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The impact of Single Supervisory Mechanism on the profitability of euro area banks that adopt ESG practices

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Abstract

The 2008 financial crisis and the subsequent eurozone sovereign debt crisis highlighted the need for more centralization of banking supervision at the European level. Therefore, in 2014, it was implemented the Single Supervisory Mechanism (SSM), by which the European Central Bank is responsible to supervise, together with the national supervisory authorities, the most significant banks in the euro area. In addition to changes in the European regulatory and supervisory framework, the 2008 financial crisis also boosted the adoption of environmental, social and governance (ESG) practices by banks, as a way of recovering their reputation among the community and accomplish with the United Nations Sustainable Development Goals. The purposes of the present dissertation are: (1) to study the impact of the adoption of ESG practices on profitability; (2) the impact of the implementation of SSM on profitability and (3) the joint impact of the adoption of ESG practices and the implementation of SSM on profitability. In our analysis, we consider the return on average assets as proxy of profitability, use a difference-in-differences approach and a balanced data panel of 128 European banks under the 2011-2019 period. The results suggest: (1) a positive impact of the adoption of ESG practices on profitability; (2) a negative impact of the implementation of SSM on profitability and (3) a neutral impact of the implementation of SSM on ESG-profitability relationship. The positive impact of the adoption of ESG practices on profitability is higher for banks operating in countries where the size of the banking sector is smaller, market concentration is greater and the institutional environment is better. Differences in the market context and in the institutional environment in which banks operate do not influence the way the implementation of SSM impacts profitability and ESG-profitability relationship.

Keywords: ESG practices; Profitability; European Banking Union; Single Supervisory Mechanism.

JEL classification: C23, C51, G21, G28

Resumo

A crise financeira de 2008 e a subsequente crise da dívida soberana da zona euro evidenciaram a necessidade de uma maior centralização da supervisão bancária a nível Europeu. Por conseguinte, em 2014, foi implementado o Mecanismo Único de Supervisão (MUS), segundo o qual o Banco Central Europeu é responsável pela supervisão, em conjunto com as autoridades nacionais competentes, dos bancos mais significativos da área do euro. Para além das mudanças no enquadramento regulatório e de supervisão Europeu, a crise financeira de 2008 também impulsionou a adoção de práticas ESG (*environmental, social and governance*) por parte dos bancos, como forma de recuperarem a sua reputação entre a comunidade e cumprirem os Objetivos de Desenvolvimento Sustentável das Nações Unidas. Os propósitos da presente dissertação são: (1) estudar o impacto da adoção de práticas ESG na rentabilidade; (2) estudar o impacto da implementação do MUS na rentabilidade e (3) o impacto conjunto da adoção de práticas ESG e da implementação do MUS na rentabilidade. Na nossa análise, consideramos a rentabilidade sobre os ativos médios como *proxy* de rentabilidade, utilizamos uma abordagem *diference-in-differences* e um painel equilibrado de dados de 128 bancos Europeus no período 2011-2019. Os resultados sugerem: (1) um impacto positivo da adoção de práticas ESG na rentabilidade; (2) um impacto negativo da implementação do MUS na rentabilidade e (3) um impacto neutro da implementação do SSM na relação ESG-rentabilidade. O impacto positivo da adoção de práticas ESG na rentabilidade é maior para os bancos que operam em países onde a dimensão do setor bancário é menor, a concentração de mercado é maior e o ambiente institucional é melhor. Diferenças no contexto de mercado e no ambiente institucional em que os bancos operam não influenciam a forma como a implementação do MUS impacta a rentabilidade e a relação ESG-rentabilidade.

Palavras-chave: Práticas ESG; Rentabilidade; União Bancária Europeia; Mecanismo Único de Supervisão

Classificação JEL: C23, C51, G21, G28

Content Index

Index of tables

Index of figures

Acronyms List

CA - Comprehensive Assessment

CSP - Corporate Social Performance

CSR - Corporate Social Responsibility

DID - Difference-in-differences

DJSI - Dow Jones Sustainability Index

EBA - European Banking Authority

EBU - European Banking Union

ECB - European Central Bank

EP - Equator Principles

ESG - Environmental, Social and Governance

ESM - European Stability Mechanism

EU - European Union

FP - Financial Performance

NSAs - National Supervisory Authorities

OLS - Ordinary Least Squares

ROA - Return on Assets

ROAA - Return on Average Assets

ROE - Return on Equity

SDGs - Sustainable Development Goals

SRM - Single Resolution Mechanism

SSM - Single Supervisory Mechanism

UN - United Nations

US - United States

1. Introduction

The 2008 financial crisis and the subsequent eurozone sovereign debt crisis shed light on the need to make regulatory and supervisory reforms in Europe. Multiple banks across different European countries needed to be bailed out by governments, as a consequence of bank financed housing booms, leading to the deterioration of public debt ratios. To decouple the sovereign debt-banking risk nexus and to promote a better functioning, more resilient and integrated banking system, the European Central Bank (ECB) proposed a Banking Union.

It was in June 2012 at the Euro Area Summit that the first step towards a Banking Union was taken, with the agreement on the implementation of a Single Supervisory Mechanism (SSM) and the possibility of direct recapitalization of banks by the European Stability Mechanism (ESM) to reduce the feedback loop between bank risk and sovereign risk, often called contagion effect. During the 2008 financial crisis, when governments rescued banks with weak capital positions and liquidity problems, they raised national deficits, already exacerbated by economic recession, resulting in higher sovereign risk. Higher sovereign risk means that domestic banks and banks holding large amounts of sovereign bonds also became riskier. This negative effect motivated the admission of direct recapitalization by the ESM, thus avoiding governments intervention and the transfer of risk from banks to sovereign. This decision, in turn, motivated the creation of SSM, that together with the Single Resolution Mechanism (SRM) and the European Deposit Insurance Scheme, constitute the three pillars of the European Banking Union (EBU) (ECB, 2012).

The SSM was the first pillar to be implemented in November 2014. Under the SSM, the ECB works closely to national supervisory authorities (NSAs) to monitor the most significant banks of the euro area and other banks of European Union (EU) non-euro area countries that choose to participate voluntarily. The ECB is responsible to check if banks comply with EU prudential rules, to conduct supervisory reviews, to grant or withdraw banking licenses and to set higher capital requirements (ECB, 2021a).

Before the implementation of SSM in November 2014, the ECB launched a preparatory step: the 12-month Comprehensive Assessment (CA). It consisted of a financial health check for the significant banks that would be supervised by the ECB, under the SSM, and comprised three main pillars – a supervisory risk assessment, an asset quality review and a stress test – and three main objectives – increase transparency regarding the information available, implement corrective actions on banks' balance sheets if it was needed and build confidence among stakeholders. The results were published in October 2014 (ECB, 2014).

In addition to changes in the European regulatory and supervisory framework, the 2008 financial crisis also promote an increase in the level of adoption of environmental, social and governance (ESG) practices in the banking industry (Cornett, Erhemjamts, and Tehranian, 2016; Miralles-Quirós, Miralles-Quirós, and Redondo Hernández, 2019). Banks were accused of triggering the financial crisis for being obsessed with profitability and engaging in risky speculations, like subprime mortgages. Their failure to be socially responsible has degraded society's confidence in the banking sector: "interest manipulation, subprime mortgages, and other toxic banking products have adversely affected employee and consumer perception (…)" (Esteban-Sanchez, de la Cuesta-Gonzalez, and Paredes-Gazquez, 2017, p. 1102); "corporate scandals, a lack of transparency and the subsequent government bailouts undermined public trust in the sector" (Forcadell and Aracil, 2017, p. 4). Since then, banks have been trying to restore their reputation, the trust of their customers and accomplish with the United Nations Sustainable Development Goals (SDGs) by engaging in ESG practices like "(…) the publication of sustainability reports following the Global Reporting Initiative guidelines, the adoption of the Equator Principles and the Global Compact, the inclusion of environmental risk assessments in their credit policies, among other practices" (Miralles-Quirós et al., 2019, p. 1).

In 2015, several governments around the world adopted the United Nations (UN) 2030 Agenda for Sustainable Development, thus committing themselves to achieve a set of economic, social, and environmental objectives to support the transaction for a more resilient and sustainable society. The achievement of the SDGs, under the UN 2030 Agenda, depends on the reorientation of capital from both public and private sectors to

more sustainable investments. The process of including environmental and social considerations in investment decision-making is called "sustainable finance" (EBA, 2019). Environmental considerations refer essentially to climate change mitigation, biodiversity protection and the efficient use of natural resources. Social considerations include, for example, the fight against poverty, hungry, and inequality issues, ensure the access to health, education, and better labor conditions. The inclusion of environmental and social considerations in the decision-making process depends on the adoption of good governance practices by institutions regarding management structures, employee relations and executive remuneration (EBA, 2019).

Banks play a key role in financing environmental and social activities, thus contributing to the accomplishment of the SDGs and to a more sustainable development, defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UN, 2021). Sustainability issues introduce both new opportunities and risks for banks, which in turn means, increased concerns over regulatory and supervision measures. In March 2018, the European Commission adopted an action plan on sustainable finance aiming to redirect capital flows to sustainable investments, to mainstream sustainability in risk management and to enhance transparency and long-termism. In 2019, the European Banking Authority (EBA) also published an action plan on sustainable finance after being challenged by the ECB to assess how ESG risks can be incorporated into the three pillars of European Banking Supervision. More recently, in November 2020, the ECB published a guide on climate-related and environmental risks describing what is expected from significant banks relating to risk management and disclosure (ECB, 2020).

Having all the above-mentioned in consideration, the present dissertation has the following research objectives:

(1) To study the impact of the adoption of ESG practices on profitability;

(2) To study the impact of the implementation of SSM on profitability;

(3) To study the joint impact of the adoption of ESG practices and the implementation of SSM on profitability.

From a methodological perspective, this study is based on panel data, with a sample comprised of 128 EU banks from 13 eurozone and 7 non-eurozone countries, over 2011-2019 period. To address our research objectives, a difference-in-differences (DID) approach is used.

The present dissertation contributes to the literature in several ways. It is the first empirical study, to the best of our knowledge, that explores the joint impact of the adoption of ESG practices and the implementation of SSM on banks' profitability. We also provide empirical evidence contributing (1) to the long-standing debate about the impact of the adoption of ESG practices on banks' financial performance and (2) to the scarce literature regarding the impact of SSM on banks' profitability.

This study has implications not only for academics, but also for financial institutions in terms of business strategy definition (Marques and Alves, 2021); for policymakers, providing valuable information of the impact of their decisions; for stakeholders and investors, in terms of reactions and expectations regarding the allocation of capital to ESG activities and the imposition of transnational supervision standards; and for society in general.

The remainder of this study is organized as follows. Section 2 presents the review of the relevant literature. Section 3 describes the methodological approach and presents the variables, the sample, and data sources. Section 4 focuses on empirical analysis and discussion of the results. Section 5 concludes. Section 6 presents the main limitations of the study and provide suggestions of further research.

2. Literature review

There is no empirical evidence relating the adoption of ESG practices, the implementation of SSM, and the profitability of banks. Therefore, the literature review is divided in two subsections: the first one presents the previous empirical evidence regarding the impact of the adoption of ESG practices on banks' financial performance and the second one explores the previous empirical evidence regarding the impact of Single Supervisory Mechanism on banks' financial performance.

2.1. The impact of the adoption of ESG practices on banks' financial performance

According to the existent empirical evidence (Cornett et al., 2016; Esteban-Sanchez et al., 2017; Forcadell and Aracil, 2017; Scholtens and Dam, 2007; Shen, Wu, Chen, and Fang, 2016; Simpson and Kohers, 2002; Soana, 2011; Wu and Shen, 2013), the relationship between ESG practices and banks' financial performance is ambiguous and difficult to generalize. It can either be positive, negative, mixed, or neutral. Before proceeding and to reduce conceptual confusion, in this study the term "ESG activities" has the same meaning as "corporate social responsibility (CSR) activities". Variety in terminology is identified by Daugaard (2020) as a major constraint in the field of sustainable finance. The same author mentions that different terms ("ethical", "socially responsible", "sustainable", "ESG" …) are used to refer to the same kind of activities.

