Essays on Credit Risk, Information Environment and Uncertainty

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Abstract

Chapter 1 discusses the investors' reactions to events due to economic policy uncertainty, and changes in the regulatory environment. Using the financial market players' actions such as governments' during an uncertain environment and firms' information environment including financial and non-financial disclosures, this thesis makes an introduction to investors' stance on main uncertainty periods and regulatory changes.

In Chapter 2, I examine the investors' confidence in the UK government's actions to achieve its Brexit goal. Using an objective approach where I employ main Brexit events (the UK Referendum vote on June 23, 2016, Triggering of Article 50 on March 29, 2017, Brexit day on January 2020, etc.), I investigate the investors' perception of the UK government actions to achieve its Brexit goal. This chapter tries to find out whether the UK government's actions are taken for granted by the investors to complete its Brexit goal.

Chapter 3 shows that the bank opacity provides sufficient information about the banks' credit risk under a supervision change of Single Supervisory Mechanism (SSM). In this context, I break down credit risk into its factors of default and information risk,

then focus on the effect of bank opacity (i.e. information risk) on the pricing of a credit risk after the introduction of SSM.

In Chapter 4, I examine the effect of banks' information environment due to their non-financial disclosures (sustainability disclosures) on their creditworthiness, in particular, using ESG scores, on the pricing of CDS spreads. In this chapter, I focus on ESG scores, particularly ESG governance pillars, to investigate investors' trust in banks after the European debt crisis by assessing the link between credit risk and ESG scores.

In Chapter 5, I examine the nexus between ESG activities and credit risk of non-financial firms after the Covid-19 crisis. This chapter questions whether improvement in ESG scores is beneficial for non-financial firms to decrease their credit risk, i.e. increasing their creditworthiness.

Chapter 6 concludes this thesis by highlighting significant remarks, limitations, and avenues for future research.

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Declaration

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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Chapter 1

Introduction

The information environment of firms gives crucial insights into their financial and non-financial positions on the current state of the economy and expectations regarding the future. Therefore, investors pay close attention to the measures taken by financial market players like governments and firms' information disclosures.

During uncertainty periods such as Covid-19, the UK Referendum vote to exit the European Union in June 2016, and the European debt crisis in 2010, the importance of information disclosures increases as evaluating the creditworthiness of business becomes even more complex. Therefore, investors employ financial and non-financial information to support their decision-making mechanisms and monitor measures taken by financial market players such as governments like the UK government's actions after the UK's Referendum vote in June 2016.

UK referendum vote on June 23, 2016, is one of the peaks of the world uncertainty index (Ahir et al. (2022)) and this period is surrounded by various actions taken by

the UK government which questioned the achievement of the Brexit goal. From the UK's Referendum vote day on 23 June 2016, till the end of the transition period on 31 December 2020, the Brexit process witnessed crucial stages that significantly affected the Brexit process including 1) UK's referendum vote on June 23, 2016, 2) UK's triggering of Article 50 on March 29 2017, 3) Withdrawal Act becomes law on June 26, 2018; 4) Brexit plan suffers defeat in the House of Commons on February 14, 2019; 5) Former PM May loses vote second vote time on March 12, 2019, 2019, 6) former Prime Minister May's losing loses vote a third time on March 29, 2019; 7) Brexit Party wins in European Parliament elections on May 26, 2019, 8) Boris Johnson's becomes new PM on July 23 2019; 9) Extension of Brexit deal on October 19, 2019, 10) UK General Election day on 12 December 2019, 11) Ratification of Brexit deal on 30 January. Chapter 2 of the thesis studies the following question: Did investors trust that the UK Government was able to manage the Brexit process? Using an objective approach based on the co-movement between sovereign and corporate CDS spread of the UK and European firms, Chapter 2 examines the concept of government credibility. If UK government actions are (not) valid, then we expect to find a positive (negative or insignificant) effect on the corporate credit risk. There exist two transmission mechanisms to explain this response: (1) government guarantees, and (2) the business cycle. An increase (decrease) in the nexus between sovereign and corporate credit risk is associated with a higher (lower) likelihood of government support and a higher (lower) interconnectedness with

the domestic economy due to limited access to European markets. Results from Chapter 2 show an increase in the nexus between sovereign and corporate CDS spread after the UK's referendum vote on June 23, 2016, indicating increased sensitivity of firms to the sovereign risk with the UK government's Brexit goal. Results from the Differences-in-Differences (DID) analysis show a varying impact depending on the uncertainty of each Brexit stage on the accomplishment of the Brexit. As expected, Brexit stages with higher uncertainty in the achievement of the Brexit goal appear to disrupt investors' trust in UK government actions and have a negative (no significant effect) impact on the nexus between sovereign and corporate CDS spread. On the other hand, Brexit stages with a lower uncertainty in the accomplishment of the Brexit goal show an increase in the co-movement in sovereign and corporate CDS spread, implying an increase in trust in the UK government's actions to achieve its goal of Brexit.

Chapter 2 contributes to the extant literature in several folds. There is virtually no research on the impact of government actions on corporate credit risk and Chapter 2 draws attention to the evaluation of the credibility of government actions. This study is also important in terms of analysing the effects of government actions on the financial markets by constructing an objective approach.

In Chapter 3 of this study, by drilling down to components of credit risk based on the accounting model of Duffie & Lando (2001), I investigate the effect of bank information opacity on the pricing of a credit risk after a change in supervision mechanism, i.e.

Single Supervisory Mechanism (SSM).

By measuring bank opacity based on widely used accounting literature (e.g., Dou et al. (2018), Nguyen et al. (2022)), in Chapter 3 of this study, I examine the changes in credit risk premiums due to insufficient financial information disclosures and I expect that an increase (decrease) in the bank opacity is associated with an increase (decrease) in the CDS spreads after controlling for the bank default risk. Further, I study the causal effect of a change in bank supervision through examining the Single Supervisory Mechanism (SSM), the first pillar of the Banking Union in 2014, on the association between bank opacity and credit risk premium. The effects of SSM regulation on association between bank opacity and credit risk can be explained from two perspectives. From the stakeholders' view, higher cost pressures for banks under the centralized mechanism are expected to have higher bank opacity to mask negative income prospects, therefore stakeholders' perspective implies an increase on the investors' credit risk premiums. On the other hand, from the shareholders' perspective, SSM regulation increases scrutiny and oversight for significant banks under the single supervision and therefore it is expected have a positive effect on their asset quality, therefore a negative effect on investors' credit risk premiums.

Findings from Chapter 3 show that after the launch of SSM, investors increase their credit risk premiums on opaque and significant banks. This finding is in line with the stakeholder's view: Single Supervisory Mechanism increases the costs on the

SSM-supervised banks compared to non-SSM banks as it puts pressure on the future profitability of SSM-supervised banks and gives rise to managerial discretion and therefore bank opacity that is reflected as an inflated credit risk premium by the investors. Thus, investors penalise centrally supervised banks due to additional costs pressures resulting from the implementation of tighter direct supervision. The framework introduced in Chapter 3 to investigate the credit risk provides bank opacity as a determinant of bank credit risk, particularly for systemically important banks.

The main contribution of this Chapter 3 is that, to my knowledge, this is the first attempt in constructing a link between credit risk premiums and banks' information sharing under a supervision change. Chapter 3 also complements to the existing literature on the bank opacity (e.g., Beatty & Liao (2014), Dou et al. (2018), Nguyen et al. (2022)) and also limited literature investigating the market reaction to bank information disclosures (e.g., Chiu et al. (2018), Altunbaş et al. (2022)) and studies investigating the effect of the supervision change on the stock market return (Andrieş et al. (2020)) and bank risk disclosure (Altunbaş et al. (2022)).

In Chapter 4 of this thesis, I explore the gaining interest in non-financial disclosures of environmental, social and governance (ESG) scores. After the European Union's Directive in 2014 on the disclosure of non-financial disclosures, reporting ESG scores have gained great importance as ESG scores have been used by investors as an input for investment goals.

Although it took interest in recent years, these scores particularly those on the governance pillars have been disclosed for more than a decade. In Chapter 4 of this thesis, I examine the effect of the European debt crisis and following bail-in regulation on the nexus between ESG scores and bank credit risk. This chapter explores one of the economic policy uncertainty periods of the European debt crisis that significantly affected the banking sector: by looking at the periods of pre-bail (1 January 2010- 1 January 2011), during bail-in (1 January 2011- 6 July 2012) and post-bail-in periods (14 April 2014-1 January 2016) similar to the analysis of (Fiordelisi, Girardone, Minnucci & Ricci (2020)).

The transmission from ESG scores to credit risk can be explained with two views: risk mitigation and over-investment. The risk mitigation view is based on the risk management goals and values addition by investing in moral capital (e.g.,Godfrey et al. (2009), Chiaramonte et al. (2021)). If this view is valid, investor decreases their credit risk premiums on banks with higher ESG performance as those banks creates value at the same time contributes to the sake of society and long-term sustainability goals. Therefore, investing in ESG activity increases their resilience under stressful events and thus increases their creditworthiness. From the over-investment view, based on agency theory (e.g., Barnea & Rubin (2010), Chiaramonte & Casu (2013)), banks with better ESG scores tend to involve in opportunistic managerial behaviour by investing in ESG activities to sound more responsible and increase their reputation but their efforts for the

sake of their own rather than society as a whole. Therefore, from the over-investment view, banks with superior ESG scores are associated with opportunistic behaviours rather than risk management goals. This, results in higher credit risk premiums as according to the over-investment view superior ESG performance does not increase banks' resilience under shocks or any economic downturns.

Chapter 4 shows that investors lower the credit risk of banks with superior ESG scores after the European debt crisis (or pre-bail-in period) which presents evidence of the investors' confidence in banks' management to govern risks during economic uncertainty periods and, to maintain their creditworthiness in the long run. Results from the bail-in (1 January 2011- 6 July 2012) are similar to the European debt crisis (1 January 2010- 1 January 2011) with a lower effect, investors find banks with higher ESG scores more creditworthy and lower their credit risk of those banks. Finally, results from after the bail-in mechanism are higher compared to the previous periods (European debt crisis (pre-bail in) and during bail-in periods) which implies investors' confidence in the bail-in mechanism (14 April 2014-1 January 2016) is higher for banks with higher ESG scores.

Chapter 4 complements the prior literature in several strands: it contributes to the burgeoning literature (Bond & Zeng (2022)) on corporate sustainability disclosures, particularly those employing ESG metrics. This chapter also adds to limited research examining the relationship between non-financial disclosures and bank credit risk through

the employment of a credit risk measure from a market perspective. To my knowledge, this study is the first to present evidence on the effect of banks' information environment on credit risk during economic policy uncertainty periods by investigating banks' governance capacity. Prior literature looks at the corporate governance practices on the credit risk or financial stability during the financial crisis (Anginer et al. (2018)).

This study is also the first to provide evidence in showing the effect of banks' management ability to cope with economic policy uncertainty, i.e., the European debt crisis and following the bail-in mechanism process and their stance against those significant events. Finally, this chapter contributes to the literature by focusing on bank regulation (Bonner & Eijffinger (2016), Fiordelisi et al. (2017), Banerjee & Mio (2018), DeYoung et al. (2018)) from a bank-bail out and bail-in regulatory perspective and enhances recent but limited literature studying the effects of ESG scores on the bank risk (Di Tommaso & Thornton (2020), Aevoae et al. (2022), Chiaramonte et al. (2021)).

The Covid-19 crisis has brought the greatest recession to the economy since the Global Financial crisis and investors call it the 21st century's first sustainability crisis (Morgan (2020)). Covid-19 has affected different economic agents like investors by affecting behaviour such as altering their risk perceptions. After the Covid-19 that coincided with increased concerns regarding climate issues and sustainability, investors incorporated ESG activities in their decision-making tools to assess the creditworthiness of the firms under a sustainability crisis. In this context, Chapter 5 of this thesis

investigates the effect of Covid-19 shocks on the nexus between credit risk and ESG activities for non-financial corporations (NFCs). This chapter first examines the effect of ESG scores on the creditworthiness of non-financial firms and investigates the nexus between ESG scores and credit risk after the Covid-19 shock. Then, this analysis replicates the same analysis based on different sub-sectors including industrial, energy, communications, basic materials, consumer-cyclical and consumer-non-cyclical.

Increased engagement in ESG activities and its effect on firms' credit risk can be explained with two views as in Chapter 4 of this PhD thesis: risk mitigation and over-investment. The risk mitigation view is based on the risk management goals and values addition by investing in moral capital (e.g.,Godfrey et al. (2009), Chiaramonte et al. (2021)). If this view is valid, investor decreases their credit risk premiums on NFCs with higher ESG performance as those firms creates value at the same time contributes to the sake of society and long-term sustainability goals. Therefore, investing in ESG activity increases their resilience under stressful events and thus increases their creditworthiness. From the over-investment view, based on agency theory ((e.g., Barnea & Rubin (2010), Chiaramonte & Casu (2013)), firms with better ESG scores tend to involve in opportunistic managerial behaviour by investing in ESG activities to sound more responsible and increase their reputation but their efforts for the sake of their own rather than society as a whole. Therefore, from the over-investment view, firms with superior ESG scores are associated with opportunistic behaviours rather than risk

management goals. This, results in higher credit risk premiums as according to the over-investment view superior ESG performance does not increase firms' resilience under shocks or any economic downturns.

Results from Chapter 5 show an increase in the nexus between ESG scores and credit risk after the Covid-19 crisis for NFCs that improved their ESG scores, indicating a decrease in their creditworthiness from the investors' perspective in line with agency theory (over-investment view).

Chapter 5 contributes to the extant literature in several folds. There is virtually no research investigating the effect of the Covid-19 crisis on the creditworthiness of the non-financial sector and its association with ESG scores. This study is also important in terms of showing the Covid-19 effects from the sector breakdown by defining each firm with improvement in ESG scores. This study also complements to limited literature on the nexus between credit risk-ESG scores (Chiaramonte et al. (2021), Aevoae et al. (2022)) from the non-financial firms perspective and as well as few research on the Covid-19 crisis (Demers et al. (2021), Ilhan et al. (2021)).

Chapter 2

Investor Confidence in Government's Ability to Run Complex Actions: the Brexit case[1]

2.1 Introduction

There is copious literature investigating the effect of policymakers' actions on the various aspects of the economy. The spectrum of policy actions analyzed is considerable, ranging from interventions made by monetary authorities, both conventional actions (see for recent studies e.g., Galariotis et al. (2018), Curdia et al. (2020), Hohberger et al. (2020)) and non-conventional actions (Fratzscher et al. (2016), Jäger & Grigoriadis (2017), Varghese & Zhang (2018), Apergis et al. (2020), Luck & Zimmermann (2020)), and other authorities, such as fiscal authorities (Gootjes & de Haan (2020), Azad et al. (2021)) and legislative authorities introducing a new piece of regulation, e.g. in banking (Armstrong et al. (2010), Bonner & Eijffinger (2016), Fiordelisi et al. (2017), Banerjee

[1]A version of the study was presented at FINEST and EFiC Conferences in June and July 2022, respectively.

& Mio (2018), DeYoung et al. (2018)). Policy actions are typically used as exogenous shocks to check the effects on a given category of economic agents after the entry in force of the new policy. However, a number of studies also analyze the effect generated by these actions before their entry into force (usually, at its first announcement) to account for the anticipation behaviour (Drago & Gallo (2016), Bruno et al. (2018), Ambler & Rumler (2019), Fiordelisi, Minnucci, Previati & Ricci (2020)) the underlying assumption in all these works is that policy-makers are credible in successfully achieving their actions.

Following the UK's watershed decision (aka "Brexit") to leave the European Union on June 23, 2016, only a few studies have been analysing the effects focusing on various economic agents, such as stock market (Ramiah et al. (2017), Davies & Studnicka (2018), Shahzad et al. (2019)), banking sector (Samitas et al. (2018)), and impacts on the economy such as trade (Kee & Nicita (2017), Sampson (2017), Breinlich et al. (2020), Fernandes & Winters (2021), Graziano et al. (2021)). Other works have investigated the impact of Brexit on UK firms (see e.g. Gornicka (2018), Hill et al. (2019)). This chapter is closely related to literature on the market reaction to regulation (Armstrong et al. (2010), Bruno et al. (2018), Fiordelisi, Minnucci, Previati & Ricci (2020)), monetary or fiscal policy interventions (Fiordelisi & Galloppo (2018)), limited literature on the government measures to fight against Covid-19 (Ashraf (2020), Chan-Lau & Zhao (2020)). Particularly this chapter is associated with very few studies studying the stock market reaction to Brexit events (Schiereck et al. (2016), Ramiah et al. (2017), Shahzad

et al. (2019)). This study differs from prior literature in that using Brexit related events starting with the UK's Referendum day as a natural experiment to investigate credibility of government actions to accomplish the goal of Brexit.

Brexit process is a highly influential process for the future between the UK and EU. Therefore, analysing the effect of Brexit on the CDS market through its crucial steps is important to understand the credibility of government actions on the financial markets, particularly on the investors. CDS market is an important input in understanding investors' valuations of the corporate risk. CDS instruments are hedging instruments, providing a protection against credit risk due to default on its debt (see e.g. Acharya et al. (2014), Bedendo & Colla (2015)), and capture the creditworthiness of firms and sovereigns (Ejsing & Lemke (2011), Annaert et al. (2013), Singh et al. (2016), Culp et al. (2018*a*), D'errico et al. (2018)) show that banks' CDS spread tends to rise with an increase in the sovereign CDS spreads as they hold more of government debt securities which tend to increase the interconnection with the sovereign CDS spread. On the other hand, Acharya et al. (2014) describes the impacts of sovereign interventions as the sovereign-bank loop and this feedback is receiving increasing attention in the literature (Alter & Schüler (2012), Li & Zinna (2018)). To study the link between sovereign and corporate credit risk, we use CDS spread which is highly responsive to increased tension in the markets that UK witnessed after the referendum vote on 23 June 2016. Based on this link between sovereign and corporate credit risk, this chapter examines

the credibility of government actions after the UK's Referendum vote to complete its complex goal of Brexit.

Brexit provides us with a good setting to measure the credibility of a government for its complex actions, whose successful completion could not be taken for granted. From the UK's Referendum vote day on 23 June 2016, till the end of the transition period on 31 December 2020, Brexit process witnessed crucial stages that significantly affected the Brexit process including 1) UK's referendum vote on June 23, 2016, 2) UK's triggering of Article 50 on March 29 2017, of Treaty of Rome[2] on March 29, 2017, 3) Withdrawal Act becomes law on June 26, 2018; 4) Brexit plan suffers defeat in the House of Commons on February 14, 2019; 5) former PM May loses vote second vote time on March 12, 2019, 2019, 6) former Prime Minister May's losing loses vote a third time on March 29, 2019; 7) Brexit Party wins in European Parliament elections on May 26, 2019, 8) Boris Johnson's becomes new PM on July, 23 2019; 9) extension of Brexit deal on October 19, 2019, 10) UK General Election day on 12 December 2019, 11) ratification of Brexit deal on 30 January [3], known as the exit of UK on 31 January 2020, and at the same time starting date of the transition negotiations period between UK and EU, and 12) lastly end of transition period on December 31, 2020 [4]. Thus, this study employs the varying effects of the twelve Brexit stages listed above to examine the

[2]Article 50 is a clause in the European Union's (EU) Lisbon Treaty that outlines the steps to be taken by a country seeking to leave the bloc voluntarily. Invoking Article 50 kick-starts the formal exit process and allows countries to officially declare their intention to leave the EU.

[3]namely exit of UK on 31 January 2020

[4]Brexit day on 31 January 2020 started the transition period that ending by 31 December 2020

credibility of UK government during the Brexit process.

This study addresses the following research question: Did investors trust that the UK Government was able to manage the Brexit process? We use an objective approach based on the co-movement between sovereign and corporate CDS spread of the UK and European firms to measure government credibility. The main idea is straightforward: After the UK's Referendum on June 23, 2016, UK firms had to face more difficulties in trading in Europe both exporting and importing products and services and, thus, domestic firms were more connected with the UK economy and thus their corporate risk became more correlated to the domestic country risk. Put it differently, the trust of investors in the UK government's actions to accomplish its ultimate Brexit goal would expose them to hedge against increased domestic country risk hence implying a natural rise in the corporate risk premiums. From UK's Referendum vote on June 23, 2016, until the UK's official complete exit (i.e., end of the transition period) from the European Union on 31 December 2020, UK government actions have varying impacts on its Brexit goal. Within this scope, Brexit stages showing a positive step in its successful completion (showing lower uncertainty on the Brexit steps taken) are followed by a significant increase in the co-movement between the credit risk of the sovereign and corporate CDS spreads. The reason behind this is that being close to Brexit makes firms more dependent on the public guarantees in the event of any default and also increases the correlation with the business cycles of the UK economy. Conversely, Brexit stages resulting in a disruption

in the Brexit process (i.e., showing an increased uncertainty of the UK's departure from the EU, i.e, Brexit) are followed by a significant decline in the co-movement or no impact between the credit risk of the sovereign and corporate CDS spread. The reason behind this decline is just opposite to events that increase the possibility of the UK's exit from the EU. A decrease in the possibility of being rescued by public guarantees and less sensitivity to market risk or UK government business cycles. If our hypotheses are met, this provides a clear signal that the UK government was considered credible in its actions to achieve its goal of "Brexit" and investors reacted in advance of Brexit day on January 31, 2020.

Our empirical analysis is set out in two stages. First, this study analyses the nexus between sovereign and corporate credit risk over the whole period (February 2013-March 2021)and then for the twelve highlighted Brexit stages in which we argue the effect of each Brexit stage on the successful Brexit completion was different. To study the correlation between sovereign and corporate CDS spread for each Brexit stage, this study first investigates the period prior to the UK's Referendum vote on 23 June 2016 (pre-Referendum) and then the period starting with the UK's Referendum vote, i.e, for each crucial Brexit stages. We take the starting date of each Brexit stage and the date ten days prior to the following Brexit stages to investigate the correlation effects. In this way, this study analyzed each Brexit stage effect and minimize the following stage effects on the analyzed stage.

Second, we rely on a Differences-in-Differences (DID) framework to establish a causal link between Brexit stages and the change in the co-movement between sovereign and corporate CDS spread. Similar to correlation analysis, we use treatment periods to investigate the Brexit stages in the following manner: this study takes 10 days prior the treatment period until 10 days before the following Brexit stage for each Brexit stage analyzed. In this way, we include potential news effects prior to the announcement of each event and exclude potential news stemming from the following Brexit stage.An increase (decrease) in Average Treatment Effect (ATE) indicates that corporate CDS spread of UK firms become more (less) sensitive to sovereign CDS than European firms after the analyzed Brexit stage.

This study provides empirical evidence that investors consider the UK government credible over the entire Brexit process, i.e., starting the UK's Referendum day on June 23 2016 until the end of the transition period on December 31 2020. Results show that overall there is an increase in the nexus between sovereign and corporate CDS spread after the UK's referendum vote on June 23, 2016, indicating increased sensitivity of firms to the sovereign risk with the UK government's Brexit goal. As we suspected investors' sensitivity to Brexit differs during each Brexit stage with varying impacts on the Brexit goal and the results confirm correlation analysis shows a varying impact depending on each Brexit stage effect. Results from DID analysis show a varying impact depending on the uncertainty of each Brexit stage on the accomplishment of Brexit.

As expected, Brexit stages with higher uncertainty regarding the Brexit goal appear to contribute to disrupting investors' trust in UK government actions and to end up with a lower impact on the nexus between sovereign and corporate CDS spread. On the other hand, Brexit stages with lower disruption in Brexit goal show an increase in the co-movement in sovereign and corporate CDS spread implying an increase in trust in UK government actions to achieve its goal of Brexit. Among all Brexit stages, we find the strongest positive impact of UK sovereign credibility on corporate CDS spread after the Brexit day on January 31, 2020, when the UK officially exits the EU, which suggests evidence for government credibility. This chapter also replicates the DID analysis based on the distinction between a bank and a non-bank corporate to account for whether reactions differ between them. Overall, this chapter suggests that the UK government was successful at convincing investors to actions taken during the Brexit process.

We also perform various of robustness checks to account for the potential effects of global risk factors (systematic factors) on the link between sovereign and corporate CDS spreads such as Global Financial Crisis or Global Pandemic. Based on an intuition associated with the Capital a Pricing Model (CAPM) which explores the relationship between systematic risk and expected asset price return, this study checks for the consistency of our analysis by excluding the impact of global risk factors on the sovereign risk; then, we study the effects of idiosyncratic factors of sovereign CDS spreads on corporate risk. Specifically, this study regresses corporate CDS spread against VIX, which is a measure

for a global volatility index or fear index to control for global risk factors and re-run our DID analysis. In addition, we incorporate alternative global risk factors including the MOVE index, fear index based on the bond market, to strengthen the validity of our analysis. We also replicate the DID analysis while controlling for Covid-19 impact on the association between sovereign and corporate CD spread. Specifically, we employ the recently constructed Oxford's Covid-19 Government Response tracker(OxCGRT) and employ this index, particularly the overall government response index.[5] Results from robustness checks state that our findings are consistent and supported by the robustness check.

This study contributes to the relatively limited literature examining the link between sovereign and non-financial corporate risk (Peter & Grandes (2005), Durbin & Ng (2005), Arteta & Hale (2008), Dittmar & Yuan (2008), Borensztein et al. (2013), Bedendo & Colla (2015), Augustin et al. (2018)). By exploiting a gap in the literature and using Brexit to measure the credibility of a government this study also focuses on Brexit but, differently from previous works, it contributes to the relevant literature by using the UK Brexit case to study the credibility of a Government in carrying out a complex and long-run project. in addition, by using a sophisticated econometric technique to carry out the empirical investigation to measure government credibility, this study employs an objective approach based on a comparative analysis of the nexus between sovereign

[5]This index of OxCGRT records how the response of governments has varied overall indicators in the database, becoming stronger or weaker over the course of the outbreak. It is calculated using all ordinal indicators.

and corporate risk. In addition to the contribution to studies investigating sovereign and corporate risk transfer, this study also contributes limited literature on the stock market reaction to Brexit.

