without violating any of the others (European Commission, 2023a).

The EU Taxonomy Regulation is part of the Sustainable Finance Action Plan (henceforth SFAP), a ten-point action plan aligned with the Green Deal and categorized into three main strategies. Firstly, the capital flows are to be steered to sustainable investment at the expense of climate change fostering industries. Second, climate risks should be incorporated into financial

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[1] Google Trends indicates an increase for the search terms "sustainability" and "ESG" (Google Trends, 2023). The visualization of the Scopus year range filter indicates an exponential increase of publications for the search term "sustainability" starting in the early 2000er years and for "ESG" around 2018 with years of many publications from 2011 to 2015.

[2] The Green Deal incorporates the United Nations Sustainable Development Goals into the European strategy. The main objectives are: "Increasing the EU's Climate ambition for 2030 and 2050; Supplying clean affordable and secure energy; Mobilising industry for a clean and circular economy; Building renovating in an energy and resource efficient way, A zero pollution ambition for a toxic-free environment; Preserving and restoring ecosystems and biodiversity; From 'Farm to Fork': [A] fair, healthy and environmentally friendly food system; Accelerating the shift to sustainable and smart mobility; Leave no one behind (Just Transition); Financing the transition" (European Commission, 2019)

[3] The goals are: "Climate change mitigation; Climate change adaptation; The sustainable use and protection of water and marine resources; The transition to a circular economy; Pollution prevention and control; The protection and restoration of biodiversity and ecosystems" (European Commission, 2023a)

risk management. Third, increased transparency and a long-term orientation of investments shall make economic growth "sustainable and inclusive" (European Commission, 2020).

Another point in the SFAP is the Sustainable Finance Disclosure Regulation (henceforth SFDR). It is addressed to financial market participants, aiming to reduce greenwashing and to promote transparency. This is achieved, among others, through a standardized reporting on sustainability-related assets (European Parliament & Council of the European Union, 2019).

Financial market participants, especially banks with their key role in the allocation of capital are required to increase the sustainability of their operations as "financing the transition" (European Commission, 2019) is an important theme in the EU's sustainability strategy.

This need for sustainable finance has not been left undetected. In recent years, the emergence of sustainability driven FinTech and challenger banks that solely invest in sustainable assets has risen (Puschmann et al., 2020). These Startups and banks have taken a stance in the fight against climate change.

1.2 Aim of the Thesis

Building on this, this thesis aims to investigate whether it pays off for large banks in the EU to invest sustainably or if an increased sustainability focus decreases the banks' profitability. Particularly, the proportion of assets a bank invests in sustainable assets will be investigated in lieu of its profitability.

Therefore, the results of this thesis are not only of interest for banks to assess the threat of sustainability driven entrants, but also for policymakers to evaluate if sustainable finance is economically viable for banks in the long-term.

1.3 Structure of the Thesis

To answer the question if the sustainability orientation of a bank affects the bank's profitability, this thesis will be structured as follows: In the second chapter, an overview of the relevant literature will be given followed by the description of the data and the methodology used. Afterwards, in chapter four, the results are presented and initially parsed. Next, in chapter five, the analysis is discussed in light of the reviewed literature. Finally, chapter six offers a conclusion precedented by implications for policies and potential limitations, respectively points of further research, of this thesis.

2 Literature Review

A key requirement for efficacious sustainable banking is the standardization of definitions and reporting (Kemfert & Schmalz, 2019; Park & Kim, 2020). Therefore, the following subchapters will offer a definition of sustainable banking as well as providing an overview of the SFDR. Further, the determinants of bank profitability are explained, followed by an overview of nexus of sustainable banking and profitability.

2.1 Sustainable Banking

To understand sustainable banking, a common definition is a prerequisite. The EU Taxonomy defines sustainable economic activities for the first time officially. From this, the European Commission (2023b) derives its definition for sustainable finance as financial decision-making designed for the long-term with the simultaneous consideration of the ecological, social, and governmental impact and implications resulting from the business.[4]

However, in the context of EU policies, the definition slightly changes to a mediating role, supporting both economic growth and the environment under social and governance considerations. Disclosure and management of financial ESG-related risks are additional expectancies towards the sustainable finance sector (European Commission, 2023b).[5]

Recent academic literature borrowed from this definition (see for instance Kemfert & Schmalz, 2019; Park & Kim, 2020). Berensmann and Lindeberg (2016) not only included promoting and financing environmentally beneficial investments in their definition of sustainable banking, but also implementing government policies on sustainability. Further, they considered the use of a financial product designated for sustainable investments, such as green bonds, as the third component for green finance.

Sustainable banking, environmental banking, green banking or climate banking are sometimes used interchangeably although the UNEP[6] defines sustainable banking as the encompassing term while the latter are subsets with particular foci (Forstater & Zhang, 2016). A more detailed overview of the terms can be found in Appendix A.1.

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[4] The considerations are usually referred to as Environmental, Social, and Governance (ESG) factors.

[5] The Taxonomy Regulation amends the sustainable investment definition of the SFDR which viewed it as investments pursuing an environmental or social aim without causing detriment to the other, while maintaining minimum requirements in government aspects (European Parliament & Council of the European Union, 2019, 2020).

[6] The United Nations Environment Programme (UNEP) is with its Finance Initiative one of the largest green banking alliances. The UNEP published the Principles for Responsible Banking, aligning banking strategies with the UN Sustainable Development Goal and the Paris Agreement (UNEP, 2023).

The share of sustainable investments in the EU is growing. As of March 2022, 45.6 percent of the assets held by funds (excluding fund of funds and money market funds) were managed considering ESG criteria; this amounts to 4.18 trillion Euro, 9.2 percent of these assets were deployed explicitly pursuing a sustainable impact (Van Hoorn & Gallagher, 2022). On a global scale, professionally managed assets with an ESG aligned mandate are expected to exceed those without (Taylor & Collins, 2022).

In the course of this thesis, the assets under management (AUM) invested according to ESG criteria or strategy will be used as a measure of the sustainable finance activities of banks to analyze profitability.

2.2 Regulatory Framework: SFDR

Sustainable banking is promoted and supported by the European Commission through regulatory measures like the SFDR. As has been put into context in the introduction, the EU introduced, inter alia, the SFDR to create more transparency and accountability in order to counteract greenwashing and ensure consistent and comparable disclosure of sustainability-related data. Further, it facilitates integrating ESG factors into financial decision making.

The regulation was published in late 2019 and partially phased-in starting with the main provisions becoming effective on March 10, 2021. (European Parliament & Council of the European Union, 2019). The implementation of the second level was postponed to January 2023 (Hielkema & European Commission, 2022). In this second phase, financial market participants are obliged to disclose a series of benchmarks regarding sustainable investments, these numbers will be published in 2024 (Deloitte, 2023).

The two main components of the SFDR are the disclosure requirements for risk. Specifically, first, sustainability risks, i.e., financial risks arising from sustainability-related matters concerning the investment. Second, risks arising for the environment from the investment have to be disclosed in the yearly Principal Adverse Impact (PAI) Statement on both entity and product level. The management and mitigation of the sustainability risk and of the PAI needs to be explained. In sum they make up the Double Materiality concept, capturing the reciprocal effects of financial product and environment (Deloitte, 2020; European Parliament & Council of the European Union, 2019).

Finally, to ease comparability for investors, the SFDR prescribes a classification of assets into one of three categories: First, assets referred to in Article 6 of the regulatory framework don’t consider sustainability and are thus not referred to as Green Assets. Second, assets under

article 8 promote the consideration of ESG aspects. Third, assets under article 9 actively pursue a sustainable strategy (European Parliament & Council of the European Union, 2019).

The increased transparency that the SFDR is expected to provide does not come without effort for the financial market participants (Deloitte, 2020). Despite larger administrative cost, it is crucial for banks to remain profitable as a stable financial system implies a stable economy (Shahbaz et al., 2018). Therefore, it is important to comprehend the various drivers that shape bank profitability.

2.3 Determinants of Bank Profitability

The factors influencing the banks' profitability are multifaceted as are the measures of profitability. Besides the more common profitability measures Return on Average Assets (ROAA) and Return on Average Equity (ROAE), the Net Interest Margin (NIM) is also used for banks.

Regarding the determinants that shape these measures, Dietrich and Wanzenried (2011) found "operational efficiency, the growth of total loans, funding costs, the business model, and the effective tax rate" to be the five most important explanans. The determinants of bank profitability can be categorized into bank-specific, industry-specific, and macroeconomic factors and are presented in the following.

2.3.1 Bank-Specific Determinants

One of the most common bank-specific determinants is the *size* of a bank. While the bank's size in terms of total assets is negatively associated with its profits (Pasiouras & Kosmidou, 2007), Shehzad et al. (2013) found persistent higher profitability in larger banks. Taliento et al. (2019) found a significant influence of size as large corporation can allocate resources more easily and can spare some as well.