2.1.1. Positive impact of the adoption of ESG practices on banks' financial performance

Starting with the empirical evidence that supports the existence of a positive relationship between the adoption of ESG practices and banks' financial performance. Simpson and Kohers (2002) studied the impact of corporate social performance (CSP) on financial performance (FP), considering a sample of 385 United States (US) commercial banks and a measure of social performance unique to the banking industry: the Community Reinvestment Act Rating. They found a strong positive CSP-FP link: banks

with higher CSP have lower loan losses and higher return on assets (ROA). However, the authors did not test any hypothesis that may explain this result.

In a relatively more recent study, Cornett et al. (2016) explored the relationship between corporate social responsibility and financial performance around the financial crisis, considering a sample of 235 US commercial banks. The years 2003-2007 were used to analyze CSR activities before the crisis and the years 2010-2013 after the crisis. The years 2008 and 2009 were removed from the analysis because they represent the worst years of the financial crisis. The authors found that the return on equity (ROE) is positively and significantly related to CSR and that large banks engage more actively in CSR activities, especially after the crisis, time at when they were connoted of too-big-to-fail and accused of putting their own interests ahead of those of society.

The study developed by Shen et al. (2016) also supports the existence of a positive CSP-FP link. The authors studied whether banks engaging in CSR activities can bring profits and reduce non-performing loans, considering a sample of 6060 non-CSR banks and 65 CSR-banks – those that are members of the FTSE4Good Global Index – from 18 countries in the 2000-2009 period. They assumed that being member of the FTSE4Good Global Index is a strong signal of the adoption of CSR practices. The results suggest that banks that engage in CSR activities outperform the other banks in terms of ROA and ROE. They also present higher net interest income, non-interest income and lower non-performing loans.

Different authors present different explanations for the positive relationship between corporate social performance and financial performance. Waddock and Graves (1997) argue that not engaging in CSR activities has substantial implicit costs (e.g., reputational costs) and that the costs of corporate social responsibility are minimal when compared to the potential benefits. According to the same authors, good managers can conciliate a good social and financial performance – “good management hypothesis”. Also, Preston and O'bannon (1997) suggest that when corporations try to meet the needs of multiple non-owner stakeholders, it will have a positive impact on financial performance – “social impact hypothesis”. Wu and Shen (2013) also recognize the importance of stakeholder relationships (especially, those with clients) for better financial

performance. In fact, banks that engage in CSR activities increase customer loyalty and build reputation, which in turn translates into brand awareness and differentiation. As a consequence, CSR-banks may attract more deposits and loans (Shen et al., 2016; Wu and Shen, 2013); increase loan interest rates and decrease deposit rates, resulting in higher net interest income (Wu and Shen, 2013); differentiate their financial products and charge higher prices, increasing non-interest income (Shen et al., 2016; Wu and Shen, 2013); attract and retain high quality employees, reducing hiring and training costs (Shen et al., 2016); reduce information asymmetries and agency problems among stakeholders (Shen et al., 2016; Wu and Shen, 2013); reduce advertisement expenses (Shen et al., 2016). In sum, CSR-banks gain a competitive advantage when compared to non-CSR banks.

Despite the previous empirical evidence supporting the existence of a positive impact of adopting CSR practices on financial performance, some authors raise doubts about the causal relationship between CSR practices and financial performance: is it the engagement in CSR practices that leads to improved financial performance, or the opposite? On the one hand, and for all the previously mentioned reasons, CSR activities may lead to improved financial performance. On the other hand, and according to Preston and O'bannon (1997) and Waddock and Graves (1997), companies with better financial performance have more resources available to pursue CSR activities – "the slack resources theory". Waddock and Graves (1997) explored this question and concluded that there is a circular relationship between CSR activities and financial performance outcome.

2.1.2. Negative impact of the adoption of ESG practices on banks' financial performance

Contrary to the previously mentioned studies, some authors found a negative CSP-FP link. Scholtens and Dam (2007) compared the performance of banks that adopted the Equator Principles (EP), which signals a responsible conduct, with those that do not. The EP are a voluntary set of guidelines addressed to financial institutions for identifying, assessing, and managing environmental and social risks in financing projects. The authors considered a sample of 56 non-adopters and 27 EP adopters. By performing an event study, where the event is the announcement of the adoption of the EP, they found that

there is no significant response by financial market participants. By performing tests for the equality of means, they found that banks that adopt the Equator Principles have significantly higher CSR policies, tend to be bigger and have lower returns on average assets (ROAA) indicating that there might be some real costs associated with the implementation of the Equator Principles. However, the authors did not test any formal causality.

This finding is consistent with the neoclassical theory: CSR activities can be negatively related with financial performance due to increased real costs (e.g., charitable donations, programs to address corruption and money laundering, etc.), being thus a harmful weapon when it comes to maximize shareholders wealth (Shen et al., 2016; Simpson and Kohers, 2002). Preston and O'bannon (1997) present another explanation for the negative CSP-FP link: “the managerial opportunism hypothesis”. When financial performance is strong and managers compensation is tied to short-term profitability, they reduce CSR expenditures to increase their compensation. When financial performance is poor, managers engage in CSR activities to divert attention.

2.1.3. Mixed impact of the adoption of ESG practices on banks’ financial performance

Some empirical studies found a mixed relationship between CSR practices and financial performance. Wu and Shen (2013) studied the relationship between corporate social responsibility and financial performance, considering a sample of 162 banks in 22 countries from 2003 to 2009. They also test the driving motives of banks to engage in CSR activities: strategic choices, altruism, and greenwashing. On the one hand, strategic banks engage in CSR activities to improve profits. They use interest rates to increase the net interest income, since CSR activities reduce consumer price sensitivity: consumers prefer to borrow at higher interest rates and make deposits at lower interest rates because CSR-banks provide a sense of trust. Brand differentiation also allows strategic banks to charge higher commissions and fees for their products, increasing non-interest income. On the other hand, altruistic banks engage in CSR activities for reasons other than profits, like environmental improvement and/or social problems mitigation. Finally, greenwashing banks engage in superficial CSR activities, without significant

repercussion in the business. The authors found that when banks engage in CSR activities for strategic motives, there is (1) a positive relationship between CSR activities and return on assets, return on equity, net interest income and non-interest income; (2) a negative relationship between CSR activities and non-performing loans ratio. Altruistic banks, although are not interested in improving profits by engaging in CSR, are able to increase the net interest income and the non-interest income. However, costs also increase and the net effect in profit (ROA and ROE) is uncertain. Greenwashing does not influence banks' income and costs. In sum, the findings suggest that CSP-FP relationship is positive, non-negative and non-existent when banks engage in CSR activities for strategic, altruistic, and greenwashing motives, respectively.

In a relatively more recent study, Forcadell and Aracil (2017) explored the impact of having a reputation for CSR on European banks' financial performance during 2003-2013 period. The sample was selected under the assumption that banks that are members of the Dow Jones Sustainability Index (DJSI) are sustainable banks. Therefore, being member of DJSI signals the adoption of CSR practices and a reputation for CSR engagement. The authors found a positive CSP-FP relationship prior to the economic turmoil. This result is in line with the idea that banks that engage in CSR activities improve their reputation, positively influence customers' perceptions, and enhance financial performance. However, during the economic recession (2008-2013), the reputation derived from sustainability strategies does not result in improved returns. This finding might be justified by the involvement of banks in multiple corporate scandals during the financial crisis. Bad management, lack of transparency and integrity degraded public perception towards the sector. It can also show that CSR outcomes are only paid in the long term.

A similar study was carried out by Esteban-Sanchez et al. (2017). The authors explored the extent to which the adoption of CSR activities has attenuated the decrease in CFP during the crisis. The authors analyzed a sample of 154 financial entities in 22 countries, from 2005 to 2010, and found that banks with better employee relationships and corporate governance had a better financial performance when compared to the others. However, the crisis negatively moderated the effect of corporate governance dimension on CFP, suggesting failures in corporate governance mechanisms. Customer

relations and product responsibility (the third and fourth CSR dimensions considered in the study) did not have a positive impact on CFP during the crisis. This finding might suggest that commercial issues were not well managed, resulting in a loss of consumer confidence in the products and information provided by banks. The authors recommend a regulatory and supervision reform in terms of product responsibility and information disclosure, to better protect customers.

In addition to the previously mentioned studies, it is worth mentioning that other authors found a U-shaped CSP-FP relationship, suggesting that in the short-term costs overcome benefits and only in the medium-long term do CSR investments translate into a better financial performance. Still others found an inverted U-shaped relationship, suggesting that there is an optimal level of adoption of CSR practices. Below such level, companies can improve their performance by engaging in CSR activities. However, above the optimum, higher costs will compromise financial performance (Soana, 2011).

2.1.4. Neutral impact of the adoption of ESG practices on banks' financial performance

In addition to being positive, negative, or mixed, the relationship between the adoption of CSR practices and financial performance can also be neutral. Soana (2011) studied the relationship between corporate social performance and corporate financial performance in the banking sector, measuring CSP by three different ethical ratings and CFP by market and accounting ratios. The results suggest that, at least for Italian banks which supplied most of the data, there is no evidence of a significant relationship between CSP and CFP.

Table 1 summarizes the previous empirical evidence on the impact of the adoption of ESG practices on banks' financial performance.

TABLE 1 – SUMMARY OF THE PREVIOUS EMPIRICAL EVIDENCE ON THE IMPACT OF THE ADOPTION OF ESG PRACTICES ON BANKS' FINANCIAL PERFORMANCE

Reference	Sample	Corporate financial performance variables	Corporate social performance variables	CSP-FP relationship
Simpson and Kohers (2002)	385 US commercial banks in period 1993-1994	Return on assets, loan losses	Community Reinvestment Act Rating	Positive
Cornett et al. (2016)	235 US commercial banks in period 2003-2013 (excluding 2008 and 2009)	Return on equity	CSR Index (All Strengths Score subtracted from All Concerns Score from MSCI ESG STATS database)	Positive
Shen et al. (2016)	6125 banks from 18 countries in period 2000-2009	Return on assets, return on equity, net interest income ratio, non-interest income ratio, non-performing loans	Dummy that assumes the value 1 in the case of the bank being member of FTSE4Good Index	Positive
Scholtens and Dam (2007)	27 EP adopters (as of April 2007) and 56 EP-non adopters	Return on average assets, return on average equity, net interest margin, cost to income ratio and others	Factor scores of CSR indicators (from EIRIS database)	Negative
Wu and Shen (2013)	162 banks from 22 countries in period 2003-2009	Return on assets, return on equity, net interest income ratio, non-interest income ratio, non-performing loans	CSR Index (from EIRIS database)	Mixed
Forcadell and Aracil (2017)	198 European banks in period 2003-2013	Return on average assets	Dummy that assumes the value 1 in the case of the bank being member of Dow Jones Sustainability Index (DJSI)	Mixed
Esteban-Sanchez et al. (2017)	154 banks from 22 countries in period 2005-2010	Return on assets, return on equity	Corporate governance, relations with employees, relations with the community and product responsibility (from Asset4 database)	Mixed
Soana (2011)	21 international banks and 34 Italian banks during 2005	Return on average assets, return on average equity, cost-to-income ratio, market-to-book value, price-to-book value, price/earnings adjusted	Ethical ratings (from Ethibel, AXIA and AEI rating agencies)	Neutral

These confounding findings about the impact of the adoption of ESG practices on financial performance demand further investigation and motivated one of the research objectives addressed in the present dissertation: to study the impact of the adoption of ESG practices on banks' profitability. The hypothesis tested is:

Hypothesis 1: The adoption of ESG practices has a positive impact on banks' profitability.