There is no research on the impact of government actions on the corporate credit risk and this might draw attention to the evaluation of the credibility of government actions. This study is important in terms of analysing the causal effects of government actions on the financial markets. As Brexit influences the different aspects of countries including the economy, social life and trade, it is mainly a political process that has a huge impact on the UK, the European Union and the rest of the world. Therefore, the UK government's efforts to complete this process have vital importance on various issues for the countries. One of the issues is related to economics and investor risk awareness due to the increase in risk exposure to sovereign risk due to UK's exit from the European Union (i.e., Brexit), therefore this new environment force investors to be pre-cautious about the potential risk exposures to country risk and potential use of government guarantees in the case of default. Therefore, this study has important policy implications in showing the reaction of investors due to changes in government policy. Since this study employs a unique setting to analyze the investor trust in government actions, the results enable us to comment on whether the investor trust is maintained or interrupted during the process. Thus, this study has important policy implications in analysing the effects of government actions on the financial markets, particularly on investor behaviour.

2.2 Literature Review

Our paper is at the interception of two different branch of literature: the one dealing the effects generated by Brexit (Acharya et al. (2014), Kee & Nicita (2017), Ramiah et al. (2017), Sampson (2017), Davies & Studnicka (2018), Gornicka (2018), Samitas et al. (2018), Hill et al. (2019), Shahzad et al. (2019), Breinlich et al. (2020), Fernandes & Winters (2021), Graziano et al. (2021)), and the one examining the link between sovereign and non-financial corporate risk (Peter & Grandes (2005), Durbin & Ng (2005), Arteta & Hale (2008), Dittmar & Yuan (2008), Borensztein et al. (2013), Bedendo & Colla (2015), Augustin et al. (2018)).

Prior literature examines the effects of UK's Referendum vote and as well as its impact on the post-Brexit era (Steinberg (2019)). The common feature of these literature is that they analyze the effects of the UK's Referendum vote or the Brexit goal well before Brexit process officially ended. Born et al. (2019) provides an evidence in showing that Brexit vote results were not anticipated prior to Referendum vote on June 2016 and they show that economy reacted well before any policy implemented in the scope of Brexit goal. These findings are in line with our expectation in this study to show that financial market agents reacted well before Brexit process officially ended.

As emphasized a lot in the newspapers (Cohn (2016)), UK Referendum vote results had a surprise effect on the financial markets and decision making mechanism of economic agents. That's why it followed by significant uncertainties in the market.

Steinberg (2019) quantify the impact of uncertainty about post-Brexit trade policies and find that on the post-Brexit trade on the welfare cost and find that less than a quarter of a percent of welfare cost is due to uncertainty caused by Brexit. Similarly studies focusing on the effects of Brexit goal or UK Referendum vote, studies (Nishimura & Sun (2018), Dao et al. (2019)) analysing the effects of the uncertainty caused by Brexit is also assuming that Brexit goal has been achieved. Nishimura & Sun (2018) studies the the effect of Referendum vote on volatility spillovers among five major European stock markets and find that after the vote the volatility spillovers increase in the first month and then decrease in the second month. Similarly, Dao et al. (2019) investigates the effect of the Brexit vote on the volatility transmission among major foreign exchanges and find the correlation and find that although Brexit vote causes an increase in the correlation among the safe-haven currencies such as Swiss franc and Japanese, volatility transmission due to Brexit vote suggests a decrease in correlation between the directly involved currencies of British sterling and the Euro.

Due to volatility caused by the UK Referendum, financial markets and economic agents such as banks (Schiereck et al. (2016), Fernández et al. (2020), Berg et al. (2021)) and non-financial corporations (Kee & Nicita (2017), Sampson (2017), Samitas et al. (2018)) reacted correspondingly. Before the UK Referendum vote, UK was a part of European Union that is connected in politics, economics and trade. An exit of UK from EU aroused questions on the future of those areas and potential adverse scenarios

firms. That's why Brexit deal negotiations between the parties had a significant effect on the post-Brexit expectations. Hill et al. (2019) examine the firm's exposure to Brexit uncertainty using stock market data and show that high-growth firms are more affected by the Brexit and at the industry firms in the consumer-facing sectors are affected the one most due to Brexit-related uncertainty. In providing the effects of government actions' on the international trade, Douch & Edwards (2021) show policy uncertainty following the UK referendum has significantly affected the British commercial services' exports and find that this deterioration in exports began before the announcement of referendum vote which provide evidence in exporters' monitoring of political trends.

This paper is also related to the relatively scarce literature examining the link between sovereign and corporate credit risk (Arteta & Hale (2008), Durbin & Ng (2005), Peter & Grandes (2005), Dittmar & Yuan (2008), Borensztein et al. (2013), Bedendo & Colla (2015), Drago & Gallo (2017)). Bedendo & Colla (2015) explain the risk transfer from sovereign to corporate in three steps: first, when sovereign becomes less creditworthy, then government guarantees start to deteriorate. Secondly, the value of the government securities that banks hold tends to shrink which causes bank funding cost to rise and fear of bank runs increase. Third, as banks face higher funding costs and deteriorated balance sheets, they tend to cut the lending to non-financial firms and those with a higher share of bank funding is likely to be affected from the sovereign credit risk worsening. Government guarantees main motivation on the feedback between sovereign and bank

credit risk (Acharya et al. (2014), Fiordelisi, Minnucci, Previati & Ricci (2020)) as they works as a "sovereign ceiling" that investors cannot lower credit risk of any firm than its home government (see. Durbin & Ng (2005)). Government guarantees is on the one hand works as a cushion to lower stress level but it increases dependency on the government default risk and also it increases costs on the social welfare as they are financed through the taxpayers' money. UK referendum vote accelerated the stress level on the business on how to deal with different Brexit deal scenarios. To address these stress on the businesses due to no-deal Brexit scenarios, UK government promised bailout funds to alleviate stress on the businesses (see. Wilkes (2019)). On the other hand, after European debt crises of 2010, it became harder to bailout firms for any country in EU. The increased possibility of bailing out business after the UK Referendum vote incentives the feedback between sovereign and corporate risk.

This novel contribution of this study is that this paper complements to prior literature on the link between sovereign and corporate risk through employing this unique setting to examine the credibility of government actions after the Referendum vote and during the whole Brexit process. The main idea is that the Brexit process ends up with a departure of the UK from the EU and implying an increase in the domestic country exposure on the domestic firms (in other words, UK firms become more correlated with the home country risk during the Brexit process) and UK firms will face difficulty in trading in the European Union. On the other hand, investors are aware of the increasing

domestic country risk after the Referendum vote and if they trust government actions during the Brexit process that would reinforce corporate corporate credit risk exposure to sovereign credit risk. Due to that reason investors need to hedge themselves against increased country risk that puts pressure on the corporate creditworthiness. We expect that if investors hedge themselves against UK firms' default on debt that are exposed to increased home country risk during the Brexit process that ensures investors' trust on the government actions during the Brexit process and get ready before Brexit accomplished.

This increased nexus between the sovereign and corporate credit risk after the 2016 Referendum vote can be attributed to two transmission channels: first is the government guarantees (De Bruyckere et al. (2013), Arslanalp & Liao (2014), Leonello (2018)). Arslanalp & Liao (2014) studies the explicit deposit insurance programs or implicit guarantees on other liabilities stemming from potential government intervention to prevent bank bailouts or to restore confidence. Through constructing a contingent liability index for a banking sector that allows to monitor potential government liabilities related to bank failures, authors find that an increase in contingent liabilities related to bank failures can be attributed to a sizeable increase in sovereign CDS, particularly during the crisis period and for emerging markets. Therefore, an increase in the possibility of Brexit scenario also comes with an increased government interventions on the UK firms. Meaning that if Brexit happens this increases the possibility of corporate to be bailed out by the UK government if it is bankrupt and UK government decides to bail them out.

Second channel it is due to business cycles during the economic booms (recessions). The pressure on the firms is to be less (more) due to increase (decrease) in the economic activity that also firm credit risk more more correlated with the domestic economic activity.

Not only the Referendum vote shaped the Brexit process, Brexit process involves many crucial steps those also significantly that affected the completion of Brexit process with varying uncertainty: lower uncertainty due to positive influence on the ultimate Brexit goal and greater uncertainty due to negative impact on the accomplishment of departure of UK from EU.

We expect that stages in Brexit process that can be considered as positive steps (with a lower uncertainty regarding the accomplishment of Brexit goal) are followed by increase in the co-movement between sovereign and corporate risk that implies an increasing trust on the UK government actions during the Brexit process. On the other hand, we expect that Brexit stages that can be considered as negative steps with a greater uncertainty for the departure of UK from the EU is associated with a decreasing or no impact on the co-movement between sovereign and corporate credit risk. Finally, amongst of all Brexit stages, this study expects to find the highest impact on the corporate-sovereign credit risk nexus after the Brexit day on January 31, 2020 when UK government successfully accomplishes its Brexit goal. Then, this paper presents those hypothesis as follows:

H_1: At the UK's Referendum vote on June 23, 2016, investors trusted the UK

Government ability to complete Brexit.

H_2: Investors' trust on the UK Government ability to complete Brexit changed during the main stages in the process.

H_3: Amongst the Brexit stages, the official end, of Brexit day on January 31, 2020, has the highest impact on the nexus between sovereign and corporate CDS spread, implying investors' confidence stored.

2.3 Institutional Setting: The Brexit Process

Brexit is a short version of "Britain Exit" from the European Union. History behind the formation of European Union dates back to Treaty of Rome in 1957 through which the European Economic Committee (EEC) was formed to establish a common market among the member states that eliminates trade barriers and which is a major stepping stone in the creation of the European Union (EU). Originally founded by six countries (Belgium, Germany, Italy, France, Luxembourg and the Netherlands), EU at the time of writing (2022) composed of 27 countries considering the exit of UK (Dennison & Carl (2016)).

The UK referendum on June 23, 2016, is a turning point in the relationship between UK and EU. The victory of "leave" voters by 51.9% to "remain" voters of 48.1% triggered the Brexit process, with an ultimate of exit of UK from the EU by January 31, 2020. Brexit day also starts the negotiations in the Brexit process on various topics regarding

the future of EU and UK relations, which is commonly called "transition period" to end by December 31, 2020. Apart from its ultimate importance in terms of Brexit process the UK went for Referendum vote to decide on the UK being a member of EU and Britons voted for leaving the EU (52% in favour of the Brexit), this result was largely unexpected (Born et al. (2019)). Odds ahead of the Referendum vote implied the reverse, i.e., to remain in the EU. Financial Times (Times (2016)) last update of Brexit polls tracker on the polls results on Referendum vote even showing 48% to 46% remain vs. leave. Also, time prior to the referendum, most polls suggested a victory for the 'Remain'.

The largely unexpected result of the Referendum vote makes this date a shock regarding the Brexit history and Referendum vote provides a unique setting to study the causal effect of a natural experiment, i.e., Referendum day on June 23, 2016. Prior studies using Referendum vote as a natural experiment includes (Born et al. (2019)) and in their study authors examine Brexit as a natural experiment to study its macroeconomic impacts and employs Referendum vote on June 23, 2016 as "treatment" since outcome of the referendum was largely unexpected and find that by the end of 2018, the Brexit vote has caused a reduction of GDP by 1.7% to 2.5%. Apart from Born et al. (2019), other studies such as (Schiereck et al. (2016), Oehler et al. (2017), Ramiah et al. (2017)) also studies the reaction of financial markets in response to Referendum vote which provides a unique setting to explore causal effects of a natural experiment.

In line with prior literature, the first Brexit event analyzed in our paper is UK's

Referendum vote. Different than to previous research, we identify various crucial stages of the Brexit process that were influential and, in many cases, also unexpected. We summarize the Brexit crucial stages in chronologically order in Table 2.1. Below, we report a short summary of each of the twelve Brexit events investigated in our paper.

[Insert Tables 2.1 Here.]

1) Referendum vote 2016

In 2013, Prime Minister (PM) David Cameron proposed to go for a referendum if the Conservatives win the elections. Since the PM Cameron won the election, UK went for the Referendum[6] on 23 June 2016 and Britons voted for the leaving the EU. The Referendum vote on June 23, 2016 (#1 in Table 2.1) is not the only stage in Brexit process that produces unexpected result. On the contrary, Referendum vote triggered subsequent crucial Brexit stages that also shaped the Brexit process and most of which were also unexpected. As this study is interested in the pivotal stages in the Brexit process, those stages form our "treatment" dates to examine the causal effect of Brexit process. Following the result of "leave" from the UK Referendum vote, former PM David Cameron accepted the defeat and resigned on June 24, 2016 as he led the party to keep UK in the EU and Theresa May became the new PM on July 13, 2016. Since those two events occur within a short period to the referendum date, we do not include those periods in this study.

[6]The question that appeared on ballot papers in the referendum was "*Should the United Kingdom remain a member of the European Union or leave the European Union?*"

2) Triggering of Article 50

On March 29, 2017 (#2 in Table 2.1), the UK government invoked the Article 50 of the Treaty of Rome[7] which sets out the initial deadline as 29 March 2019 and giving a 2-year time horizon, that is one of major steps in Brexit process as it can be considered as the official beginning of the negotiations of UK withdrawal from the EU, i.e, the Brexit. Although official negotiations started by the UK's Invocation of Article 50, Brexit process still was not straightforward.

3) Withdrawal Act becomes law

On 26 June 2018, Withdrawal Act became law (#3 in Table 2.1. Thus, The European Union (Withdrawal) Bill receives Royal Assent and becomes an Act of Parliament, i.e. the European Union (Withdrawal) Act.

4) Brexit Plan suffers defeat in the House of Commons

PM Theresa May lost first meaningful vote in the House of Commons[8] rejected the deal and UK government is defeated by 432 votes to 202. The lose of 'Meaningful Vote' indicates a no confidence in the Government. However, following day the Prime Minister wins a vote of confidence in the Government. After PM May presents the government's

[7]This states that any member may leave the European Union according to their legal and constitutional requirements.

[8]The UK public elects 650 Members of Parliament (MPs) to represent their interests and concerns in the House of Commons. MPs consider and propose new laws, and can scrutinise government policies by asking ministers questions about current issues either in the Commons Chamber or in Committees.

'Plan B' Brexit deal on 21 January 2019 and government's Brexit plan suffers a defeat in the House of Commons on the 14 February 2019 (#4 in Table 2.1).Instead of lose of first vote, we take Brexit plan suffers a defeat as lose of meaningful vote first time followed by a win of confidence in the Government which blocks effect of lose of first meaningful vote.

5) PM May loses vote second time

On March 12, 2019, The Prime Minister Theresa May opens a House of Commons debate on the European Union (Withdrawal Act) and again PM May loses the second meaningful vote (#5 in Table 2.1) with lose the vote by a majority of 149 (with 242 voting in favour of the Prime Minister's Brexit deal and 391 against).

6) PM May loses vote third time

On March 29, 2019 former PM Theresa May lost vote third time (#6 in Table 2.1) to pass the deal for the Brexit goal in the House of Commons by 344 votes to 286 which delayed the Article 50 process until to 31 October 2019.

7) Brexit Party wins European Parliament Elections

On 26 May 2019 UK votes in European Parliament elections and The Brexit Party wins (#7 in Table 2.1) the most votes in the UK with 31.6% of the vote. Former PM May announced her resignation from position on May 24, 2019 and officially resigned on

July 24, 2019.

8) Boris Johnson becomes new PM

Following the resignation of former PM May, Boris Johnson become the new prime minister on 23 July 2019 (#8 in Table 2.1) and promises to exit the EU by October 31, 2019.

9) Extension of Brexit Deal

Although PM Johnson promises to exit EU by 19 October 2019, The European Council agreed to extend the Brexit deadline to 31 January 2020 on 19 October 2019 (#9 in Table 1).

10)UK General Election Day

On 29 October 2019, UK Government introduces the Early Parliamentary General Election Act 2019 ([9]) that an early parliamentary general election is to take place on 12 December 2019 in consequence of the passing of this Act. On October 31, 2019, there was still no agreement on the Brexit, implying PM Johnson's promise to exit EU by this date was not met by this date. UK General Elections were important but particularly on the Brexit goal that would result in favor of Labour party that would delay the deal negotiations or affect the Brexit process in favor of "remain" in the EU. On December

[9]a legal binding of Government to hold UK General Election in 2019

12, 2019 (#10 in Table 2.1), UK General Elections was held and results are in favor of the Conservative Party, receiving the majority of 80 seats. UK General Election day on December 12, 2019 is another important date in Brexit history: in addition to winning 43.6% of the popular vote, it is considered as the highest percentage for any party since 1979. Also victory of Conservative party on December 12, 2019 gave PM Boris Johnson a mandate to formally accomplish the departure of UK from the EU by January 31, 2020.

11) Brexit day

On January 30, 2020 (#11 in Table 2.1), a day before the Brexit day on 31 January 2020, The Council of the European Union concludes the ratification of the Withdrawal agreement. Finally, UK departed from EU on January 31, 2020. Although official UK's exit of EU is on January 31, 2020, ratification of Brexit deal is on January 30, 2020 which has news effects on that date. Therefore, this study employs this date (January 30, 2021) to analyze the effect of Brexit day.

12) Transition period

Brexit day initiated a 11-months transition period ending on December 31, 2020 (#12 in Table 2.1). Transition period still maintains the relationship between UK and EU as before the Brexit, but at the same time aims to work on the future relationship between the EU and the UK. Therefore, transition period is significant for the Brexit process.

2.4 Data and Methodology

2.4.1 Data

We collect corporate and sovereign CDS spread data, firm- and market-level control variables from Eikon-Refinitiv and country-level control variables from the IMF data sources. Our sample period spans from February 2013 to March 2021.

Regarding the CDS spreads, we collect CDS quotes written on senior unsecured debt with modified restructuring and with a five-year maturity, to ensure liquidity. Following Bedendo & Colla (2015), we restrict our sample only to liquid USD currency CDS spread and calculate for daily change in corporate (ΔSCDS) and sovereign (ΔCDS) CDS spreads.

We include distinct control variables[10] that might influence the co-movements of corporate and sovereign CDS spreads (Martin (2001), Campbell & Taksler (2003), Longstaff et al. (2011), Dieckmann & Plank (2012)). Specifically, we control for global factors Pan & Singleton (2008), Longstaff et al. (2011), macroeconomic determinants (Remolona et al. (2008), Basurto et al. (2010), Aizenman et al. (2013)), and firm-specific effects to capture idiosyncratic factors for changes in CDS spreads. Firm-level control variables include the logarithm of total assets ($asset$), the equity to assets ratio (eta), the logarithm of market value ($marketcap$)), the return on equity (roe)[11]. Macroeconomic

[10]Control variables taken by firms' annual financial accounts are matched with CDS spreads using their distinct Eikon Instrument Code (RIC), a ticker-like code for the CDS spreads.

[11]As robustness check, we also use the Return On Assets (roa)

control variables include the GDP growth rate (GDP), the loan growth ($loan$), the money market rate ($mmrate$), the change in 5-year Treasury bond risk-free interest rate ($bond$); and the public debt ratio ($debtratio$). Finally, we include financial market control variables, such as The Merrill Lynch Option Volatility Estimate Index (Move index[12]) ($move$), and an index for the traded CDS spreads in the European financial markets ($itraxx$). All variables used in our investigation are summarized in Table 2.2.

[Insert Table 2.2 Here.]

Our sample includes nine countries: the UK, and eight European countries (Denmark, France, Germany, Italy, the Netherlands, Portugal, Spain, and Sweden) selected based either for their importance or their close relationship with the UK. Restricting our sample to firms whose CDS are liquid and with the full data time series available, our analysis includes 140 firms, 38 from UK and 92 from Europe, operating in various sectors. Table 2.3 reports average summary statistics We also report Table 2.4 that depicts the country average of pairwise correlations of corporate and sovereign CDS spread. Values (1)-(9) shows average corporate CDS spread and values between (10)-(18) represents average sovereign CDS spread. Besides having positive correlation between sovereign and corporate CDS spread, correlations vary among the countries. Average corporate CDS spread in UK has a similar correlation level with other countries' sovereign CDS countries. Due to their close relations and recent shared history between

[12]an implied volatility index of S&P 500 index options of Chicago Board Options Exchange (CBOE) (VIX)

UK and EU countries, descriptive statistics of our sample (UK vs. EU firm) do not diverge which forms a solid foundation for further analysis.

[Insert Table 2.3 Here.]

[Insert Table 2.4 Here.]

2.4.2 Identification Strategy

Our identification strategy is based on two stages. In the first step, we follow Acharya et al. (2014) to test our theoretical prediction of a significant increase in the co-movement between the credit risk of the sovereign and corporate CDS spread, during the Brexit. To this aim, we use the following panel data model:

$$\begin{aligned} \Delta CDS_{ijt} = \alpha + \beta \Delta SCDS_{jt} + \gamma \sum FirmControls_{it} + \\ + \theta \sum CountryControls_{jt} + \eta \sum MarketControls_{t} + \nu_i + \delta_t + \varepsilon_{ijt} \end{aligned} \tag{2.1}$$

where ΔCDS_{ijt} is the daily change in the CDS spreads of firm i, domiciled in country j between time t and *t-1*, and $\Delta SCDSjt$ depicts the daily change in sovereign CDS spread in country j from t and *t-1*. The variable of main interest is $\Delta SCDS$: its coefficient, (β) captures the intensity of co-movement between corporate and sovereign CDS spread. We also include country level control variables ($\sum Country_{j,t}$) such as the real GDP growth (GDP), money market rate ($mmrate$), loan growth ($loan$), and daily

change in risk-free treasury interest rate ($bond$). To account for country indebtedness, we also control government debt to GDP ratio ($debtratio$) [13]. Similarly, we add firm control variables,$\sum Firm_{it}$, like logarithm of total assets ($asset$),logarithm of market capitalization of a firm ($marketcap$), return on equity (roe) to control for the firms' profitability, and total equity to total assets ratio (eta) to account for leverage. We also control for main financial market factors ($\sum Market_t$): an index for overall European CDS market ($itraxx$), and an indicator for the global systemic risk indicator ($move$). Our model is also saturated including firm- and weekly time-fixed effects ($\delta_i \& \nu_t$) to account for unobservable time and firm invariant factors, respectively. In addition, this study clusters standard errors at the firm level.

The model in Eq.2.1 is estimated various times. First, we study the relationship between the sovereign and firm CDS spread over the whole period (February 2013-March, 2021). Then, we repeat the estimation the periods before and after the Brexit referendum. Our expectation is to find a greater β estimate after the Brexit referendum: this would show an increase on the nexus between sovereign and corporate CDS spread under the Brexit process. In final, we replicate the analysis for each of the twelve Brexit events: this enables us to measure the investor confidence about the British Government's ability to successfully run the Brexit in each period after the event (Table 2.1).

In the second stage, we rely on a difference-in-difference (DID) model (Eq.2.2) to examine the causal impact of Brexit process on the nexus between firms in the UK in

[13] We include $debtratio$ to account for the effect of country indebtedness on corporate CDS spreads

each of the Brexit stages reported in Table 2.1 under the treatment periods.

Although stages with negative effect (with higher uncertainty regarding the Brexit goal) might cause disruption in Brexit process, we expect to find an increase in the effect of Brexit stages that supports to complete Brexit goal of UK government and particularly highest effect on the Brexit day on January 31, 2020. To determine whether government is convincing in terms of its actions during the Brexit period, we expect to find a positive and also steady increase the association between sovereign and corporate CDS spread in the Brexit stages those supports UK's Brexit goal and negative or no impact on the association in the Brexit stages those disrupts the Brexit goal. We divide the total sample including UK an European firms into treatment (UK firms) and control (European firms (including eight countries)), with liquid CDS available in the Eikon, a database of Refinitiv. The treatment period is the period after the Brexit referendum vote (in the overall analysis) and for the each of Brexit stages (in the followup analysis), we consider only the relevant Brexit stage (for instance, triggering of Article 50 until 10 days prior to next Brexit stage (Withdrawal Act becomes Law)) as our treatment period while not including other Brexit stages (Former PM May loses significant vote, Former PM May loses vote third time, Former PM May announces resignation, Boris Johnson becomes new PM, extension of Brexit deal deadline, UK General Election day, Brexit day and transition period) into the analysis at the same time taking prior period of Referendum vote as control period.

$$\begin{aligned}\Delta CDS_{ijt} = \alpha + \beta_1 UK + \beta_2 Post_k + \beta_3 \Delta SCDS_{jt} + \beta_4 UK * Post_k * \Delta SCDS_{j,t} \\ + double\ interactions(UK, Post_k, \Delta SCDS_{jt}) + \gamma \sum Country_{jt} \\ + \theta \sum Firm_{it} + \eta \sum Market_t + \nu_i + \psi_t + \varepsilon_{ijt}\end{aligned} \tag{2.2}$$

In Eq.2, dependent variable, $\Delta CDSijt$, is the daily change in corporate CDS for firm i, headquartered in country j from t to t+1. In a DID model, to measure the causal effect of a relevant Brexit sub-period, we create variable for treated units, UK, which represents treated firms in UK and equals to one for UK firms and zero for European firms. To account for the effects of different Brexit stages, we form $Post_k$ which takes value of 1 for the relevant Brexit stage (2016 Referendum vote, triggering of Article 50, Withdrawal Act Becomes Law, Brexit deal suffers defeat, Former PM May loses vote second time, Former PM May loses vote third time, Brexit party wins in European Parliament Elections, Boris Johnson becomes new PM, extension of Brexit deal, UK General Election day, Brexit day and transition period) reported in treatment periods of Table 2.1 and zero otherwise. Although period after the Brexit day comprises transition period (period between January 2020-December 2020), due to its importance, we also present separate analysis on the transition period.

The main variable of interest is $UK * Post_k * \Delta SCDSjt$ in the Eq.2. The coefficient β_4 reports the causal effect of each Brexit stage on the firms' CDS spread: a positive

(negative or insignificant) coefficient indicates an increase (decrease) in the co-movement between firm and sovereign CDS due to this Brexit stage. For instance, a positive coefficient of (β_4) after the 2016 Referendum vote indicates that UK's Referendum vote on June 2016 increases the co-movement between sovereign and corporate CDS spread in UK compared to that of European countries (control group). In our specification, we control for firm fixed effects (ν_i). However, since variable of UK is time-invariant, DID model omits it out. However, we include firm fixed effects to consider potential unobservable factors, which are firm-related and time invariant. Also, we also include fixed effects (ψ_t) to control unobservable factor that might stem from time fixed effects.