High *operational efficiency* (i.e., lower operating expenses) is associated with a positive effect on profitability. Goddard et al. (2013) used the ratio of operating cost to income in order to assess the level of efficiency. Pasiouras and Kosmidou (2007) observed it to be the essential factor for foreign banks' profitability. Athanasoglou et al. (2008) opted for the overhead costs over total assets. The efficiency advantages are found in both sustainable and traditional banks (Torre Olmo et al., 2021). Due to competition, banks cannot pass on above-average costs to customers; these costs are thus absorbed through decreased profits (Athanasoglou et al., 2008; Pasiouras & Kosmidou, 2007).

Another determinant is the effect of the *capitalization ratio* of a bank (measured as the equity-to-assets ratio). Its effect is ambiguous. Most scholars found a positive relation with profitability mediated by lower cost of funding (Abreu & Mendes, 2002; Athanasoglou et al., 2008; García-Herrero et al., 2009; Pasiouras & Kosmidou, 2007). Goddard et al. (2013), on the other hand, found a negative relation in an investigation of EU banks in a sample from 1992 till the financial crisis of 2007.

Further, *loan loss provisions* in relation to total loan, proxying the quality of a bank's loan portfolio, only affected the profitability significantly once the magnitude was substantial enough after the financial crisis, a study on the Swiss banking market by Dietrich and Wanzenried (2011) revealed. Other studies found a negative effect on profitability of European banks (Athanasoglou et al., 2008; Staikouras & Wood, 2011).

Finally, a weak (respectively moderate (Athanasoglou et al., 2008)) *persistence of profits* seems to be present, carrying profit of banks from year to year (Goddard et al., 2004, 2013).

2.3.2 Industry-Specific Determinants

While the idiosyncratic factors of banks are more easily alterable, the industry-specific determinants face a larger dependency to other banks. As for instance, *market concentration* does not appear to have significant influence on the profit for domestic banks (Pasiouras & Kosmidou, 2007), neither does the *market share* (Abreu & Mendes, 2002; Athanasoglou et al., 2008). The *ownership* of a bank plays a role during times of financial hardship, as state-owned banks have a more robust profitability during financial crises, compared to private ones (Dietrich & Wanzenried, 2011).

2.3.3 Macroeconomic Determinants

Finally, regarding the big picture of bank profitability, the macroeconomic determinants influence individual banks economic conditions. The *inflation* affects the profitability of domestic banks positively, as they most certainly have expected it and increase revenues more than their cost (Abreu & Mendes, 2002; Athanasoglou et al., 2008). Foreign banks on the other hand suffer from unforeseen increased costs. Similarly, *economic growth* as a proxy for cyclical output is positively, but asymmetrically associated with domestic banks' profitability, more precisely, economic upswings result in a significant profitability increase, while downswings are resulting in an insignificant coefficient. (Athanasoglou et al., 2008; Pasiouras & Kosmidou, 2007). In turn, bank profitability also positively affects economic growth (Klein & Weill, 2022).

2.4 Relationship between Sustainable Banking and Profitability

Understanding sustainable banking and the determinants of bank profitability is crucial to assess the interplay between both. The existing literature studying the nexus of sustainable banking and profitability is mostly concerned with the ESG performance of banks. In fact, this relationship appears to be positive (Brogi & Lagasio, 2019; Cornett et al., 2016). In particular the environmental and the social pillar are decisive for the association with financial performance (Shakil et al., 2019). Brogi and Lagasio (2019) found "environmental awareness" to be positively associated with profitability. Especially larger banks and companies tend to have better ESG scores than smaller ones as they can reallocate slack resources more easily (Cornett et al., 2016; Drempetic et al., 2020). Taliento et al. (2019) concluded that conscientiousness with respect to the environmental, social, and governance aspects of a corporation is an essential competitive factor for companies nowadays.

The commitment to social and environmentally sustainable project finance is deterministic for the success of a bank. Signatories of the UN Principles for Responsible Banking have a higher profitability and are not as susceptible to effects of market power than banks that have not signed the pledge (Torre Olmo et al., 2021).

2.5 Research Question

Based on the literature review, an empirical investigation follows to assess whether becoming a sustainably driven bank in the EU is a financially sound decision. This thesis will depart from the common focus on ESG scores and ESG performance of banks and rather pay attention to sustainable financial products, which are generally disclosed as ESG Assets under Management in the non-financial report of a bank. This indicator has the advantage of focusing on the operations on the investments side of the financial institutes and thus reflects the banks' sustainability related actions, rather than their commitments. Specifically, the following research question (RQ) will be investigated:

RQ – *How does the ESG Assets under Management ratio of systemically important banks in the EU influence their profitability?*

3 Data Description and Methodology

In order to address the aforementioned research question and in line with the aim of this thesis, which is to explore the potential impact of sustainable activities on bank profitability, it is necessary to analyze up-to-date data. Hence, the subsequent paragraphs will outline the research approach and methodologies employed.

This thesis is based on an ontology of realism, implying that reality can be measured objectively. The underlying epistemological position is based on positivism. The empirical verifiability is therefore a prerequisite to meaningfully create knowledge (Boumans & Davis, 2016). Following this philosophical position, this thesis will use a panel data set on an entity level for the quantitative, empirical analysis.

3.1 Data Description

Following the determinants of bank profitability presented in the literature review, the analysis in this thesis is based on the subsequent variables. The profitability of banks is assessed through one of the following three different measurements. Firstly, the *Return on Average Assets* (ROAA), computed as the net income over the average total assets, measures the bank's profitability of its assets. Analogously, the second measure is the *Return on Average Equity* (ROAE), with average equity in the denominator. Finally, the bank-typical indicator *Net Interest Margin* (NIM) is measured as the delta of interest income and interest expenses in relation to the average earning assets. As with the ROAA and ROAE, a higher NIM is preferred.

The independent variable of interest is the *ESG Assets under Management* as a percentage of total assets (henceforth ESG AUM ratio). The variable is part of the ESG rating by Refinitiv, a data provider and agency for ESG ratings. Further, banks report their investments considering ESG criteria in the non-financial statements, although this is not done by every institution. While most banks provide data in the ESG reporting consistent with the EU-taxonomy-aligned SFDR reporting, the data is not available for every entity included in the sample. In case the bank published their ESG related assets under management in the non-financial statement and the datapoint was missing in the ESG reporting of Refinitiv, the figures from the statements were manually extracted. The further treatment of missing data is explained in the respective methodology sections.

While the PAI statements will contain a green-asset ratio, comparable to the ESG AUM ratio used in this analysis, the detailed level two indicators are not available in the first PAI

statements that were due to be published in June 2023 disclosing indicators for the year 2022 only, but rather for the statement year 2023 and hence published mid 2024 (Deloitte, 2023).

In contrast to the ESG score, that is commonly used to assess the propensity for sustainability of banks, the ESG AUM solely reflects the operating activities of a bank.

To control for other determinants of bank profitability, the natural logarithm of the total assets is used to measure the *size* of a bank. Further, the *operational efficiency* is measured as the ratio of operating cost to income. The ratio of equity to total assets proxies the *capitalization ratio*. To account for the quality of the lending portfolio, the *loan loss reserves* as a percentage of gross loans are included. The *persistence of profits* is being controlled for by including the one-year-lagged profitability proxy, that is ROAA, ROAE, or NIM.

In order to account for the macroeconomic determinants, the *inflation rate* of the country where the headquarters of a bank is domiciled, is included. It is calculated as the increase of the Harmonized Index of Consumer Prices. Similarly, the *economic growth* measured by the growth rate of the annual Growth Domestic Product per capita in constant prices (henceforth GDP) of the respective country is calculated.

The period of interest is oriented along the availability of the data. The ESG AUM is first filed in the ESG statements of Refinitiv for the year 2019. The data for the ESG AUM is retrieved from the database Refinitiv Eikon Datastream (2023). The time frame extents to the most recent available statements. Since a substantial part of data entries for the sample is not available in Datastream, the data for bank-specific determinants and profitability indicators will be retrieved from the bank-focused part of Bureau van Dijk's database Osiris via WRDS (2023). While this ensures consistency and reliability, it excludes the data for 2022 as the last available standardized and consolidated balance sheets are from 2021 and not from 2022, yet. Therefore, a three-year period from 2019 to 2021 will be investigated with an annual frequency. The macroeconomic determinants are obtained from the Annual Macroeconomic Database of the European Commission (AMECO (2023)).

The sample for the analysis consists of significant EU banks directly under the supervision of the ECB as of the publicized list of March 2023 (ECB, 2023). Due to the common currency and the single supervisory mechanism, the differences in the regulatory framework are limited to a minimum emanating from country-specific characteristics. The panel approach emphasizes the heterogeneity in the cross-sectional dimension (Afonso & Alves, 2015).