The null hypothesis consists in denial hypothesis 1, i.e., the adoption of ESG practices has a non-positive impact on banks' profitability. Since the previous empirical evidence is ambiguous, we have reasons to believe that any result is possible. However, considering the conclusions of the study developed by Forcadell and Aracil (2017), which also use a sample of EU banks, we expect to reject the null hypothesis.

2.2. The impact of Single Supervisory Mechanism on banks' financial performance

Empirical evidence regarding the impact of SSM on euro area banks is scarce and focuses, essentially, on stock market reactions in the run-up to the implementation of SSM.

As a first example, consider the research developed by Loipersberger (2018), who studied the impact of SSM on banks' stock returns, using a sample of 249 listed banks (88 euro area banks and 161 EU non-euro banks) and their stock prices from January 2012 to January 2015. The author found that two events - the announcement by the European Council of their intention to implement a Single Supervisory Mechanism on June 29, 2012 and the presentation of the official proposal for the SSM on September 12, 2012 - had a positive impact on eurozone banks' stock returns. The impact was more pronounced in countries with weaker institutions. This finding is consistent with the hypothesis that the SSM prevents banks from taking excessive risks, thus stabilizing the financial sector. Also, the SSM had a small but positive impact on non-euro EU banks' stock returns, suggesting the existence of spillover effects: reducing the likelihood of bankruptcy for euro area banks, decreases the bankruptcy probability for non-euro area banks.

Also Carboni, Fiordelisi, Ricci, and Lopes (2017) studied the impact of three events related with the SSM on banks' stock returns. The three events were: the announcement of the Comprehensive Assessment (CA) procedure (October 23, 2013); (2) the publication of the results of the CA procedure (October 26, 2014) and (3) the launch of SSM (November 4, 2014). Contextualizing, the CA was carried out before the implementation of the Single Supervisory Mechanism and consisted of a financial health check for the significant banks that would be supervised by the ECB, under the SSM (ECB, 2013). The assessment took 12 months and comprised three main pillars – a supervisory risk assessment, an asset quality review and a stress test – and three main objectives – increase transparency regarding the information available, implement corrective actions on banks' balance sheets if it was needed and build confidence among stakeholders (ECB, 2013). In addition to the impact on banks' stock returns, the authors also studied if the CA reached the goal of increasing transparency by producing valuable new information for the market. Considering a sample of 158 banks (50 significant banks that participated in the CA and 108 less significant banks excluded from the CA procedure), they found that both the announcement of the CA and the publication of the results negatively impacted banks' stock returns. These results are consistent with the hypothesis that at the announcement of the procedure, investors were able to identify weak banks (i.e., banks with a capital shortfall that will need to implement corrective measures) but were not able to predict the total magnitude of the capital shortfall. Therefore, at the announcement date, weak banks suffered from a negative reaction in higher magnitude and, at the publication date, they were again penalized, when investors realized the total magnitude of the capital shortfall. CA's goal of producing valuable new information for the market and achieving greater transparency seems to have been achieved. Regarding the impact of the launch of SSM on banks' stock returns, the results suggest that significant banks subject to the direct supervision of the ECB, under the SSM, where penalized in comparison to the less significant banks, which maintain their national supervisors. According to the authors, these findings suggest that investors expect a more intrusive approach by the ECB and fear inconsistencies with respect to the rules applied to banks supervised by the ECB and national authorities.

Still regarding the impact of the Comprehensive Assessment, it is worth mentioning the research developed by Fiordelisi, Ricci, and Stentella Lopes (2017), who

studied the behavior of significant banks subject to the CA and how it differed from the behavior of the other banks. The authors used a difference-in-differences estimation and considered a sample of 103 significant banks (i.e., banks that fell under the direct supervision of the ECB with the implementation of SSM) and 233 less significant banks (i.e., banks that continued to be supervised by national authorities and were not subject to the CA) during the 2011 to 2014 period. They found that significant banks reduced their lending activity more than less significant banks to shrink their balance sheets and increase their capitalization, thus reducing the probability of capital shortfalls and costly capital adjustments required under the CA. This result also suggest that the credit crunch was an unintended consequence of SSM launch.

In a somewhat different study, Galema and Koetter (2016) explored whether direct supervision by the SSM as opposed to national supervisory authorities is related to cost and profit efficiency, considering approximately 27 000 bank-year observations of European banks over the period 2004 to 2013, and employing a panel stochastic frontier analysis method. The authors found that SSM-supervised banks are both less cost and less profit efficient which may indicate an additional regulatory burden, at least during the run-up of SSM, or a more objective and efficient supervision when compared to NSAs. It is important to note, however, that the authors did not test for the causal relationship between the SSM and bank efficiency.

More recently, Sáiz, Azofra, and Olmo (2019) studied how the SSM affected contagion between bank risk and sovereign risk in the eurozone and whether this contagion is transmitted from banks to sovereigns or vice-versa. Contextualizing, the 2008 financial crisis shed light on the bank risk-sovereign risk feedback loop: when governments rescue banks with weak capital positions and liquidity problems, they raise national deficits, resulting in higher sovereign risk. In turn, higher sovereign risk means that domestic banks and banks holding large amounts of sovereign bonds also became riskier. The Banking Union, built upon three pillars – the Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM) and the Deposit Guarantee Scheme –, was an initiative launched in Europe as an attempt to mitigate this and other problems of the financial system. The SSM was the first pillar to be in place. According to the authors, the SSM may contribute to mitigate the bank risk-sovereign risk feedback loop problem

in multiple ways: (1) the common regulatory framework is expected to reduce the heterogeneity among banks, making them less dependent on their home country's sovereign risk and reducing the uncertainty premium that some may pay; (2) a stricter supervision is expected to enhance the robustness and resilience of eurozone banking system, reducing the probability of economic recessions and subsequent spillover effects; (3) troubled banks may receive the support of the European Stability Mechanism (ESM), avoiding governments intervention and the transfer of risk from banks to sovereign. In a first analysis, the authors considered a sample of 80 banks from 13 eurozone countries and their stocks returns from 2009 to 2016. They do not find enough evidence that the SSM reduced the contagion from sovereign risk to banks' stock returns. This result is in line with the fact that investors underreact to positive news during recessions, i.e., periods of higher uncertainty. Also, they found that the adoption of the first two pillars of the European Banking Union – the SSM (4 November 2014) and the SRM (1 January 2016) – negatively affected banks' stocks returns. In a second analysis, the authors considered a sample of 25 banks from 10 eurozone countries and their credit default swap spreads between 2009 and 2016. They found that the official announcement of SSM reduced contagion between banks and sovereign risk, which can be explained by the lower impact of sovereign risk on bank risk after the announcement, and not vice versa. According to the authors, the credit default swaps market was more responsive to new information during the recent financial crisis.

Finally, it is worth mentioning the research developed by Avgeri, Dendramis, and Louri (2020), who were the first authors, to the best of our knowledge, to study the impact of SSM on the profitability of European banks. They considered a sample of 344 European banks for the 2011-2017 period, employed ROA and ROE as indicators of profitability and applied a difference-in-differences methodology. The authors found that the SSM has a statistically significant and positive impact on profitability. This result is in line with the improvement of the quality of banks' lending portfolios and capital ratios, both positively related to profitability, and with the increased transparency and credibility imposed by the SSM, which improved SSM-supervised banks borrowing conditions. They also found that banks located on periphery countries, which were more negatively affected by the financial crisis when compared to banks in core countries, were more

intensely and positively affected by the SSM. This means that the SSM contributed to the reduction of fragmentation among European banks.

Table 2 summarizes the previous empirical evidence on the impact of SSM on banks' financial performance.

TABLE 2 - SUMMARY OF THE PREVIOUS EMPIRICAL EVIDENCE ON THE IMPACT OF SSM ON BANKS' FINANCIAL PERFORMANCE

Reference	Sample	Output variables	Main conclusions
Loipersberger (2018)	249 EU banks in the period 2012-2015	Stock returns	The positive impact on stock returns suggests that the SSM prevents banks from taking excessive risks, thus stabilizing the financial sector.
Carboni et al. (2017)	158 EU banks in the period 2013-2014	Stock returns	The negative impact on stock returns suggests that investors expect a more intrusive approach by the ECB and fear inconsistencies with respect to the rules applied to banks supervised by the ECB and national authorities.
Fiordelisi et al. (2017)	336 EU banks in the period 2011-2014	Gross loan growth, loan loss reserves growth, net loan growth, equity to total assets, equity capital growth	Significant banks reduced their lending activity more than less significant banks to shrink their balance sheets and their capitalization, thus reducing the probability of capital shortfalls and costly capital adjustments required under the CA. The credit crunch was an unintended consequence of SSM launch.
Galema and Koetter (2016)	3789 EU banks in the period 2004-2013	Operating costs and profits	The authors found that SSM-supervised banks are both less cost and less profit efficient which may indicate an additional regulatory burden, at least during the run-up of SSM, or a more objective and efficient supervision when compared to NSAs.
Sáiz et al. (2019)	105 EU banks in the period 2009-2016	Stock returns and credit default swap spreads	The official announcement of SSM reduced contagion between banks and sovereign risk, which can be explained by the lower impact of sovereign risk on bank risk after the announcement, and not vice versa.
Avgeri et al. (2020)	344 EU banks in the period 2011-2017	Return on assets and return on equity	The SSM has a positive impact on banks' profitability, especially in those located on periphery countries, contributing to the reduction on the fragmentation among European banks.

The scarcity of empirical results regarding the impact of SSM on euro area banks' financial performance, motivated two of the research objectives addressed in the present dissertation: to study the impact of the implementation of SSM on banks' profitability and the joint impact of the adoption of ESG practices and the implementation of SSM on banks' profitability. Thus, our hypotheses 2 and 3 are the following:

Hypothesis 2: The implementation of SSM has a positive impact on banks' profitability.

Hypothesis 3: The implementation of SSM has a positive impact on ESG-profitability relationship.

The null hypotheses consist in denial hypotheses 2 and 3, i.e., the implementation of SSM has a non-positive impact on banks' profitability and a non-positive impact on ESG-profitability relationship, respectively. Considering the previous empirical evidence, we have reasons to believe that rejecting or not the null hypotheses are both possible results.

On the one hand, and according to Galema and Koetter (2016), SSM-supervised banks may face an additional regulatory burden, thus compromising profit and cost efficiency and, therefore, profitability. They may also face higher ESG risk management costs, when compared to non-SSM supervised ESG-banks, hence compromising ESG-profitability relationship (ECB, 2020).

On the other hand, a stricter supervision is expected to enhance the robustness of banks. In fact, and according to Avgeri et al. (2020), being supervised by the ECB improves the quality of banks' lending portfolios and capital ratios, both positively related to profitability. Also, and according to the same authors, the increased transparency and credibility imposed by the SSM improves SSM-supervised banks borrowing conditions. Therefore, being subject to the SSM may have a positive impact on profitability and enhance (appease) the positive (negative) effect that the adoption of ESG practices has on profitability, namely due to increased transparency stemming from higher ESG risk disclosure requirements imposed by the ECB (ECB, 2020).

3. Methodology and data

In section 3.1., we present the methodology that we follow to address our research objectives. In sections 3.2. and 3.3., we provide a detailed description of the variables included in the study and the descriptive statistics, respectively. Finally, section 3.4. presents the sample and data sources.

3.1. Methodology

In the present study, we resort to a data panel of EU banks over the period 2011-2019 and use a difference-in-differences (DID) approach. Avgeri et al. (2020), who studied the impact of SSM on the profitability of European banks, also employed the DID methodology.

The DID method measures the effect of an event on certain outcome variables in two groups: one composed by participants in the event (treated group) and other composed by non-participants (control or untreated group) (Callaway and Sant'Anna, 2020). In the present study, the event of interest is the implementation of SSM in November 2014. The treated group is composed by euro area significant banks that are directly supervised by the ECB. The control group is composed by EU banks that are not supervised by the ECB (both from the euro area and the non-euro area) and represents what would have happened if the treated group had not received the treatment.