Global Financial crises and recent ongoing global pandemic are considered as global risk factors on the economies which produced increased uncertainty on the economies. Berger & Demirgüç-Kunt (2021) summarize this fact in the following way: COVID-19 is the most unanticipated large and widespread exogenous economic shock of all time and it was even more global than the global financial crisis as it is influencing developed and developing economies alike. Covid-19 has a dramatic effect on the world since the beginning of the 2020 and its impact coincides with the post-Brexit period (period after Brexit day on January 2020). Although time span in this analysis does not cover Global Financial crisis period, some might argue that Covid-19 might blur the impact of transition process on the corporate and sovereign CDS link as global factors such as Covid-19 itself (systematic factors) might dominate the idiosyncratic risks that are

relevant to corporate features.Therefore, in the robustness section, we propose a model where we isolate the systematic factors that might stem from Covid-19 and repeat our analysis only considering for the idiosyncratic factors.

We present alternative robustness checks to account for the effect of Covid-19 era on the co-movement between sovereign and corporate CDS spreads through employing a control variable that accounts for government actions to prevent Covid-19 implications on the economies. This methods enables us to distill government actions on the Brexit and Covid-19 during the transition process and observe implications of government actions during the Brexit process.

2.4.3 Preliminary investigation

The validity of the differences-in-differences model relies on the parallel trends assumption[14] to examine the implied counterfactual. Assumption states that the untreated units provide the appropriate counterfactual of the trend that the treated units would have followed if they had not been treated that is, in other words, the two groups would have had parallel trends. We test this assumption by testing the change in corporate CDS spread with respect to sovereign CDS spreads ($\Delta CDS - \Delta SCDS$) and we examine statistical significance prior to start of treatment date, i.e., June 23, 2016. Since data spans from

[14]Parallel trend assumption is method is used as a preliminary investigation for applicability for DID method. This test checks for statistical significance of differences between control and treated groups for the main variables investigated in the study. Expectation is to find no statistical significance in the differences between control and treated groups for variables of interest.

2013, we test this assumption for the following periods: 2013, 2014, 2015 and finally for January-June 2016. Our expectation is to find a insignificant results before June 2016 which implies that prior to treatment date examined variables of control and treatment groups do not diverge from each other.

We present the results from this test in Table 2.5. Results presents preliminary evidence that for the main variables difference between UK (treated group) and EU firms (control group) would not diverge before the Referendum vote on June 23, 2016 that constitutes valid foundation to implement causal analysis.

[Insert Table 2.5 Here.]

2.5 Empirical Findings

2.5.1 Baseline Model

Table 2.6 reports baseline results for the co-movement between sovereign and corporate credit risk for UK firm using the Eq.2.1. The main variable of interest is $\Delta SCDS$ and its coefficient shows the co-movement between corporate and sovereign CDS spread over the specified period: in column 1, this study analyses the effect of sovereign CDS spread before the 2016 Referendum vote; column 2, shows the impact of sovereign CDS spread on the corporate CDS spread after the 2016 Referendum vote and finally column 3 reports the results for the whole period (February 2013-March 2021). In all regressions, we control for firm and time fixed effects and cluster standard errors at the firm level.

[Insert Table 2.6 Here.]

Results from the baseline model in Table Table 2.6 shows that there is a positive association between sovereign and corporate CDS spread in Table 2.6. As expected, this effect increases after the 2016 Referendum vote. Findings are still valid after we control for the firm and time fixed effects.

Table 2.7 reports the regression results over the different Brexit stages using the correlation periods introduced in the Table 2.1. This table determines correlation period between the beginning date and 10 days prior to beginning of the next event. We first start by pre-referendum in Column 0, i.e., period before the UK's referendum vote (June 23, 2016)). Between Column 1-11, we examine the post period after the 2016 referendum vote in the following way: in Column 1: 2016 referendum vote (23 June 2016-19 March 2017); Column 2: Triggering of Article 50 (29 March 2017- 16 June 2018); Column 3: Withdrawal Act becomes law (26 June 2018 - 4 February 2019); Column 4: Former PM May loses meaningful vote (14 February 2019 - 2 March 2019); Column 5: Former PM loses vote second time (12 March 2019- 19 March 2019); Column 6: Former PM loses vote third time (29 March 2019- 16 May 2019); Column 7: Brexit party wins in European Parliament elections (26 May 2019 - 13 July 2019); Column 8: Boris Johnson becomes new PM (23 July 2019 -9 October 2019); Column 9: extension of Brexit deal (19 October 2019 - 2 December 2019); Column 10: UK General Election day (12 December 2019- 20 January 2020); Column 11: Brexit day (30 January 2020-

10 February 2020); Column 12: transition period (30 January 2020 -11 March 2021). In addition to that analysis, we make the same analysis for controlling for financial companies. We include an interaction dummy for financial corporate and sovereign CDS spread ($\Delta SCDS * FC$).Also, we include firm and time fixed effects and also cluster standard errors at firm level.

Results from the Brexit stages are consistent with the findings from the whole period in Table 2.6: the coefficient of $\Delta SCDS$ is positive (negative or no impact) over the corresponding Brexit stages with lower (higher) uncertainty regarding the UK's Brexit goal: Column 0 shows that prior to UK's referendum vote, there is a positive but relatively smaller impact compared to post-Referendum period; Column 1 reports that after the 2016 referendum vote contagion between sovereign and corporate risk increases compared to pre-referendum vote; Column 2 shows that during the triggering of Article 50, the impact of sovereign CDS spread increases slightly compared to previous period; Column 3 reports the co-movement between sovereign-corporate CDS spread during the period of Withdrawal Act becomes law and coefficient of $\Delta SCDS$ increases significantly compared to prior period. For the following three period starting with the period of Former PM May loses meaningful vote Brexit Plan suffers defeat on 14 February 2019, we expect to find a negative or no impact of sovereign CDS spread on the corporate CDS spread. As expected, Column 4 shows results for the correlation period of defeat of Brexit plan in the House of Commons and impact of sovereign CDS spread on corporate

CDS spread becomes insignificant; Column 5 shows results for the correlation period of Former PM loses vote second time and impact of sovereign CDS spread on corporate CDS spread becomes insignificant; Column 6 shows that during the Former PM loses vote third time, the impact of sovereign CDS spread becomes negative; Column 7 reports the correlation period of Brexit party wins in European Parliament elections, the impact of sovereign CDS spread is positive; Column 8 shows that during the period of Boris Johnson becomes new PM, the impact of sovereign CDS spread is positive; Column 9 shows that during the period of extension of Brexit deal, the impact of sovereign CDS spread is insignificant 8; Column 10 reports that during the period of UK General Election day, the impact of sovereign CDS spread is positive; in Column 11 report that during the period of Brexit day, the impact of sovereign CDS spread is positive; Column 12 shows that during the period of transition period, the impact of sovereign CDS spread is positive. Also, controlling for financial corporate, results are still consistent with the prior findings.

[Insert Table 2.7 Here.]

2.5.2 Differences-in-Differences Model

We present the regression results for the difference-in-difference approach in Table 2.8 based on the Eq.(2.2). In this setting, we investigate the effect of sovereign CDS spread ($\Delta SCDS$) on the corporate CDS spread (ΔCDS) aftermath of the Brexit stages using

the treatment periods reported in Table 2.1. This approach allows us to observe whether the link between sovereign and corporate CDS spread for UK firms differentiates than that of European firms after each Brexit stages. The main variable of interest is the coefficient of interaction term, $UK * Post * \Delta SCDS$, which shows the effect of relevant Brexit stage on the co-movement between sovereign and corporate risk for the UK firms. Our expectation is to find a overall positive significant impact after the Referendum vote and but with varying increasing causal effect of related Brexit stage on the co-movement between sovereign and corporate CDS spread for UK firms with respect to European firms. The impact of each Brexit stage varies due to uncertainty surrounding the UK's Brexit goal. The coefficient of $UK * Post * \Delta SCDS$ is positive (negative or no impact) after the referendum vote and shows that Referendum vote increases (decreases or no impact) the co-movement between sovereign and corporate CDS spread meaning that investors increase (decreases) the credit risk premiums on the firms due to increased (reduced) possibility of UK's exit from the European Union and therefore an strengthened (weaker) sensitivity of corporate CDS spread to sovereign risk.

We report the regression results of DID analysis in Table 2.8. Column 1 shows the effect of 2016 Referendum vote and shows a positive significant impact after the Referendum Vote on June 23, 2016, and in response to our first hypothesis we find that UK Referendum vote increased the contagion from sovereign to corporate which validates the first hypothesis of this study. Prior studies focusing on the stock market

reaction after the Brexit events and in general there is a negative market reaction (Ramiah et al. (2017), Davies & Studnicka (2018)). In their study, Shahzad et al. (2019) shows that market reaction is negative to Brexit events first but to the events following the Referendum vote market reacted positively. Different from the previous literature, this study employs contagion effect from sovereign to corporate to investigate market reaction to government actions. This method enables us to differentiate market reaction to each Brexit event and our expectation is to find a varying effect as we stated in our second hypothesis. Columns between 1-12 in Table 2.8 report the effect of other pivotal stages in the Brexit process and findings indicate a positive (negative or no impact) impact in the stages with lower (higher) uncertainty regarding the accomplishment of Brexit goal. We find positive effect for the following Brexit stages: 2016 Referendum vote, Triggering of UK's Invocation of Article 50, Withdrawal act becomes law, Brexit Party wins European Parliament elections, Boris Johnson becomes new PM, UK General Election day, Brexit day and transition period and it is in line with our expectation on the direction of the effect stages reported in the Table 2.1. Besides responding to our second hypothesises, this shows that Brexit stages that strengthen the Brexit goal is associated with a positive causal impact on the co-movement between corporate and sovereign CDS spread after those Brexit stages specified above which is in line with investors' expectations for the lower uncertainty regarding the Brexit goal. On the other hand, this study finds negative effect (or no impact) for the following Brexit stages: Brexit Plan suffers a defeat, PM May

loses second vote, PM May loses third vote and Extension of Brexit deal and it is in line with our expectation on the direction of the effect states reported in the Table 2.1. This shows that Brexit stages that weakens the Brexit goal is associated with a negative (or no impact) causal impact on the co-movement between corporate and sovereign CDS spread after those Brexit stages specified above which is in line with investors' expectations for the higher uncertainty regarding the Brexit goal. Lastly, this study obtain the highest impact on the nexus between sovereign and corporate CDS spread after the Brexit day on January 31, 2020 and that is line with our argument in our third hypothesis, present evidence that investors trusted government actions to complete Brexit process as this argument supported with the highest impact after that date.

Overall, this study examines whether the UK government actions are taken granted during the Brexit process and analyzes the direction and intensity of co-movement between corporate and sovereign CDS spread during the Brexit stages. After considering for the varying uncertainty in each Brexit stages, findings indicate a positive (negative or no impact) on the corporate CDS spread. Results from the 2.8 reports that coefficient of $UK * Post * \Delta SCDS$ is positive (negative or no impact) during the Brexit stages with lower (higher) uncertainty. This supports our hypothesis that UK government actions are taken granted during the Brexit process meaning that investors are pricing increased (reduced) sovereign risk due to UK's exit as they increasing (decreasing) their trust in the UK government actions and placing extra credit risk premiums to corporate CDS

spreads while UK government actions are promising (not promising) in terms of Brexit goal. In addition, although Brexit day put an end to Brexit negotiations it also started the negotiations for transition period, after we control for transition period, we find that transition period reinforces the relationship between sovereign and corporate CDS spread. Our findings are consistent across models with our previous findings from the baseline models. Those findings contributes to studies on Brexit and as well as studies investigating the nexus between sovereign and corporate credit risk and distinctively combining them presents a way to measure government credibility from the market participant perspective.

[Insert Table 2.8 Here.]

For our research hypothesis to be supported, we need to find a significant reaction to the Referendum vote. Specifically, the variable $\Delta SCDS * UK * Post$ should have a distinct impact (positive, negative or no impact) on changes in firm' CDS during the post-referendum vote depending on the direction of Brexit event on the corporate CDS spreads. This varying impact can be explained in that UK's government actions are taken granted, i.e. found to be credible. In the following section, we present our baseline model that enables us to identify the direction of each Brexit stage on the correlation between corporate and sovereign CDS spread. Overall, we expect that Brexit stages starting from the referendum vote has an impact on the persuasiveness of UK government actions and therefore we expect to find an overall positive and increasing impact on the UK

firms' CDS spread compared to prior of referendum vote. This is due to increase in the expectation of sensitivity of UK corporate CDS premium to sovereign CDS spread with the result of UK's Referendum vote that implies a more connected corporate-sovereign link if it is realize.

2.6 Robustness

In this section, this study presents alternative robustness checks. First, a model based on Capital Asset Pricing Model[15] (CAPM) is constructed to control for the impact of the global risk factors such as Global Pandemic on the nexus between sovereign and corporate CDS spread. Secondly, we employ recently constructed index of Oxford's Covid-19 government response tracker (OxCGRT) which collects information on governments' policy measures or response to tackle COVID-19 to control for government actions during the Global Pandemic and study whether our results are still valid after controlling for the Covid-19 related government actions.

2.6.1 Using CAPM model to control for Covid-19 Era

Analyzed period of this study (after the Brexit day on January 31, 2020 until the end of transition period on December 31, 2020) is intertwined with the beginning of the Global Pandemic that started at the beginning of 2020. Due to increased uncertainty

[15]describes the relationship between systematic risk and expected return for stocks

stemming from concerns related to Global Pandemic since the beginning of 2020, we present a robustness check to account for the effect of global volatility factors on the link between sovereign and corporate credit risk as both (sovereign and corporate CDS spread) are influenced by the global risk factors simultaneously. Therefore, we check for the consistency of previous analysis by excluding the global risk factors (systematic factors) on this nexus between sovereign and corporate credit risk and study the co-movement between sovereign and corporate risk by using the idiosyncratic component[16] in sovereign CDS spread. This robustness check is based on the intuition in CAPM where return of an equity is regressed on to market price index: slope coefficient of market equity index represents systematic factors in equity price and residual term depicts the factors specific to equity itself (idiosyncratic factors). Based on the literature examining determinants of sovereign CDS spreads, we run sovereign CDS spread(ΔSCDS) on VIX, an implied volatility index of S&P 500 index options of Chicago Board Options Exchange (CBOE), i.e., an indicator for the global volatility. We also include country and market controls in the Eq.2.3 to account for the cross-country heterogeneity. Using this model, we aim to filter systemic factors such as Global Financial crisis and Global Pandemic the latter is the focus of this analysis and obtain idiosyncratic component (factors specific to sovereign CDS spread itself) in the sovereign CDS spread ($\hat{\epsilon}$). Thus, this variable ($\hat{\epsilon}$), calculated using the Eq.2.3 represents the idiosyncratic factors other

[16]In reference to Capital Asset Pricing Model (CAPM), idiosyncratic component is the part that is unrelated to systematic factors like market index, global volatility and specific to individual characteristics

than systematic factors (global risk factors) of $\Delta SCDS$ that are specific to sovereign CDS spread. In other words, that method would provides us factors due to government actions or determinants specific to domestic country rather than factor effected from the global risk factors.

$$\Delta SCDS_{jt} = \alpha + \beta VIX_t + \nu_{jt} + \psi_t + \varepsilon_{jt}, \tag{2.3}$$

where $\Delta SCDS_{jt}$ represents the daily change in SCDS spread for country from t to t+1. On the other hand, VIX depicts the global volatility or fear index at time t. We also include country control variables (ν_{jt}) and as well as market control variables, i.e., ψ_t. After predicting the error term ($\hat{\epsilon}$) from the Eq.2.3, we employ it as measure of idiosyncratic component in the following model to replicate our DID analysis in Eq. 2.2.

$$\begin{aligned} \Delta CDS_{ijt} = \alpha + \beta UK + \delta Post_k + \rho\hat{\epsilon}_{jt} + \gamma UK * Post_k \\ \theta Post_k * \hat{\epsilon}_{jt} + \kappa UK * Post_k * \hat{\epsilon}_{jt} \\ + \nu_i + \psi_t + \varepsilon_{ijt}, \end{aligned} \tag{2.4}$$

In Eq.2.4, dependent variable, $\Delta CDSijt$, is the daily change in corporate CDS for firm i, headquartered in country j from t to t+1. The variable of interest in this analysis is the $UK * Post_k * \hat{\epsilon}_{jt}$, therefore κ represents the treatment effect from the DID analysis. And again the $Post_k$ depicts the treatment periods as reported in the Table 2.1. Table 2.9 shows robustness results based on Eq.2.4 and findings are consistent with our prior DID

analysis in Table 2.8. After we filter influence of the global risk factors stemming from Global Pandemic on the sovereign CDS spread, this study still find a positive causal impact of sovereign CDS spread on the corporate CDS spread and this impact becomes the greatest after the Brexit day in Column 9 in Table 2.9. The results from the rest of the Brexit stages are also in line with those from the prior DID setting in Table 2.8. We also replicate robustness checks by employing different global volatility indicators such as Move index ($move$). In comparison VIX index (VIX) which is based on stock market and showing the market's expectation of 30-day volatility, Move index ($move$) is also a fear index but it is based on bond market and shows implied volatility on 1-month Treasury options which are weighted on the 2, 5, 10, and 30 year contracts. Our results are still consistent with our findings.

[Insert Table 2.9 Here.]

2.6.2 Controlling for the Covid-19 Government Measures

After the Covid-19, governments' reaction to Global Pandemic differed such as credit facilities to support business, lock downs, compulsory vaccinations. Government's reactions taken after the Covid-19 are important in storing the credibility of governments from the investors' perspective and affect the credit risk of corporations and corporations. To stay in line with our analysis to examine investor confidence in the government actions, we control for government reactions to fight against the Covid-19 on the nexus between

sovereign-corporate credit risk. For this purpose, this study employs Oxford's Covid-19 Government Response Tracker (OxCGRT) (Hale et al. (2021)) that collects systematic information on policy measures which governments to tackle COVID-19, since January 1, 2020 and this data is important in helping decision-makers and citizens understand governmental reactions in a consistent way, to fight the pandemic. This daily index is available at the country level data is from January 31, 2020 on-wards and this data covers more than 180 countries and are coded into 23 indicators, such as school closures, travel restrictions, vaccination policy. Also, these policies are recorded on a scale to reflect the strictness of government action, and scores are aggregated into a suite of policy indices. The tracker records how the response of governments has varied across the countries and higher (lower) values indicates stricter (less strict) response to global pandemic.

Using the overall government response index ($\Delta Covidresponse$) of Oxford's database, we control for the Covid-19 effect on the co-movement between sovereign and corporate CDS spread through using the severity of measures taken by the governments. This tracker ($\Delta Covidresponse$) records how the government actions has varied across countries and higher values indicated stricter response to pandemic. Since this data span period of COvid-19 response coincides with transition period (period between January-December 2020), we employ Covid-19 tracker to control for effects of Covid-19 impact on the association between sovereign and corporate credit risk. First, we calculate change in index ($\Delta Covidresponse$)to control for lagging government actions as well. Table

2.10 reports the results after controlling for the government response to fight the Global Pandemic. Results from Columns between 2&5 are based on DID setting in Eq. 2.2 while controlling for government response index ($\Delta Covidresponse$). We only look at Brexit stages of Brexit day and transition period as government response tracker starts from 2020 and do not have effect on the previous Brexit stages. Table 2.10 shows that increase in government measures to tackle Global pandemic has a negative impact on the corporate CDS spread and therefore implying effectiveness of government actions during the Covid-19 period to fight Pandemic. Results from this robustness check is in line with previous findings and confirm that Covid-19 does not affect our findings, indicating that co-movement between sovereign and corporate CDS spread reaches highest level after the Brexit day and positive during the transition period, supports our previous findings that UK government is successful at completion of its ultimate goal of Brexit.

[Insert Table 2.10 Here.]

2.6.3 Considering for the Geographic Ownership

This study identifies firms based on their domestic country. However, geographic holdings of firms by the investors might differ: A country other than its domestic country might be a dominant holder of the company. For example, a UK company BT group's major geographic ownership comes from United States (%61). This might affect investors' expectations on the exposure to domestic country risk or the use of government

guarantees and therefore overall nexus between sovereign and corporate credit risk after the Brexit stages.

We collect geographic holdings of firms from the Bloomberg database and exclude firms whose geographic dominance does not match with their domestic residence or firms whose dominant holder country is not itself (i.e. exclude firms whose geographic holder is an another country with a majority holdings (>%50)). Thus, we identify firms whose exposure to domestic countries' risks only.

We replicate our DID analysis based on 119 firms left (21 firms excluded) based on the above criteria. Our results (Table 2.11) are fully in line with our main findings from the DID analysis.

[Insert Table 2.11 Here.]

2.6.4 Banking vs. Non-Banking

Banks have direct exposure to sovereign risk due to their holdings of government debt securities while the non-banking sector has indirect risk exposure as banks are the main funding source for a considerable part of the non-financial sector. As the sample analyzed in this study comprises both banks and non-bank sectors, we hypothesize that there might be a differentiation in the link between sovereign and corporate CDS spreads after considering the industrial distinction between the banking and non-banking sector. Therefore, this study replicates DID analysis based on the 23 banks (5- the UK and 18-

EU banks) and findings are reported in Table 2.12 and consistent with previous findings after considering the industrial distinction.

[Insert Table 2.12 Here.]

2.7 Conclusion

After the UK's referendum vote on June 23, 2016, concerns regarding the future relations between the UK and European Union increased the tension in the financial markets which led to a rise in the credit default spreads. As previously studied in the literature, an increase in the sovereign default risk is prone to be reflected in the corporate CDS spread. In this study, we argue that investors are convinced in UK's government actions to complete its Brexit goal and increase (decreases or no reaction) in the sensitivity of corporate CDS spread reflects the increase in the credibility government for its actions is taken granted during the Brexit process. Using an objective approach, we examine the UK government's dedication to accomplishing the ultimate goal of exit from the European Union, i.e., Brexit. Since Brexit process is an influential process, Brexit process affects different aspects including economics, financial markets and politics and it has a long-lasting impact on the countries. In this scope, following the Acharya et al. (2014)'s model, we analyse the co-movement between sovereign and corporate CDS spread during the relevant Brexit stages that are pivotal in terms of Brexit process.

To explore the Brexit process, we divide the Brexit period into each distinct Brexit

stages based on their influence (positive or negative (or no impact)) on the Brexit process: 2016 Referendum vote, Triggering of Article 50, Withdrawal Act becomes law, Brexit plan suffers a defeat, Former PM Theresa May loses vote second time, Former PM Theresa May loses vote third time, Boris Johnson becomes new PM, extension of UK Brexit deal, UK General Election date, Brexit day, and transition period. Therefore, we investigate the impact of different but equally crucial stages in Brexit process. Our main target is to find the causal effect of sovereign credit risk on the UK firms' CDS spread for the related Brexit stages with varying uncertainty regarding the Brexit goal. DID analysis indicates that after the Brexit stages with lower (higher) uncertainty, sensitivity of sovereign CDS spread to corporate CDS spread increases (decreases), but overall the co-movement between them reaches the highest level after the Brexit day (including the transition period) when UK officially exited the European Union. In addition, Brexit stages those put significant disruption to Brexit goal are found to be less credible in terms of Brexit goal and priced by negative or insignificant causal effects. On the other hand, Brexit stages those ensured UK's Brexit goal with a lower uncertainty resulted in higher sensitivity to sovereign CDS spread. Findings are in line with our expectations. Overall, investors priced UK government actions as trustworthy by charging higher corporate CDS spread due to increasing exposure to sovereign credit risks with the increasing possibility of Brexit goal.On the other hand, investor did not respond or react negatively to event those puts disruption on the Brexit goal and therefore by lowering or

keeping constant CDS spreads on the corporate. Thus, investors reacted in line with the UK government actions to carry its Brexit goal that presents evidence on their trust in government actions.

We also implement several robustness checks to account for the Global Pandemic impact on our analysis: first, using a CAPM setting, we filter the simultaneous impact of global systematic effect (systematic factor) on the sovereign CDS spread, and excluding the global systematic risks, this study examines sole sovereign CDS impact on the corporate CDS spread; secondly using Covid-19 government response tracker of Oxford, this study control for government measures to tackle the Global Pandemic. Results from robustness checks are still in line with baseline approach as well as from the DID approach. In addition, we control for industrial differentiation between bank and non-bank sectors as banks are prone to hold government debt securities, but findings are still valid after considering industrial difference.

This is study aims to fill a void in the literature by examining the investor trust in the government actions through presenting an analysis of the CDS spread which is highly liquid and responsive to market movements. Analysing the Brexit process which provides a perfect base to explore credibility of government actions, we present evidence on the increased sensitivity of corporate CDS spread to sovereign CDS spread over the pivotal Brexit stages those with lower uncertainty surrounding the Brexit goal and, particularly, obtain the highest impact after the Brexit day,31 January 2020. We find that

the UK government actions for the Brexit goal is found to be more trustworthy if UK government efforts supports its ultimate Brexit goal and positive and increased nexus between sovereign and corporate CDS spread reflects UK government earns the trust of investors for its actions to accomplish its goal of Brexit. Overall, this analysis supports our hypothesis on the increased credibility of UK government's actions during the Brexit process.

This analysis is important in terms of showing the effects of government actions on the financial market instruments, particularly how government actions are perceived by the financial market agents such as investors. This paper complements the CDS literature as well as Brexit literature as this study investigates the co-movement between the sovereign and corporate credit risk over the Brexit stages that are shaped by government actions for the ultimate goal of "Brit-exit".

2.8 Policy Implications

Brexit process witnessed various stages which underlined the questioning of UK government's in completing its Brexit goal. This analysis is important in terms of showing the effects of government actions on the financial market participants, particularly how government actions are perceived by the investors. Results from this study provide evidence from the market participants' perspective and show that UK government' actions are taken granted by the investors. Also, this study presents evidence on the use of

complex financial market instruments such as CDS spreads as an input to investigate the government actions on the financial markets. In addition, this study also draws new attention in the government guarantees (to support corporate sector and as well as economic activity) from a contagion context (risk transfer from sovereign to firms) in that government actions might signal about potential government guarantees. Finally, this study has potential implications for policy makers in assessing effectiveness of their actions by the financial market players.

Table 2.1: Brexit Stages

This table reports the commencing dates of Brexit stages and correlation and treatment periods applied to the baseline model and DID model, respectively. Reference dates are employed from Brexit timeline described in the report of UK Parliament (Walker (2018)).