Neither Osiris nor Datastream feature all banks under direct ECB-supervision. Especially the data of the European subsidiaries of major US banks is not available in unconsolidated form, but rather only in the balance sheets of the parent company. Unfeatured banks and those without

separate data for their EU subsidiaries were excluded, leaving a remaining sample of 40 banks (*n=40*).

An overview of the definitions and sources of the respective variables as well as a list of banks included in the analysis can be found in Appendices A.2 and A.3. The descriptive summary statistics of the sample is provided in Table 1; Table 2 presents the correlation between the variables.

Table 1: *Descriptive Statistics*

Dependent variables: bank profitability	Obs.	Mean	Std. Dev.	Min	Max
NIM	120	1.81	.772	.57	3.71
ROAA	120	.3	.772	-4.05	1.62
ROAE	120	5.178	10.301	-46.37	27.16
Independent variables					
Bank-specific determinants:					
ESG AUM ratio	120	3.612	7.134	0	41.327
Size	120	18.808	1.697	14.925	22.491
Efficiency	120	62.59	40.3	-347.44	108.02
Capitalization	120	6.986	2.369	3.71	14.44
Loan Loss Reserve	120	3.598	4.335	.11	21.88
Macroeconomic determinants:					
Inflation	120	1.128	1.206	-1.259	4.481
GDP growth	120	.513	6.274	-11.804	12.728

Table 2: *Correlation Matrix*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) NIM	1.000									
(2) ROAA	-0.108	1.000								
	(0.239)									
(3) ROAE	-0.193*	0.950*	1.000							
	(0.034)	(0.000)								
(4) ESG AUM ratio	-0.256*	0.038	0.079	1.000						
	(0.005)	(0.680)	(0.389)							
(5) Size	-0.477*	-0.054	-0.044	0.421*	1.000					
	(0.000)	(0.561)	(0.636)	(0.000)						
(6) Efficiency	-0.151	0.427*	0.291*	-0.036	0.077	1.000				
	(0.100)	(0.000)	(0.001)	(0.698)	(0.403)					
(7) Capitalization	0.711*	-0.064	-0.201*	-0.264*	-0.441*	-0.047	1.000			
	(0.000)	(0.489)	(0.028)	(0.004)	(0.000)	(0.610)				
(8) Loan Loss Reserve	0.524*	-0.247*	-0.288*	-0.203*	-0.266*	-0.061	0.543*	1.000		
	(0.000)	(0.006)	(0.001)	(0.026)	(0.003)	(0.508)	(0.000)			
(9) Inflation	-0.072	0.336*	0.362*	0.277*	0.113	0.068	-0.120	-0.369*	1.000	
	(0.436)	(0.000)	(0.000)	(0.002)	(0.218)	(0.462)	(0.193)	(0.000)		
(10) GDP growth	0.075	0.079	0.135	0.075	-0.080	-0.084	0.063	-0.084	0.636*	1.000
	(0.414)	(0.388)	(0.140)	(0.416)	(0.385)	(0.361)	(0.498)	(0.364)	(0.000)	

*p-values in parenthesis; * p<0.05*

3.2 Methodology

In terms of econometric procedure, the existing literature investigating bank profitability predominantly employs two different methodologies. Building on the work of Arellano and Bond (1991), Arellano and Bover (1995) respectively Blundell and Bond (1998), a System-Generalized Method of Moments (System GMM) technique is used to investigate the linear dynamic panel data model (see inter alia Athanasoglou et al., 2008; Dietrich & Wanzenried, 2011; García-Herrero et al., 2009). A relatively newer method is the Structural Equation Modeling (SEM). To investigate the relation between the ESG AUM ratio and bank profitability this thesis will conduct both approaches in Stata.

3.2.1 System Generalized Method of Moments

The GMM is a common econometric approach for panel data as the instruments allow for the mitigation of possible endogeneity issues and as the method can account for correlation among the variables (Athanasoglou et al., 2008). However, for samples with small timespans, the GMM estimation using the Arellano-Bond estimates tend to be inconsistent (Shehzad et al.,

2013). Succeeding GMM estimation techniques improving the Arellano-Bond estimation need large samples for its assumptions to be met (Garcia & Guerreiro, 2016).

The persistence of profits and the associated inclusion of the lagged profit variable suggest the use of a dynamic panel model. Since the timespan is relatively short, the use of Difference-GMM estimators would yield biased results (Kripfganz, 2020). Hence, using the System-GMM is indicated. The advancement by Kripfganz (2020) with the *xtdpdgmm* command in Stata for linear dynamic panel data models is able to correct for small time horizons and is thus well suited for this thesis.

To illustrate the following procedure, the undermentioned regression equation will be used for the empirical evaluation of the hypothesis:

$$\Pi_{it} = \beta_0 + \beta_1 esgassets_{it} + \beta_2 \text{size}_{it} + \beta_3 efficiency_{it} + \beta_4 capital_{it} + \beta_5 loanlossreserve_{it} + \beta_5 \Pi_{it-1} + \beta_6 inflation_{it} + \beta_7 gdp_{it} + \eta_{it} + \nu_{it} + \varepsilon_{it} \quad (1)$$

where Π denotes the profitability proxy, measured through ROAA, ROAE, and NIM, of entity *i* in year *t*; ν represents the time-invariant bank-specific error; η denotes the time-variant noise and ε is the error term; the controls are measured as described in the subchapter before with Π_{t-1} denoting the one-year lagged profitability proxy, which indicates the dynamic nature of the model.

Several econometric issues need to be checked to ensure unbiased and consistent estimation results. To start with, multicollinearity is tested using the variance inflation factor. The test does not reveal factors that are associated with multicollinearity. The results are listed in Appendix A.4.

Making use of the relaxed normality assumption, White's test, as a special form of the Breusch-Pagan test is conducted with the null hypothesis of constant variances in the residuals. The hypothesis is rejected for the model, regardless of the profitability specification, implying that the residuals are heteroskedastic and robust standard errors will be used. The tests can be found in Appendix A.5.

The standard errors are automatically corrected as proposed by Windmeijer (2005) for finite-samples in two-step GMM estimations, accounting for potential heteroskedasticity, as identified by White's test before, and autocorrelation in the residuals. Therefore, the residuals are expected to be unbiased even though the time horizon of the sample is rather short.

Missing values in the ESG AUM are substituted with zeros by default in the command. Banks that did not file the ESG AUM in their statements are therefore assumed to not explicitly

consider ESG-factors in their investment decision. This assumption is reasonable as sustainability-driven banks will most certainly put more effort into filing sustainability related declarations; further, the ESG AUM variable being zero is no statistical outlier, but rather a frequent observation.

The GMM estimation process is based on the suggested procedure by Kripfganz (2020). Following Dietrich and Wanzenried (2011), all variables that are not found to be exogenous are used as instruments, both in levels and in differences, building on the proposition by Arellanon and Bover (1995). In order to mitigate the overfitting problem of too many instruments, the instruments are collapsed (Kripfganz, 2020). The postestimation Sargan-Hansen test is implemented to assess the validity of the choice of instruments. Autocorrelation is tested for using the Arellano-Bond test. The results of both tests are reported in the next chapter and included in Table 3, below the estimation results.

The coefficients obtained in the GMM estimation only allow for short-term interpretations. In order to approximate the long-term effect of the dependent variable of interest, the following post-estimation formula, using Statas *nlcom* command, is applied:

$$\beta_{LT} = \beta_{ST} * esgassets/(1 - \beta_{ST} * \Pi_{t-1}) \qquad (2)$$

where β_{LT} is the long-term estimate of the short-term coefficient β_{ST}; Π_{t-1} denotes the one-year lagged profitability measure.

Finally, the time effects are controlled for in the estimation and the sample is grouped with respect to the entity, resulting in 40 groups and thus more than the number of instruments, which fulfills the requirement for the GMM estimation.

3.2.2 Structural Equation Modeling

The second commonly used method is the Structural Equation Modeling (SEM) (see for instance Drempetic et al., 2020; Handajani et al., 2021; Taliento et al., 2019). Following Drempetic et al. (2020), this thesis will employ an estimation with the Structural Equation Modeling Maximum Likelihood technique. This is not only an approach to verify the results obtained from the previously performed GMM estimation, but also a possibility to test multiple concurrent causalities (Drempetic et al., 2020; Thøgersen & Ölander, 2002). The variables used for the SEM are identical to the ones used in the GMM estimation. Using the SEM Builder in Stata, the Maximum Likelihood is applied, accounting for missing values as the ESG AUM ratio is not available for every entity and year. To accommodate firm effects, robust standard errors are used, clustered by bank, ensuring their unbiasedness (Petersen, 2009).