The DID method requires the fulfillment of the parallel trend assumption. This assumption states that the average outcome for both groups (treated and control), prior to the event of interest, follow a parallel trend and, in the absence of the treatment, the same would have happened over time (Callaway and Sant'Anna, 2020). Further supporting evidence about the parallel trend assumption is given in section 4.1.

Equation (1) represents the linear regression model considered to empirically address our research objectives:

$$Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 T_1 + \beta_3 T_2 + \beta_4 ESGScore_i + \beta_5 SSM_i T_1 + \beta_6 SSM_i T_2 + \beta_7 SSM_i ESGScore_i + \beta_8 SSM_i T_1 ESGScore_i + \beta_9 SSM_i T_2 ESGScore_i + \beta_{10} BSV_{i,t} + \beta_{11} ISV_{c,t} + \beta_{12} CSV_{c,t} + \varepsilon_{i,c,t} \quad (1)$$

where $Y_{i,c,t}$ is the profitability indicator (ROAA) for bank *i*, in country *c*, in period *t*. α represents the intercept or constant term. The dummy variable SSM_i equals 1 if the observation is directly supervised by the ECB and 0 otherwise. Two dummy variables (T_1 and T_2) were used to distinguish the periods after the implementation of SSM. The time period dummy variable T_1 is equal to 1 for the years 2015, 2016, 2017 and 0 otherwise. The time period dummy variable T_2 is equal to 1 for the years 2018 and 2019, and 0 otherwise. It makes sense to differentiate the years 2018 and 2019 from the 2015-2017 period to distinguish the short-term from the medium-long term. $ESGScore_i$ represents the ESG Score provided by Refinitiv Eikon for bank *i*. In order to study the effect of Single Supervisory Mechanism on profitability, we included two DID variables, defined as the product of the time period dummy variables and the treated group dummy variable. Therefore, $SSM_i T_1$ and $SSM_i T_2$ identify the banks that are bounded by the mechanism in the two periods after the implementation of SSM, i.e., SSM-supervised banks in 2015, 2016, 2017 (SSM_i= 1 and T_1 = 1) and SSM-supervised banks in 2018 and 2019 (SSM_i= 1 and T_2 = 1). Finally, and in order to study the joint impact of the adoption of ESG practices and the implementation of SSM on banks' profitability, we included another two DID variables, defined as the product of the time period dummy variables, the treated group dummy variable and the ESG Score: $SSM_i T_1 ESGScore_i$ and $SSM_i T_2 ESGScore_i$. $BSV_{i,t}$ represents a vector of bank specific control variables. $ISV_{c,t}$ represents a vector of industry specific control variables. $CSV_{c,t}$ represents a vector of country specific control variables. $\varepsilon_{i,t}$ is the residual term. A detailed description of the included variables is provided in section 3.2.

The coefficient β_4 measures the impact of the adoption of ESG practices on banks' profitability: if β_4>0, the higher the level of adoption of ESG practices, the higher the profitability; if β_4<0, the higher the level of adoption of ESG practices, the lower the

profitability; if β_4 is zero or close to zero, it means that the impact of the level of adoption of ESG practices on profitability is minimal.

The coefficients β_5 and β_6 measure the impact of the implementation of SSM on banks' profitability, in the years immediately after the SSM introduction and in the medium-long term, respectively. The coefficients β_8 and β_9 measure the impact of the implementation of SSM on ESG-profitability relationship, also in the years immediately after the SSM implementation and in the medium-long term, respectively.

$$\beta_5 = \left(Y_{SSM_i=1,T_1} - Y_{SSM_i=1,T_0}\right) - \left(Y_{SSM_i=0,T_1} - Y_{SSM_i=0,T_0}\right)$$

$$\beta_6 = \left(Y_{SSM_i=1,T_2} - Y_{SSM_i=1,T_0}\right) - \left(Y_{SSM_i=0,T_2} - Y_{SSM_i=0,T_0}\right)$$

$$\beta_8 = \left(Y_{SSM_i=1,T_1} - Y_{SSM_i=1,T_0}\right) - \left(Y_{SSM_i=0,T_1} - Y_{SSM_i=0,T_0}\right)$$

$$\beta_9 = \left(Y_{SSM_i=1,T_2} - Y_{SSM_i=1,T_0}\right) - \left(Y_{SSM_i=0,T_2} - Y_{SSM_i=0,T_0}\right)$$

In a difference-in-differences design, the average gain from time 0 to time j in the treated group $\left(Y_{SSM_i=1,T_j} - Y_{SSM_i=1,T_0}\right)$ is subtracted from the average gain from time 0 to time j in the control group $(Y_{SSM_i=0,T_j} - Y_{SSM_i=0,T_0})$. The sign of the treatment effect $\beta_n, n = 5,6$ is interpreted as follows: if $\beta_n > 0$, the implementation of SSM has a positive impact on SSM-banks' profitability; if $\beta_n < 0$, the implementation of SSM has a negative impact on SSM-banks' profitability; if β_n is equal or close to zero, the effect of the treatment is minimal, i.e., the implementation of SSM has no influence on SSM-banks' profitability. The sign of the treatment effect $\beta_n, n = 8,9$ is interpreted as follows: if $\beta_n > 0$, the implementation of SSM accentuates (appeases) the positive (negative) effect that the adoption of ESG practices has on profitability; if $\beta_n < 0$, the implementation of SSM accentuates (appeases) the negative (positive) effect that the adoption of ESG practices has on profitability; if β_n is equal or close to zero, the effect of the treatment is minimal, i.e., the implementation of SSM has no influence on the impact that the adoption of ESG practices has on profitability.

Ordinary least squares (OLS) is used to estimate the regression parameters. It is worth mentioning, however, that studies of how the adoption of ESG practices affect financial performance are often considered to suffer from an endogeneity problem (Cornett et al., 2016; Shen et al., 2016; Wu and Shen, 2013), resulting in biased OLS estimated coefficients (Angrist and Imbens, 1995). Nevertheless, using instrumental variables methods (namely the two-stage least squares) to control for endogeneity requires, as the name implies, choosing instrumental variables, i.e. "(…) variables related to the outcome of interest solely through the treatment of interest" (Angrist and Imbens, 1995, p. 432). The lack of a well-developed *a priori* model of the determinants of CSP (Simpson and Kohers, 2002) makes it difficult to choose an instrumental variable based on theoretical considerations. Furthermore, we have reasons to believe that, regardless of the size and resources available to engage in ESG activities, EU banks are required to pursue sustainable conduct. In fact, the adoption of ESG activities is becoming a regulatory requirement and, in this sense, it is exogenous. The transaction to a more sustainable economy is being driven by issues such as climate change and scarcity of natural resources, which have a negative impact on society's well-being, the real economy, and the financial system. The shift is urgent and gained prominence on international authorities' agendas, giving rise, for example, to the 2015 Paris Agreement and the UN's 2030 Agenda (ECB, 2021b). We believe that this kind of sustainability policies are forcing banks to be sustainable. For example, according to the existent empirical evidence, after the Paris Agreement, European banks changed their lending behavior, reallocating credit away from polluting firms. This result suggests that EU banks may anticipate more stringent policies or significant fluctuations in the asset values of polluting firms (Reghezza, Altunbas, Marques-Ibanez, d'Acri, and Spaggiari, 2021). In sum, despite the reasonable hypothesis that good financial performance leads to good corporate social performance, we believe that, at least for EU banks, it is CSP that causes FP and not vice-versa, since the driving motives to engage in CSR seem to be other than performance, namely sustainability policies imposed by international authorities.

3.2. Variables

3.2.1. Dependent variable

The most widely recognized measures of profitability are probably the return on assets and the return on equity. In all the previously mentioned studies that explored the CSP-FP relationship, at least one of these two variables were used to measure financial performance (Cornett et al., 2016; Esteban-Sanchez et al., 2017; Forcadell and Aracil, 2017; Scholtens and Dam, 2007; Shen et al., 2016; Simpson and Kohers, 2002; Soana, 2011; Wu and Shen, 2013). However, according to Simpson and Kohers (2002) and Forcadell and Aracil (2017), in the banking industry, the return on assets provides the same financial information as the return on equity because the relationship between total assets and total equity is tightly regulated. Therefore, in the present study, we use the return on average assets (ROAA) as dependent variable. It measures the ability of banks to invest the funds collected as deposits in profitable assets (Simpson and Kohers, 2002).

3.2.2. Explanatory variables

3.2.2.1. ESG Scores

The Refinitiv ESG Scores are available on over 10 000 companies globally and measure ESG performance based on publicly reported data. They collect more than 450 ESG measures (from which the 186 most relevant are selected, based on materiality and industry relevance) over 10 categories – resource use, emissions, innovation, management, stakeholders, CSR strategy, workforce, human rights, community, and product responsibility. ESG Scores are comprised in a range of 0 to 100 – the higher the score, the better the ESG performance (Refinitiv, 2021).

3.2.2.2. Control variables

We consider several control variables that are likely to influence banks' profitability and explore the significance of their impact.

According to the literature pertaining to the determinants of bank profitability (e.g. (Batten and Vo, 2019; Demirgüç-Kunt and Huizinga, 1999; Dietrich and Wanzenried, 2011; Garcia and Guerreiro, 2016; Kosmidou, 2008; Petria, Capraru, and Ihnatov, 2015;

Trujillo-Ponce, 2013)), banks' size, risk, capitalization and efficiency impact profitability. Other industry specific factors (e.g., market concentration) and country specific factors (e.g., macroeconomic environment, legal and institutional systems) also influence profitability.

i. Bank specific control variables

Total assets controls for banks' differences in size. Some studies found that larger banks are more likely to have higher profitability due to economies of scale (Kosmidou, 2008) and scope (Trujillo-Ponce, 2013). Still other found that larger banks "(…) are often affected by rigidities, inertia, bureaucracy, that may decrease performance (…)" (Petria et al., 2015, p. 520). We considered the natural logarithm of total assets to avoid skewness on the original metric.

Equity-to-assets ratio controls for banks' differences in average capitalization. According to Dietrich and Wanzenried (2011) and Garcia and Guerreiro (2016), the impact of banks' capitalization on profitability cannot be anticipated theoretically. On the one hand, better capitalized banks are considered less risky and, therefore, face lower costs of funding. On the other hand, considering the conventional risk-return hypothesis, safer banks are more likely to have lower returns.

Cost-to-income ratio is used as a proxy of banks' operational efficiency. Multiple studies found a significant relationship between profitability and efficiency. More efficient banks are expected to be more profitable (Garcia and Guerreiro, 2016; Petria et al., 2015).

Z-score, measured as the ratio between the sum of ROAA and the equity-to-assets ratio and the standard deviation of ROAA over the full period of the sample, was used as a measure of bank risk. It represents the number of standard deviations that a bank's profit must fall to drive the bank into insolvency. The natural logarithm of Z-score was used to avoid skewness on the original metric. Some studies found that the relationship between risk and profitability is positive, which is in line with the risk-return hypothesis. Still others found that the relationship between the two variables is negative, indicating that banks that are exposed to riskier loans, although receive higher interest income, also

experience higher loan losses, which negatively affects profitability (Dietrich and Wanzenried, 2011).

ii. Industry specific control variables

Bank concentration ratio, calculated by dividing the assets of the three largest banks of one country to the assets of all commercial banks operating in that country, is used as a proxy for banking industry concentration. According to multiple authors (Dietrich and Wanzenried, 2011; Kosmidou, 2008; Petria et al., 2015), market concentration has influence on bank profitability, namely on ROAA. Such relationship is, however, ambiguous: some studies found a statistically significant and positive relationship and others found a negative one.