#	Brexit Stages	Beginning Date	Correlation Period	Treatment Period	Expected Effect \
0	Pre-Referendum	23 June-2016	<13 June 2016		
1	Referendum vote 2016	23-June-2016	23 June 2016 -19 March 2017	Post=1 if 23 June 2016 - 19 March 2017 Post=0 if 1 February 2013 - 12 June 2016 Post=. if >19 March 2017 Post=. if 13 June 2016 - 22 June 2016	Positive
2	Triggering of Article 50	29-March-2017	29 March 2017 - 16 June 2018	Post=1 if 29 March 2017 - 16 June 2018 Post=0 if 1 February 2013- 12 June 2016 Post=. if 13 June 2016 - 28 March 2017 Post=. if >16 June 2018	Positive
3	Withdrawal Act becomes Law	26 June 2018	26 June 2018 - 4 February 2019	Post=1 if 26 June 2018 - 4 February 2019 Post=0 if 1 February 2013- 12 June 2016 Post=. if 13 June 2016 - 25 June 2018 Post=. if >4 February 2019	Positive
4	Brexit deal suffers defeat in the House of Commons	14 February 2019	14 February 2019 - 2 March 2019	Post=1 if 14 February 2019-2 March 2019 Post=0 if 1 February 2013 - 12 June 2016 Post=. if 13 June 2016 -13 February 2019 Post=. if >2 March 2019	Negative/Insignificant
5	Former PM May loses vote second time	12 March 2019	12 March 2019- 19 March 2019	Post=1 if 12 March - 19 March 2019 Post=0 if 1 February 2013- 12 June 2016 Post=. if 13 June 2016 - 11 March 2019 Post=. if >19 March 2019	Negative/ Insignificant
6	Former PM May loses vote third time	29 March 2019	29 March 2019 - 16 May 2019	Post=1 if 29 March 2019 - 16 May 2019 Post=0 if 1 February 2013 - 12 June 2016 Post=. if 13 June 2016 - 28 March 2019 Post=. if >16 May 2019	Negative/Insignificant
7	Brexit party wins in European Parliament elections	26-May-2019	26 May 2019 - 13 July 2019	Post=1 if 26 May 2019 - 13 July 2019 Post=0 if 1 February 2013- 12 June 2016 Post=. if 13 June 2016- 25 May 2019 Post=. if >13 July 2019	Positive
8	Boris Johnson becomes new PM	23-July-2019	23 July 2019 - 9 October 2019	Post=1 if 23 July 2019 - 9 October 2019 Post=0 if 1 February 2013 - 12 June 2016 Post=. if 13 June 2016 - 22 July 2019 Post=. if >9 October 2019	Positive
9	Extension of Brexit Deal	19-October-2019	19 October 2019 - 2 December 2019	Post=1 if 19 October 2019 - 2 December 2019 Post=0 if 1 February 2013 - 12 June 2016 Post=. if 13 June 2016 - 18 October 2019 Post=. if >2 December 2019	Negative/Insignificant
10	UK General Election day	12-December-2019	12 December 2019 - 20 January 2020	Post=1 if 12 December 2019 - 20 January 2019 Post=0 if 1 February 2013 - 12 June 2016 Post=. if 13 June 2016 - 11 December 2019 Post=. if >20 January 2020	Positive
11	Brexit day	30-January-2020	30-January - 10 February 2020	Post=1 if 30 January 2020- 10 February 2020 Post=0 if 1 February 2013 - 12 June 2016 Post=. if 13 June 2016 - 29 January 2020 Post=. if >10 February 2020	Positive
12	Transition Period	30-January-2020	30 January - 11 March 2021	Post=1 if 30 January 2020 - 11 March 2021 Post=0 if 1 February 2016 - 12 June 2016 Post=. if 13 June 2016 - 30 January 2020	Positive

Table 2.2: Variable Definitions

This table reports definition of variables and their calculation used in the analysis.

Variable	Description	Source
ΔCDS	Daily change in corporate credit default spreads (in percentage points)	Eikon
$\Delta SCDS$	Daily change in sovereign credit default spread (in percentage points)	Eikon
asset	Natural logarithm of total assets	Eikon
eta	Winsorized total equity to total asset ratio at 1 % significance level	Eikon
roe	Winsorized return on equity at 1 % significance level	Eikon
marketcap	Natural logarithm of market capitalization of the relevant firm	Eikon
bond	Daily change in reference 5-year treasury bond interest rates	Eikon
itraxx	An index for traded CDS spreads in the European financial market	Eikon
move	An implied volatility index of S&P 500 index options	Eikon
VIX	Daily Chicago Board Options Exchange's CBOE Volatility Index	Eikon
GDP	Year on year % change (yoy) in real GDP growth	IMF
loan	Year on year % change (yoy) in loan growth	IMF
debtratio	Public debt to GDP ratio in %	IMF
mmrate	Money market interest rate in the economy in %	IMF
UK	Dummy variable equal to 1 if the country is United Kingdom, 0 otherwise	Our calculation
Post	Dummy variable equal to 1 if the period is equal to relevant Brexit stage, 0 otherwise	Our calculation
$\Delta Covidresponse$	Change in the Covid-19 overall government response index	Oxford

Table 2.3: Summary Statistics

This table reports summary statistics for the whole sample, for UK firms (38 out of 140) and European firms over the whole period between February 2013 and March 2021. All ratios are winsorized at the 1st and 99th percentile.

Whole					
Variable	Mean	Std. Dev.	P25	P75	Obs.
ΔCDS	0.0000	0.0290	-0.0140	0.0110	296380
$\Delta SCDS$	0.0000	0.0450	-0.0040	0.0010	296380
GDP	0.2810	3.4630	0.6000	2.1500	296380
loangrowth	1.3350	4.5700	-1.2900	4.4100	296380
mmrate	0.0410	0.4070	-0.3300	0.3600	296380
debtratio	87.3950	22.8520	72.1900	98.3500	296380
bond	0.9990	0.2630	0.9600	1.0370	296380
asset	24.8530	1.7390	23.8290	25.8540	296380
roe	13.7440	21.7250	6.3600	15.5900	296380
eta	6.9530	7.0520	2.4620	8.8720	296380
marketcap	23.7730	1.2930	23.1260	24.6340	296380
itraxx	308.5330	69.3740	257.0000	337.0000	296380
move	64.7280	14.9250	53.3760	73.5570	296380
VIX	16.8640	7.4130	12.6600	18.7400	296380
UK					
Variable	Mean	Std. Dev.	P25	P75	Obs.
ΔCDS	0.0000	0.0270	-0.0120	0.0100	80446
$\Delta SCDS$	0.0010	0.0520	-0.0050	0.0030	80446
GDP	0.3950	3.7810	1.3400	2.1400	80446
loangrowth	1.3230	3.2990	-1.0000	4.2000	80446
mmrate	0.5780	0.1290	0.5100	0.6000	80446
debtratio	88.7800	6.9160	85.7200	86.9200	80446
bond	1.0010	0.2140	0.9690	1.0270	80446
asset	24.3490	2.0460	23.1020	25.8570	80446
roe	23.6070	35.0950	6.0100	28.2800	80446
eta	8.3120	8.2950	2.5560	12.3870	80446
marketcap	23.5050	1.5260	22.7150	24.6340	80446
closeitraxx	308.5330	69.3740	257.0000	337.0000	80446
move	64.7280	14.9250	53.3760	73.5570	80446
VIX	16.8640	7.4130	12.6600	18.7400	80446
EU					
Variable	Mean	Std. Dev.	P25	P75	Obs.
ΔCDS	0.0000	0.0290	-0.0140	0.0110	215934
$\Delta SCDS$	0.0000	0.0410	-0.0030	0.0010	215934
GDP	0.2380	3.3360	0.6000	2.1500	215934
loangrowth	1.3400	4.9610	-1.3500	4.4100	215934
mmrate	-0.1590	0.2720	-0.3600	-0.0200	215934
debtratio	86.8790	26.4190	67.6600	98.3600	215934
bond	0.9980	0.2790	0.9560	1.0400	215934
asset	25.0410	1.5690	24.1400	25.8500	215934
roe	10.0690	11.7980	6.4000	14.7000	215934
eta	6.4470	6.4560	2.4460	6.7600	215934
marketcap	23.8730	1.1790	23.2070	24.6380	215934
itraxx	308.5330	69.3740	257.0000	337.0000	215934
move	64.7280	14.9250	53.3760	73.5570	215934
VIX	16.8640	7.4130	12.6600	18.7400	215934

Table 2.4: Pairwise Correlations

(1) This table shows the pairwise correlations between firm and country CDS spreads. Value between SCDS_UK-SCDS_PT & CDS_UK-CDS_PT reports average sovereign and corporate CDS spread for United Kingdom, Germany, France, Italy, Spain, Denmark, Netherlands, Sweden and Portugal respectively. * indicate statistical significance at 1%.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
CDS_UK	1																	
CDS_GE	0.897*	1																
CDS_FR	0.897*	0.919*	1															
CDS_IT	0.814*	0.853*	0.853*	1														
CDS_ES	0.827*	0.861*	0.862*	0.895*	1													
CDS_DE	0.631*	0.699*	0.608*	0.635*	0.586*	1												
CDS_NE	0.864*	0.891*	0.857*	0.756*	0.783*	0.658*	1											
CDS_SW	0.850*	0.848*	0.781*	0.746*	0.727*	0.697*	0.812*	1										
CDS_PT	0.717*	0.749*	0.672*	0.704*	0.760*	0.521*	0.726*	0.658*	1									
SCDS_UK	0.551*	0.464*	0.458*	0.523*	0.465*	0.432*	0.448*	0.533*	0.340*	1								
SCDS_GE	0.511*	0.459*	0.471*	0.439*	0.403*	0.370*	0.470*	0.536*	0.380*	0.499*	1							
SCDS_FR	0.510*	0.518*	0.514*	0.599*	0.496*	0.522*	0.449*	0.535*	0.486*	0.503*	0.633*	1						
SCDS_IT	0.481*	0.543*	0.498*	0.703*	0.537*	0.408*	0.457*	0.429*	0.430*	0.409*	0.395*	0.504*	1					
SCDS_ES	0.581*	0.630*	0.579*	0.703*	0.612*	0.508*	0.546*	0.548*	0.483*	0.491*	0.569*	0.623*	0.771*	1				
SCDS_DE	0.331*	0.305*	0.255	0.308*	0.233	0.349*	0.298*	0.359*	0.215	0.533*	0.452*	0.486*	0.246	0.330*	1			
$SCDS_NE$	0.373*	0.390*	0.327*	0.406*	0.350*	0.373*	0.355*	0.411*	0.317*	0.564*	0.517*	0.582*	0.297*	0.348*	0.721*	1		
SCDS_SW	0.346*	0.282*	0.262*	0.276*	0.199	0.213	0.279*	0.345*	0.208	0.365*	0.477*	0.418*	0.285*	0.365*	0.418*	0.469*	1	
SCDS_PT	0.471*	0.499*	0.406*	0.584*	0.466*	0.493*	0.457*	0.506*	0.510*	0.453*	0.445*	0.555*	0.649*	0.690*	0.342*	0.466*	0.365*	1

Table 2.5: Summary Statistics Until the Referendum Vote 2016

This table shows summary statistics for change between corporate CDS spread (ΔCDS) and sovereign CDS spread ($\Delta SCDS$): ($\Delta CDS - \Delta SCDS$) prior to Referendum vote for UK (treated group) and European firms (control group).

Year	Mean EU	Mean UK	Mean Difference	P-Value
2013	-0.1152	-0.0326	-0.0826	0.7530
2014	-0.0042	0.0018	-0.0060	0.9866
2015	0.1992	-0.3329	0.5320	0.2703
January-June 2016	-0.1616	-0.5262	0.3646	0.5720

Table 2.6: Results for Baseline Model

This table shows the regression results of the co-movement between sovereign ($\Delta SCDS$) and corporate credit default spread (ΔCDS) based on the Eq. (2.1) for UK firms: Column 1: pre−2016 Referendum (period before the UK's 2016 Referendum vote− <13 June 2016), Column 2 : Post−2016 Referendum (period after the Referendum vote>=23 June 2016) ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively. In line with Petersen (2009), this study cluster standard errors at firm level.

	(1) ΔCDS Pre- 2016 Referendum	(2) ΔCDS Post-2016 Referendum
ΔCDS	0.0122***	0.0441***
	(0.0022)	(0.0028)
GDP	0.0168*	-0.0666***
	(0.0090)	(0.0051)
loangrowth	-0.0011	0.0462***
	(0.0007)	(0.0025)
mmrate	0.3727***	-0.0361***
	(0.0314)	(0.0114)
debtratio		-0.0218***
		(0.0025)
bench	-0.0253***	-0.0009*
	(0.0067)	(0.0005)
asset	0.0000	-0.0001
	(0.0006)	(0.0001)
roe	0.0000	0.0000
	(0.0000)	(0.0000)
eta	0.0000	-0.0000
	(0.0000)	(0.0000)
marketcap	-0.0028***	0.0001
	(0.0009)	(0.0001)
itraxx	0.0007***	0.0005***
	(0.0000)	(0.0000)
move	-0.0005***	0.0005***
	(0.0000)	(0.0000)
Constant	-0.3565***	1.6425***
	(0.0328)	(0.2214)
Observations	33,592	46,854
R-squared	0.1815	0.1752
Number of id	38	38
Firm FE	YES	YES
Time FE	YES	YES
Cluster	YES	YES

Table 2.7: Results for Brexit Stages

This table reports regression results for UK firms based on correlation periods reported in the Table 2.1 using the Eq. (2.1). This table investigates the each Brexit stage in the following way: in Column 0 - Pre-Referendum vote (before June 13, 2016); in Column 1- 2016 Referendum vote (23 June 2016 and 19 March 2017); in Column 2- Triggering of Article 50 (29 March 2017 and 16 June 2018); in Column 3- Withdrawal Act becomes law (26 June 2018 -4 February 2019); in Column 4- Brexit Plan suffers defeat (14 February 2019 - 2 March 2019); in Column 5- Former PM May loses vote second time (12 March 2019- 19 March 2019) ; in Column 6- Former PM May loses vote third time (29 March 2019- 16 May 2019); in Column 7- Brexit party wins European Parliament Elections (26 May 2019- 13 July 2019); in Column 8- Boris Johnson becomes new PM (23 July 2019-9 October 2019); in Column 9- Extension of Brexit deal (19 October-2 December 2019); in Column 10 - UK General Election Day (12 December 2019 -20 January 2020); in Column 11- Brexit Day (30 January-10 February 2020); in Column 12 - transition period (30 January 2020 - 11 March 2021) . ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Variable	(0) ΔCDS	(1) ΔCDS	(2) ΔCDS	(3) ΔCDS	(4) ΔCDS	(5) ΔCDS	(6) ΔCDS	(7) ΔCDS	(8) ΔCDS	(9) ΔCDS	(10) ΔCDS	(11) ΔCDS	(12) ΔCDS
$\Delta SCDS$	0.0108***	0.0276***	0.0306***	0.1024***	0.0059	-0.4713***	-0.0999***	0.1142***	0.2127***	-0.0054	0.1336***	0.5529***	0.0601***
	(0.0022)	(0.0043)	(0.0034)	(0.0108)	(0.0354)	(0.0929)	(0.0280)	(0.0331)	(0.0299)	(0.0104)	(0.0203)	(0.1526)	(0.0099)
bond	-0.0226***	-0.0182***	-0.0263***	-0.1620***	-0.1731***	0.1242***	-0.1183***	0.0445***	-0.0251***	0.0221*	0.0022	0.0315*	0.0007
	(0.0067)	(0.0017)	(0.0046)	(0.0137)	(0.0554)	(0.0402)	(0.0176)	(0.0082)	(0.0041)	(0.0130)	(0.0119)	(0.0166)	(0.0005)
itraxx	0.0007***	0.0001	0.0006***	0.0003***	0.0005	-0.0016***	0.0009***	0.0009***	-0.0002**	0.0018***	0.0009***	0.0023***	0.0004***
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0003)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0005)	(0.0000)
move	-0.0005***	0.0016***	0.0004***	0.0010***	0.0025**	0.0140***	-0.0015***	-0.0002	0.0012***	0.0004**	-0.0006***	0.0003	0.0006***
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0012)	(0.0018)	(0.0004)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0007)	(0.0000)
Constant	-0.1134***	-0.1209***	0.0398	-0.0067	-0.0867	-0.3383***	-0.0355	-0.2867***	-0.0310*	-0.4608***	-0.1648**	-0.5618***	-0.1883***
	(0.0256)	(0.0327)	(0.1487)	(0.0425)	(0.1484)	(0.0996)	(0.0266)	(0.0248)	(0.0182)	(0.0575)	(0.0669)	(0.0981)	(0.0104)
Observations	33,288	7,296	12,084	6,080	456	228	1,406	1,330	2,204	1,178	1,102	342	10,944
R-squared	0.1773	0.1527	0.2177	0.2410	0.2671	0.5341	0.2568	0.1853	0.2360	0.1180	0.1674	0.2914	0.1670
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Table 2.8: Results for Differences-in-Differences Model

This table reports results from the DID approach based on the Eq. (2.2) using the treatment periods specified in the Table 2.1. The variable of interest is $UK * Post * \Delta SCDS$, an interaction term for change in sovereign CDS spread ($\Delta SCDS$), UK and treatment period for the relevant Brexit events ($Post$) reported in the Table 2.1. We also control for itraxx and move index in this analysis.. s

	(1) ΔCDS	(2) ΔCDS	(3) ΔCDS	(4) ΔCDS	(5) ΔCDS	(6) ΔCDS	(7) ΔCDS	(8) ΔCDS	(9) ΔCDS	(10) ΔCDS	(11) ΔCDS	(12) ΔCDS
UK*Post*$\Delta SCDS$	0.0709***	0.0941***	0.1895***	0.0399	-1.1440***	0.0057	0.1994***	0.1093***	0.0310	0.2075***	1.1545***	0.1450***
	(0.0108)	(0.0086)	(0.0179)	(0.0405)	(0.0931)	(0.0287)	(0.0625)	(0.0352)	(0.0250)	(0.0274)	(0.2454)	(0.0181)
$\Delta SDCS$	0.1323***	0.1322***	0.1321***	0.1322***	0.1322***	0.1321***	0.1183***	0.1183***	0.1183***	0.1321***	0.1322***	0.1345***
	(0.0146)	(0.0145)	(0.0145)	(0.0146)	(0.0146)	(0.0146)	(0.0107)	(0.0107)	(0.0107)	(0.0146)	(0.0146)	(0.0149)
UK*Post	-0.0007**	-0.0004	-0.0003	0.0011	-0.0213***	-0.0020***	-0.0004	-0.0009	0.0002	-0.0010	0.0041***	-0.0000
	(0.0004)	(0.0003)	(0.0005)	(0.0015)	(0.0022)	(0.0007)	(0.0010)	(0.0006)	(0.0008)	(0.0008)	(0.0015)	(0.0004)
UK*$\Delta SCDS$	-0.1153***	-0.1150***	-0.1149***	-0.1151***	-0.1152***	-0.1150***	-0.0987***	-0.0986***	-0.0987***	-0.1151***	-0.1153***	-0.1187***
	(0.0144)	(0.0144)	(0.0144)	(0.0145)	(0.0144)	(0.0144)	(0.0109)	(0.0109)	(0.0109)	(0.0144)	(0.0145)	(0.0149)
Post*$\Delta SCDS$	-0.0549***	-0.0805***	-0.0788***	-0.1252***	0.1381**	-0.0743***	-0.0576***	0.1069***	-0.0734***	-0.0826***	0.4945***	-0.1040***
	(0.0101)	(0.0078)	(0.0127)	(0.0236)	(0.0572)	(0.0149)	(0.0203)	(0.0246)	(0.0222)	(0.0182)	(0.1072)	(0.0135)
GDP	0.0003***	0.0001	0.0002**	0.0003***	0.0004***	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***	0.0002**	0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
loangrowth	-0.0000	0.0000	0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	0.0000	-0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
mmrate	0.0005	-0.0007	0.0004	0.0006	0.0007	0.0007	0.0006	0.0007	0.0005	0.0007	0.0004	0.0006
	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
debtratio	0.0001***	0.0000	-0.0000	0.0000	0.0001***	0.0000	0.0000	-0.0000	0.0000	0.0000	0.0001**	0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
bond	0.0006*	0.0008***	0.0007**	0.0011***	0.0012***	0.0011***	0.0013***	0.0012***	0.0013***	0.0012***	0.0012***	0.0008***
	(0.0004)	(0.0002)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0003)
asset	0.0007**	0.0010***	0.0009***	0.0006	0.0010**	0.0004	0.0007**	0.0005**	0.0006*	0.0007*	0.0009*	0.0002
	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0005)	(0.0003)	(0.0004)	(0.0002)	(0.0004)	(0.0004)	(0.0005)	(0.0001)
roe	0.0000	0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
eta	-0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	0.0000	-0.0000	-0.0000	0.0000	-0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
marketcap	-0.0015***	-0.0018***	-0.0015***	-0.0013***	-0.0013***	-0.0010**	-0.0011**	-0.0007**	-0.0011**	-0.0008	-0.0015***	-0.0003
	(0.0004)	(0.0003)	(0.0004)	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0003)	(0.0005)	(0.0006)	(0.0004)	(0.0002)
Constant	-0.0397***	-0.0267*	-0.0320**	-0.0343**	-0.0488***	-0.0350**	0.0036	0.0039	0.0073	-0.0479***	-0.0398**	-0.1226***
	(0.0149)	(0.0148)	(0.0159)	(0.0167)	(0.0184)	(0.0158)	(0.0073)	(0.0043)	(0.0083)	(0.0167)	(0.0185)	(0.0087)
Observations	149,520	167,160	145,040	124,320	123,480	127,820	127,540	130,760	126,980	126,700	123,620	162,960
R-squared	0.1197	0.1212	0.1218	0.1229	0.1249	0.1201	0.1851	0.1907	0.1851	0.1207	0.1227	0.1423
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Table 2.9: Results for Robustness

This table reports robustness results based on the Eq 2.4. The variable of interest is UK*Post*$\hat{\epsilon}$. $\hat{\epsilon}$ calculated from the Eq. (2.3). *Post* period specified in the Table 2.1 $\hat{\epsilon}$

Variables	(1) ΔCDS	(2) ΔCDS	(3) ΔCDS	(4) ΔCDS	(5) ΔCDS	(6) ΔCDS	(7) ΔCDS	(8) ΔCDS	(9) ΔCDS	(10) ΔCDS	(11) ΔCDS	(12) ΔCDS
$\hat{\epsilon}$ UK*Post*$\hat{\epsilon}$	0.0771***	0.1052***	0.2003***	0.0453	-0.5936***	-0.0331	0.2516***	0.0934**	0.0332	0.2193***	1.2882***	0.1806***
	(0.0110)	(0.0090)	(0.0183)	(0.0408)	(0.1086)	(0.0303)	(0.0610)	(0.0383)	(0.0259)	(0.0281)	(0.2453)	(0.0189)
$\hat{\epsilon}$	0.1382***	0.1379***	0.1378***	0.1379***	0.1379***	0.1378***	0.1242***	0.1242***	0.1242***	0.1379***	0.1381***	0.1431***
	(0.0149)	(0.0149)	(0.0149)	(0.0149)	(0.0149)	(0.0149)	(0.0110)	(0.0110)	(0.0110)	(0.0149)	(0.0149)	(0.0156)
UK*Post	-0.0006*	-0.0002	0.0002	0.0017	-0.0127***	-0.0018**	-0.0005	-0.0005	0.0006	-0.0007	0.0038***	0.0002
	(0.0004)	(0.0003)	(0.0005)	(0.0014)	(0.0021)	(0.0007)	(0.0011)	(0.0006)	(0.0008)	(0.0008)	(0.0014)	(0.0004)
UK*$\hat{\epsilon}$	-0.1272***	-0.1268***	-0.1268***	-0.1270***	-0.1270***	-0.1268***	-0.1122***	-0.1121***	-0.1122***	-0.1269***	-0.1271***	-0.1324***
	(0.0151)	(0.0151)	(0.0151)	(0.0151)	(0.0151)	(0.0151)	(0.0113)	(0.0113)	(0.0113)	(0.0151)	(0.0151)	(0.0158)
Post*$\hat{\epsilon}$	-0.0588***	-0.0858***	-0.0855***	-0.1267***	0.1383**	-0.0729***	-0.0683***	0.1059***	-0.0744***	-0.0887***	0.4254***	-0.1296***
	(0.0102)	(0.0081)	(0.0135)	(0.0234)	(0.0571)	(0.0147)	(0.0204)	(0.0252)	(0.0226)	(0.0181)	(0.1085)	(0.0150)
GDP	0.0003***	0.0001	0.0002**	0.0003***	0.0004***	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
loangrowth	-0.0000	0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	0.0000	-0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
mmrate	0.0002	-0.0010*	0.0000	0.0002	0.0004	0.0003	0.0003	0.0003	0.0002	0.0003	0.0001	0.0001
	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
debtratio	0.0001***	0.0000	-0.0000	0.0000	0.0001***	0.0000	0.0000	-0.0000	0.0000	0.0000	0.0001**	0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
bond	0.0005	0.0008***	0.0006**	0.0011***	0.0011***	0.0010***	0.0013***	0.0011**	0.0012***	0.0011***	0.0012***	0.0008**
	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0003)
asset	0.0007**	0.0010***	0.0009***	0.0006	0.0010**	0.0004	0.0008**	0.0005**	0.0006	0.0007*	0.0008*	0.0002
	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0005)	(0.0003)	(0.0004)	(0.0002)	(0.0004)	(0.0004)	(0.0005)	(0.0001)
roe	0.0000	0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
eta	-0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	0.0000	-0.0000	-0.0000	0.0000	-0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
marketcap	-0.0014***	-0.0018***	-0.0015***	-0.0013***	-0.0013***	-0.0010**	-0.0011**	-0.0007**	-0.0011**	-0.0008	-0.0015***	-0.0003
	(0.0004)	(0.0003)	(0.0004)	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0003)	(0.0005)	(0.0006)	(0.0004)	(0.0002)
Constant	-0.0464***	-0.0327**	-0.0386**	-0.0409**	-0.0552***	-0.0416***	0.0038	0.0042	0.0071	-0.0545***	-0.0462**	-0.1286***
	(0.0142)	(0.0142)	(0.0152)	(0.0161)	(0.0179)	(0.0151)	(0.0072)	(0.0043)	(0.0083)	(0.0161)	(0.0180)	(0.0083)
Observations	150,587	168,353	146,075	125,207	124,361	128,732	128,450	131,693	127,886	127,604	124,502	164,123
R-squared	0.1208	0.1222	0.1227	0.1241	0.1257	0.1213	0.1873	0.1928	0.1873	0.1218	0.1238	0.1434
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Table 2.10: Controlling for Government Actions During the Covid-19 Era

This table reports from the robustness checks after including the government policy response tracker for the Covid-19 (Hale et al. (2021)). Column (2) & (4) reports results from the DID setting for treatment periods of Brexit day and transition periods in the Table 2.1 while controlling for government policy response index for Covid-19. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Variables	(1) Brexit day	(2) Brexit day	(3) Transition	(4) Transition
UK*Post*$\Delta SCDS$	1.1465***	1.2194***	0.1466***	0.1441***
	(0.2455)	(0.2461)	(0.0181)	(0.0181)
$\Delta SCDS$	0.1332***	0.1286***	0.1355***	0.1337***
	(0.0145)	(0.0144)	(0.0149)	(0.0149)
UK*Post	0.0039***	0.0044***	-0.0001	-0.0000
	(0.0015)	(0.0015)	(0.0004)	(0.0004)
UK*$\Delta SCDS$	-0.1162***	-0.1130***	-0.1196***	-0.1184***
	(0.0144)	(0.0143)	(0.0149)	(0.0149)
Post*$\Delta SCDS$	0.5058***	0.4978***	-0.1054***	-0.1017***
	(0.1078)	(0.1073)	(0.0135)	(0.0136)
$\Delta Covidresponse$		-0.0008***		-0.0003***
		(0.0001)		(0.0000)
GDP	0.0002**	0.0002**	0.0003***	0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
loangrowth	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
mmrate	0.0004	0.0004	0.0005	0.0005
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
debtratio	0.0001**	0.0001**	0.0000*	0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
bond	0.0012***	0.0015***	0.0008***	0.0008***
	(0.0004)	(0.0004)	(0.0003)	(0.0003)
asset	0.0009*	0.0009*	0.0002	0.0002
	(0.0005)	(0.0005)	(0.0001)	(0.0001)
roe	-0.0000	-0.0000	-0.0000*	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
eta	-0.0000	-0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
marketcap	-0.0015***	-0.0015***	-0.0003	-0.0003
	(0.0004)	(0.0004)	(0.0002)	(0.0002)
itraxx	0.0002***	0.0002***	0.0003***	0.0003***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
move	-0.0001***	-0.0001***	0.0003***	0.0003***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	-0.0377**	-0.0376**	-0.1215***	-0.1230***
	(0.0186)	(0.0186)	(0.0087)	(0.0087)
Observations	124,502	124,502	164,123	164,123
R-squared	0.1228	0.1253	0.1422	0.1427
Firm FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Cluster	Firm	Firm	Firm	Firm

Table 2.11: Accounting for Geographic Holdings of Businesses

This table reports results from the DID approach based on the Eq. (2.2) using the treatment periods specified in the Table 2.1 while we account for firms whose geographic ownership is in line with its country residence as discussed in robustness section. The variable of interest is $UK * Post*$, an interaction term for $\Delta SCDS$, UK and treatment period for the relevant Brexit events reported in the Table 2.1. We also control for itraxx and move index in this analysis..