The model is illustrated in Figure 1 where the double-arrow connections (on the left side) between the respective determinants depict the covariances, the straight arrows from the determinants toward the profitability measure represent the causal paths and ε denotes the disturbance.

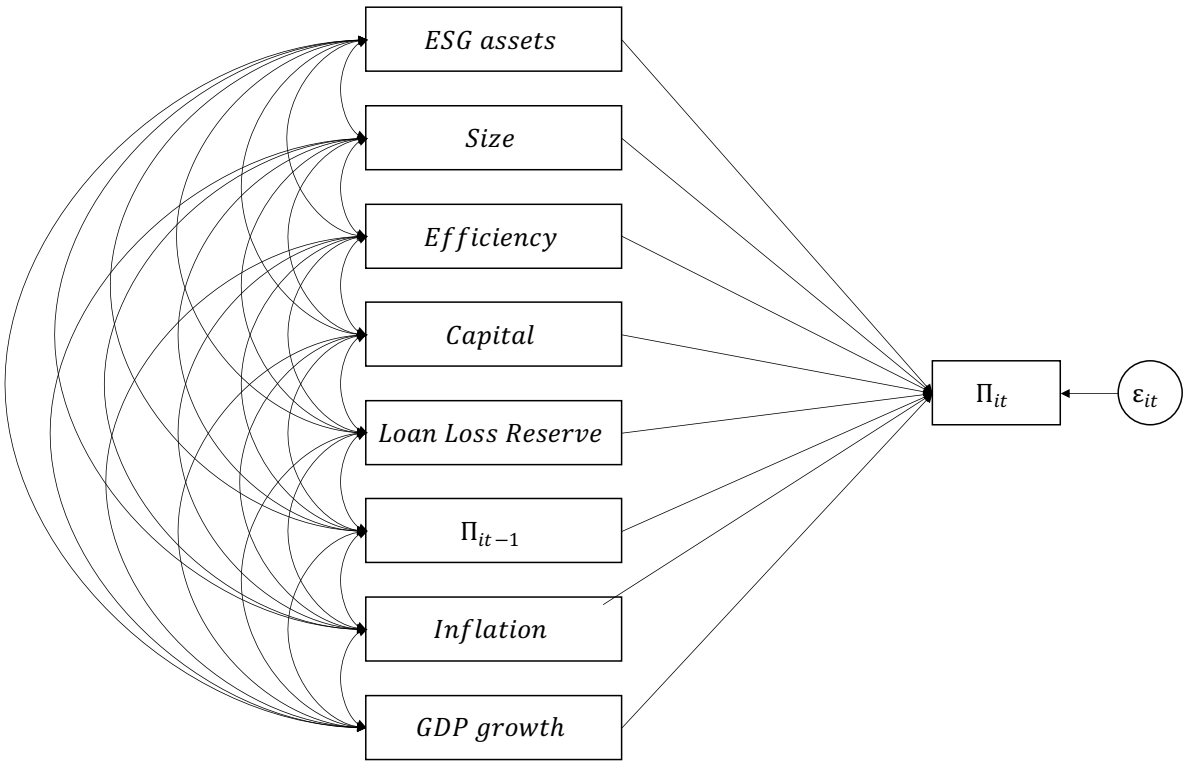

Figure 1: *Structural Equation Model*

4 Results and Analysis

After running the preliminary diagnostics tests, the estimations of the aforementioned models were conducted. The results of the estimations differ with respect to the dependent variable. In short, in neither of the two estimation techniques is the ESG AUM ratio a significant determinant of the banks' ROAA nor of the ROAE at the 5 percent level. With NIM as a dependent variable, on the other hand, a significant relationship has been detected for either of the two estimation techniques. The results of the GMM estimation are presented below, followed by the ones using the SEM.

4.1 Results of the GMM Estimation

Having conducted the two-step System GMM estimation, the results allow for a short-term interpretation, however, the long-term coefficients are calculated as described in the previous chapter. All models control for time-varying effects by including year dummies.

In model (1), NIM is used as the dependent variable. The lagged profitability measure has a positive significant effect on NIM. Notably, the coefficient of the lagged NIM is the largest in the model as a 1 percent change in the previous year's NIM is associated with a 0.859 percent increase in NIM in the short-run, ceteris paribus, which is close to a unit elastic relationship.

The ESG AUM ratio is negatively associated with NIM, although the economic magnitude is relatively small. In the short run, NIM decreases by 0.0058 percent for a 1 percent increase in the ESG AUM ratio. However, in the long run, the effect becomes insignificant.

Further, the relation of inflation and NIM is positive at 10 percent significance. The Sargan-Hansen test and the Arellano-Bond test for autocorrelation have both not been rejected. Hence, it is reasonable to conclude that the instruments are valid and no autocorrelation is present.

Concerning the model (2) with ROAA as the dependent variable, merely the cost-to-income ratio and the inflation rate affect the profitability measure significantly. Both estimators are positive, with the former amounting to 0.0084 percent and the latter to 0.255 percent with a significance level of 10 percent. The fit of the model is not as good as of model (1); however, the instruments are also valid and no autocorrelation was detected.

Finally, model (3) comprising the ROAE is depicted by a positive significant association of the lagged dependent variable as well as the cost-to-income ratio, and a negative capitalization ratio, the latter at 10 percent. While the instruments are valid, the model exhibits first-order autocorrelation. According to Arellano and Bond (1991), only from the second-order, the presence of autocorrelation causes the estimates to be inconsistent. The results should,

however, be viewed with caution, due to the short time span. Below, Table 3 shows the complete results of the two-step System GMM estimations.

Table 3: *GMM Estimation Results*

Independent Variables	(1) NIM	(2) ROAA	(3) ROAE
Lagged NIM	0.859***		
	(0.0980)		
Lagged ROAA		0.487	
		(0.292)	
Lagged ROAE			0.549**
			(0.248)
ESG AUM ratio	-0.00581**	0.000161	-0.00131
	(0.00255)	(0.0119)	(0.203)
Size	0.0421	-0.0871	-1.535
	(0.0612)	(0.190)	(2.826)
Cost-to-income	-5.33e-05	0.00840***	0.0757***
	(0.000159)	(0.00152)	(0.0214)
Capitalization	0.00876	-0.0909	-1.837*
	(0.0330)	(0.0900)	(1.090)
Loan Loss Reserve	0.0147	-0.00754	-0.0726
	(0.0107)	(0.0474)	(0.745)
Inflation	0.0619*	0.255*	4.406
	(0.0363)	(0.139)	(2.713)
GDP growth	-0.00246	-0.00970	0.0388
	(0.00772)	(0.0185)	(0.212)
Constant	-0.730	1.720	35.82
	(1.183)	(3.758)	(56.77)
Long-term: ESG AUM ratio	-0.041194	0.0003136	-0.0029096
	(0.0391051)	(0.0231098)	(0.451042)
Sargan-Hansen test	$\chi^2(24)=21.54$	$\chi^2(24)=28.15$	$\chi^2(24)=26.84$
	$p> \chi^2=0.61$	$p> \chi^2=0.25$	$p> \chi^2=0.31$
AR (1)	z=-0.44	z=-1.66	z=-2.64
	p>z=0.66	p>z=0.97	p>z=0.0084
Groups / Instruments	40/35	40/35	40/35
Year Dummies	Yes	Yes	Yes
Observations	120	120	120
Number of banks	40	40	40

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

AR (1) refers to the first-order autocorrelation according to Arellano-Bond.

4.2 Results of the Structural Equation Model

Having presented the GMM estimations, the results of the SEM indicate similar results. The Wald Chi-Squared Test is significant for each of the three profitability measures, but the chi-square value when using NIM is the highest, indicating the best fit among the three.[7]

Looking at the causal paths, the ESG AUM ratio is significant and negatively associated with NIM with a coefficient of -0.35, however the relationship with ROAA and ROAE is insignificant. The confidence interval of the NIM-model is negative at both boundaries, implying that in more than 95 percent of the samples drawn, the effect will remain negative.

Further, both size and the cost-to-income ratio have a negative effect on NIM (having coefficients of -0.27 and -0.55 respectively). The loan loss reserves are positively associated with NIM at a 10 percent significance level. Additionally, the lagged NIM and inflation affect NIM positively (with coefficients of 0.78 and 0.24 respectively).

Notably, the covariance between the ESG AUM ratio and size, capitalization, loan loss reserves, and inflation are significant, indicating a strong interconnection between the determinants for bank profitability.

In the SEM using ROAA as a profitability measure, the cost-to-income, previous year's ROAA, and inflation are positive and significant determinants of bank profitability.

When measuring profitability through ROAE, only the lagged profitability measure and inflation are direct effects that positively and significantly influence ROAE.

The complete overview of the results for the SEM using NIM can be found in Table 4, the tables showing the SEMs for ROAA and ROAE are to be found in Appendix A.6.