Banking industry assets to GDP, calculated as total assets of deposit money banks divided by real GDP per capita, is an important variable to control for cross-country differences in the size of the banking sector. Demirgüç-Kunt and Huizinga (1999) found that banking industry assets to GDP ratio is negatively related to margins and profits, probably reflecting more intense competition.

iii. Country specific control variables

Real GDP growth controls for the impact of the economic cycle on banks' performance. When the economic activity increases, the demand for loans and deposits increases as well as profit margins. In contrast, when economic activity decreases, banks' profitability is expected to be negatively affected (Petria et al., 2015).

Inflation rate is used since the observations belong to different monetary zones and multiple studies show that there is a statistically significant relationship between inflation and profitability (Kosmidou, 2008; Petria et al., 2015). In fact, when inflation is anticipated, banks adjust interest rates accordingly to pass the costs of inflation onto customers. If revenues grow faster than costs, inflation will lead to profitability increases. However, it may happen that costs grow faster than revenues, especially if inflation is not anticipated and banks take some time to adjust interest rates, negatively affecting bank's profitability.

To control for national institutional differences, and following Avgeri et al. (2020), the sum of the scores of the six dimensions of World Bank Governance Indicators were included in the analysis. According to Kaufmann, Kraay, and Mastruzzi (2011), *voice and accountability* measures the ability of citizens to participate in selecting their government, freedom of expression and association; *political stability and absence of violence/terrorism* measures the likelihood of politically-motivated violence and terrorism; *government effectiveness* measures the quality of public and civil services, as well as the quality of policy formulation and implementation; *regulatory quality* measures the ability of government to formulate and implement policies that promote private sector development; *rule of law* measures the quality of contract enforcement, property rights, the policy, the courts and the likelihood of crime and violence; *control of corruption* measures the extent to which public power is exercised for private gain. All the indexes range from -2.5 (weak) to 2.5 (strong) governance performance.

3.2.3. Other variables

Two dummy variables (T_1 and T_2) were used to distinguish the periods after the implementation of SSM. The time period dummy variable T_1 is equal to 1 for the years 2015, 2016, 2017 and 0 otherwise. The time period dummy variable T_2 is equal to 1 for the years 2018 and 2019, and 0 otherwise. The dummy variable SSM_i equals 1 if the observation is directly supervised by the ECB and 0 otherwise. In order to study the effect of the Single Supervisory Mechanism on profitability, we included two DID variables, defined as the product of the time period dummy variables and the treated group dummy variable. Therefore, SSM_iT_1 and SSM_iT_2 identify the banks that are bounded by the mechanism in the two periods after the implementation of SSM, i.e., SSM-supervised banks in 2015, 2016, 2017 (SSM_i= 1 and T_1 = 1) and SSM-supervised banks in 2018 and 2019 (SSM_i= 1 and T_2 = 1). Finally, and in order to study the effect of SSM on the ESG-profitability relationship, we included another two DID variables, defined as the product of the time period dummy variable, the treated group dummy variable and the ESG Score: $SSM_iT_1ESGScore_i$ and $SSM_iT_2ESGScore_i$.

The dependent and explanatory variables are summarized in **Table 3**.

TABLE 3 - VARIABLES DEFINITIONS

Variables	Definition	Notation	Source	References
Dependent variable				
Return on average assets	Net income divided by the average total assets at the beginning and the end of the year	ROAA	Bank Focus	(Avgeri et al., 2020; Esteban-Sanchez et al., 2017; Forcadell and Aracil, 2017; Scholtens and Dam, 2007; Simpson and Kohers, 2002; Soana, 2011; Wu and Shen, 2013)
Explanatory variables				
ESG Score	Score calculated considering 186 relevant ESG measures over 10 categories	ESGSCORE	Refinitiv Eikon	
Bank specific control variables				
Size	Natural logarithm of total assets	LNTA	Bank Focus	(Avgeri et al., 2020; Cornett et al., 2016; Scholtens and Dam, 2007; Shen et al., 2016; Simpson and Kohers, 2002; Wu and Shen, 2013)
Efficiency	Cost-to-income ratio defined as operating expenses divided by operating revenues	CI	Bank Focus	(Avgeri et al., 2020; Shen et al., 2016; Wu and Shen, 2013)
Capitalization	Equity-to-assets ratio defined as the book value of equity divided by total assets	EA	Bank Focus	(Avgeri et al., 2020; Scholtens and Dam, 2007; Shen et al., 2016; Simpson and Kohers, 2002; Wu and Shen, 2013)
Risk	Natural logarithm of the ratio between the sum of ROAA and EA and the standard deviation of ROAA over the full period of the sample	LNZSCORE	Own calculations	(Bouheni, Ameur, Cheffou, and Jawadi, 2014)

TABLE 3 – VARIABLES DEFINITIONS (CONTINUATION)

Industry specific control variables				
Concentration	Ratio of total assets of the three largest banks in each country to total banking sector assets	CONC	World Bank	(Dietrich and Wanzenried, 2011; Kosmidou, 2008; Petria et al., 2015)
Banking industry assets to GDP	Total assets of deposit money banks divided by real GDP per capita	BANKGDP	World Bank	(Demirgüç-Kunt and Huizinga, 1999; Kosmidou, 2008)
Country specific control variables				
Economic growth	Annual real GDP growth rate (%)	GDP	Eurostat	(Avgeri et al., 2020; Forcadell and Aracil, 2017; Shen et al., 2016; Wu and Shen, 2013)
Inflation	Annual average rate of change (%)	INF	Eurostat	(Forcadell and Aracil, 2017; Kosmidou, 2008; Petria et al., 2015)
Institutional environment	Sum of the scores of the six dimensions of World Bank Governance Indicators – voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law and control of corruption.	INST_ENV	World Bank	(Avgeri et al., 2020)
Other variables				
SSM_i	Dummy variable that assumes the value 1 if the observation is directly supervised by the ECB and 0 otherwise.			
T_1	Dummy variable that assumes the value 1 if the post implementation period of SSM (years 2015, 2016 and 2017) and 0 otherwise.			
T_2	Dummy variable that assumes the value 1 if the post implementation period of SSM (years 2018 and 2019) and 0 otherwise.			
$SSM_i T_1$	Dummy variable that assumes the value 1 if the observation corresponds to a SSM-supervised bank in the post implementation period of SSM (years 2015, 2016 and 2017) and 0 otherwise.			

TABLE 3 – VARIABLES DEFINITIONS (CONTINUATION)

Other variables	
$SSM_i T_2$	Dummy variable that assumes the value 1 if the observation corresponds to an SSM-supervised bank in the post implementation period of SSM (years 2018 and 2019) and 0 otherwise.
$SSM_i T_1 ESGScore_i$	Dummy variable that assumes the value 1 if the observation corresponds to an SSM-supervised bank in the post implementation period of SSM (years 2015, 2016 and 2017) and 0 otherwise, multiplied by banks' ESG Score.
$SSM_i T_2 ESGScore_i$	Dummy variable that assumes the value 1 if the observation corresponds to an SSM-supervised bank in the post implementation period of SSM (years 2018 and 2019) and 0 otherwise, multiplied by banks' ESG Score.

3.3. Descriptive statistics

Table 4 shows the descriptive statistics for the dependent and explanatory variables. By looking at the mean values for the dependent variable, it is possible to observe that SSM-banks present a significant lower ROAA when compared to non-SSM banks (0,63% versus 2,11%). Non-SSM banks also present higher dispersion of values for the same variable. The mean of ESG Score is slightly higher for SSM-banks, which means that, on average, they engage more actively in sustainable activities when compared to non-SSM banks. There are significant differences in the average size of banks between the two groups, with the average total assets of SSM-banks totaling €89 045 million and of non-SSM banks totaling €23 783 million, being the dispersion higher in the former group. In what concerns the differences in capitalization, it is possible to notice that non-SSM banks are, on average, better capitalized than SSM-banks and slightly more efficient, since the mean value of the cost-to-income ratio is lower (52,13% for non-SSM banks and 54,51% for SSM-banks). Average Z-score differs substantially for the two groups, indicating that the level of risk exposure is higher for SSM-banks. The values for average bank concentration ratio indicate that SSM-banks operate in more concentrated markets. Similarly, values for average deposit money bank assets to GDP indicate that SSM-banks operate in countries where the size of the banking sector is greater. Average real GDP growth and inflation rate are higher for non-SSM banks. In what concerns to the institutional environment, SSM-banks operate in countries with better quality institutions when compared to non-SSM banks.

TABLE 4 - DESCRIPTIVE STATISTICS

	Mean		Median		Std. Dev.		Max.		Min.		Observations	
	Control	Treated	Control	Treated	Control	Treated	Control	Treated	Control	Treated	Control	Treated
Dependent variable												
ROAA (%)	2,11	0,63	0,79	0,45	7,58	1,64	78,46	25,75	-12,38	-6,74	64	64
Explanatory variables												
ESG Score	67,39	71,52	68,81	75,62	17,89	16,97	94,56	94,56	15,21	18,17	64	64
Bank-specific controls												
Total assets (m EUR)	23 783	89 045	8 128	12 446	40 474	239 546	273 628	1 767 643	6	199	64	64
Cost to income ratio (%)	52,13	54,51	52,17	59,56	30,09	42,38	195,26	681,82	-165,97	-280,42	64	64
Equity-to-assets ratio (%)	11,41	7,58	9,40	6,05	11,01	7,25	76,84	60,35	-3,93	-8,50	64	64
Z-score	62,32	41,69	25,29	27,36	130,50	65,51	773,02	576,91	-3,77	-2,52	64	64
Industry-specific controls												
Bank concentration ratio (%)	62,27	65,05	61,12	61,81	13,38	9,26	95,79	95,42	34,32	51,36	64	64
Deposit money bank assets to GDP (%)	96,66	108,56	100,74	112,95	34,07	24,11	199,45	194,34	36,68	18,01	64	64
Country-specific controls												
Real GDP growth (%)	1,93	1,51	1,85	1,30	2,38	2,41	25,20	25,20	-10,10	-6,60	64	64
Inflation rate (%)	1,46	1,32	1,30	1,20	1,33	1,05	5,80	5,10	-1,40	-1,50	64	64
Institutional environment	5,54	6,33	5,33	6,64	2,71	1,84	10,99	10,34	0,42	2,82	64	64

3.4. Sample and data sources

The sample consists of a data panel of 128 EU banks under the 2011-2019 period. It includes 97 banks from 13 eurozone countries (Austria, Belgium, Cyprus, Estonia, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Slovakia, and Spain) and 31 banks from 7 EU non-euro zone countries (Croatia, Czechia, Denmark, Hungary, Poland, Romania, Sweden). **Table 5** reports the distribution of banks per country. Latvia and Lithuania banks were excluded from the sample since they joined the eurozone in 2014 and 2015, respectively. Also, Luxembourg banks were excluded since they present a different business model than the eurozone banks (Avgeri et al., 2020; Marques and Alves, 2020).

TABLE 5 - DISTRIBUTION OF BANKS PER COUNTRY

SSM	Number of banks
Austria	2
Belgium	4
Cyprus	1
Estonia	2
France	32
Germany	1
Ireland	3
Italy	11
Netherlands	2
Portugal	2
Slovakia	3
Spain	1
Total	64

TABLE 5 - DISTRIBUTION OF BANKS PER COUNTRY (CONTINUATION)

Non-SSM	Number of banks
Austria	6
Belgium	2
Croatia	3
Czechia	6
Denmark	2
France	11
Greece	3
Hungary	4
Ireland	1
Italy	6
Netherlands	1
Poland	9
Portugal	1
Romania	4
Slovakia	1
Spain	1
Sweden	3
Total	64

The treated group is composed by 64 eurozone banks that were classified as significant during the 2014-2019 period, thus being directly supervised by the ECB. According to ECB (2021c), financial institutions are classified as significant if any one of these four conditions is met: (1) the total value of bank's assets exceeds €30 billion; (2) it has economic significance for the specific country or EU economy as a whole, regardless of the size; (3) the total value of its assets exceeds €5 billion and the ratio of its cross-border assets/liabilities in more than one other participating Member State to its total assets/liabilities is above 20%; (4) it has requested or received funding from the ESM or the European Financial Stability Facility. The control group is composed by 64 banks from both eurozone and EU non-euro zone countries.