	(1) ΔCDS	(2) ΔCDS	(3) ΔCDS	(4) ΔCDS	(5) ΔCDS	(6) ΔCDS	(7) ΔCDS	(8) ΔCDS	(9) ΔCDS	(10) ΔCDS	(11) ΔCDS	(12) ΔCDS
UK*Post*$\Delta SCDS$	0.0681***	0.0959***	0.1781***	0.0077	-1.1717***	0.0144	0.1712***	0.1130***	0.0411	0.2014***	1.2107***	0.1445***
	(0.0111)	(0.0094)	(0.0200)	(0.0468)	(0.1037)	(0.0361)	(0.0640)	(0.0402)	(0.0266)	(0.0292)	(0.3133)	(0.0201)
$\Delta SCDS$	0.1263***	0.1262***	0.1261***	0.1261***	0.1262***	0.1261***	0.1135***	0.1135***	0.1136***	0.1261***	0.1263***	0.1285***
	(0.0146)	(0.0145)	(0.0145)	(0.0146)	(0.0145)	(0.0145)	(0.0107)	(0.0107)	(0.0107)	(0.0145)	(0.0146)	(0.0150)
UK*Post	-0.0006	-0.0006	-0.0003	0.0020	-0.0231***	-0.0022***	-0.0001	-0.0004	0.0005	-0.0005	0.0051***	-0.0002
	(0.0004)	(0.0004)	(0.0005)	(0.0016)	(0.0027)	(0.0008)	(0.0012)	(0.0007)	(0.0009)	(0.0010)	(0.0016)	(0.0004)
UK*$\Delta SCDS$	-0.1109***	-0.1106***	-0.1106***	-0.1107***	-0.1108***	-0.1106***	-0.0970***	-0.0970***	-0.0970***	-0.1107***	-0.1109***	-0.1145***
	(0.0144)	(0.0144)	(0.0144)	(0.0144)	(0.0144)	(0.0144)	(0.0109)	(0.0109)	(0.0109)	(0.0144)	(0.0145)	(0.0150)
Post*$\Delta SCDS$	-0.0528***	-0.0801***	-0.0796***	-0.1185***	0.1221**	-0.0688***	-0.0572***	0.1113***	-0.0890***	-0.0817***	0.4735***	-0.1018***
	(0.0103)	(0.0083)	(0.0133)	(0.0244)	(0.0564)	(0.0151)	(0.0211)	(0.0259)	(0.0220)	(0.0183)	(0.1215)	(0.0140)
GDP	0.0003***	0.0001	0.0002	0.0002**	0.0004***	0.0003***	0.0003**	0.0003**	0.0002**	0.0003***	0.0002*	0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
loangrowth	-0.0000	0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	0.0000	-0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
mmrate	0.0005	-0.0007	0.0002	0.0005	0.0007	0.0007	0.0005	0.0005	0.0004	0.0006	0.0003	0.0004
	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
debtratio	0.0001***	0.0000	-0.0000	0.0000	0.0001**	0.0000	-0.0000	-0.0000	0.0000	0.0000	0.0001	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
bond	0.0006	0.0008***	0.0006**	0.0010***	0.0011***	0.0010***	0.0013***	0.0011**	0.0012***	0.0011***	0.0011***	0.0007**
	(0.0004)	(0.0002)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0003)
asset	0.0011*	0.0014***	0.0006	0.0005	0.0008	0.0010*	0.0004	0.0007	0.0001	0.0008*	0.0005	0.0007*
	(0.0006)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0004)
roe	-0.0000	0.0000	0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0000	0.0000	-0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
eta	-0.0000	0.0000	-0.0000	-0.0000	-0.0000	0.0000	0.0000	0.0000	-0.0000	0.0000	-0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
marketcap	-0.0015***	-0.0018***	-0.0017***	-0.0014***	-0.0014***	-0.0010**	-0.0012**	-0.0007**	-0.0013**	-0.0008	-0.0016***	-0.0003
	(0.0004)	(0.0003)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0003)	(0.0005)	(0.0007)	(0.0004)	(0.0002)
Constant	-0.0360*	-0.0263	-0.0089	-0.0172	-0.0317	-0.0379*	0.0153	0.0001	0.0234	-0.0389*	-0.0174	-0.1299***
	(0.0187)	(0.0181)	(0.0194)	(0.0200)	(0.0205)	(0.0210)	(0.0150)	(0.0116)	(0.0150)	(0.0214)	(0.0192)	(0.0116)
Observations	127,091	142,085	123,283	105,671	104,957	108,646	108,408	111,145	107,932	107,694	105,076	138,515
R-squared	0.1196	0.1209	0.1214	0.1229	0.1252	0.1200	0.1888	0.1942	0.1887	0.1207	0.1226	0.1441
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Table 2.12: Results from the Robustness Checks - Banking Sector

This table reports results from the DID approach based on the Eq. (2.2) using the treatment periods specified in the Table 2.1 for banking sector only. The variable of interest is $UK * Post*$, an interaction term for $\Delta SCDS$, UK and treatment period for the relevant Brexit events reported in the Table 2.1. We also control for itraxx and move index in this analysis..

	(1) ΔCDS	(2) ΔCDS	(3) ΔCDS	(4) ΔCDS	(5) ΔCDS	(6) ΔCDS	(7) ΔCDS	(8) ΔCDS	(9) ΔCDS	(10) ΔCDS	(11) ΔCDS	(12) ΔCDS
UK*Post*$\Delta SCDS$	0.0733**	0.0959***	0.3082***	-0.1213	-1.0309***	0.0025	0.5790***	0.2324***	0.0628	0.3322***	0.4207	0.1565***
	(0.0262)	(0.0247)	(0.0690)	(0.1239)	(0.2206)	(0.0517)	(0.2047)	(0.0777)	(0.0660)	(0.0842)	(0.4111)	(0.0463)
$\Delta SCDS$	0.2217***	0.2211***	0.2212***	0.2215***	0.2215***	0.2213***	0.1699***	0.1700***	0.1699***	0.2214***	0.2216***	0.2255***
	(0.0501)	(0.0499)	(0.0499)	(0.0501)	(0.0501)	(0.0500)	(0.0349)	(0.0349)	(0.0349)	(0.0501)	(0.0501)	(0.0515)
UK*Post	-0.0021***	-0.0008	0.0003	-0.0085***	-0.0187***	-0.0032**	-0.0032	-0.0034***	-0.0018	0.0011	-0.0016	-0.0003
	(0.0004)	(0.0008)	(0.0007)	(0.0022)	(0.0046)	(0.0012)	(0.0019)	(0.0009)	(0.0015)	(0.0016)	(0.0031)	(0.0006)
UK*$\Delta SCDS$	-0.1849***	-0.1841***	-0.1841***	-0.1847***	-0.1848***	-0.1845***	-0.1296***	-0.1298***	-0.1297***	-0.1847***	-0.1850***	-0.1904***
	(0.0494)	(0.0492)	(0.0493)	(0.0495)	(0.0494)	(0.0494)	(0.0346)	(0.0346)	(0.0347)	(0.0494)	(0.0495)	(0.0511)
Post*$\Delta SCDS$	-0.0665**	-0.0756***	-0.0903	-0.1121	0.0605	-0.0951**	-0.0868	0.0351	-0.0871	-0.1570**	0.5189**	-0.1417***
	(0.0258)	(0.0221)	(0.0617)	(0.0767)	(0.1887)	(0.0449)	(0.0724)	(0.0718)	(0.0566)	(0.0638)	(0.2340)	(0.0418)
GDP	0.0004***	0.0001	0.0004***	0.0004***	0.0005***	0.0005***	0.0006***	0.0005***	0.0005***	0.0005***	0.0004**	0.0005***
	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
loangrowth	0.0000	0.0001**	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001*	0.0001	0.0001	0.0001	0.0000
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)
mmrate	0.0022***	-0.0002	0.0019***	0.0028***	0.0028***	0.0021***	0.0034***	0.0023***	0.0028***	0.0029***	0.0026***	0.0028***
	(0.0005)	(0.0009)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0011)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0009)
debtratio	0.0001***	0.0001	0.0000	0.0001	0.0001	0.0001*	0.0000	0.0001	0.0000	0.0001	0.0001*	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)
bond	0.0000	0.0010	0.0000	0.0008	0.0009	0.0001	0.0001	-0.0001	0.0001	0.0008	0.0009	0.0011
	(0.0011)	(0.0007)	(0.0008)	(0.0012)	(0.0011)	(0.0012)	(0.0014)	(0.0015)	(0.0015)	(0.0011)	(0.0012)	(0.0008)
asset	-0.0016	-0.0021	-0.0004	0.0014	0.0004	-0.0031	0.0033	-0.0016	0.0012	0.0013	0.0003	0.0022*
	(0.0023)	(0.0017)	(0.0024)	(0.0033)	(0.0028)	(0.0027)	(0.0039)	(0.0022)	(0.0023)	(0.0027)	(0.0029)	(0.0012)
roe	0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
eta	0.0001	0.0001**	0.0000	0.0000	0.0000	0.0001	-0.0000	0.0001	0.0000	-0.0000	0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)
marketcap	-0.0004	-0.0006	-0.0003	-0.0003	-0.0001	-0.0001	-0.0002	-0.0001	-0.0003	-0.0001	-0.0003	-0.0003
	(0.0004)	(0.0007)	(0.0006)	(0.0007)	(0.0007)	(0.0007)	(0.0008)	(0.0006)	(0.0007)	(0.0007)	(0.0007)	(0.0005)
Constant	0.0243	0.0603	0.0097	-0.0486	-0.0310	0.0614	-0.0854	0.0361	-0.0282	-0.0507	-0.0269	-0.1601***
	(0.0627)	(0.0531)	(0.0719)	(0.0904)	(0.0785)	(0.0768)	(0.1044)	(0.0560)	(0.0613)	(0.0772)	(0.0842)	(0.0405)
Observations	24,564	27,462	23,828	20,424	20,286	20,999	20,953	21,482	20,861	20,815	20,309	26,772
R-squared	0.1766	0.1737	0.1753	0.1824	0.1832	0.1792	0.3059	0.3076	0.3085	0.1798	0.1823	0.1838
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

Chapter 3

Investor's Confidence in Supervision: Evidence From Bank Opacity

3.1 Introduction

There is evidence of the relationship between corporate transparency and credit risk but limited studies focus on the bank transparency (Kanagaretnam et al. (2016), Norden (2017), Chiu et al. (2018)). Also, what is not clear is the role of supervision on this association? Prior literature focuses on the financial market reaction due to change of a supervision (Andrieş et al. (2020)) or bank risk disclosures after a change in supervision (Altunbaş et al. (2022)). Bridging between those two concepts of bank opacity and credit risk together, this study first examines the link between bank opacity and credit risk premium, and secondly studies this association after a change in the Single Supervisory Mechanism (SSM). Thus, this study presents evidence on the risk transfer due to bank opacity under a change in the banking supervision.

Introduced on January 31, 2013, SSM is the first pillar of the Banking Union and in addition to ensuring soundness of banking system, it also brings a consistent centralized

supervision mechanism in the banking sector at the European level. Its first step of running comprehensive review checks targets a transparency in the credit quality of the banks' loan portfolios, having an effect on the overall asset quality of banks. Asset quality checks are important as they are targeted to increase the banks' information transparency (Fiordelisi et al. (2017)). Thus, SSM was introduced to increase overall bank transparency in asset quality and therefore contribute on the market efficiency by decreasing the information asymmetry between banks and the outsiders. Therefore, SSM provides a unique mechanism, targeting asset quality, and as wells as transparency, to investigate the association between bank opacity and credit risk premiums.

We can argue that two perspectives shape investors' credit risk premiums on banks' information transparency after a change in the SSM regulation: stakeholders' and shareholders' views as discussed in the previous literature (Andrieş et al. (2020)). From the stakeholder's perspective, the launch of the SSM means higher costs due to increased administrative and operational costs (Moenninghoff et al. (2015)) of stricter regulations for the SSM-supervised banks. We argue that increased costs negatively affect a bank's profitability prospects and provide a basis for managerial discretion for concealing the true and fair financial disclosures, accordingly increasing the bank opacity (or less transparent banks). That would put pressure on the creditworthiness of banks' financial disclosures and thereby on banks' credit risk premiums. On the other hand, from the shareholder's perspective, significant banks are subject to high-level scrutiny and over-

sight due to regular asset quality checks. That would have a positive effect on their asset qualities and lower their credit risk. Thus, from the shareholders' view, high-level scrutiny and tightened supervision would increase bank credit risk premiums.

Based on Duffie & Lando (2001)'s incomplete accounting model which states that information transparency and default risks are included in the credit risk premiums, this study investigates the changes in investor risk premiums by drilling into its main components i.e. default risk and bank opacity. This study first examines the association between bank opacity and credit risk premiums, that is studied rarely in the previous literature. We expect that deficiency in financial information disclosure blurs the information transparency of banks and complicates the pricing of financial instruments. This study measures banks' opacity using the loan loss provision (LLPs), based on the discretionary loan loss provisioning model, extensively investigated in the literature for calculating information transparency and examining banks' discretionary earnings management motives (Beatty & Liao (2014), Dou et al. (2018), Nguyen et al. (2022)). The discretionary loan provisioning model decomposes LLPs into two parts: discretionary and non-discretionary LLPs (abnormal LLP), and abnormal LLPs are the part that cannot be estimated using the disclosed information or that is due to managerial discretion resulting in information asymmetry between the bank and the investors. An increase (decrease) in discretionary LLPs means less (more) information disclosure and an increase (decrease) in the information asymmetry between the bank and outsiders.

Using this as measure of bank opacity, this study first explores the changes in credit risk premiums due to insufficient financial information disclosure and we expect that an increase (decrease) in the bank opacity is associated with an increase (decrease) in the CDS spreads after controlling for the bank default risk. In the second step, this study investigates the causal effect of a change in the bank supervision through the SSM, first pillar of the Banking Union of 2014, on the association between bank opacity and credit risk premium. SSM can be linked with cost pressures on those banks under the centralized mechanism and tendency to increase bank opacity to mask negative income prospects, therefore implying a positive treatment effect on the investors' credit risk premiums, on the other hand, SSM increases scrutiny and oversight and therefore it might have a positive effect on the asset quality, therefore have a negative (no effect) treatment effect on the investors' credit risk premiums.

We present evidence on bank opacity as a determinant of bank credit risk, particularly for systemically important banks. Also, this study shows that after the launch of SSM, investors increase their credit risk premiums on opaque and systemically-important banks. This finding is in line with the stakeholder's view: SSM increases the costs on the SSM-supervised banks compared to non-SSM banks as it puts pressure on the future profitability of SSM-supervised banks and gives rise to managerial discretion and bank opacity that is reflected as an inflated credit risk premium by the investors. Findings are in contrast with the shareholder's view: investors' credit risk premiums do not take

advantage of strengthened asset quality under the centralized supervision mechanism. Thus, investors penalise centrally supervised banks due to cost pressures on their income prospects and tracking increased bank opacity resulting from the implementation of tighter direct supervision.

We also present several robustness checks. First, we differentiate our bank opacity measure by scaling it in line with the literature (Cornett et al. (2009)). Secondly, we use a placebo test and findings are still consistent. Thirdly, this study replicates the analysis using different treatment groups by changing the composition of the countries in the control group to validate the counterfactual effect is due to the launch of SSM and not due to any other geographical factors on the increase in the bank opacity. Lastly, different LLP models have been discussed and applied in the literature due to the absence of one correct econometric model (Beatty & Liao (2014)). Due to the complexity of the LLP model as it includes various variables to estimate loan loss provisions, this study explores the increasing interest in the machine learning methods and employs regularized linear regression [1] of the toolbox of machine learning to calculate bank opacity through a better simplified and correct specification. Results from the robustness checks are in line with the previous findings.

This study contributes to the prior literature in several strands: first, this chapter voids the gap in the literature by bridging the bank opacity and credit risk premiums and

[1]regularized linear regression is an extension of linear regression and regularized linear regression minimizes the sum of squared deviations between observed and model-predicted values like ordinary least squares (OLS), but it also imposes a regularization penalty aimed at limiting model complexity.

analyses this nexus under a counterfactual effect of centralized supervisory mechanism. This chapter also complements to the the existing literature on the bank opacity (Beatty & Liao (2014), Dou et al. (2018)) and also limited literature investigating the market reaction to bank information disclosures (Chiu et al. (2018)). Differently, this study also complements to discretionary loss provisioning literature (Bushman & Williams (2012), Beltrame et al. (2016), Valverde et al. (2016)) through measuring bank opacity to investigate it implications on the the investors' risk premiums. Thirdly, this study contributes to literature investigating the effect of the supervision change on the stock market return and credit risk premiums (Andrieş et al. (2020)) and bank risk disclosure (Altunbaş et al. (2022)). In addition, it also contributes to studies those analysing the effect of corporate disclosures on the corporate default spread (Yu (2005), Andrade et al. (2014)), this study contributes to banking literature. Finally, this study construct a model enabling to study the risk transfer from bank opacity to credit risk premiums under a change in the supervision mechanism.

3.2 Literature Review

Previous literature presents evidence of bank opacity and credit risk. An intriguing question is how would the inclusion of supervision would affect his link. This study first drills down to the association between bank opacity and credit risk premium and then through investigating a unique supervision change of Single Supervisory Mechanism

(SSM) with its goal to increase asset quality, this study examines the counterfactual effect of the launch of a centralized supervisory mechanism on this link for those banks assigned under this mechanism.

The global financial crisis and the following European banking crisis have proved how quickly risks in the financial sector can spread in a monetary union. After the global financial crisis and the subsequent sovereign debt crisis, increased scrutiny of the banking system was a must in the European Union. Also, there were concerns related to the increased connection between sovereign and bank risk (Polizzi (2022)). To address those issues, European Council established the Banking Union (BU) in November 2014 and BU is based on three pillars: the Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM) and the European Deposit Insurance Scheme.

The main goal of European banking supervision is to ensure the safety and soundness of the European banking system as well as increase financial integration and stability. Consistent supervision European banking supervision is one of the two pillars of the EU banking union, along with the Single Resolution Mechanism[2]. The launch of the SSM was a historic event. Beginning in November 2014, the most significant banks came under the direct supervision of the European Central Bank, while national supervisory authorities maintained direct supervision of the remaining banks.

Table 3.1 report the institutional setting for the launch of SSM. The SSM is the

[2]Being one of the pillars of the banking union, the Single Resolution Mechanism (SRM) is a central institution for bank resolution in the EU.

first pillar of European banking supervision, which is to rebuild trust in the European banking sector and increase the resilience of the banks. Also, one of its goals is to increase scrutiny through single supervision and improve the supervision of the banks. On January 31, 2013, the speech by Vítor Constâncio, former Vice-President of the ECB, the first pillar of the Banking Union was introduced: Single Supervision Mechanism (SSM) and SSM comprises the ECB and the national supervisory authorities of the participating countries. On October 23, 2013, together with the national supervisors, ECB starts the comprehensive assessment, a "financial health check" of banks[3]. On November 2013, SSM Regulation and on May 15, 2014, framework regarding the SSM Regulation came into force. On August 19, 2014, the Regulation on the SRM sets out uniform rules and procedures for the resolution of banks under the SRM, through the support of the Single Resolution Fund. On September 4, 2014, the ECB announced the list of significant and less significant institutions to designate the banks that are under the supervision of the SSM, i.e. systemically important financial institutions and those less significant financial institutions supervised by the national supervisory authorities.

Following the completion of the comprehensive assessments, the ECB publishes the results for individual banks and countries as a whole, together with recommendations for supervisory measures on October 26, 2014. Lastly, ECB Regulation on supervisory fees enters into force on November 2014 which states that The ECB Regulation on supervisory fees sets out how the annual supervisory fee for banks is calculated and

[3]130 banks under the comprehensive assessment

applied, and how it is levied from all supervised banks on the same date.

[Insert Table 3.1 Here.]

Previous literature focuses on the supervisory implications on the market reaction and risk disclosures. Using an event study analysis, Andrieş et al. (2020) examine the stock market reaction to the disclosure of the list of Other Systemically Important Institutions (O-SIIs) by the European Banking Authority and find that both credit default swap (CDS) spread and stock price immediate reaction of the stock market is negative, suggesting that the banks under the SSM are perceived to be less profitable because they are subject to tighter regulation and thereby incurring higher costs. Also, authors find that this is an immediate effect and investors change their perspective due to their feature of too big to fail status of those banks. Carboni et al. (2017) suggest that due to that reason there are might be national discretion which might result in regulatory inconsistencies for the financial institutions supervised by the SSM. Since banks may want to hide some information from their supervisors, any supervisory mechanism is described as a principal-agent problem. On the other hand, using stock market and CDS spreads, Sahin & De Haan (2016) find no significant impact due to European bank stock market prices and credit default swap showed no reaction to the launch of Banking Union. Pancotto et al. (2020) investigates the announcements related to the SSM on the financial markets, and find that there is an increase in the CDS spread with a detrimental effect on the shareholder's wealth. In addition, the authors also investigate market reaction to

the events with ECB's 2014 Comprehensive Assessments and also Global Systemically Important Banks (G-SIBs) reaction to the establishment of Banking Union and in both studies, they find that CDS spread is positive. On the other hand, studies (Morgan et al. (2014)) investigating the effect of market reaction to the stress test result of 19 largest U.S. bank holding companies conducted by federal bank supervisors in 2009, find that the market had largely deciphered on its own which banks would have capital gaps before the stress test results were revealed. Empirical research investigating the effect of information transparency on the investors' credit risk premium is rather limited and incorporates different measures for information disclosures, such as narrative risk disclosures. Chiu et al. (2018) analyzes the effect of narrative risk factor disclosures of firms on the CDS pricing after the Securities and Exchange Commission (SEC) mandate of risk factor disclosures (RFDs) and finds that CDS spreads decrease significantly after the SEC requirement for including a risk factor disclosure which presents evidence on the increased transparency of firm and ease of reading credit quality by the investors. Similarly, Altunbaş et al. (2022) study the effect of the European Banking Union on the banks' risk disclosures, calculated using a content analysis method and find risk disclosure of SSM supervised banks are weaker compared to national supervised by after the Banking Union.

Prior literature examines the SSM from different perspectives: Fiordelisi et al. (2017) studies the SSM's launch on banks' lending activity and finds that the significant

banks reduced their lending activity more than the less significant banks. Sáiz et al. (2019) address the question of whether the Banking Union has influenced the contagion mechanism amongst financial institutions and sovereign risk, the main goals of the ECB, findings show that there is no evidence that the Banking Union decreased the contagion between bank stock returns and sovereign risk. Colliard (2020) focuses on bank regulation after the Banking Union and finds that the supervisory architecture might be an important determinant of regulatory effectiveness. Hüser et al. (2018) examines the implications of bank bail-ins suing a network structure and expects that despite the obvious benefits of shifting the burden of resolution from taxpayers to bank creditors, bank bail-ins may also give rise to costs as the financial consequences for bank shareholders and creditors being bailed in could produce risk for their financial situation and potentially trigger systemic implications. They find that there is no direct contagion in terms of creditor banks failing as a result of another bank being bailed in, which is due to low levels of securities cross-holdings in the interbank network and this study presents evidence on the embedded contagion risk and altered network structure through quantification of the bail-in consequences on the liability holders and recapitalisation.

Recent literature also investigates the SSM:Carletti et al. (2021) states that the SSM monitoring function is not pure direct supervision as it still depends on the information provided by the national supervisory authorities. Carboni et al. (2017) suggest that due to that reason there are might be national discretion which might result in regulatory

inconsistencies for the financial institutions supervised by the SSM. Since banks may want to hide some information from their supervisors, any supervisory mechanism is described as a principal-agent problem. Nevertheless, Carletti et al. (2021) states that the current European supervisory mechanism entails a double principal-agent problem: between the bank and its supervisor and between the local and the central supervisor. The latter is an important issue, as the two supervisors have different utility functions and final objectives. These regulatory problems might be reflected in the way banks provide information in their annual financial statements.