[7] The chi-square values for the Wald Chi-Squared Test with NIM, ROAA, and ROAE are 587.73, 461.67, and 322.90, respectively; always with eight degrees of freedom and p-values smaller than 0.0000.

Table 4: *Structural Equation Model - NIM*

Estimation method: Maximum Likelihood with missing values					Number of observations = 120	
Log pseudolikelihood = -2438.1904					(Std. err. adjusted for 40 clusters in Bank)	
Standardized **Structural**	Coefficient	Robust std. err.	z	P>z	[95% confidence interval]	
Direct Effects						
ESG AUM ratio → NIM	-0.348 ***	0.130	-2.680	0.007	-0.602	-0.094
Size → NIM	-0.272 **	0.111	-2.460	0.014	-0.489	-0.055
Cost-to-Income → NIM	-0.055 ***	0.025	-2.170	0.030	-0.104	-0.005
Capitalization → NIM	0.017	0.109	0.160	0.876	-0.197	0.231
Loan Loss Reserve → NIM	0.107 *	0.059	1.800	0.071	-0.009	0.223
Lagged NIM → NIM	0.779 ***	0.112	6.970	0.000	0.560	0.998
Inflation → NIM	0.243 ***	0.063	3.860	0.000	0.119	0.366
GDP growth → NIM	-0.092	0.057	-1.610	0.106	-0.205	0.020
Constant	2.935 **	1.261	2.330	0.020	0.464	5.406
ESG AUM ratio ↔ Size	0.421***	0.091	4.630	0.000	0.243	0.599
ESG AUM r. ↔ Cost-to-Income	-0.036	0.054	-0.660	0.511	-0.142	0.071
ESG AUM r. ↔ Capitalization	-0.264***	0.084	-3.150	0.002	-0.428	-0.099
ESG AUM r. ↔ Loan Loss Res.	-0.203***	0.037	-5.480	0.000	-0.275	-0.130
ESG AUM ratio ↔ Lagged NIM	0.219	0.162	1.350	0.177	-0.099	0.537
ESG AUM ratio ↔ Inflation	0.277***	0.061	4.570	0.000	0.158	0.396
ESG AUM ratio ↔ GDP growth	0.075	0.048	1.560	0.119	-0.019	0.169
Size ↔ Cost-to-Income	0.077	0.050	1.550	0.121	-0.020	0.174
Size ↔ Capitalization	-0.441***	0.120	-3.670	0.000	-0.676	-0.205
Size ↔ Loan Loss Reserve	-0.266***	0.083	-3.200	0.001	-0.428	-0.103
Size ↔ Lagged NIM	-0.069	0.174	-0.400	0.692	-0.409	0.271
Size ↔ Inflation	0.113	0.078	1.450	0.146	-0.039	0.266
Size ↔ GDP growth	-0.080**	0.040	-1.990	0.047	-0.159	-0.001
Cost-to-Income ↔ Capitalization	-0.047	0.071	-0.660	0.508	-0.186	0.092
Cost-to-Income ↔ Loan Loss R.	-0.061	0.045	-1.360	0.174	-0.149	0.027
Cost-to-Income ↔ Lagged NIM	-0.134**	0.058	-2.320	0.020	-0.247	-0.021
Cost-to-Income ↔ Inflation	0.068**	0.032	2.090	0.036	0.004	0.131
Cost-to-Income ↔ GDP growth	-0.084	0.079	-1.070	0.285	-0.239	0.070
Capitalization ↔ Loan Loss Res.	0.543***	0.102	5.340	0.000	0.344	0.742
Capitalization ↔ Lagged NIM	0.587***	0.111	5.270	0.000	0.369	0.805
Capitalization ↔ Inflation	-0.120	0.084	-1.430	0.154	-0.284	0.045
Capitalization ↔ GDP growth	0.063	0.066	0.950	0.343	-0.067	0.192
Loan Loss Res. ↔ Lagged NIM	0.441***	0.088	5.030	0.000	0.269	0.613
Loan Loss Res. ↔ Inflation	-0.369***	0.055	-6.700	0.000	-0.477	-0.261
Loan Loss Res. ↔ GDP growth	-0.084**	0.041	-2.040	0.041	-0.164	-0.003
Lagged NIM ↔ Inflation	-0.107	0.087	-1.240	0.216	-0.277	0.063
Lagged NIM ↔ GDP	0.026	0.057	0.470	0.641	-0.085	0.138
Lagged Inflation ↔ GDP	0.636***	0.040	15.840	0.000	0.558	0.715

**p < 0.1; **p < 0.05; ***p < 0.01;* "→" represent causal paths, "↔" symbolizes covariances

5 Discussion

5.1 General Discussion

Building on the results described in the previous chapter, the following section will connect the findings to the reviewed literature and provide possible explanations for the impact of the ESG AUM ratio on the banks profitability as well as providing an evaluation of the robustness of the models used for the analyses.

With respect to the descriptive statistics of the sample, among the banks under direct supervision of the ECB, none invests the majority of their assets in sustainable financial products and the average ESG AUM ratio is relatively low (3.6 percent), therefore financial startups that only invest in sustainable assets differ fundamentally from the significant banks in the sample of this thesis in terms of their investment strategy. However, a growing public interest and higher regulatory requirements have led to an increase of the sustainable investments in the last years and most certainly will in the near future.

Much of what has been found to be deterministic of bank profitability in the reviewed literature did not significantly impact the profitability proxies in the sample during 2019 to 2021, respectively not in the anticipated direction.

While the GMM estimation did not reveal a significant relation between profitability and size, in the SEM, a negative relation was found, although it is only significant for NIM. However, as the sample consists of the banks under direct supervision of the ECB, which is mainly due to their asset size, the differences within the sample may be marginalized. In fact, the SEM reveals a positive association between the ESG AUM ratio and size, in line with the literature finding that larger banks score better in ESG performance (Cornett et al., 2016; Drempetic et al., 2020).

Further, the literature regarding bank profitability finds the persistence of profits especially prominent for large banks (Shehzad et al., 2013). This holds true for the investigated sample, as every model specification, except for the GMM estimation with ROAA, showed a high deterministic influence of the previous year's profit on the bank's profitability.

Surprisingly, the cost-to-income ratio is significant and positive in the GMM estimation models with ROAA and ROAE. The expected outcome, as has been found by e.g. Goddard et al. (2013), was a negative relation, as lower cost for a given income result in higher profitability by definition, a positive relation is therefore reason to be cautious. Using the SEM estimation with NIM, the coefficient is negative and significant, as expected, with ROAA as the profitability measure on the other hand, the coefficient is positive.

Concerning the capitalization ratio, the equity only negatively affects ROAE at a 10 percent significance level, the coefficient remains insignificant in all other specifications. While the literature about this influence is ambiguous, earlier research on EU banks finds a negative relation (Goddard et al., 2013). The sample of large banks in this thoroughly regulated industry suggests little deviation, which is supported by the relatively small standard deviation for the capitalization ratio of 2.369.

Similarly, the loan loss reserves positively affect NIM at a 10 percent significance level. This is in contrast to the negative relation found in the literature (Athanasoglou et al., 2008; Staikouras & Wood, 2011). However, this difference could be explained by the economic impact of the COVID-19 pandemic starting in 2020, as more cautious banks may have both set aside more reserves and weathered the crisis better. Since the impact of the pandemic was not as prominent for the banking sector as the financial crisis of 2008, the effects found by Dietrich and Wanzenried (2011) during the latter period are not easily transferable. The absence of a significant influence of the loan loss reserves on ROAA and ROAE, on the other hand, could indicate that the magnitude may have not been substantial enough, as described by the authors.

Among the macroeconomic determinants, only the inflation positively influenced bank profitability. As the banks in the sample are predominantly operating in their domestic markets, respectively are all domiciled in the EU, this finding is in accordance with the reviewed literature, that discovered the positive relation for domestic banks, while foreign banks suffered from the inflation, resulting in a negative association (Abreu & Mendes, 2002; Athanasoglou et al., 2008).

While the GDP growth did not significantly influence the profitability, it is important to emphasize the COVID-19 pandemic starting 2020, which resulted in a short-term halt of economic activities with an economic recovery in the subsequent years (Statista Research Department, 2022). Earlier research found an asymmetric relation between bank profitability and economic growth, with only economic upswings resulting in a significant association (Athanasoglou et al., 2008; Pasiouras & Kosmidou, 2007). The results of this thesis are in line with the asymmetric relation.

Finally, the independent variable of interest, the ESG AUM ratio, is found to negatively affect NIM, however, neither ROAA nor ROAE. The results regarding sustainable finance imply a positive relation, as both the pledge to sustainable finance principles (Torre Olmo et al., 2021) and having a good ESG performance benefit the bank's profitability (Brogi & Lagasio, 2019; Cornett et al., 2016). In this respect, the result is unexpected; several possible explanations can put this finding into perspective.