To construct our sample, we start by collecting a list of active banks in EU countries during the period under analysis using Orbis Bank Focus database. We reached a total of 3 487 banks. Then, we collected data for all variables. Bank specific variables were compiled from Refinitiv Eikon and from Orbis Bank Focus (provided by Bureau

van Dijk). Industry specific and country specific control variables were extracted from World Bank and Eurostat database. To obtain a balanced panel, all banks with missing information in any year or variable were excluded from the sample. We reached a total of 137 banks. After excluding Latvia, Lithuania, and Luxembourg banks and eliminating the ones that leave ECB's list of most significant banks in the euro area during the period under analysis, we end up with 128 banks.

4. Empirical results

As a first step in our empirical analysis, in section 4.1. we present supporting evidence that the parallel trend assumption holds during the pre-treatment period (2011-2014), allowing us to perform valid statistical inference. Section 4.2. presents the results of our regression analysis. Section 4.3. provides additional robustness tests to assess the reliability of our results.

4.1. Does the parallel trend assumption hold?

The DID method requires the fulfillment of the parallel trend assumption to perform valid statistical inference (Avgeri et al., 2020). This assumption states that the average outcome for both treated and control groups, prior to the event of interest, follow a parallel trend and, in the absence of the treatment, the same would have happened over time (Callaway and Sant'Anna, 2020).

In **figure 1**, and following Avgeri et al. (2020) and Fiordelisi et al. (2017), we plot the evolution of the annual average dependent variable (ROAA) into a graph, for both the treated and control group, as a visual inspection of the parallel trend assumption in the pre-treatment period (2011-2014).

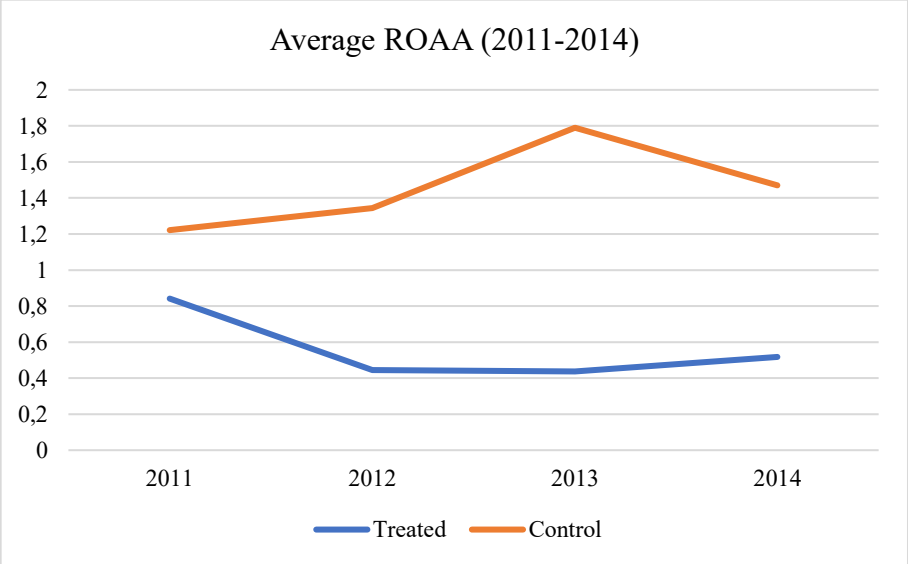

Figure 1 - Visual inspection of the parallel trend assumption in the evolution of ROAA for treated and control groups (2011-2014).

However, comparing the trend of profitability of the two groups without controlling for differences between them may lead to misleading findings, since banks that are under the supervision of the ECB were selected based on specific criteria, namely size. To overcome this issue, and following Avgeri et al. (2020), we estimate equation (2) OLS, for each groups (treated and control):

$$Y_{i,c,t} = \alpha + \beta_1 2011_t + \beta_2 2012_t + \beta_3 2013_t + \beta_4 ESGScore_i + \beta_5 BSV_{i,t} + \beta_6 ISV_{c,t} + \beta_7 CSV_{c,t} + \varepsilon_{i,c,t} \quad (2)$$

where $Y_{i,c,t}$ is the profitability indicator (ROAA) for bank *i*, in country *c*, in period *t*. α represents the intercept or constant term. The time dummy variables 2011_t, 2012_t and 2013_t equal 1 for the years 2011, 2012 and 2013, respectively. $ESGScore_i$ represents the ESG Score provided by Refinitiv Eikon for bank *i*. $BSV_{i,t}$ represents a vector of bank specific control variables. $ISV_{c,t}$ represents a vector of industry specific control variables. $CSV_{c,t}$ represents a vector of country specific control variables. $\varepsilon_{i,t}$ is the residual term. The description of the variables is provided in section 3.2.

In **figure 2**, we plot the year dummies estimated coefficients for equation (2).

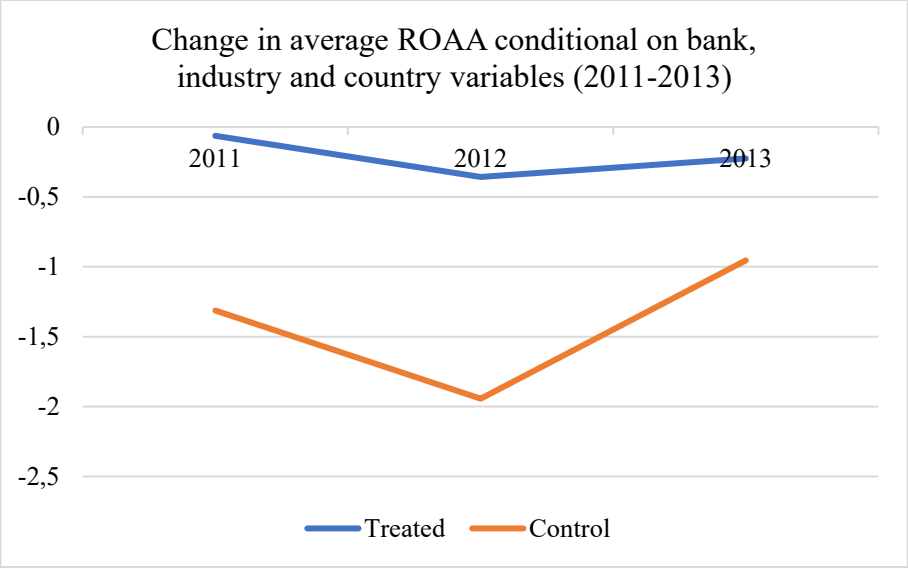

Figure 2 - Visual inspection of the parallel trend assumption considering the change in average ROAA conditional on bank, industry, and country variables for the treated and control groups (2011-2013).

When controlling for bank specific, industry specific, and country specific variables, the parallel trend assumption seems plausible enough. However, there is another reason for this assumption to be violated, besides the imbalances between the treatment and control groups: treated banks' reaction in anticipation of SSM introduction. Some empirical studies explored this issue, as it was previously mentioned in the literature review. For example, Fiordelisi et al. (2017) studied the behavior of banks subject to the Comprehensive Assessment (CA) conducted before the implementation of SSM, and concluded that significant banks reduced their lending activity more than less significant banks to shrink their balance sheets and increase their capitalization. Therefore, in order to check if the parallel trend assumption is violated due to treated banks' reaction in anticipation of SSM introduction, and following Avgeri et al. (2020), we perform a placebo test, focusing on years 2012 to 2014, where 2013 is treated as the year during which a fictious event (i.e., the possible anticipation of SSM establishment) is supposed to have taken place. Thus, 2012-2013 is considered the fictious pre-treatment period and 2014 is considered the post-treatment year. We estimate OLS the following equation:

$$Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 2014_t + \beta_3 ESGScore_i + \beta_4 SSM_i 2014_t + \beta_5 SSM_i ESGScore_i + \beta_6 SSM_i 2014_t ESGScore_i + \beta_7 BSV_{i,t} + \beta_8 ISV_{c,t} + \beta_9 CSV_{c,t} + \varepsilon_{i,c,t} \quad (3)$$

which is very similar to equation (1), except in what concerns to the period dummy variable 2014_t that equals 1 for the year 2014 and 0 otherwise. The description of the variables is provided in section 3.2.

As **Table 6** reports, there is no evidence of statistically significant effects on ROAA resulting from banks' reaction to the announcement and preparation of SSM implementation, reinforcing the idea that the parallel trend assumption holds.

TABLE 6 - PLACEBO TEST (THRESHOLD YEAR: 2013)

Threshold year: 2013	
Variables	**ROAA**
2014	0,260
	(0,584)
SSM*2014	-0,086
	(1,966)
SSM*2014*ESGSCORE	-0,002
	(0,027)
Observations	512
R-squared	0,452
Adjusted R-squared	0,435
Wald test (p-value)	0,000

Table 6 presents the OLS regression results of equation (3). For brevity reasons, only the coefficients of the main independent variables are reported. Standard errors are reported in parentheses. Statistical significance: *, ** and *** at the 10%, 5% and 1% level, respectively.

4.2. Regression analysis

Table 7 reports our estimation results. Columns 1, 2, 3 and 4 present the estimation results for equation (1) adjusted, i.e., including only some of the main explanatory variables. Column 1 presents the estimation results for equation (1), including only $ESGScore_i$ as main explanatory variable. Column 2 presents the estimation results for equation (1), including only SSM_iT as main explanatory variable. T is a dummy variable that equals 1 for the years 2015-2019 (the entire post-treatment period), and 0 otherwise. Column 3 presents the estimation results for equation (1), including SSM_iT_1 and SSM_iT_2 as main explanatory variables. Column 4 presents the estimation results for equation (1), including $ESGScore_i$, SSM_iT and $SSM_iTESGScore_i$ as main explanatory variables. Column 5 presents the estimation results for equation (1), without adjustments. The results for the Wald t-tests reject the null hypothesis of joint insignificance of the explanatory variables.

TABLE 7 - ESTIMATION RESULTS

Variables	Column 1	Column 2	Column 3	Column 4	Column 5
ESGSCORE	0,040***			0,052***	0,051***
	(0,007)			(0,009)	(0,010)
SSM*T		-1,153**		-2,504*	
		(0,472)		(1,464)	
SSM*T1			-0,914*		-2,682*
			(0,537)		(1,610)
SSM*T2			-1,503**		-2,090
			(0,608)		(2,113)
SSM*T*ESGSCORE				0,022	
				(0,020)	
SSM*T1*ESGSCORE					0,027
					(0,022)
SSM*T2*ESGSCORE					0,014
					(0,027)
LNTA	-0,130**	-0,140**	-0,143**	-0,114*	-0,116*
	(0,062)	(0,064)	(0,064)	(0,063)	(0,063)
LNZSCORE	0,005	0,189	0,196	0,134	0,137
	(0,340)	(0,348)	(0,348)	(0,344)	(0,344)
CI	-0,006*	-0,008**	-0,008**	-0,007**	-0,007**
	(0,003)	(0,003)	(0,003)	(0,003)	(0,003)
EA	0,391***	0,377***	0,377***	0,387***	0,386***
	(0,014)	(0,014)	(0,014)	(0,014)	(0,014)
CONC	-0,016	-0,030***	-0,030***	-0,022**	-0,023**
	(0,011)	(0,011)	(0,011)	(0,011)	(0,011)
BANKGDP	0,008	0,012**	0,012**	0,008	0,008
	(0,005)	(0,005)	(0,005)	(0,005)	(0,005)
GDP	-0,011	-0,073	-0,073	-0,064	-0,063
	(0,059)	(0,062)	(0,062)	(0,062)	(0,062)
INF	-0,019	0,114	0,067	0,054	0,035
	(0,100)	(0,106)	(0,113)	(0,105)	(0,112)
INST_ENV	0,283***	0,379***	0,380***	0,324***	0,325***
	(0,057)	(0,057)	(0,057)	(0,057)	(0,058)

TABLE 7 – ESTIMATION RESULTS (CONTINUATION)

R-squared	0,500	0,494	0,494	0,508	0,509
Adjusted R-squared	0,495	0,488	0,488	0,502	0,501
Observations	1152	1152	1152	1152	1152
Wald test (p-value)	0,000	0,000	0,000	0,000	0,000

Column 1 presents OLS estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 ESGScore_i + \beta_2 BSV_{i,t} + \beta_3 ISV_{c,t} + \beta_4 CSV_{c,t} + \varepsilon_{i,c,t}$. Column 2 presents OLS estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 T + \beta_3 SSM_i T + \beta_4 BSV_{i,t} + \beta_5 ISV_{c,t} + \beta_6 CSV_{c,t} + \varepsilon_{i,c,t}$. Column 3 presents OLS estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 T_1 + \beta_3 T_2 + \beta_4 SSM_i T_1 + \beta_5 SSM_i T_2 + \beta_6 BSV_{i,t} + \beta_7 ISV_{c,t} + \beta_8 CSV_{c,t} + \varepsilon_{i,c,t}$. Column 4 presents OLS estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 T + \beta_3 ESGScore_i + \beta_4 SSM_i T + \beta_5 SSM_i ESGScore_i + \beta_6 SSM_i ESGScore_i T + \beta_7 BSV_{i,t} + \beta_8 ISV_{c,t} + \beta_9 CSV_{c,t} + \varepsilon_{i,c,t}$. Column 5 presents OLS estimation results of our main equation (1). For brevity reasons, only the coefficients of the main independent variables are reported. Standard errors are reported in parentheses. Statistical significance: *, ** and *** at the 10%, 5% and 1% level, respectively.