An ample literature analysis the impact of supervision on bank behaviour by focusing on bank risk (Harris & Raviv (2014)), market reaction. and also bank credit risk using financial disclosures. Altunbaş et al. (2022) show that Banking Union has a negative effect on the centrally supervised banks' risk disclosures: using content analysis techniques, authors develop a bank risk disclosure measure and also using a Banking Union as a natural experiment, analyzes the effect of Banking Union on the bank risk disclosures and find that bank risk is disclosure increased overall following the Banking Union but there is a weakening of risk disclosures by SSM-supervised banks relative to banks supervised by national authorities. Thus, the authors find that risk disclosure of SSM-supervised banks worsened relative to that of nationally supervised banks after the Banking Union.

This chapter is related to literature investigating the market reaction through inves-

tigating the credit risk premiums and bank behaviour due to the introduction of the SSM. In addition, this study contributes to prior literature by focusing on determinants of credit risk premiums based on the accounting literature (Duffie & Lando (2001)) and presents causal evidence and explanation on the investor behaviour due to a change in the supervision. Carboni et al. (2017) suggest that the European Supervisory Mechanism is associated with potential national discretion due to regulatory inconsistencies, this study is relevant to that literature but explores the determinants of market response to the SSM through investigating the bank opacity stemming from managerial discretion after the SSM.

Investors' preference on the pricing of information disclosures is mainly shaped by the stakeholder's and bondholder's views (Andrieş et al. (2020)). From the shareholders' point of view, SSM-supervised banks are perceived to be less profitable because they must maintain a capital buffer and are subject to tighter supervision, which is costly for the banks; no effect, i.e., this inclusion does not bring any new information to the market; or a positive effect due to the classification of banks under SSM's as globally systemically important banks (GSIBs) which increases the probability of future bank runs and may help such institutions obtain lower funding costs, thereby increasing profitability (Morgan et al. (2014)). Therefore, shareholders' view entails penalization of banks by the market after the announcement of SSM-supervised banks that must comply with additional regulatory requirements like capital surcharges, or tighter supervisory requirements,

thereby reducing banks' earnings prospects (Abreu & Gulamhussen (2013), Dewenter & Riddick (2018)). Also, following regulations under the SSM supervised banks could affect future earnings if banks are exposed to regulation related administrative and operational costs (Moenninghoff et al. (2015)). In line with this view, Andrieş et al. (2020) find that reaction to the stock market is negative implying a decrease in profitability in financial institutions due to tighter regulations. However, the authors also investigate which perspective dominates the other (bondholder or stakeholder's view). Bondholder view suggests a decrease in the probability of bank defaults after the designation of SSM-supervised banks as those banks are supervised by a single authority implying a more strict regulation and also lower cost of funding in case of probable bank bailouts that would maintain trust in the SSM-supervised banks, thereby increasing bank's earnings' prospects and lowering the probability of defaults. Similar to Andrieş et al. (2020), a negative reaction on the investor risk premiums, i.e. CDS spread can be associated with being other systemically important financial institution and an implicit too- big to fail (TBTF) classification (Abreu & Gulamhussen (2013)) and increase in risk-taking and moral hazard (Farhi & Tirole (2012)). Farhi & Tirole (2012) show that time-consistent, imperfectly targeted support to distressed institutions makes private leverage choices strategic complements and that would result in those institutions adopting a risky balance sheet to become profitable that insights have important consequences, thus banks choose to correlate their risk exposures to the need for macro-prudential supervision.

Based on the Duffie & Lando (2001)'s incomplete accounting model to decompose investor risk premiums into default probability and information opacity, this study examines the investors' pricing of bank financial disclosures after the implementation of SSM in November 2014: if investors expect banks to increase their opacity (less transparent) due to increased scrutiny and therefore regulatory and administrative costs, then investors decrease their confidence in those banks under the SSM and increase credit risk premiums which is in line with stakeholders' view; on the other hand; if investors expects banks to decrease (or no change) in their opacity (more transparent) stemming from tighter supervision and disclosing more information due to designation as significant financial institutions, then investors increases their confidence in those banks and decrease (or do not alter) bank credit risk premiums, that is in line with bondholder's view. To study the implications of SSM on the association between bank opacity and credit risk premiums: this study first investigates the overall impact, then on the SSM-supervised banks and finally banks those were previously assigned as globally systemically important banks.

H_1: An increase in bank opacity (less transparent banks) has a positive effect on the bank credit risk spreads (less creditworthy),

H_2: The effect of bank opacity on the credit risk premiums increased for centrally supervised banks after the launch of SSM as supervision became stricter.

3.2.1 Bank Opacity and Incomplete Accounting Model

The global financial crisis revealed the complexity of financial markets and the sophistication of banks' financial products. As a response to Global Financial Crisis, banks started to use CDS spread which is a financial derivative aiming to protect lenders from potential default of debt holders. In other words, CDS spread represents creditworthiness or risk premiums of a financial entity, i.e, higher values reflect increased risk premiums (or increased caution on the corresponding entities). CDS market has been examined in that CDS spreads decrease lenders' incentives to monitor borrowers (Duffie & Lando (2001), Stulz (2010)) and CDS spreads reflect risk premiums for financial entities and credit risk premiums composed of two parts: information transparency and default risk.

According to the incomplete accounting model of Duffie & Lando (2001), imprecise accounting disclosures is associated with an increase in corporate credit spreads (Pritsker (2013)): precision and transparency risk in accounting disclosures are important determinants while pricing of credit risk premiums. In this study Duffie & Lando (2001) studies the implications of imperfect information for term structures of credit spreads on corporate bonds and states that it is not possible for bond investors to observe the issuer's assets fully, and instead they can only access only periodic and but imperfect accounting reports. While Duffie & Lando (2001) theoretically investigates the association between CDS spreads and information imprecision, using annual ranking of corporate disclosure practices, Yu (2005) empirically confirms that opacity due to imprecise accounting

figures leads to higher corporate bond spreads. Culp et al. (2018*b*) review the empirical academic literature on the informational content of CDS spreads and summarize the following: (i) CDS spreads include essential information about the potential and severe credit events that the financial entities might encounter; (ii) they reflect a risk premium that protection sellers demand to compensate them for reference entity-specific and systematic risks; and (iii) are anticipatory and contain information regarding future announcements about the credit risk and financial condition of the underlying reference entity. Andrade et al. (2014) examines the corporate transparency and corporate default spread: investigates the impact of the Sarbanes–Oxley (SOX) Act[4] on the firms' cost of debt through its effect on the reliability of financial reporting and using CDS spreads and finds that that corporate opacity and the cost of debt decrease significantly after SOX.

Prior literature examines the information content of CDS spreads in various ways: Norden (2017) investigates the effect of public and private information on the corporate CDS spreads before rating announcement and this study provides evidence on the informational efficiency of the CDS market, the impact of credit rating announcements, and insider trading. Griffin et al. (2016) base their study on the anticipatory information concern of CDS spread and they find a negative relation between equity short interest and future returns on CDS spread. Batta et al. (2016) study CDS spread in information production surrounding earnings announcements and using bond market data, authors find

[4]The Sarbanes-Oxley Act(2002) is a federal law that established to sweep auditing and financial regulations for public companies

that the strength of CDS price discovery before earnings announcements is associated with the presence of private information and the corporate bonds il-liquidity and CDS market is described as a centre for informed trading. This comprehensive analysis studies the impact of the information content in CDS trading on the output of equity and credit rating analysts and find that post-CDS trading, the dispersion and error of earnings per share forecasts are generally reduced, and downgrades by both types of analysts become more frequent and more timely before large negative earnings surprises, suggesting that the CDS market conveys information valuable to financial analysts. Jenkins et al. (2016) exploit the semi-strong market efficiency hypothesis and test the degree of semi-strong form market efficiency in the CDS spread through investigating the association between CDS spread and earnings surprises and accruals both suggested as a source of stock market anomalies. They find that the CDS market is efficient during periods of relative economic stability but less efficient during less stable economic periods. Nasiri et al. (2019) study the relation between CDS spread and the release of periodic financial reports and show that periodic financial reports contain essential information for the CDS market which suggest value relevance of accounting information for the CDS market. Sun et al. (2011) investigates the implications of payout policy on the credit risk using CDS spreads and find that CDS spreads increases significantly as a response to announcements of dividend cuts, particularly during recessions. This evidence is more strong for dividend cuts that are less anticipated and permanent. Also, this study

presents evidence on the information content effect of change in dividend dominates the wealth-transfer effect. A recent study of Kim et al. (2020) explore the role of investor relations in debt markets using earnings announcement and how investor relations departments help credit investors internalise information and find that investor relations departments decrease the negative impact on CDS spreads resulting from bad earnings news, implying that importance of investor relations departments on the information accuracy and reducing information opacity or increasing information transparency.

3.2.2 Bank Loan Loss Provisioning Model and Bank Opacity

Banks are inherently more opaque than other financial intermediaries and this raises uncertainty about the riskiness of the banks (Flannery et al. (2004)). A vast literature examine the loan loss provisioning models (Wahlen (1994), Bushman & Williams (2012), Beatty & Liao (2014)) and measure bank opacity through discretionary disclosures of loan loss provisions which are called abnormal loan loss provisions or discretionary loan loss provisions (DLLPs). DLLPs reflect information opacity of banks: an increase (lower) in bank opacity suggests a lower (higher) information disclosure. Literature examines banks' motives for discretion in loan loss provisioning: income smoothing (Kanagaretnam et al. (2003), Tucker & Zarowin (2006), Fonseca & Gonzalez (2008), Baik et al. (2020)), capital management (Liu & Ryan (2006)), signalling (Huizinga & Laeven (2019)) and describe the abnormal in loan loss provisioning as in discretionary

disclosure or bank opacity due to vagueness contained during the provisioning process. Irrespective of motives for using discretionary loan loss provisioning, asymmetry in information transfer would give to a rise in information opacity between bank and investors that would have an impact on banks' creditworthiness.

Loan loss provisioning is one of the most important financial disclosure decisions of banks (Beatty & Liao (2014)) and delivers information to investors in terms of banks' risk taking behaviours and prior literature employs abnormal LLP, i.e., bank opacity measure in different areas in examining bank cost of equity and bank risk taking. Bushman & Williams (2015) study the effect of bank transparency on risk profile of banks and find that banks having high delayed loan loss recognition might simultaneously face elevated financing frictions and enhanced opportunities for risk-shifting behavior during the crisis periods. Similarly, Valverde et al. (2016) investigates the "disincentive effect" of DLLPs, where bank does not have a motive for discretionary earnings management and find a positive strong impact of DLLPs on the cost of funding. Beltrame et al. (2016) find positive impact of DLLPs on cost of equity due to overall increase in bank risk. Other than use of prudent risk taking practices of banks through LLPs, Fosu et al. (2017) uses a distinct measure of bank opacity measured using analysts' forecasts to investigate the impact of opacity on bank stability for publicly-traded US banks and conclude that bank opacity increases insolvency risks, given the competition and the business model.

Literature reports studies on the effect of loan loss provisioning on bank competition.

Jiang et al. (2016) examine the effects of deregulation under reciprocal state agreements prior to Interstate Banking and Branching Efficiency Act of 1994 (IBBEA) and nationally under IBBEA on the volatility of incumbent banks' abnormal loan-loss provisions and show that increased competition improves the quality of governance and decreases incentives to conceal sub-optimal actions through manipulation of financial statements, thereby reducing bank opacity. Dou et al. (2018) exploit the effects of deregulation on banks' loan-loss provisions and investigate the effect of entry threat on incumbent banks' loan-loss provisioning and find that there is a dominant incentive to increase apparent loan-underwriting quality. Similarly, Tomy (2019) examines the effects of use of discretionary LLPs by bank managers on the market entry using state-level changes in branching regulation and finds that geographically-constrained community banks increases their loan loss provisions to appear less profitable when faced with the threat of entry by competitors. Andries et al. (2017) examine the effect of corporate tax system on the treatment of loan losses provisions and show that loan loss provisions are increasing in the tax rate for countries that permit general provision tax deductibility.

There are also studies investigating the effect of regulation on bank transparency. Kim et al. (2020) investigate the effect of the Capital Purchase Program under the Troubled Asset Relief Program (TARP) on the transparency of participating banks by examining changes in their loan loss provisions and find that TARP banks reduced transparency to a greater extent than non-TARP banks did by recognizing smaller and less timely loan

loss provisions for changes in nonperforming loans and increasing discretionary loan loss provisions more after receiving TARP funds. Hamadi et al. (2016) examines the adoption of the Basel II Capital Accord in 2008 on the market valuation of discretionary loan loss provisions (DLLPs). The main idea is that Basel II affects the internal ratings-based (IRB) banks' incentives to have income-increasing DLLPs in an opportunistic manner, but it has no such impact on the remaining banks adopting the standardized methodology for loan losses. Authors find that Basel II is linked with less income-increasing DLLPs (positive DLLPs) and less income-smoothing via DLLPs, enhancing the informational content of DLLPs about future loan losses and therefore leading to higher market valuation of DLLPs.

Bank opacity has implications on the market pricing as well. Blau et al. (2017) study the opaqueness in banking sector on the bank stock price and find that opacity has associated with equity price delay. Hegde & Kozlowski (2021) also examines the discretionary loan loss provisioning to bank stock returns during the economic booms and downs and find that DLLP is linked with negative abnormal returns during economic downturns and it is associated with significantly higher abnormal stock returns during economic booms. Balakrishnan & Ertan (2018) links bank's quarterly reporting to risk-taking of banks using CDS spread and show that quarterly reporting reduces bank risk-taking. Callen et al. (2009) study the impact of earnings on credit risk and find that earnings accruals are negatively associated with CDS spread.

3.3 Data and Methodology

3.3.1 Data

Variables used in this analysis are extracted from different data resources: bank-level quarterly financial disclosures data from Bloomberg, whilst macroeconomic variables such as GDP growth and price index from OECD, financial market variables such as itraxx (a weighted index for European CDS market), treasury bond interest rate interest rate with 5-year maturity and VIX index for global volatility (that to control for systematic factors in the pricing of CDS spread) from the Refinitiv's Eikon. Bank financial variables in ratios are winsorized at the 1% and 99% level to mitigate the influence of outlier. We present variables used in this study in the Table 3.2. In addition, using country level uncertainty index of Ahir et al. (2022), this study control for country-level uncertainty that might stem from different factors such as politics or economics 2016 US General Election or June 2016 UK Brexit Referendum and 2010 European Debt crisis).

[Insert Table 3.2 Here.]

This study focuses only on the credit institutions extending loan and accepting customer deposits. Also, in line with European Bank's list of significant banks supervised under the single supervisory mechanism, this study defines banks as under the single supervisory mechanism. In addition, we also consider for banks being global systemically important which is in line with the G-SIB list of both the Basel and Financial Standards

Authority Board (FSAB). Overall, we have 65 banks operating in 16 different countries. Of total 65 banks, 25 are under the SSM and 22 of them G-SIB and 7 of banks under SSM are also classified as G-SIB.

Single Supervisory Mechanism reclassified supervision of the banks in European Union and in addition to that banks with quoted CDS spreads are large scale banks and those banks can be classified as systematically important. That is why this study considers banks under the SSM as treatment group and banks those are not under the SSM, i.e, supervised by national supervisors in different countries and also some of them globally systemically important financial institutions as our control group. That can be thought as a drawback but CDS quotes are available for large scale banks and those banks are perceived in the same way by the investors apart from their geographic positions. But to account for cross country differences, we present falsification tests where we change the control group compositions to account for this effect.

[Insert Table 3.3 Here.]

Final sample covers years between 2011Q1-2019Q4. To analyse bank opacity on banks' credit risk premiums, we use quarterly CDS spread as a proxy for credit risk premium measure as CDS spread provides more accurate measure for the market risk (Pan & Singleton (2008), Longstaff et al. (2011)) compared to bond market and they are standardized and more liquid (Longstaff et al. (2005), Acharya et al. (2014)) than the bond market, obtained from Bloomberg. We select CDS quotes on senior unsecured

debt with modified restructuring and five-year maturity to ensure liquidity as majority of CDS contracts are with five-year maturity. Longstaff et al. (2005) states that CDS spreads are measures of credit risk and Griffin et al. (2016) state that CDS spreads do not show interest rate risk, currency risk. This study incorporates quarterly CDS spreads to associate with banks' financial disclosures. Also, this chapter obtains benchmark government treasury bonds with 5-year maturity in line with the CDS spread maturity from the Bloomberg. This study accounts for uncertainty in the market, and uses world uncertainty index of Ahir et al. (2022) which depicts historical quarterly data series.

Table 3.4 reports the descriptive statistics for SSM-banks (treatment) and non-SSM (control group) before and after the Single Supervision Union.

[Insert Table 3.4 Here.]

3.3.2 Preliminary Results

The DID setting needs to satisfy the parallel trend assumption to analyse the effect of the SSM on bank credit risk (Imbens & Wooldridge (2009)). According to the parallel trend assumption, changes in the dependent variables over time should be the same in both treatment (banks supervised by SSM) and control groups (non-SSM banks) in the absence of an intervention (before the introduction of the Single Supervisory Mechanism).

Table 3.5 shows that parallel trend assumption holds since since the trend in both

dependent and main independent variables are moving together before the launch of SSM in 2014. In line with our expectation this suggests that in the absence of a supervisory changes in main variables is same and presents a good base for further analysis.

[Insert Table 3.5 Here.]

3.3.3 Methodology

We construct the following model to examine the association between bank information disclosure, i.e, opacity and bank CDS spreads. Following the literature on information content of CDS spreads that investigates information quality and credit risk (Callen et al. (2009), Chiu et al. (2018)), we construct the following fixed effect panel regression model on a set of country, bank variables coupled with bank, time and country fixed effects:

$$\Delta CDS_{i,t} = \beta_0 + \beta_1 \Delta opacity_{i,t} + \beta_2 Cont_{t-1} + \delta_t + \kappa_i + \mu_{i,t} \tag{3.1}$$

where $\Delta CDS_{i,t}$ change in credit default swap spread of bank i in country j between time t and t-1 and $\Delta opacity$ is change in bank information disclosure between time t and t-1, calculated from the discretionary loan loss provisioning model in Eq. 3.3. Based on the prior literature (Collin-Dufresn et al. (2001), Chiu et al. (2018), Callen et al. (2009)), we include control variables that are potentially associated with CDS spreads: capitalization ratio (eta) which we include lagged total equity to total assets ratio, in

line with 5-year CDS data we include change in risk-free rate treasury bond return with 5 year maturity ($bond$). Following Callen et al. (2009), we also include return to assets ratio to control profitability (roa), and bank size ($size$). As Duffie & Lando (2001) states that CDS premiums are composed of information quality risk and default risk. Therefore, we include 5-year default probability of bank $\Delta default$ to control for pricing of default risk in the CDS spreads. We also control for the term premium ($slope$) impact through including the difference between risk free interest rate with 2 year and 5 year. In line with Chiu et al. (2018), we also control for liquidity, $liqu_{i,t}$: bid-ask spread of equity price. Table 3.2 presents the detailed information on the variables used in the regression. This study also controls for volatility of asset (vol). In addition to all, we also include market control variables such as an index for derivative market index for European Union ($itraxx$), country GDP growths (ΔGDP), change in government indebtedness ($\Delta domdebt$), world uncertainty index (WUI).

To study the effect of Single Supervisory Mechanism on the investors' CDS pricing, this study employs a difference-in-difference methodology which has been widely adopted in banking and accounting studies (Fiordelisi & Ricci (2016), Altunbaş et al. (2022)).

$$\Delta CDS_{i,t} = \theta_0 + \theta_1 Post + \theta_2 SSM + \theta_3 Post * SSM + \theta_4 \Delta opacity_{i,t} + \theta_5 Post * \Delta opacity_{i,t} + \theta_7 * SSM * \Delta opacity_{i,t} * Post + \theta_8 \kappa CONT_{t-1} + \delta_t + \kappa_i + \mu_{i,t} \quad (3.2)$$

where $\Delta opacity_{i,t}$ is change in bank opacity of bank i between time t and t-1; $Post_t$ is the implementation date of Single Supervisory Mechanism and equal to one after 2014 and zero otherwise in line with Fiordelisi et al. (2017). Fiordelisi et al. (2017) shows that banks under the SSM regulation (significant banks) decreased their lending activity compared to non-significant banks after the launch of the SSM regulation in 2014. Although the European Banking Authority (EBA) was estab $SSM_{i,j}$ is for the banks under the supervision of SSM and is equal to 1 for banks under the Single Supervisory Mechanism and zero otherwise for banks introduced in Table 3.3. θ_1 depicts the effect of onset of BU; θ_2 shows the effects of significant banks classified under the Single Supervision Mechanism; θ_3 captures differences between the treatment and control groups after the BU; θ_4 captures bank opacity measure calculated from 3.3. θ_5 shows the overall effect of bank opacity after the Single Supervisory Mechanism; θ_6 shows the differences of bank opacity for two groups of treatment and control groups; θ_7 represents the main coefficient of interest because it captures the effect of bank opacity of treatment groups after the Banking Union. Particularly, θ_7 measures the difference in

the effects of bank opacity from the pre-treatment to the post-treatment period between SSM supervised banks relative to non-SSM supervised. A positive (negative) statistically significant coefficient of θ_7 would imply ceteris paribus that the effect of bank opacity on the pricing of CDS spread increases (decreases) more for SSM-supervised banks than for banks supervised by the national regulators.

Identification of Bank Opacity

Loan loss provisions (LLP) are the largest bank accrual used as an cushion against the future loan losses. Prior studies (Dechow et al. (2010), Bushman & Williams (2012), Beatty & Liao (2014), Andries et al. (2017)) use loan loss provision model to investigate bank information disclosures. Banks manage both earnings and regulatory capital through loan loss provisions. Since determining potential loan losses requires banks' decision making process, loan loss provisioning models consists of managerial discretion.

In line with prior literature (Jiang et al. (2016), Danisewicz et al. (2021)), this study employs loan loss provisioning model as main method to measure the bank opacity that targets to estimate current loan loss provisioning of banks based on current, past non-performing loan formations and as well as confounding factors that might affect banks' decision making mechanism on the set of loan loss provisions. Using LLP's model, this study obtain non-discretionary and discretionary loan loss provisioning (namely bank opacity). And higher (lower) values of discretionary loan loss provisions indicates more

(less) opaque banking industry and lower transparency (more) or less opaque banking industry.

We construct the following model to measure bank opacity based on the prior literature on the discretionary loan loss provisioning model (Jiang et al. (2016), Nguyen et al. (2022)). Following model comprises factors such current and past formation of non-performing assets while deciding on their LLPs and the same time, co founding factors affecting their decision making mechanisms [5]:

$$\begin{aligned} LLP_{i,t} = \beta_0 + \beta_1 \Delta NPA_{i,t:t-1} + \beta_2 \Delta NPA_{i,t-1:t-2} + \\ \beta_3 \Delta NPA_{i,t-2:t-3} + \beta_4 size_{i,t-1} + \beta_5 ALL_{i,t-1} + \beta_6 eta_{i,t-1} + \beta_7 EBT_{i,t-1} + \\ \beta_8 \Delta GDP_{j,t:t-1} + \beta_9 PRICEINDEX + \epsilon_{i,t} \end{aligned} \tag{3.3}$$

where, $LLP_{i,t}$: loan loss provision of bank i at time t deflated by lagged total loans, $\Delta NPA_{i,t:t-1}$ is change in non-performing assets (NPAs) of bank i between time t and t-1, scaled by lagged total loans at time t-1. Banks use current non-performing asset formations to set current loan loss provisions and at the same time banks might incorporate historical information on NPAs in setting LLPs. In line with the literature, we include past non-performing asset formations: $\Delta NPA_{i,t-1:t-2}$: change in non-performing asset of bank i between time t-1 and t-2 deflated by lagged total loan at time t-2;

[5]This study also perform robustness checks by including for bank's expectations on non-performing assets in line with literature (Beatty & Liao (2014))

$\Delta NPA_{i,t-2:t-3}$: change in non-performing asset of bank i between time t-2 and t-3 deflated by lagged total loan at time t-3. Due to potential observation loss, Jiang et al. (2016) does not include $NPA_{i,j,t-3:t-4}$, but Beatty & Liao (2014) suggest including historical NPA formations. This study also account for changes in non-performing asset ($NPA_{i,j,t-3:t-4}$) of bank i between time t-3 and t-4. $size_{i,t-1}$ is the the natural logarithm of lagged total assets and is to control for systemic significance of bank which also determines a banks is under the Single Supervision or not. $\Delta loan_{i,t,t-1}$: difference of total loans between t and t-1 divided by lagged total loans at t-1, $ALL_{i,t-1}$: lagged loan loss allowance amount divided by lagged total loans at time t-1 which account the for excess holdings of allowance in the past. We also control for macroeconomic factors: $\Delta GDP_{j,t}$, change in GDP growth over in country j between quarters t and t-1 and $PriceIndex_{j,t}$, overall price level index of a country. We also include bank-level and county-level control variables that are motivated by the prior literature (Beatty & Liao (2014), Andries et al. (2017)). For example, we include net income before loan loss provisions divided by lagged total loans at t-1, ($EBT_{i,t-1}$) to capture banks' exercise of discretion over loan loss provisions to smooth income (Fonseca & Gonzalez (2008), Osma et al. (2019)) and $eta_{i,t-1}$ lagged total equity to total assets ratio at time t-1.

The abnormal accrual in the Eq. 3.3, representing the unexplained component of the regression, is regarded as discretionary loan loss provisions (DLLP), i.e., bank opacity (Fan et al. (2019)). This measure shows the magnitude of available information that

is not incorporated during the loan loss formation process. The higher (lower) the absolute value of the error term, the higher the (lower) bank opacity and lower (higher) information transparency is. Therefore, to obtain bank opacity, we measure the residual of loan loss provisioning model from the Eq. 3.3 as our measure for the bank opacity. Following the literature on the loan loss provisioning, this study calculates the change in the bank opacity in the following way:

$$opacity_{i,t} = (abs(\epsilon_{i,t})) \tag{3.4}$$

where $opacity_{i,t}$ is absolute value of the error term estimated from the Eq. 3.3 which shows the intensity of the information opacity. An increase in absolute value indicates an increase (decrease) in bank opacity (transparency). A higher value indicates lower information disclosure quality, a lower bank transparency or a higher bank opacity. As a robustness check, following (Cornett et al. (2009), Leventis & Dimitropoulos (2012)), this study also calculates the change in the bank opacity with standardizing absolute abnormal accrual in the following way:

$$opacity_{i,t} = (abs(\epsilon_{i,t})) * (loan_{i,t-1}/asset_{i,t-1}) \tag{3.5}$$

3.4 Empirical Results

In this section, we report the results from the baseline model in the Eq.3.1 and DID setting introduced in the Eq. 3.2.