First, the results obtained are short-term relations, extrapolating the coefficient to a long run estimate diminishes the significance, yet sustainable business models are commonly long-term oriented; examining a longer time span might thus be necessary.

Second, green bonds can be subsidized or guaranteed by the government thus decreasing the nominal interest earned by the bank which results in a lower NIM compared to non-subsidized or non-guaranteed investments. The risk-adjusted return would in case of a guarantee be on a similar level, because of the lowered risk.

Third, the profit earned has to be put into relation to its underlying risk. In a study about carbon-neutral lending, Umar et al. (2021) found that the carbon emission is positively associated with the default risk due to the less volatile business models in sustainability oriented companies. An increased sustainability focus will also enlarge the resilience of the economy (European Commission, 2023b) and could thus benefit banks due to decreased risks.

The economic impact of the negative effect can be regarded of minor concern for the banks when taking the coefficient of the GMM estimation as a basis. Given a 1 percent increase in the ratio of ESG assets to total assets, NIM is expected to decrease by 0.00581 percent, all else equal. In this sample, the average total assets are EUR 538 billion, 3.612 percent of assets are invested in ESG-assets, and the mean NIM is 1.8495 percent. Consequently, a 1 percent increase in the ESG AUM ratio would theoretically result in EUR 11,290 of foregone margin, a comparably small amount for the largest banks in the EU.

A latent variable, that was not incorporated in the models used in this thesis, was the bank's reputation. With the growing environmental concerns and increased public interest in corporate responsibility, a bank's efforts and investments in ESG-related activities can or will play a role in its standing, respectively a lack thereof should be considered as a reputational risk. While the effect is not instantly visible in the short run, it can influence the operations and customer retention in the future and should thus not be disregarded by the bank's management.

The timeframe of this thesis was relatively short and did not include 2022, due to missing data from the Osiris database. Regarding a more standardized ESG asset dataset, the first publication of the PAI Statement was due on 30 June 2023, however, this only applies to the disclosure of 2022 on a comply-or-explain basis (ESMA, 2022). The statements disclosing the year 2023 of SFDR will be done on a comply basis and can thus be expected to yield insightful data.

Concerning the covariances obtained in the SEM estimations, the positive relation between the ESG AUM ratio and size confirms the findings of Cornett et al. (2016) and Drempetic et al. (2020) who observed better ESG performance of larger corporations and banks. As the sample

consists of most of the largest banks in the EU, it is reasonable to assume better ESG scores in the sample compared to the remaining smaller and mid-sized banks. In the following, a minor robustness check for the sample using the ESG scores of the bank is presented.

5.2 Robustness Check Using the ESG Score

As mentioned in the literature review, most studies use the ESG score of a bank to approximate its sustainability tendencies. One advantage of using these scores is the availability of the data. While not all banks that are under direct supervision of the ECB report the ESG AUM, the vast majority of them is rated with respect to ESG aspects.

Substituting the ESG AUM ratio with the ESG score yields insignificant results for all profitability measures using either GMM estimation or SEM. This could imply that the ESG scores and the actual sustainable operating activities, measured through the investment in ESG assets, diverge. While the ESG score encompasses a larger set of factors than solely the ESG AUM ratio, a potential dissonant relation stresses the need for standardized reporting once again, to increase comparability and prevent greenwashing.

Concerning the general robustness of the empirical model, it is important to mention that the results of the GMM estimation are relatively fragile with respect to shifts in the specifications. Although the results are reasonably assumed to be valid, the findings should be regarded as a starting point for further research in this area of sustainable banking, rather than imposing strict implications for policies.

6 Conclusion

Based on a sample of 40 banks domiciled in the EU that are under direct supervision of the ECB, a GMM estimation and a Structural Equation Modelling were conducted. The estimations controlled for commonly used bank-specific and macroeconomic factors determining the profitability of banks and were focused on the years 2019 through 2021, aiming to understand the influence of the sustainability emphasis of a bank's operating activities on its profitability.

Sustainable finance is becoming more important as the EU incorporates financial market participants centrally in the SFAP and the SFDR as intermediaries that provide and allocate the financial means to reach the goal of carbon neutrality in the EU.

With regard to the research question: *How does the ESG Assets under Management ratio of systemically important banks in the EU influence their profitability?,* a negative impact of the ratio of the ESG AUM ratio to total assets on NIM was found using either of the two estimation techniques, however, no significant impact of the ESG AUM ratio on ROAA nor on ROAE was detected. The relation found appears to be only valid in the short-run and becomes insignificant once it is extrapolated to the longer term.

6.1 Implications of the Findings

Given the results of the analysis, the negative relation suggests an alarming initial situation for the transition to a sustainable financial system. However, no impetuous implications should be derived. While NIM was affected negatively, no effects on ROAA and ROAE were found. The explicit political will to increase sustainability in the financial sector means that the transition does not necessarily have to be intrinsic, as long as clearly defined regulations, that apply to all financial market participants in the EU, ensure the implementation of sustainability. The EU taxonomy is an important step for a common definition and thus a prerequisite for successful regulations. The newly implemented SFDR benefits from this and the PAI statements will allow for a better comparison of sustainable investment ratios among banks.

Regarding the emergence of FinTechs, the threat of sustainability driven entrants seems low for major traditional banks, given the results. However, this topic is highly value-laden and investment decisions are made considering more factors than merely the return. An explicit sustainability investment mandate favors the banks that can deliver on that promise, and thus could be a potential benefit for those sustainability driven startup banks. Additionally, as mentioned before, given the growing sustainability awareness, not having enough ESG endeavors can be regarded as a reputational risk and thus potential future drawbacks.

6.2 Limitations and Further Research

As touched upon in chapter 3.1, this thesis uses data of the ESG AUM that are not yet reported using the standardized mutual definitions from the SFDR. Therefore, a repetition of this study considering sustainable asset holdings under the SFDR article 8 and 9 would yield a more fruitful comparison. In addition, and more importantly, a comparison of the analysis with SFDR-conform reported data and this thesis ex post would reveal potential greenwashing or overestimations on the part of the banks.

Furthermore, due to the relatively young topic, the data available was limited to starting in 2019. However, the long-term results could alter or attenuate the findings. Thus, future research should investigate the long-term effects.

Finally, as mentioned in the discussion, including the underlying risks of the investments could shed light on the risk-adjusted return of the ESG related assets in comparison to traditional investments.

6.3 Final Remarks

Concludingly, a short-term negative effect of the ESG AUM ratio on NIM of major EU banks has been found, that diminishes in the long run. Further research is necessary to draw more robust conclusions and derive implications for policymakers. In this respect, the common definitions in the EU taxonomy and the standardized reporting of the SFDR will help the transition toward a more sustainability-oriented banking system. Making use of the soon to be published detailed PAI statements within the level-two SFDR framework will yield more comparable results.

Nonetheless, this analysis can be seen as a starting point for the inclusion of the sustainable assets held by a bank and their effects on its profitability, especially due to the key role of sustainable banking in the strategy of the EU and the reputational effects this value-laden topic is expected to have in the future.

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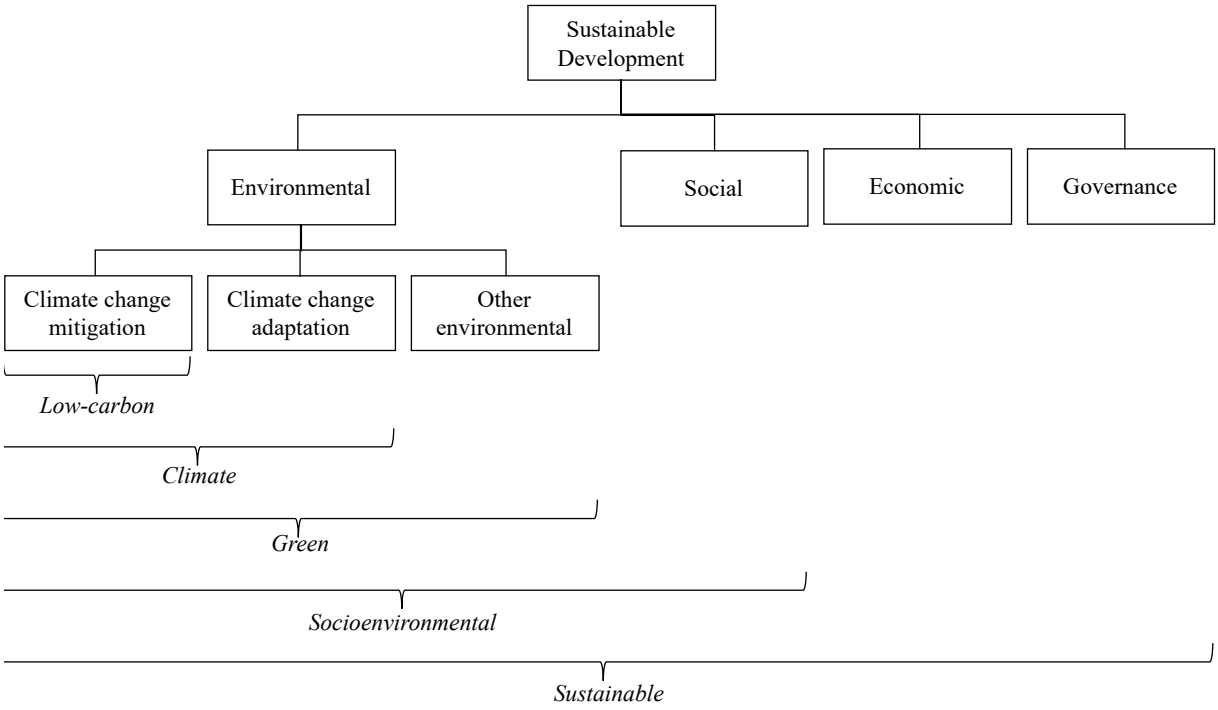
A Appendix