The results presented in column 1 report a positive and statistically significant (at 1% level) impact of the adoption of ESG practices on banks' profitability. The value of 0,040 for ESGSCORE coefficient indicates that, on average, an increase of 1 unit in the ESG Score raises ROAA by 0,040 pp.

The result presented in column 2 for SSM*T coefficient suggests that the implementation of SSM had a negative and significant (at 5% level) impact on SSM-banks' profitability. The value of -1,153 for SSM*T coefficient means that, on average, as we move from the pre-treatment period to the post-treatment period, SSM-banks' profitability was 1,153 pp lower when compared to non-SSM banks' profitability.

In column 3, the results for SSM*T1 and SSM*T2 coefficients suggest that the implementation of SSM had a negative and statistically significant impact on SSM-banks' profitability, which is in line with the results reported in column 2. Such negative impact is more pronounced in the medium-long term. The value of -0,914 for SSM*T1 coefficient (significant at 10% level) means that, on average, as we move from the pre-treatment period to the years immediately after the introduction of SSM, SSM-banks' profitability was 0,914 pp lower when compared to non-SSM banks' profitability. The value of -1,503 for SSM*T2 coefficient (significant at 5% level) indicates that, on average, as we move from the pre-treatment period to the medium-long term, SSM-banks'

profitability was 1,503 pp lower when compared to non-SSM banks' profitability. In sum, these findings suggest that the implementation of SSM had a negative impact on SSM-banks' profitability.

Regarding the results reported in column 4, the positive and statistically significant (at 1% level) coefficient for ESGSCORE suggests that the higher the level of adoption of ESG practices, the higher ROAA, which is in line with results reported in column 1. The negative and statistically significant (at 10% level) estimation result for SSM*T coefficient, is in line with the results reported in column 2 and supports the negative impact of the implementation of SSM on SSM-banks' profitability. The value of -2,504 for SSM*T coefficient means that, on average, as we move from the pre-treatment period to the post-treatment period, SSM-banks' profitability was 2,504 pp lower when compared to non-SSM banks' profitability. Finally, since SSM*T*ESGSCORE is not significant, we may conclude that the implementation of SSM had no impact on ESG-profitability relationship, i.e., in the way the adoption of ESG practices impacts profitability.

Column 5 reports the estimation results of our main equation (1). The result for ESGSCORE coefficient is in line with those reported in columns 1 and 4, supporting the positive ESG-profitability relationship and our hypothesis 1. The value of 0,051 for ESGSCORE coefficient (significant at 1% level) means that, on average, an increase of 1 unit in the ESG Score raises ROAA by 0,051 pp. Regarding the result for SSM*T1 coefficient, it is in line with the one reported in column 3 and does not support our hypothesis 2. The value of -2,682 for SSM*T1 coefficient (significant at 10% level) suggests that, on average, as we move from the pre-treatment period to the years immediately after the introduction of SSM, SSM-banks' profitability was 2,682 pp lower when compared to non-SSM banks' profitability. In sum, we may conclude that the introduction of SSM had a negative impact on SSM-banks' profitability, at least in the years immediately after its implementation. In the medium-long term, the SSM had no significant impact on profitability as it is suggested by SSM*T2 coefficient. Finally, the results also suggest that the SSM had no impact on ESG-profitability relationship, since SSM*T1*ESGSCORE and SSM*T2*ESGSCORE are not significant.

In sum, our results support hypothesis 1: the adoption of ESG practices has a positive impact on banks' profitability. Nevertheless, hypotheses 2 and 3 are rejected since our findings suggest a negative impact of the implementation of SSM on banks' profitability and a neutral impact on ESG-profitability relationship.

The previous empirical evidence regarding ESG-financial performance relationship and the impact of SSM on the banking sector may help to explain our results.

In fact, and according to Shen et al. (2016) and Wu and Shen (2013), banks that engage more actively in ESG practices gain a competitive advantage when compared to the other banks, since ESG activities help to build reputation and trust among customers, translating into higher interest income, higher non-interest income, reduced information asymmetries and agency problems among stakeholders, reduced advertisement expenses and employee hiring/training costs. Such competitive advantage may help to explain our results of higher profitability for banks that present higher ESG Scores.

In what concerns to the negative impact of SSM on banks' profitability, and according to Galema and Koetter (2016), SSM-banks might face a significantly larger regulatory burden, compromising profit and cost efficiency and, therefore, profitability. However, neither the authors nor the present study explored the causal relationship between the SSM and financial performance. Therefore, further research is needed to understand the channels through which the SSM impacts profitability.

Regarding the neutral impact of the implementation of SSM on ESG-profitability relationship. Only recently, more precisely in 2019/2020, has the ECB begun to assess how ESG risks can be incorporated into the three pillars of European Banking Supervision (ECB, 2020). Therefore, it is possible that the higher ESG risk management and disclosure requirements imposed by the ECB during last years (ECB, 2020), do not have an expression in profitability in the considered sample period. In forthcoming studies, we find it particularly interesting to explore the impact of SSM on ESG-profitability relationship, considering a longer time range of analysis.

In what concerns to the determinants of banks' profitability, included as control variables in our model. The negative sign of LNTA estimated coefficient, reported in all

columns, suggests that larger banks present lower profitability. We also find a negative and statistically significant relationship between CI and profitability, suggesting that more efficient banks (with lower cost-to-income ratios) have higher profitability, as suggested by Petria et al. (2015) and Garcia and Guerreiro (2016). The positive and significant (at 1% level) coefficient of EA, reported in all columns, suggests that better capitalized banks present higher profitability. The negative coefficient of CONC (significant in the regression results reported in columns 2, 3, 4 and 5) suggests that banks operating in countries with more concentrated banking systems have lower profitability. The positive and significant (at 5% level) coefficient of BANKGDP, reported in columns 2 and 3, suggests that banks operating in countries where the size of the banking sector is greater present higher profitability. This finding is not in line with the results of the previous empirical studies (Demirgüç-Kunt and Huizinga, 1999). The positive and significant (at 1% level) coefficient of INST_ENV, reported in all columns, suggest that banks operating in countries with better institutional environment present higher profitability. We find no significant relationship between profitability and bank risk (proxied by Z-Score), economic growth, and inflation rate.

4.3. Robustness tests

4.3.1. Heterogeneous effects on profitability for banks operating under different market and institutional settings

In the present section, we check for heterogenous effects on profitability, derived from the adoption of ESG practices and the establishment of SSM, for banks operating in countries with different market and institutional settings. In panel A, we check for heterogeneous effects between banks operating in countries where the size of the banking system is above the median versus below the median. In panel B, we check for heterogeneous effects between banks operating in countries where market concentration is above the median versus below the median. Finally, in panel C, we check for heterogeneous effects between banks operating in countries with an institutional environment above the median versus below the median.

Table 8 presents our estimation results. We use a difference-in-differences approach and, therefore, we add another dummy variable to our equation (1) named

ABOVE, that assumes the value 1 for banks that present above the median values for the variables BANKGDP (Panel A), CONC (Panel B) and INST_ENV (Panel C), and 0 otherwise. As in section 4.2., we estimate our main equation (1) with adjustments (columns 1, 2, 3 and 4), i.e., with only some explanatory variables, and without adjustments (column 5).

TABLE 8 – HETEROGENEOUS EFFECTS ON PROFITABILITY FOR BANKS OPERATING UNDER DIFFERENT MARKET AND INSTITUTIONAL SETTINGS

Panel A: Size of banking sector					
Variables	**Column 1**	**Column 2**	**Column 3**	**Column 4**	**Column 5**
ESGSCORE*ABOVE	-0,037***	-	-	-0,041**	-0,042**
SSM*T*ABOVE	-	-0,623	-	-3,082*	-
SSM*T1*ABOVE	-	-	-0,323	-	-3,216
SSM*T2*ABOVE	-	-	-1,006	-	-2,947
SSM*T*ESGSCORE*ABOVE	-	-	-	0,037	-
SSM*T1*ESGSCORE*ABOVE	-	-	-	-	0,043
SSM*T2*ESGSCORE*ABOVE	-	-	-	-	0,030
R-square	0,503	0,492	0,493	0,509	0,509
Adjusted R-square	0,498	0,486	0,486	0,501	0,500
Observations	1152	1152	1152	1152	1152
Wald test (p-value)	0,000	0,000	0,000	0,000	0,000
Panel B: Market concentration					
Variables	**Column 1**	**Column 2**	**Column 3**	**Column 4**	**Column 5**
ESGSCORE*ABOVE	0,010	-	-	0,059***	0,060***
SSM*T*ABOVE	-	-0,520	-	-0,990	-
SSM*T1*ABOVE	-	-	-0,469	-	-0,879
SSM*T2*ABOVE	-	-	-0,650	-	-1,186
SSM*T*ESGSCORE*ABOVE	-	-	-	0,009	-
SSM*T1*ESGSCORE*ABOVE	-	-	-	-	0,007
SSM*T2*ESGSCORE*ABOVE	-	-	-	-	0,012
R-squared	0,503	0,494	0,495	0,517	0,517
Adjusted R-squared	0,498	0,488	0,487	0,510	0,508
Observations	1152	1152	1152	1152	1152
Wald test (p-value)	0,000	0,000	0,000	0,000	0,000

TABLE 8 – HETEROGENEOUS EFFECTS ON PROFITABILITY FOR BANKS OPERATING UNDER DIFFERENT MARKET AND INSTITUTIONAL SETTINGS (CONTINUATION)

Panel C: Institutional environment					
Variables	**Column 1**	**Column 2**	**Column 3**	**Column 4**	**Column 5**
ESGSCORE*ABOVE	0,070***	-	-	0,133***	0,132***
SSM*T*ABOVE	-	-1,086**	-	-2,115	-
SSM*T1*ABOVE	-	-	-0,770	-	-1,465
SSM*T2*ABOVE	-	-	-1,467**	-	-2,944
SSM*T*ESGSCORE*ABOVE	-	-	-	0,017	-
SSM*T1*ESGSCORE*ABOVE	-	-	-	-	0,010
SSM*T2*ESGSCORE*ABOVE	-	-	-	-	0,026
R-squared	0,509	0,495	0,496	0,529	0,529
Adjusted R-squared	0,504	0,489	0,489	0,521	0,520
Observations	1152	1152	1152	1152	1152
Wald test (p-value)	0,000	0,000	0,000	0,000	0,000