3.4.1 The effect of Bank Opacity on the Bank Credit Risk Premiums

Table 3.6, depicts the results for the association between bank opacity and credit default risk premium based on the baseline model in the Eq. 3.1. Baseline model shows that bank opacity ($\Delta opacity$) derived from discretionary loan loss provision models has a positive effect on the CDS spread in Column 1-5, implying that investors increase credit risk premiums of banks when there is an increase in bank opacity. Findings are in line with prior literature those studying relationship between narrative risk disclosures in mandatory reports and the pricing of credit risk (Chiu et al. (2018)).

The results from the baseline model confirms that change in bank opacity has a positive impact on the change in bank CDS spread in Column 1-5. According to Duffie & Lando (2001)'s incomplete model of accounting, credit default premiums needs to compensate investors both for the banks' probability of default and information opacity. This is why this study controls for the bank default probabilities in Column 3-5 separately and as expected an increase in bank default probability increases the bank CDS spread. In Column 3-5, control variables are in included. Between Column 1 & 5, bank and time fixed effects are included and standard error is clustered at bank level only.

[Insert Table 3.6 Here.]

3.4.2 CDS spread and Bank Opacity Under Single Supervisory Mechanism

This section repeats baseline analysis based on a difference-in-difference setting. This method allows us to confirm the results from the previous baseline analysis in that first examining the baseline relationship and secondly investigating the investors' reactions to bank opacity of treated banks under the SSM compared to its peers after the SSM. In the baseline, we find a positive link between bank opacity and CDS spread which is in line with our expectations as an increase in the bank opacity is costly for investor to price credit risks due to increased information asymmetry.

Table 3.7 shows the results from the difference-in-difference framework. In all calculations bank opacity $\Delta opacity_{i,t}$ is derived from the Eq. 3.3. Banks under the SSM supervision are treatment group and others under national authorities are control group. Since this analysis is based on a cross-country analysis, control group includes countries apart from European Union. We also present robustness checks using different sub samples for the control group in the robustness section.

Results from DID setting are in line with the baseline findings in Table 3.6 bank opacity ($opacity$) has positive impact on the CDS spread. Coefficient of $Post * opacity$ is negative: measuring bank opacity impact on the CDS spread pricing after the bank

union and it is negative which in line with the transparency purpose of the Banking Union and in line with prior literature (Altunbaş et al. (2022)) finding that banking system has improved its risk disclosure after the Banking Union. Also it is in line with agency theory which posits that increased managerial monitoring in this case single supervision is positively associated with risk disclosure and bank transparency.

However, when we consider SSM banks compared to non-SSM supervised banks: coefficient of $SSM * Post * opacity$ becomes positive. This indicates that the effect of the opacity of SSM supervised banks on the bank risk premium, increases compared to non-SSM banks after the launch of the Single Supervision Mechanism. This result is in line with the literature finding that there is a decrease in the bank information disclosures after the Banking Union (Altunbaş et al. (2022)) for SSM supervised banks.The main variable of interest is $SSM * Post * \Delta opacity_{i,t}$ and its coefficient is reflects the change in the effect of bank opacity due to Single Supervision Mechanism.

The findings from DID setting in the Table 3.7 is in line with shareholder's perspective: in that the introduction of SSM introduced additional costs, like capital surcharges, or tighter supervisory requirements and this puts pressure on the banks' earnings prospects and therefore decreases banks' earnings prospects and reduces profitability due to stricter regulation under the Single Supervisory Mechanism. Although one of the goal of Banking Union is to increase the information disclosures or information transparency through regular asset quality checks after the Single Supervision that would be in line

with bondholders' perspective and would lessen pressure on the risk premiums due to increased information disclosure, SSM increased the cost on the bank credit risk premium for SSM banks which went under the stricter regulatory implementations and therefore costs compared their non-SSM banks. Thus, attainment of banks as SSM does not make SSM banks as more trustworthy from the investor's perspective, conversely, investors penalize SSM supervised banks due to decreased information disclosure due to increased managerial discretion to cope with supplementary administrative and operational cost resulting from being a SSM bank.

A decrease in the earnings prospects is linked with earnings management while additional cost of stricter supervision such as regulatory capital is linked with capital management. As banks inherently opaque in their business, banks generally is associated with managerial discretion: income smoothing, earnings management or capital management which decrease bank transparency and increase information or bank opacity. Therefore, results are in line with investor expectation on banks that due to increased pressure on the banks' income prospects and additional regulatory burden, SSM banks becomes more opaque (disclosure less information) as suggested by Altunbaş et al. (2022) that is reflected as an increased cost on the risk premiums by the market participants.

[Insert Table 3.7 Here.]

3.5 Robustness Checks

This section presents several robustness checks to examine the validity of results.

3.5.1 Placebo Test

This section results form the presents placebo test as a robustness checks. If homogeneity across time-periods is assumed then similar results should also hold prior to the treatment period. Following Imberman et al. (2012), the difference-in-differences is conducted for the pre-policy period of Banking Union, i.e, SSM. Instead of taking the start date of SSM (i.e., after 2014), it is assumed that the European Banking Union took place between 2012 and 2011. We avoid any news effect in 2013 that might affect the analysis and therefore we exclude 2013 in that analysis. If there are any pre-existing trends, then there should be a significant impact on the variable of interest, i.e, $SSM * Post * opacity$. opacity is a dummy variable taking values of 1 for ΔCDS is greater than 1 and zero otherwise. This test checks whether results are still consistent with absence of this the treatment effect. If the results show insignificant effects of the bank opacity on the CDS spreads, then it confirms the validity of the treatment effect of the launch of SSM.

Table 3.8 presents the results from the placebo test showing treatment effects when difference-in-difference is performed using period of 2012 only for treatment period and 2011 for pre-treatment period with same treatment units. Column 1-3 investigates the effect of bank opacity of banks' under SSM supervision on the CDS spread under a

hypothetical scenario for the launch of SSM, in 2012. Therefore, post is equal to 1 if date is 2012 and zero otherwise. Also, SSM is equal to 1 if banks are under the Banking Union and zero otherwise. Variable of interest is $SSM * Post * opacity$ and treatment effect is captured by its coefficient. Results from this analysis show an insignificant treatment effects on the CDS spread due to change in the treatment period and support the main hypothesis of investors' risk premium on the banks increased after the SSM indicating an increase on the costs (either operational or managerial) that puts pressure on the bank risk premiums. In addition, findings are still consistent after controlling for time, firm fixed effects and clustering standard errors at bank.

[Insert Table 3.8 Here.]

3.5.2 Alternative Measure

In line with literature (Cornett et al. (2009)), instead of use of absolute values of residual of LLP model, we scale residual that we calculated in Eq. 3.5. Findings from this analysis are in line with we have found in the previous part.

Table 3.9 shows the results the DID approach while scaling the bank opacity measure based on the literature.

[Insert Table 3.9 Here.]

3.5.3 Falsification Test

In this section, we repeat our analysis using different treatment (country) groups. We change the composition of countries in the control group analyzed. The reason is to validate the counterfactual effect of the Single Supervisory Mechanism in that no other geographical factors matter on the increase in the bank opacity due to the launch of the SSM.

For that purpose, while maintaining the same treatment group which includes banks under the SSM specified in Table 3.3: first, we exclude banks in Japan, China and the United States from the control group and reduce heterogeneity in the control and treatment groups; secondly,secondly, one can argue experience after the Global Financial Crisis is similar to banks in the United States, therefore, we exclude banks in the United States only.

We report the results in Table 3.10 and the results from the falsification test are in line with what we have found in the previous analysis.

[Insert Table 3.10 Here.]

3.5.4 Predicting Bank Opacity and Dimensionality

This section presents robustness results from a formal statistical selection method for the bank opacity estimated in the baseline regression. Regularized linear regression is only one of many methods in the toolbox of machine learning and it is a straightforward

extension of linear regression (Ahrens et al. (2020)). Like ordinary least squares (OLS), regularized linear regression minimizes the sum of squared deviations between observed and model-predicted values but this method imposes a regularization penalty aimed at limiting model complexity. Prior studies use and compare different models in measuring bank opacity. Nascent studies uses this method in calculating bank transparency metrics (Kim et al. (2020)).

The main motivation is to compare our results from the previous findings after considering the dimensional in the discretionary loan loss provisioning model where we calculate bank opacity. In a simple linear regression model, the true specification of the model is nearly impossible because it might lead to over-fitting if we add unnecessary determinants and as well as omitted variable bias if do not include necessary determinants. How to construct correct specifications important? Previous literature compares different models in discretionary loan loss accounting models using principle component analysis and concludes that one model generates better results. Similar to this model, this study runs Lasso (Least Absolute Shrinkage and Selection Operator) model to examine whether the specification of our model is valid.

Lasso minimizes the objective function based on penalization term and the parameter of penalty term is the shrinkage penalty that has the impact of shrinkage some of the estimates to zero. For that purpose, this study first estimates the model corresponding to minimum information. Information criteria such as Akaike and Bayesian information

criterion provide measures of model performance that account for model complexity and help to distinguish how well the model fits the data with a term that penalizes the model in proportion to its number of parameters. After that, this study store model according to the minimum information criterion and predicts bank opacity based on this model. Table 3.11 shows the results from the baseline and difference-in-difference regressions using alternative bank opacity measures where estimated from the regularized linear regression. Results are in line with our previous findings: in the baseline, there is a positive association between bank opacity and credit risk premium and in the DID setting, we find that the effect of bank opacity increases after the the launch of Single Supervisory Mechanism compared to non-SSM banks.

[Insert Table 3.11 Here.]

3.6 Conclusion

Extensive literature examines model precision and information risk in loan loss accounting through analysing its components: innate and discretionary (Beatty & Liao (2014), Nguyen et al. (2022)). This study aims to extend this literature by investigating the influence of information transparency in banks' financial disclosures on the investor's hedging premiums. Using the responsiveness of credit default swap spreads, this study first measures the information risk contained in banks' loan loss provisioning and triggered information opacity and finds that information risks are positively priced in the

investors' credit risk premiums. In the second step, using a unique set of Single Supervisory Mechanism followed by asset quality checks, this study explores the effect of bank opacity on the pricing of credit risk premiums in the era of a tighter, rigid regulatory environment. Findings show that investors charge more to those banks under the new single supervisory mechanism compared to other banks implying that although one goal of the new single supervisory mechanism is to increase transparency through regular asset quality checks, it has adverse implications on the investors' hedging premiums. This study also presents several robustness checks and results from various analyses are in line with previous findings.

3.7 Policy Implications

This study provides a close connection with Duffie's incomplete accounting model (Duffie & Lando (2001)). This model provides a way to explore the effect of bank opacity on the investor's risk premiums as it helps to examine the information transparency as a determinant of credit risk. In other words, this method enables us to drill down CDS spread into its components and analyze it during significant events. An increase in CDS spread might be due to both increases in default risks and information opacity. It might be confusing to find out which one (default or information transparency risk) leads to this under a regulatory change such as after the launch of a Single Supervisory Mechanism one of its goals was to increase information transparency in asset quality

through regular asset quality checks. SSM is the first pillar of the Banking Union and SSM has been analyzed in-depth from different perspectives including those analysing from the market perspective. Policymakers can benefit from the study as it provides a different perspective to analyse the implications of changes in supervision on the association between information sharing (bank opacity) and investors' reactions.

Table 3.1: The Institutional Setting

This table shows the timeline for the launch of the Single Supervisory Mechanism.

Date	Key Steps
25 April 2012	ECB President Mario Draghi refers to the strengthening of banking supervision and resolution at the European level
29 June 2012	European Council paves way for banking union
9 December 2012	European Commission presents legislative proposals
15 October 2013	Council of the European Union adopts the SSM Regulation
23 October 2013	ECB starts comprehensive assessment
3 November 2013	SSM Regulation enters into force
15 May 2014	SSM Framework Regulation comes into force
19 August 2014	Regulation on the Single Resolution Mechanism enters into force
4 September 2014	ECB publishes list of credit institutions
26 October 2014	ECB publishes results of comprehensive assessment
4 November 2014	ECB Regulation on supervisory fees enters into force

Table 3.2: Definition of Variables

This table reports definitions of variables used in this study.Ratios are winsorized in %1 and %99 percentiles.

Acronym	Description	Source
ΔCDS	Change in CDS spread. Values are in % points.	Bloomberg
$\Delta opacity$	Change in absolute residuals measured from the discretionary loan loss provisioning model in Eq 3.3 Higher values means lower information disclosure and higher bank opacity	Author
opacity	Dummy variable equals to 1 when $\Delta opacity$ greater than 0 and zero otherwise.	Author
$\Delta default$	Logarithm change in probability of default within 5-year	Bloomberg
size	Natural logarithm of total asset	Bloomberg
roa	Total return on total assets.	Bloomberg
eta	Total equity to total assets in % points.	Bloomberg
liqu	Difference between bid and ask price spread.	Bloomberg
slope	Difference between 2 and 5-year treasury bond interest rate.	Bloomberg
$\Delta bond$	Percent change in treasury bond interest rate with 5-year maturity	Bloomberg
GDP	GDP growth rate	OECD
WUI	World uncertainty index, computed by counting the percent of word "uncertain" (or equivalent) in the Economist Intelligence Unit country reports. A higher number means higher uncertainty and vice versa.	*Ahiret al.* (2022)
$\Delta domdebt$	percent change in government indebtedness	OECD
VIX	Chicago Board Options Exchange's CBOE Volatility Index	Eikon
itraxx	A measure for the respective on-the-run iTraxx CDS contracts for 125 equally-weighted European names	Eikon
priceindex	ratios of purchasing power parities to market exchange rates and this indicator is measured as an index	OECD
LLP	Loan loss provisions scaled by lagged total loans.	Bloomberg
ΔNPA	change in non-performing assets divided by lagged by total loans	Bloomberg
ALL	Allowance for loan losses divided by lagged total loans.	Bloomberg
EBT	Earnings before tax and provisions scaled by lagged total loans.	Bloomberg
$\Delta loan$	Change in total loans compared to previous period (in % points.)	Bloomberg
SSM	Dummy variable if a bank is under the SSM, zero otherwise.	Author
Post	Dummy variable equal to 1 if date is later than 2014, zero otherwise,	Author

Table 3.3: Banks by Supervision and Country

This table reports the country representation of 62 banks used in this analysis: out of total of banks of 62, 25 are classified as SSM and 37 are non-SSM. Also, 6 of 25 SSM banks are also G-SIBs.

	Frequency	Percent	Cumulative	SSM	GSIB
Austria					
Erste Group Bank AG	36	50.00	50.00	Yes	
Raiffeisen Bank International AG	36	50.00	100.00	Yes	
Belgium					
KBC Group NV	36	100.00	100.00	Yes	
United Kingdom					
Barclays PLC	36	25.00	25.00	No	Yes
HSBC Holdings PLC	36	25.00	50.00	No	Yes
Lloyds Banking Group PLC	36	25.00	75.00	No	
NatWest Group PLC	36	25.00	100.00	No	
China					
Bank of Beijing Co Ltd	36	6.72	13.43	No	
Bank of China Ltd	36	6.72	20.15	No	Yes
Bank of Communications Co Lt	36	6.72	26.87	No	
Bank of Nanjing Co Ltd	36	6.72	33.58	No	
China CITIC Bank Corp Ltd	36	6.72	47.01	No	
China Construction Bank Corp	36	6.72	53.73	No	Yes
China Merchants Bank Co Ltd	36	6.72	60.45	No	
China Minsheng Banking Corp	36	6.72	67.16	No	
Huaxia Bank Co Ltd	36	6.72	73.88	No	
Industrial & Commercial Bank	36	6.72	80.60	No	Yes
Industrial Bank Co Ltd	36	6.72	87.31	No	
Shanghai Pudong Development	36	6.72	100.00	No	
Denmark					
Danske Bank A/S	36	50.00	50.00	No	
Jyske Bank A/S	36	50.00	100.00	No	
France					
BNP Paribas SA	36	33.33	33.33	Yes	Yes
Credit Agricole SA	36	33.33	66.67	Yes	Yes
Societe Generale SA	36	33.33	100.00	Yes	Yes
Germany					
Commerzbank AG	36	50.00	50.00	Yes	
Deutsche Bank AG	36	50.00	100.00	Yes	Yes
Greece					
Alpha Services and Holdings	36	25.00	25.00	Yes	
Eurobank Ergasias Services SA	36	25.00	50.00	Yes	
National Bank of Greece SA	36	25.00	75.00	Yes	
Piraeus Financial Holdings SA	36	25.00	100.00	Yes	
Italy					
Banca Monte dei Paschi di Si	36	16.67	16.67	Yes	
Italy continue..					
Banco BPM Spa	36	16.67	33.33	Yes	
Intesa Sanpaolo Spa	36	16.67	50.00	Yes	
Mediobanca Banca di Credito	36	16.67	66.67	Yes	
UniCredit SpA	36	16.67	83.33	Yes	Yes
Unione di Banche Italiane Spa	36	16.67	100.00	Yes	
Japan					
Aozora Bank Ltd	36	25.00	25.00	No	
Mizuho Financial Group Inc	36	25.00	50.00	No	Yes
Shinsei Bank Ltd	36	25.00	75.00	No	
Yamaguchi Financial Group Inc	36	25.00	100.00	No	
Netherlands					
ING Groep NV	36	100.00	100.00	Yes	Yes
Portugal					
Banco BPI SA	36	50.00	50.00	Yes	
Banco Comercial Portugues SA	36	50.00	100.00	Yes	
Spain					
Banco Bilbao Vizcaya Argenta	36	25.00	25.00	Yes	
Banco Santander SA	36	25.00	50.00	Yes	Yes
Banco de Sabadell SA	36	25.00	75.00	Yes	
Bankinter SA	36	25.00	100.00	Yes	
Sweden					
Skandinaviska Enskilda Banke	36	33.33	33.33	No	
Svenska Handelsbanken AB	36	33.33	66.67	No	
Swedbank AB	36	33.33	100.00	No	
Switzerland					
Credit Suisse Group AG	36	50.00	50.00	No	
UBS AG	36	50.00	100.00	No	Yes
United States					
Bank of America Corp	36	10.00	10.00	No	Yes
Bank of New York Mellon Corp	36	10.00	20.00	No	Yes
CIT Group Inc	36	10.00	30.00	No	
Citigroup Inc	36	10.00	40.00	No	Yes
Fifth Third Bancorp	36	10.00	50.00	No	
JPMorgan Chase & Co	36	10.00	60.00	No	Yes
Morgan Stanley	36	10.00	70.00	No	Yes
PNC Financial Services Group	36	10.00	80.00	No	
US Bancorp	36	10.00	90.00	No	
Wells Fargo & Co	36	10.00	100.00	No	Yes
Total	2232	100	100		

Table 3.4: Descriptive statistics for SSM and Non-SSM.

This table shows summary statistics of variables used in this study for banks classified under the SSM and non-SSM. Then, this table breakdowns the quarterly bank-level data (62 banks and 36 quarters between 2011-2019) into two periods: Before and after the 2014, i.e launch of the SSM. $\Delta opacity$ and $\Delta opacity*$ are calculated based on the Eq. 3.4 and Eq. 3.5, respectively.

Panel A: SSM										
	<=2014					>2014				
Variable	Obs	Mean	Std. dev.	Min	Max	Obs	Mean	Std. dev.	Min	Max
ΔCDS	400	0.1129	0.5616	-0.4029	2.1667	500	0.0192	0.3234	-0.4029	2.1667
$\Delta opacity$	400	0.0001	0.0050	-0.0282	0.0379	500	-0.0001	0.0032	-0.0215	0.0151
$\Delta opacity*$	400	0.0001	0.0025	-0.0065	0.0080	500	0.0000	0.0020	-0.0065	0.0080
opacity	400	0.5125	0.5005	0.0000	1.0000	500	0.4720	0.4997	0.0000	1.0000
$\Delta default$	400	0.0372	0.5020	-2.6421	2.2667	500	-0.0225	0.4070	-2.3369	1.9335
size	400	12.5508	1.2672	10.3676	15.7251	500	12.4798	1.2634	10.2875	14.7359
roa	400	-0.3448	2.1199	-12.6162	5.4288	500	0.1121	0.9093	-5.4993	2.2360
eta	400	0.0592	0.0272	-0.0490	0.1309	500	0.0742	0.0252	0.0212	0.1583
liqu	400	32.1829	252.6394	0.0000	2857.9250	500	0.2894	3.5649	-1.8350	65.1807
vol	400	55.1496	64.1837	12.5070	599.6590	500	43.5652	30.2453	5.6960	204.1350
GDP	400	-0.2016	0.8577	-4.4241	1.9310	500	0.4095	0.4851	-1.9514	1.7961
$\Delta domdebt$	400	1.5622	13.4992	-87.3025	76.2221	500	-0.1117	1.7907	-6.8287	7.3962
$\Delta bond$	400	-0.2936	1.8203	-9.6129	6.0000	500	-0.0062	2.0119	-9.6129	6.0000
WUI	400	0.2394	0.1776	0.0000	0.6891	500	0.2986	0.1742	0.0000	0.9281
slope	400	-18.0691	51.3840	-201.3860	4.3020	500	-2.1461	24.3562	-194.4360	12.0150
itraxx	400	291.3400	36.7415	226.1800	343.0800	500	372.3190	22.2908	329.8800	415.8400
VIX	400	17.9869	6.9862	11.5700	42.9600	500	15.4825	4.0448	9.5100	25.4200
LLP	400	0.0149	0.0114	-0.0023	0.0564	500	0.0109	0.0123	-0.0023	0.0564
ΔNPA	400	0.0051	0.0237	-0.0614	0.0838	500	-0.0032	0.0172	-0.0614	0.0838
ALL	400	0.0515	0.0374	0.0016	0.2224	500	0.0697	0.0647	0.0073	0.2224
EBT	400	-0.0005	0.0186	-0.0528	0.0798	500	0.0053	0.0155	-0.0528	0.0273
size	400	12.5508	1.2672	10.3676	15.7251	500	12.4798	1.2634	10.2875	14.7359
$\Delta loan$	400	1.0425	0.6932	0.0258	11.1578	500	1.0030	0.0493	0.7551	1.4098
priceindex	400	97.8200	9.8127	77.0000	112.0000	500	89.4480	10.0352	73.0000	105.0000
Panel B: Non-SSM										
	<=2014					>2014				
ΔCDS	740	-0.0076	0.1642	-0.3529	0.7838	592	0.0674	0.4011	-0.4029	2.1667
$\Delta opacity$	740	0.0000	0.0012	-0.0070	0.0055	592	0.0000	0.0053	-0.0370	0.0361
$\Delta opacity*$	740	0.0000	0.0005	-0.0023	0.0018	592	0.0000	0.0017	-0.0065	0.0080
opacity	740	0.4892	0.5002	0.0000	1.0000	592	0.4578	0.4986	0.0000	1.0000
$\Delta default$	740	0.0037	0.2042	-0.7013	0.9101	592	-0.0090	0.2476	-1.3128	1.2211
size	740	14.6999	1.5202	10.7454	19.1603	592	14.4669	1.5303	10.6642	19.1324
roa	740	0.7591	0.4585	-1.3077	2.3785	592	0.7544	0.5335	-1.7325	2.1766
eta	740	0.0784	0.0263	0.0418	0.1893	592	0.0741	0.0316	0.0331	0.2002
liqu	740	0.7739	2.7305	-0.0200	20.0000	592	1.3319	4.6952	-2.3550	50.0000
vol	740	24.8050	9.2681	9.9410	71.5240	592	28.0817	11.8198	10.3820	81.4210
GDP	740	0.8773	0.6108	-0.7955	2.0000	592	0.8599	0.9347	-2.3907	2.5000
$\Delta domdebt$	740	0.2432	1.4720	-5.7136	6.7500	592	-1.1318	15.2927	-199.6159	160.9409
$\Delta bond$	740	0.0199	1.2418	-9.1304	6.0000	592	-0.1770	1.3336	-9.6129	3.6556
WUI	740	0.2808	0.2751	0.0000	1.7567	592	0.2000	0.1544	0.0000	0.7106
slope	740	0.3583	0.2933	-0.0841	1.1380	592	0.4945	0.4070	-0.6880	1.4555
itraxx	740	372.3190	22.2836	329.8800	415.8400	592	291.3400	36.7265	226.1800	343.0800
VIX	740	15.4825	4.0434	9.5100	25.4200	592	17.9869	6.9833	11.5700	42.9600
LLP	740	0.0058	0.0062	-0.0023	0.0313	592	0.0057	0.0069	-0.0023	0.0564
ΔNPA	740	-0.0001	0.0031	-0.0614	0.0099	592	0.0002	0.0127	-0.0614	0.0838
ALL	740	0.0167	0.0111	0.0016	0.0508	592	0.0226	0.0198	0.0016	0.2224
EBT	740	0.0221	0.0150	-0.0237	0.0798	592	0.0230	0.0180	-0.0528	0.0798
size	740	14.6999	1.5202	10.7454	19.1603	592	14.4669	1.5303	10.6642	19.1324
$\Delta loan$	740	1.0149	0.0350	0.7946	1.3652	592	1.1101	1.2107	0.0200	21.3630
priceindex	740	101.3189	22.1649	70.0000	146.0000	592	96.1081	29.7855	52.0000	150.0000

Table 3.5: Testing for Parallel Trends

This table shows differences in means between treatment and control groups due to launch of SSM. We report parallel trends results only for the dependent (ΔCDS) and main independent variable of interest ($\Delta opacity$).