A.1 Visualization of Sustainability Definitions

Figure 2: *Simplified Schema of Sustainability Terms (Adapted from: Forstater and Zhang 2016)*



A.2 Definition and Source of Variables

Name	**Code**	**Definition**	**Source**
ESG Assets Under Management	ENPIDP080	Total amount of Assets Under Management (AUM) according to an ESG criteria or ESG investment strategy as reported by the company.	Datastream
ESG Score	TRESGS	Refinitiv's ESG Score is an overall company score based on the self-reported information in the environmental, social and corporate governance pillars.	Datastream
Net Interest Margin	DATA995190	Net Interest Margin (in percent) *(Total Interest Income - Total Interest Expense) / Average Total Earning Assets * 100*	Osiris
Return on Average Assets	DATA995250	Return On Average Assets (ROAA) (in percent) *Net Income / Average Total Assets * 100*	Osiris
Return on Average Equity	DATA995260	Return On Average Equity (ROAE) (in percent) *Net Income / Average Total Equity * 100*	Osiris
Total Assets	DATA952600	The sum of total current assets, long-term receivables, investments in unconsolidated companies, other investments, net property, plant and equipment and other assets.	Osiris
Efficiency	DATA995300	Cost-To-Income Ratio (in percent) *Overheads / (Net Interest Revenue + Other Operating Income) * 100*	Osiris
Capitalization	DATA995100	*Equity / Total Assets* * 100	Osiris
Loan Loss Reserve	DATA995000	*Loan Loss Reserves / Gross Loans* (in percent)	Osiris
Inflation	ZCPIH	Growth rate of the Harmonized Index of Consumer Prices (HICP), base year is 2015	AMECO / EUROSTAT
GDP	RVGDP	Growth rate of the Gross Domestic Product per capita in constant prices	AMECO / EUROSTAT

Definitions as reported by the respective source.

A.3 List of Banks

Bank	Country	Datastream	Osiris Code
Aareal Bank AG	Germany	D:ARL	DEFEB13222IC
ABN AMRO Bank N.V.	Netherlands	H:ABN	NL34334259IC
Addiko Bank AG	Austria	O:ADKO	ATFEB52823IC
AIB Group plc	Ireland	IE:A5G	IE594283IC
ALPHA SERVICES AND HOLDINGS S.A.	Greece	G:PIST	GR000223701000IC
AS LHV Group	Estonia	EO:LHV	EE11098261IC
Banca Mediolanum S.p.A.	Italy	I:BMED	IT02124090164IC
BANCA MONTE DEI PASCHI DI SIENA S.p.A.	Italy	I:BMPS	IT00884060526IC
Banca Popolare di Sondrio, Società per Azioni (S.p.A.)	Italy	I:BPSO	IT00053810149IC
Banco Bilbao Vizcaya Argentaria, S.A.	Spain	E:BBVA	ESA48265169IC
Banco de Sabadell, S.A.	Spain	E:BSAB	ESA08000143IC
Banco Santander, S.A.	Spain	E:SAN	ESA39000013IC
Bank of Cyprus Holdings Public Limited Company	Ireland	CP:BNC	IE585903IC
Bank of Ireland Group plc	Ireland	IE:BIRG	IE593672IC
Bank of Valletta plc	Malta	MT:BOV	MTC2833IC
Bankinter, S.A.	Spain	E:BKT	ESA28157360IC
BAWAG Group AG	Austria	O:BWGP	ATFEB96069IC
BNP Paribas S.A.	France	F:BNP	FR662042449IC
BPER Banca S.p.A.	Italy	I:BPE	IT01153230360IC
CaixaBank, S.A.	Spain	E:CABK	ESA08663619IC
Commerzbank AG	Germany	D:CBK	DEFEB13190IC
Crédit Agricole S.A.	France	F:CRDA	FR784608416IC
Credito Emiliano Holding S.p.A.	Italy	I:CE	IT01806740153IC
Deutsche Bank AG	Germany	D:DBK	DEFEB13216IC
Deutsche Pfandbriefbank AG	Germany	D:PBB	DEFEB13105IC
Erste Group Bank AG	Austria	O:ERS	ATFEB46146IC
Eurobank Ergasias Services and Holdings S.A.	Greece	G:EFG	GR000223001000IC
FinecoBank S.p.A.	Italy	I:FCBK	IT01392970404IC
Hellenic Bank Public Company Limited	Cyprus	CP:HEL	CYC6771IC
ING Groep N.V.	Netherlands	H:INGA	NL33231073IC
Intesa Sanpaolo S.p.A.	Italy	I:ISP	IT00799960158IC
KBC Group NV	Belgium	B:KB	BE0403227515IC
National Bank of Greece S.A.	Greece	G:ETE	GR000237901000IC
Nordea Bank Abp	Finland	W:NDAS	FI28583949IC
Nova Ljubljanska banka d.d., Ljubljana	Slovenia	SV:NVB	SI5860571IC
Piraeus Financial Holdings S.A.	Greece	G:PEIR	GR000225501000IC
Raiffeisen Bank International AG	Austria	O:RAI	ATFEB40494IC
Société Générale S.A.	France	F:SGE	FR552120222IC
Unicaja Banco, S.A.	Spain	E:UNI	ESA93139053IC
UniCredit S.p.A.	Italy	I:UCG	IT00348170101IC

A.4 Variance Inflation Factors for Multicollinearity

Table 5: *Variance Inflation Factor including NIM*

	VIF	1/VIF
Inflation	2.227	.449
Capitalization	2.222	.45
Lagged NIM	2.207	.453
GDP growth	1.861	.537
Loan Loss Reserve	1.741	.574
Size	1.53	.653
ESG AUM ratio	1.328	.753
Efficiency	1.085	.922
Mean VIF	1.775	.

Table 6: *Variance Inflation Factor including ROAA*

	VIF	1/VIF
Inflation	2.24	.447
GDP growth	2.043	.489
Loan Loss Reserve	1.73	.578
Capitalization	1.708	.586
Size	1.529	.654
ESG AUM ratio	1.33	.752
Lagged ROAA	1.228	.814
Efficiency	1.053	.949
Mean VIF	1.608	.

Table 7: *Variance Inflation Factor including ROAE*

	VIF	1/VIF
Inflation	2.23	.448
GDP growth	1.99	.502
Capitalization	1.689	.592
Loan Loss Reserve	1.685	.593
Size	1.549	.646
ESG AUM ratio	1.33	.752
Lagged ROAE	1.18	.848
Efficiency	1.055	.948
Mean VIF	1.589	.