Column 1 presents OLS estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 ABOVE_i + \beta_2 ESGScore_i + \beta_3 ABOVE_i ESGScore_i + \beta_4 BSV_{i,t} + \beta_5 ISV_{c,t} + \beta_6 CSV_{c,t} + \varepsilon_{i,c,t}$. Column 2 presents OLS estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 T + \beta_3 ABOVE_i + \beta_4 SSM_i ABOVE_i + \beta_5 SSM_i ABOVE_i T + \beta_6 BSV_{i,t} + \beta_7 ISV_{c,t} + \beta_8 CSV_{c,t} + \varepsilon_{i,c,t}$. Column 3 presents OLS estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 T_1 + \beta_3 T_2 + \beta_4 ABOVE_i + \beta_5 SSM_i ABOVE_i + \beta_6 SSM_i ABOVE_i T_1 + \beta_7 SSM_i ABOVE_i T_2 + \beta_8 BSV_{i,t} + \beta_9 ISV_{c,t} + \beta_{10} CSV_{c,t} + \varepsilon_{i,c,t}$. Column 4 presents OLS estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 T + \beta_3 ESGScore_i + \beta_4 ABOVE_i + \beta_5 SSM_i ABOVE_i + \beta_6 SSM_i ABOVE_i T + \beta_7 SSM_i ABOVE_i ESGSCore_i + \beta_8 SSM_i ABOVE_i ESGSCore_i T + \beta_9 BSV_{i,t} + \beta_{10} ISV_{c,t} + \beta_{11} CSV_{c,t} + \varepsilon_{i,c,t}$. Column 5 presents OLS estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 T_1 + \beta_3 T_2 + \beta_4 ESGScore_i + \beta_5 ABOVE_i + \beta_6 SSM_i ABOVE_i + \beta_7 SSM_i ABOVE_i T_1 + \beta_8 SSM_i ABOVE_i T_2 + \beta_9 SSM_i ABOVE_i ESGSCore_i + \beta_{10} SSM_i ABOVE_i ESGSCore_i T_1 + \beta_{11} SSM_i ABOVE_i ESGSCore_i T_2 + \beta_{12} BSV_{i,t} + \beta_{13} ISV_{c,t} + \beta_{14} CSV_{c,t} + \varepsilon_{i,c,t}$. For brevity reasons, only the coefficients of the main independent variables are reported. Statistical significance: *, ** and *** at the 10%, 5% and 1% level, respectively.

The positive impact of the adoption of ESG activities on profitability is higher for banks operating in countries where the size of the banking sector is smaller, market concentration is greater, and the institutional environment is better. Regarding the impact of the implementation of SSM on profitability, the negative sign for SSM*T*ABOVE coefficient reported in column 4 of panel A suggests that banks operating in countries where the size of the banking sector is greater were more negatively impacted by the introduction of SSM, compared to banks operating in countries where the size of the banking sector is smaller. Market concentration does not have a significant impact in the

way the implementation of SSM impacts banks' profitability. The negative signs for SSM*T*ABOVE (column 2, panel C) and SSM*T2*ABOVE (column 3, panel C) coefficients suggest that banks operating in countries with better institutional environment were more negatively impacted by the introduction of SSM. However, the results for SSM*T*ABOVE, SSM*T1*ABOVE and SSM*T2*ABOVE coefficients, reported in the five columns of the three panels, are not consistent with each other. Therefore, we cannot conclude that there are heterogenous effects of the implementation of SSM on profitability for banks operating in countries with different market and institutional settings. Also, the results for SSM*T*ABOVE*ESGSCORE, SSM*T1*ABOVE*ESGSCORE and SSM*T2*ABOVE*ESGSCORE coefficients reported in the five columns of the three panels, suggest that there are not significant heterogenous effects of the implementation of SSM on ESG-profitability relationship for banks operating in countries with different market and institutional settings.

4.3.2. Placebo tests

We perform two placebo tests, following Avgeri et al. (2020), where 2015 and 2016 are treated as the threshold years. By doing so, we are trying to explore if other policy events (e.g., the Paris Agreement in 2015 and the implementation of the SRM in 2016) could have impact on profitability.

TABLE 9 – PLACEBO TESTS (THRESHOLD YEARS: 2015 AND 2016)

Threshold year: 2015		
Variables	**Column 1**	**Column 2**
SSM*2016_2019	-2,834*	
SSM*2016_2017		-3,373*
SSM*2018_2019		-1,954
SSM*2016_2019*ESGSCORE	0,027	
SSM*2016_2017*ESGSCORE		0,036
SSM*2018_2019*ESGSCORE		0,014
Observations	1152	1152
R-squared	0,507	0,508
Adjusted R-squared	0,501	0,500
Wald test (p-value)	0,000	0,000

TABLE 9 - PLACEBO TESTS (THRESHOLD YEARS: 2015 AND 2016) (CONTINUATION)

Threshold year: 2016		
Variables	**Column 3**	**Column 4**
SSM*2017_2019	-1,895	
SSM*2017		0,624
SSM*2018_2019		0,994**
SSM*2017_2019*ESGSCORE	0,016	
SSM*2017*ESGSCORE		0,028
SSM*2018_2019*ESGSCORE		0,007
Observations	1152	1152
R-squared	0,506	0,506
Adjusted R-squared	0,500	0,499
Wald test (p-value)	0,000	0,000

Column 1 presents our estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 2016\_2019_t + \beta_3 ESGScore_i + \beta_4 SSM_i ESGScore_i + \beta_5 SSM_i 2016\_2019_t + \beta_6 SSM_i ESGScore_i 2016\_2019_t + \beta_7 BSV_{i,t} + \beta_8 ISV_{c,t} + \beta_9 CSV_{c,t} + \varepsilon_{i,c,t}$. Column 2 presents our estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 2016\_2017_t + \beta_3\ 2018\_2019_t + \beta_4\ ESGScore_i + \beta_5\ SSM_i ESGScore_i + \beta_6\ SSM_i 2016\_2017_t + \beta_7\ SSM_i ESGScore_i 2016\_2017_t + \beta_8\ SSM_i 2018\_2019_t + \beta_9\ SSM_i ESGScore_i 2018\_2019_t + \beta_{10}\ BSV_{i,t} + \beta_{11} ISV_{c,t} + \beta_{12} CSV_{c,t} + \varepsilon_{i,c,t}$. Column 3 presents our estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2\ 2017\_2019_t + \beta_3\ ESGScore_i + \beta_4\ SSM_i ESGScore_i + \beta_5\ SSM_i 2017\_2019_t + \beta_6 SSM_i ESGScore_i 2017\_2019_t + \beta_7 BSV_{i,t} + \beta_8 ISV_{c,t} + \beta_9 CSV_{c,t} + \varepsilon_{i,c,t}$. Column 4 presents our estimation results of regression $Y_{i,c,t} = \alpha + \beta_1 SSM_i + \beta_2 2017_t + \beta_3 2018\_2019_t + \beta_4 ESGScore_i + \beta_5 SSM_i ESGScore_i + \beta_6\ SSM_i 2017_t + \beta_7\ SSM_i ESGScore_i 2017_t + \beta_8\ SSM_i 2018\_2019_t + \beta_9\ SSM_i ESGScore_i 2018\_2019_t + \beta_{10} BSV_{i,t} + \beta_{11} ISV_{c,t} + \beta_{12} CSV_{c,t} + \varepsilon_{i,c,t}$. For brevity reasons, only the coefficients of the main independent variables are reported. Statistical significance: *, ** and *** at the 10%, 5% and 1% level, respectively.

The results reported in **Table 9** suggest that other policy events implemented after the SSM do not have a statistically significant impact on banks' profitability, thus supporting our main findings.

5. Conclusion

The 2008 financial crisis and the subsequent eurozone sovereign debt crisis shed light on the need to make regulatory and supervisory reforms in Europe, in order to promote a better functioning, more resilient and integrated banking system. The recognition of this need led to the creation of the European Banking Union, based on three pillars: the Single Supervisory Mechanism, the Single Resolution Mechanism, and the European Deposit Insurance Scheme. The Single Supervisory Mechanism was the first pillar to be implemented in November 2014. Under the SSM, the ECB works closely to the national supervisory authorities to monitor the most significant banks of the euro area and other banks of EU non-euro area countries that choose to participate voluntarily.

The creation of the European Banking Union was not the only change that the 2008 crisis brought about in the European banking system. Banks have been accused of triggering the financial crisis, for being obsessed with profitability and engaging in risky speculations. Therefore, since then, they start to engage more actively in ESG practices, to restore their reputation among the community.

In the present dissertation, we study (1) the impact of the adoption of ESG practices on banks' profitability, (2) the impact of the implementation of SSM on banks' profitability and (3) the joint impact of the adoption of ESG practices and the implementation of SSM on banks' profitability. In our analysis, we employ the return on average assets (ROAA) as indicator of profitability, use a difference-in-differences (DID) approach and consider a balanced data panel of 128 European banks under the 2011-2019 period.

Our results suggest the existence of a positive and statistically significant relationship between the adoption of ESG practices and profitability, which may signal that banks that engage more actively in ESG activities have better reputation and a competitive advantage relative to the other banks. The positive impact of the adoption of ESG activities on profitability is higher for banks operating in countries where the size of the banking sector is smaller, market concentration is greater, and the institutional environment is better. Regarding the negative impact of SSM on profitability, it may

suggest that SSM-banks face higher regulatory costs, thus compromising profitability. Finally, with regard to the neutral impact of SSM on ESG-profitability relationship, one possible explanation may be the recent imposition by the ECB of higher ESG risk management and disclosure standards under the SSM, without significantly repercussion on profitability in the period under analysis. Differences in the market context and in the institutional environment in which banks operate do not influence the way the implementation of SSM impacts profitability and ESG-profitability relationship.

The present dissertation contributes to the literature in several ways. It is the first empirical study, to the best of our knowledge, that explores the joint impact of the adoption of ESG practices and the implementation of SSM on banks' profitability. We also provide empirical evidence contributing (1) to the long-standing debate about the impact of the adoption of ESG practices on banks' financial performance and (2) to the scarce literature regarding the impact of SSM on banks' profitability.

This study has implications not only for academics, but also for financial institutions in terms of business strategy definition (Marques and Alves, 2021); for policymakers, providing valuable information of the impact of their decisions; for stakeholders and investors, in terms of reactions and expectations regarding the allocation of capital to ESG activities and the imposition of transnational supervision standards; and for society in general.

6. Limitations of the study and future research

The present study presents some limitations. One limitation is the reduced size of the sample. We start by collecting (from Orbis Bank Focus) a list of active banks in EU countries during the period under analysis. Only 64 of 117 significant institutions directly supervised by the ECB and 64 non-SSM banks were included, due to missing data for several variables. When the only missing variable was the ESG Score, and to avoid eliminating the bank from the sample, the ultimate owner's ESG Score was considered. Another limitation is the choice of the proxies for our variables. When choosing, we took into consideration data availability and the literature. However, there are a multitude of alternative measures and there is no guarantee that we choose the best ones. Still regarding the limitations related with our variables, it is worth mentioning that for CONC and BANKGDP, we assumed the values of 2017 to be equal for 2018 and 2019, since for the most recent years there was no data available.

Regarding the impact of SSM on banks' financial performance and since it is a relatively recent event, further research is needed, including more data and considering a longer time range. In particular, and as mentioned in the section where we present the empirical results of our study, further research is needed to fully understand the channels through which the implementation of SSM impacts profitability. In forthcoming studies, we also find it particularly interesting to explore the impact of SSM on ESG-profitability relationship. In fact, ECB concerns over ESG risk management and disclosure have increased in recent years. Therefore, in the near future, the higher supervisory requirements may have a significant impact on SSM-banks' financial performance, thus demanding further research.

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