A.5 Results of White's Test for Heteroskedasticity

Table 8: *White's Test - NIM*

White's test: **NIM**
H0: Homoskedasticity, Ha: Unrestricted heteroskedasticity
chi2(44) = 94.88 Prob > chi2 = 0.0000

Cameron & Trivedi's decomposition of IM-test

chi2	df	p
94.880	44	0.000
11.830	8	0.159
3.640	1	0.056
110.350	53	0.000

Table 9: *White's Test - ROAA*

White's test: **ROAA**
H0: Homoskedasticity, Ha: Unrestricted heteroskedasticity
chi2(44) = 72.15 Prob > chi2 = 0.0047

Cameron & Trivedi's decomposition of IM-test

chi2	df	p
72.150	44	0.005
7.550	8	0.479
1.250	1	0.263
80.950	53	0.008

Table 10: *White's Test - ROAE*

White's test: **ROAE**
H0: Homoskedasticity, Ha: Unrestricted heteroskedasticity
chi2(44) = 62.50 Prob > chi2 = 0.0346

Cameron & Trivedi's decomposition of IM-test

chi2	df	p
62.500	44	0.035
6.950	8	0.542
1.320	1	0.251
70.770	53	0.052

A.6 Results of the Structural Equation Modeling

Table 11: *Structural Equation Model - ROAA*

Estimation method: Maximum Likelihood with missing values				Number of observations = 120		
Log pseudolikelihood = -2547.4325				(Std. err. adjusted for 40 clusters in Bank)		
Standardized **Structural**	Coefficient	Robust std. err.	z	P>z	[95% confidence interval]	
Direct Effects						
ESG AUM ratio → ROAA	-0.011	0.047	-0.230	0.815	-0.102	0.080
Size → ROAA	-0.050	0.062	-0.810	0.417	-0.172	0.071
Cost-to-Income → ROAA	0.430**	0.218	1.980	0.048	0.003	0.857
Capitalization → ROAA	-0.062	0.105	-0.600	0.552	-0.268	0.143
Loan Loss Reserve → ROAA	-0.050	0.106	-0.470	0.636	-0.257	0.157
Lagged ROAA → ROAA	0.467***	0.102	4.560	0.000	0.266	0.667
Inflation → ROAA	0.310***	0.106	2.920	0.003	0.102	0.517
GDP growth → ROAA	0.032	0.108	0.300	0.768	-0.180	0.244
Constant	-0.088	0.926	-0.090	0.925	-1.903	1.728
ESG AUM ratio ↔ Size	0.421***	0.091	4.630	0.000	0.243	0.599
ESG AUM r. ↔ Cost-to-Income	-0.036	0.054	-0.660	0.511	-0.142	0.071
ESG AUM r. ↔ Capitalization	-0.264***	0.084	-3.150	0.002	-0.428	-0.099
ESG AUM r. ↔ Loan Loss Res.	-0.203***	0.037	-5.480	0.000	-0.275	-0.130
ESG AUM r. ↔ Lagged ROAA	-0.063	0.097	-0.650	0.517	-0.252	0.127
ESG AUM ratio ↔ Inflation	0.277***	0.061	4.570	0.000	0.158	0.396
ESG AUM ratio ↔ GDP growth	0.075	0.048	1.560	0.119	-0.019	0.169
Size ↔ Cost-to-Income	0.077	0.050	1.550	0.121	-0.020	0.174
Size ↔ Capitalization	-0.441***	0.120	-3.670	0.000	-0.676	-0.205
Size ↔ Loan Loss Reserve	-0.266***	0.083	-3.200	0.001	-0.428	-0.103
Size ↔ Lagged ROAA	-0.225*	0.115	-1.960	0.050	-0.450	-0.000
Size ↔ Inflation	0.113	0.078	1.450	0.146	-0.039	0.266
Size ↔ GDP growth	-0.080**	0.040	-1.990	0.047	-0.159	-0.001
Cost-to-Income ↔ Capitalization	-0.047	0.071	-0.660	0.508	-0.186	0.092
Cost-to-Income ↔ Loan Loss R.	-0.061	0.045	-1.360	0.174	-0.149	0.027
Cost-to-Income ↔ Lag. ROAA	-0.053	0.077	-0.690	0.492	-0.204	0.098
Cost-to-Income ↔ Inflation	0.068**	0.032	2.090	0.036	0.004	0.131
Cost-to-Income ↔ GDP growth	-0.084	0.079	-1.070	0.285	-0.239	0.070
Capitalization ↔ Loan Loss Res.	0.543***	0.102	5.340	0.000	0.344	0.742
Capitalization ↔ Lagged ROAA	0.120	0.126	0.960	0.339	-0.126	0.366
Capitalization ↔ Inflation	-0.120	0.084	-1.430	0.154	-0.284	0.045
Capitalization ↔ GDP growth	0.063	0.066	0.950	0.343	-0.067	0.192
Loan Loss Res. ↔ Lag. ROAA	-0.077	0.145	-0.530	0.597	-0.361	0.208
Loan Loss Res. ↔ Inflation	-0.369***	0.055	-6.700	0.000	-0.477	-0.261
Loan Loss Res. ↔ GDP growth	-0.084**	0.041	-2.040	0.041	-0.164	-0.003
Lagged ROAA ↔ Inflation	-0.086	0.073	-1.180	0.236	-0.230	0.057
Lagged ROAA ↔ GDP	-0.250***	0.072	-3.480	0.001	-0.391	-0.109
Lagged Inflation ↔ GDP	0.636***	0.040	15.840	0.000	0.558	0.715

**p < 0.1; **p < 0.05; ***p < 0.01;* "→" represent causal paths, "↔" symbolizes covariances

Table 12: *Structural Equation Model - ROAE*

Estimation method: Maximum Likelihood with missing values				Number of observations = 120		
Log pseudolikelihood = -3181.568				(Std. err. adjusted for 40 clusters in Bank)		
Standardized **Structural**	Coefficient	Robust std. err.	z	P>z	[95% confidence interval]	
Direct Effects						
ESG AUM ratio → ROAE	0.004	0.048	0.070	0.941	-0.091	0.098
Size → ROAE	-0.074	0.061	-1.230	0.218	-0.193	0.044
Cost-to-Income → ROAE	0.308	0.193	1.600	0.111	-0.070	0.686
Capitalization → ROAE	-0.115	0.095	-1.210	0.228	-0.302	0.072
Loan Loss Reserve → ROAE	-0.048	0.110	-0.430	0.664	-0.262	0.167
Lagged ROAE → ROAE	0.508***	0.084	6.080	0.000	0.344	0.672
Inflation → ROAE	0.316***	0.106	2.980	0.003	0.108	0.524
GDP growth → ROAE	0.080	0.121	0.660	0.506	-0.157	0.317
Constant	0.584	0.990	0.590	0.555	-1.355	2.524
ESG AUM ratio ↔ Size	0.421***	0.091	4.630	0.000	0.243	0.599
ESG AUM r. ↔ Cost-to-Income	-0.036	0.054	-0.660	0.511	-0.142	0.071
ESG AUM r. ↔ Capitalization	-0.264***	0.084	-3.150	0.002	-0.428	-0.099
ESG AUM r. ↔ Loan Loss Res.	-0.203***	0.037	-5.480	0.000	-0.275	-0.130
ESG AUM r. ↔ Lagged ROAE	-0.030	0.104	-0.290	0.772	-0.234	0.174
ESG AUM ratio ↔ Inflation	0.277***	0.061	4.570	0.000	0.158	0.396
ESG AUM ratio ↔ GDP growth	0.075	0.048	1.560	0.119	-0.019	0.169
Size ↔ Cost-to-Income	0.077	0.050	1.550	0.121	-0.020	0.174
Size ↔ Capitalization	-0.441***	0.120	-3.670	0.000	-0.676	-0.205
Size ↔ Loan Loss Reserve	-0.266***	0.083	-3.200	0.001	-0.428	-0.103
Size ↔ Lagged ROAE	-0.171	0.109	-1.580	0.114	-0.384	0.041
Size ↔ Inflation	0.113	0.078	1.450	0.146	-0.039	0.266
Size ↔ GDP growth	-0.080**	0.040	-1.990	0.047	-0.159	-0.001
Cost-to-Income ↔ Capitalization	-0.047	0.071	-0.660	0.508	-0.186	0.092
Cost-to-Income ↔ Loan Loss R.	-0.061	0.045	-1.360	0.174	-0.149	0.027
Cost-to-Income ↔ Lag. ROAE	-0.067	0.094	-0.710	0.476	-0.252	0.118
Cost-to-Income ↔ Inflation	0.068**	0.032	2.090	0.036	0.004	0.131
Cost-to-Income ↔ GDP growth	-0.084	0.079	-1.070	0.285	-0.239	0.070
Capitalization ↔ Loan Loss Res.	0.543***	0.102	5.340	0.000	0.344	0.742
Capitalization ↔ Lagged ROAE	-0.087	0.109	-0.800	0.422	-0.300	0.126
Capitalization ↔ Inflation	-0.120	0.084	-1.430	0.154	-0.284	0.045
Capitalization ↔ GDP growth	0.063	0.066	0.950	0.343	-0.067	0.192
Loan Loss Res. ↔ Lag. ROAE	-0.108	0.173	-0.620	0.532	-0.448	0.231
Loan Loss Res. ↔ Inflation	-0.369***	0.055	-6.700	0.000	-0.477	-0.261
Loan Loss Res. ↔ GDP growth	-0.084**	0.041	-2.040	0.041	-0.164	-0.003
Lagged ROAE ↔ Inflation	-0.097	0.077	-1.260	0.206	-0.248	0.054
Lagged ROAE ↔ GDP	-0.242***	0.064	-3.780	0.000	-0.368	-0.117
Lagged Inflation ↔ GDP	0.636***	0.040	15.840	0.000	0.558	0.715

**p < 0.1; **p < 0.05; ***p < 0.01;* "→" represent causal paths, "↔" symbolizes covariances