Year	Mean Non-SSM	Mean SSM	Mean Difference	P-Value
		ΔCDS		
2011	0.4522	0.7379	-0.2858	0.5695
2012	-0.0972	-0.1065	0.0093	0.9416
2013	0.4522	0.7379	-0.2858	0.5695
2014	-0.0505	-0.0808	0.0303	0.7687
		$\Delta opacity$		
2011	0.0005	0.0005	0.0001	0.9859
2012	-0.0004	-0.0005	0.0001	0.8887
2013	0.0000	0.0001	-0.0002	0.7574
2014	-0.0001	0.0003	-0.0004	0.5617

Table 3.6: Bank Opacity and CDS spread

This table reports results from the effect of bank opacity $\Delta opacity$, measured from the Eq.3.1, on the investor's credit risk premiums (ΔCDS). In Column 1 control variables are not included; in Column 2, banks' default probability is controlled and between Column 3-6 control variables are included in the analysis. We cluster standard errors at the bank level between Column 1-5; and in Column 5, and country and time level fixed effects are included)

Variables	(1) ΔCDS	(2) ΔCDS	(3) ΔCDS	(4) ΔCDS	(5) ΔCDS
$\Delta opacity$	15.2412***	14.8902***	15.6089***	16.0982***	15.6089***
	(3.4149)	(3.2378)	(2.7425)	(2.9850)	(3.0603)
$\Delta default$		0.2993***	0.2779***	0.2924***	0.2779***
		(0.0474)	(0.0492)	(0.0492)	(0.0594)
size			0.2146***	0.2568***	0.2146***
			(0.0416)	(0.0495)	(0.0420)
roa			0.0066	0.0020	0.0066
			(0.0061)	(0.0108)	(0.0118)
eta			1.6000*	2.8678**	1.6000*
			(0.8313)	(1.2948)	(0.9567)
vol			-0.0009**	-0.0014***	-0.0009
			(0.0003)	(0.0005)	(0.0006)
liqu			0.0000	0.0001***	0.0000
			(0.0000)	(0.0000)	(0.0001)
GDP			-0.0396***	-0.0697***	-0.0396
			(0.0135)	(0.0171)	(0.0322)
$\Delta domdebt$			-0.0038**	-0.0037**	-0.0038*
			(0.0016)	(0.0015)	(0.0022)
$\Delta bond$			-0.0436***	-0.0505***	-0.0436***
			(0.0081)	(0.0092)	(0.0108)
WUI			0.0639**	0.0938***	0.0639
			(0.0290)	(0.0329)	(0.0544)
slope			-0.0005	0.0022***	-0.0005
			(0.0003)	(0.0003)	(0.0012)
itraxx			0.0009***	0.0011***	0.0009
			(0.0003)	(0.0003)	(0.0009)
VIX			0.0093***	0.0097***	0.0093***
			(0.0013)	(0.0014)	(0.0034)
Constant	0.0399***	0.0397***	-3.4717***	-4.1525***	-3.4717***
	(0.0000)	(0.0000)	(0.5538)	(0.6694)	(0.6706)
Observations	2,232	2,232	2,232	2,232	2,232
R-squared	0.3501	0.4196	0.5133	0.5973	0.5133
Firm FE	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES
Country x Time Effects	NO	NO	NO	NO	YES
Cluster	Firm	Firm	Firm	Firm	Firm

Table 3.7: Bank opacity and Credit Risk Premium: the Effect of Launch of SSM

This table reports the results from the DID setting in Eq 3.2. Dependent variable is bank credit risk premium (ΔCDS) and main independent variable is $SSM * post * opacity$ which is an interaction of bank opacity, SSM supervised banks and $post$, period after the launch of SSM. opacity is a dummy variable and equal to 1 for values of $\Delta opacity$ higher than 1 and zero otherwise. $\Delta opacity$ is derived from Eq. 3.3 as stated above.

Variables	(1) ΔCDS	(2) ΔCDS	(3) ΔCDS
SSM*Post*opacity	0.1146**	0.1110**	0.1110**
	(0.0552)	(0.0530)	(0.0533)
opacity	0.0896***	0.0616***	0.0616**
	(0.0219)	(0.0202)	(0.0284)
Post	0.0942***		
	(0.0271)		
SSM*Post	0.0042	0.0169	0.0169
	(0.0423)	(0.0392)	(0.0566)
SSM*opacity	-0.0864**	-0.0767*	-0.0767*
	(0.0398)	(0.0390)	(0.0436)
Post*opacity	-0.0932***	-0.0687***	-0.0687**
	(0.0284)	(0.0247)	(0.0315)
$\Delta default$	0.3076***	0.2885***	0.2885***
	(0.0510)	(0.0505)	(0.0587)
size	0.2090***	0.1979***	0.1979***
	(0.0611)	(0.0508)	(0.0503)
roa	0.0194***	0.0095	0.0095
	(0.0070)	(0.0060)	(0.0120)
eta	1.5441	1.5543*	1.5543
	(0.9999)	(0.8852)	(0.9670)
liqu	0.0001**	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0001)
vol	-0.0010***	-0.0009**	-0.0009
	(0.0004)	(0.0003)	(0.0006)
GDP	-0.0463**	-0.0493***	-0.0493
	(0.0175)	(0.0140)	(0.0381)
$\Delta domdebt$	-0.0064***	-0.0041**	-0.0041*
	(0.0020)	(0.0016)	(0.0023)
$\Delta bond$	-0.0532***	-0.0467***	-0.0467***
	(0.0102)	(0.0087)	(0.0118)
WUI	-0.0659**	0.0635**	0.0635
	(0.0266)	(0.0312)	(0.0564)
slope	-0.0006*	-0.0007**	-0.0007
	(0.0003)	(0.0003)	(0.0012)
itraxx	-0.0015***	0.0011***	0.0011
	(0.0002)	(0.0003)	(0.0009)
VIX	0.0155***	0.0088***	0.0088**
	(0.0016)	(0.0013)	(0.0037)
Constant	-2.6877***	-3.2867***	-3.2867***
	(0.8361)	(0.6770)	(0.7609)
Observations	2,232	2,232	2,232
R-squared	0.4072	0.4916	0.4916
Firm FE	YES	YES	YES
Time FE	NO	YES	YES
Time x Country Effects	NO	NO	YES
Cluster	Firm	Firm	Firm

Table 3.8: Placebo Test

This table reports the results from placebo test: treatment period is 2012 to avoid any influence that might affect the results from the news effect of SSM in 2013. There is no change in control and treatment groups. Thus, 2012 is treatment period and 2011 is the pre-treatment period. The variable of interest is $SSM * Post * opacity$, is an interaction term for CDS spread, post period of introduction of SSM and SSM supervised banks.

	(1)	(2)	(3)
Variables	ΔCDS	ΔCDS	ΔCDS
SSM*Post*opacity	0.2114	0.2114	0.2052
	(0.1361)	(0.1361)	(0.1384)
opacity	0.1858***	0.1858***	0.1962***
	(0.0645)	(0.0645)	(0.0667)
SSM*opacity	-0.1637	-0.1637	-0.1902
	(0.1191)	(0.1191)	(0.1237)
Post*opacity	-0.1843**	-0.1843**	-0.1879**
	(0.0809)	(0.0809)	(0.0833)
Post	-0.1967***		
	(0.0407)		
SSM*Post	-0.2732***	-0.2732***	
	(0.0926)	(0.0926)	
$\Delta default$	0.4887***	0.4887***	0.4943***
	(0.0708)	(0.0708)	(0.0790)
size	0.2006***	0.2006***	0.2021***
	(0.0512)	(0.0512)	(0.0534)
roa	-0.0714**	-0.0714**	-0.0312
	(0.0322)	(0.0322)	(0.0407)
eta	6.4754**	6.4754**	5.9744**
	(2.7954)	(2.7954)	(2.8723)
vol	-0.0071***	-0.0071***	-0.0072***
	(0.0013)	(0.0013)	(0.0014)
liqu	-0.0001	-0.0001	-0.0001**
	(0.0001)	(0.0001)	(0.0001)
GDP	-0.0989***	-0.0989***	-0.0871***
	(0.0246)	(0.0246)	(0.0280)
$\Delta domdebt$	-0.0035**	-0.0035**	-0.0041**
	(0.0014)	(0.0014)	(0.0015)
$\Delta bond$	-0.1343***	-0.1343***	-0.1379***
	(0.0183)	(0.0183)	(0.0190)
WUI	0.2244*	0.2244*	0.2581*
	(0.1240)	(0.1240)	(0.1307)
slope	-0.0028	-0.0028	0.0020
	(0.0020)	(0.0020)	(0.0021)
itraxx	-0.0018	-0.0018	-0.0020
	(0.0018)	(0.0018)	(0.0018)
VIX	0.0040	0.0040	0.0037
	(0.0028)	(0.0028)	(0.0029)
Constant	-2.2517***	-2.3500***	-2.3206**
	(0.8397)	(0.8425)	(0.8745)
Observations	496	496	496
R-squared	0.7525	0.7525	0.7636
Firm FE	YES	YES	YES
Time FE	NO	YES	YES
Time x Country Effects	NO	NO	YES
Cluster	Firm	Firm	Firm

Table 3.9: Alternative Bank Opacity Measure

This table reports the results from DID setting. The variable of interest is $SSM * Post * opacity$, is an interaction term for CDS spread, post period and SSM supervised banks. Opacity is dummy variable taking values of 1 for $\Delta opacity*$ is greater than 1 and zero otherwise. $\Delta opacity*$ is measured from Eq. 3.5.

	(1)	(2)	(3)	(4)
Variables	ΔCDS	ΔCDS	ΔCDS	ΔCDS
SSM*Post*opacity	0.1080*	0.1146**	0.1110**	0.1203**
	(0.0564)	(0.0552)	(0.0530)	(0.0541)
opacity	0.0868***	0.0896***	0.0616***	0.0654***
	(0.0214)	(0.0219)	(0.0202)	(0.0212)
SSM	0.0881***			
	(0.0299)			
Post	0.1238***	0.0942***		
	(0.0201)	(0.0271)		
SSM*Post	-0.0309	0.0042	0.0169	
	(0.0338)	(0.0423)	(0.0392)	
SSM*opacity	-0.0776*	-0.0864**	-0.0767*	-0.0893*
	(0.0429)	(0.0398)	(0.0390)	(0.0447)
post*opacity	-0.0925***	-0.0932***	-0.0687***	-0.0649**
	(0.0266)	(0.0284)	(0.0247)	(0.0259)
$\Delta default$	0.3180***	0.3076***	0.2885***	0.2997***
	(0.0512)	(0.0510)	(0.0505)	(0.0514)
size	0.0159**	0.2090***	0.1979***	0.2216***
	(0.0069)	(0.0611)	(0.0508)	(0.0591)
roa	0.0114***	0.0194***	0.0095	0.0033
	(0.0037)	(0.0070)	(0.0060)	(0.0096)
eta	0.8915***	1.5441	1.5543*	2.8761**
	(0.2890)	(0.9999)	(0.8852)	(1.3578)
liqu	0.0002***	0.0001**	0.0000	0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
vol	-0.0006**	-0.0010***	-0.0009**	-0.0015***
	(0.0003)	(0.0004)	(0.0003)	(0.0005)
GDP	-0.0347***	-0.0463**	-0.0493***	-0.0687***
	(0.0115)	(0.0175)	(0.0140)	(0.0167)
$\Delta domdebt$	-0.0053***	-0.0064***	-0.0041**	-0.0040**
	(0.0019)	(0.0020)	(0.0016)	(0.0016)
$\Delta bond$	-0.0570***	-0.0532***	-0.0467***	-0.0545***
	(0.0106)	(0.0102)	(0.0087)	(0.0099)
WUI	-0.0614**	-0.0659**	0.0635**	0.0917**
	(0.0241)	(0.0266)	(0.0312)	(0.0367)
slope	-0.0009***	-0.0006*	-0.0007**	0.0020***
	(0.0002)	(0.0003)	(0.0003)	(0.0004)
itraxx	-0.0013***	-0.0015***	0.0011***	0.0012***
	(0.0002)	(0.0002)	(0.0003)	(0.0003)
VIX	0.0157***	0.0155***	0.0088***	0.0090***
	(0.0016)	(0.0016)	(0.0013)	(0.0014)
Constant	-0.1312	-2.6877***	-3.2867***	-3.7018***
	(0.1303)	(0.8361)	(0.6770)	(0.7937)
Observations	2,232	2,232	2,232	2,232
R-squared	0.3632	0.4072	0.4916	0.5731
Firm FE	YES	YES	YES	YES
Time FE	NO	NO	YES	YES
Time x Country Clusters	NO	NO	NO	YES
Cluster	Firm	Firm	Firm	Firm

Table 3.10: Falsification Test

This table reports the results from falsification test using the DID approach. The variable of interest is SSM*Post*$\Delta opacity_{i,t}$ which is an interaction term for $\Delta opacity$, $post$, period of introduction of SSM and SSM supervised banks. This analysis changes the composition of control group while maintaining the same treatment group which includes banks under the SSM. In column 1 and 2, banks in Japan, China and United States are excluded from the control group; in column 3 and 4 banks in United States are excluded from the control group.

Variables	(1) ΔCDS	(2) ΔCDS	(3) ΔCDS	(4) ΔCDS
SSM*Post*$\Delta opacity$	49.7646***	51.0956***	25.3753**	24.2421**
	(15.8708)	(16.0031)	(10.8558)	(11.0265)
$\Delta opacity$	23.8828***	23.5496***	20.9669***	21.3572***
	(5.1335)	(5.1609)	(3.8899)	(3.7860)
SSM*Post	0.0437		0.0798**	
	(0.0376)		(0.0317)	
SSM*$\Delta opacity$	-10.1267	-9.7894	-8.2136	-8.4822
	(8.6168)	(8.9358)	(7.3071)	(7.7649)
Post*$\Delta opacity$	-53.4922***	-55.0950***	-27.7879***	-26.9054***
	(12.3913)	(12.4147)	(6.3707)	(6.2351)
$\Delta default$	0.1883***	0.2046***	0.2773***	0.2880***
	(0.0406)	(0.0416)	(0.0488)	(0.0496)
size	0.2887***	0.3105***	0.2314***	0.2639***
	(0.0624)	(0.0684)	(0.0429)	(0.0484)
roa	-0.0079	-0.0022	0.0065	0.0020
	(0.0068)	(0.0123)	(0.0060)	(0.0094)
eta	2.8462***	4.0640**	1.5546*	2.8444**
	(0.9867)	(1.7620)	(0.8397)	(1.2719)
vol	-0.0005*	-0.0012**	-0.0008**	-0.0014***
	(0.0003)	(0.0005)	(0.0003)	(0.0005)
liqu	0.0000	0.0001***	0.0000	0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	-0.0613***	-0.0682***	-0.0464***	-0.0677***
	(0.0161)	(0.0232)	(0.0138)	(0.0167)
$\Delta domdebt$	-0.0024	-0.0031	-0.0037**	-0.0037**
	(0.0026)	(0.0026)	(0.0016)	(0.0015)
$\Delta bond$	-0.0361***	-0.0417***	-0.0432***	-0.0502***
	(0.0082)	(0.0096)	(0.0081)	(0.0092)
WUI	0.1161***	0.1691***	0.0736**	0.1047***
	(0.0387)	(0.0456)	(0.0286)	(0.0318)
slope	-0.0009***	0.0019***	-0.0006**	0.0021***
	(0.0003)	(0.0004)	(0.0003)	(0.0003)
itraxx	0.0009**	0.0010**	0.0009***	0.0010***
	(0.0004)	(0.0005)	(0.0003)	(0.0003)
VIX	0.0126***	0.0125***	0.0094***	0.0097***
	(0.0018)	(0.0019)	(0.0014)	(0.0014)
Constant	-4.4294***	-4.7665***	-3.7061***	-4.2292***
	(0.7973)	(0.8664)	(0.5757)	(0.6539)
Observations	1,296	1,296	2,232	2,232
R-squared	0.5164	0.5902	0.5196	0.6011
Firm FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Time x Country Effects	NO	YES	NO	YES
Cluster	Firm	Firm	Firm	Firm

Table 3.11: Results from Alternative Method for Bank Opacity

This table reports the results from measurement of bank opacity using regularized linear regression. The variable of interest is SSM*Post*$\Delta opacity_{i,t}$ which is an interaction term for $\Delta opacity$, $post$, period of introduction of SSM and SSM supervised banks.

	(1)	(2)	(3)	(4)
Variables	ΔCDS	ΔCDS	ΔCDS	ΔCDS
SSM*Post*$\Delta opacity$	0.2653**	0.3015***	0.2791**	0.2156**
	(0.1020)	(0.1096)	(0.1129)	(0.1004)
$\Delta opacity$	0.2000***	0.2478***	0.2092***	0.1675***
	(0.0426)	(0.0473)	(0.0490)	(0.0448)
SSM	0.0538**			
	(0.0246)			
Post	0.0789***	0.0446*		
	(0.0164)	(0.0226)		
SSM*Post	0.0204	0.0648*	0.0758**	
	(0.0238)	(0.0353)	(0.0318)	
SSM*$\Delta opacity$	-0.1109*	-0.1541**	-0.1351*	-0.1011
	(0.0616)	(0.0731)	(0.0773)	(0.0673)
Post*$\Delta opacity$	-0.2411***	-0.2746***	-0.2336***	-0.1868***
	(0.0587)	(0.0608)	(0.0635)	(0.0570)
$\Delta default$	0.3184***	0.3059***	0.2870***	0.3155***
	(0.0515)	(0.0509)	(0.0505)	(0.0542)
size	0.0177**	0.2336***	0.2190***	0.0282***
	(0.0067)	(0.0563)	(0.0468)	(0.0089)
roa	0.0079**	0.0149**	0.0055	0.0002
	(0.0036)	(0.0069)	(0.0059)	(0.0081)
eta	0.9534***	1.5994	1.6168*	1.1909**
	(0.2829)	(0.9782)	(0.8765)	(0.5035)
vol	-0.0005*	-0.0010**	-0.0008**	-0.0011***
	(0.0003)	(0.0004)	(0.0003)	(0.0004)
liqu	0.0002***	0.0001	-0.0000	0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	-0.0338***	-0.0451**	-0.0489***	-0.0624***
	(0.0114)	(0.0172)	(0.0139)	(0.0173)
$\Delta domdebt$	-0.0056***	-0.0069***	-0.0045***	-0.0033**
	(0.0018)	(0.0018)	(0.0016)	(0.0015)
$\Delta bond$	-0.0560***	-0.0514***	-0.0452***	-0.0566***
	(0.0105)	(0.0100)	(0.0086)	(0.0102)
WUI	-0.0583**	-0.0612**	0.0665**	0.0916***
	(0.0244)	(0.0264)	(0.0298)	(0.0340)
slope	-0.0009***	-0.0005	-0.0006*	0.0021***
	(0.0002)	(0.0004)	(0.0003)	(0.0003)
itraxx	-0.0013***	-0.0015***	0.0010***	0.0015***
	(0.0002)	(0.0002)	(0.0003)	(0.0003)
VIX	0.0165***	0.0164***	0.0098***	0.0096***
	(0.0016)	(0.0016)	(0.0013)	(0.0014)
Constant	-0.1435	-3.0264***	-3.5791***	-1.0513***
	(0.1261)	(0.7681)	(0.6240)	(0.1699)
Observations	2,232	2,232	2,232	2,232
R-squared	0.3770	0.4274	0.5073	0.5542
Firm FE	NO	YES	YES	YES
Time FE	NO	NO	YES	YES
Time#Country FE	NO	NO	NO	YES
Cluster	Firm	Firm	Firm	Firm

Chapter 4

Do ESG scores immunize banks risks under an uncertainty environment? Evidence from the European Debt Crisis

4.1 Introduction

Recent and growing literature investigates the effect of non-financial information disclosures, particularly sustainable reporting on the firm performance (Brooks & Oikonomou (2018)), cost of equity (Ng & Rezaee (2015), Gillan et al. (2021)), stock market performance (Garel & Petit-Romec (2021)) and as well as investors portfolio choice preferences (Pedersen et al. (2020)).

Surprisingly, banks have been disclosing ESG (Environmental, Social and Governance) scores, particularly their governance scores more than a decade which reflects corporate governance scores and as well as bank management's ability to manage long-term risks. This opportunity during economic policy uncertainty periods such as the European debt crisis. Following the European debt crisis, the banking sector underwent

a bail-in process (2012-2016) which targeted banks to pay their debt using their own resources in the event of a default which decreased dependency on taxpayers' money and increase the sustainability of banks. Recent and growing literature investigates the effect of non-financial information disclosures, particularly sustainability reporting on the firm performance (Brooks & Oikonomou (2018)), cost of equity (Ng & Rezaee (2015), Gillan et al. (2021), stock market performance (Garel & Petit-Romec (2021)), investors portfolio choice preferences (Pedersen et al. (2020)) and limited research on its effect on the credit risk .This study examines the effect of non-financial disclosures on the creditworthiness of banks after an economic uncertainty period such as the European debt crisis which is followed by bank bail-outs and bail-in mechanisms afterwards.

This study first looks at the effect of banks' information environment due to their non-financial disclosures governance, social and environmental (ESG) scores on their credit risk. Then, this study investigates the economic policy uncertainty period of the European debt crisis when bank creditworthiness questioned due to potential bank bail-outs and looks at the relationship between bank credit risk and ESG disclosures for European banks after the European debt crisis. During economic uncertainty periods, bank management's ability to manage risks is a sign for long-term sustainability of banks that has a vital effect impact on the creditworthiness of banks from the investors' perspective. This research asks whether ESG scores, which imply banks' management ability to manage risks (as well as their long-term risks), had a stabilizing effect on

the investors' confidence in banks after the European debt crisis. With this question, this study tries to answer investors' trust in banks' management during economic policy uncertainty periods to maintain the creditworthiness of banks. Due to the European debt crisis, European banks' credit risk increased and their creditworthiness was questioned due to potential bail-outs where the burden of the European debt crisis was reflected in taxpayers' money which gave rise to bail-in resolution mechanisms which focuses on the shared burden of losses between shareholders, debt holders, and depositors. This study finally examines the effect of introduction of bail-in regulation and market participants' perception of banks' ESG scores to mitigate credit risk due to introduction of bail-in mechanism: share of burden due to bank losses in the event of stress and as well as investors' reaction to bank management capacity to govern and manage risks and being transparent in their policies.a

The transmission mechanism from ESG scores to credit risk can be explained from two perspectives: risk mitigation and over-investment. The risk mitigation view is based on the stakeholder theory (Chiaramonte et al. (2021), Di Tommaso & Thornton (2020)) and the over-investment view on the other hand is based on the agency theory which focuses on opportunistic managerial behaviour and states that managers may improve sustainability scores for the sake of their reputation as responsible social citizens (Barnea & Rubin (2010)). If risk mitigation is valid investors expect that banks with higher ESG scores are associated with a decrease in credit risk as these banks have higher ability to

foresee long-term risks and manage them accordingly will be considered as creditworthy during economic uncertainty periods. On the other hand, if the over-investment view is valid banks with higher ESG scores are likely to be more opaque and conceal risks, therefore investors are likely to charge higher credit spreads to those banks due to their information opacity which makes them less creditworthy during economic uncertainty periods.

We construct a comprehensive sample of European, US, Japan, China and UK banks using quarterly data from 2005Q1-2021Q4. To explore the relationship between the non-financial information environment of bank disclosures and the creditworthiness of banks, we use environmental, social and corporate scores (ESGs) to investigate the causal effect of the economic policy uncertainty period on the association between CDS spread and ESG disclosures. We explore one of the economic policy uncertainty period of European debt crisis that significantly affected the banking sector: by looking at the periods of pre-bail (1 January 2010- 1 January 2011), during bail-in (1 January 2011-6 July 2012) and post bail-in periods (14 April 2014-1 January 2016) similar to the analysis of (Fiordelisi, Girardone, Minnucci & Ricci (2020)). Then, this study applies a differences-in-differences setting to analyse the causal effects of this association during those periods.

Our baseline model shows that non financial disclosures of banks have negative effect on the credit bank credit risk which implies investors charge lower credit risk to

banks with higher ESG scores that is in line with risk mitigation hypothesis. Our second analysis is based on the DID setting and targets to answer whether the effect of ESG scores is valid after an economic policy uncertainty period such as the European debt crisis. This results show that investors lower the credit risk of banks with better ESG scores after the European debt crisis (or pre-bail-in period) which presents evidence of the investors' confidence in banks' management to manage risks during economic uncertainty periods and, maintain their creditworthiness in the long run. Results from the during-bail-in mechanism are similar to the European debt crisis periods, investors find banks with higher ESG scores more trustworthy and lower their credit risk of those banks. Finally, results from after the bail-in mechanism are higher compared to the previous periods (European debt crisis (pre-bail in) and during bail-in periods) which implies investors' confidence in the bail-in mechanism is higher for banks with higher ESG scores. The main goal of this study is to understand investors' reaction to bank management capability to manage risk during uncertainty periods therefore this study particularly use corporate governance ESG scores (GESG) to investigate persuasiveness of bank management to maintain creditworthiness of banks during uncertainty periods and test our results through employment of ESG governance score (GESG). Our results show that banks with better governance scores have lower credit risk and investors lower credit risk of banks with better corporate governance after the uncertainty periods.

This study complements the prior literature in several strands. First, we comple-

ment the burgeoning literature (Bond & Zeng (2022)) on the corporate sustainability disclosures, particularly those employing ESG scores. This study also adds to limited research examining the relationship between non-financial disclosures and bank credit risk through employing a credit risk measure from a market perspective. To our knowledge, this study is the first to present evidence on the effect of banks' information environment on credit risk during economic policy uncertainty periods. Prior literature looks at the corporate governance practices on the credit risk or financial stability during the financial crisis (Anginer et al. (2018)). This study is the first to provide evidence in showing the effect of banks' management ability to cope with economic policy uncertainty, i.e., the European debt crisis and following the bail-in mechanism process. This study contributes to the recent growing literature on economic policy uncertainty (Ahir et al. (2022)) by investigating the European debt crisis period where the world uncertainty index reached one of its peaks and presents first evidence on the investors' perception of credit risk due to banks' corporate governance capacity during economic uncertainty periods. Finally, this study adds to the literature by focusing on bank regulation (Bonner & Eijffinger (2016), Fiordelisi et al. (2017), Banerjee & Mio (2018), DeYoung et al. (2018)) from a bank-bail out and bail-in perspective.

This study also performs several robustness checks: first, we explore an alternative economic policy uncertainty periods of the UK's Referendum vote on 23 June 2016 which started high volatility in the financial market regarding the future of the UK and

European Union. Secondly, we perform a placebo test for the European debt crisis period, by using an alternative treatment period that would indicate no prior influence is effective on the causal impact of the European debt crisis on the effect of ESG scores on the creditworthiness of banks. Lastly, this study differentiate the treatment period by excluding the Global Financial Crisis period from our pre-treatment period. Results from the robustness checks confirm prior findings in that investors find bank with better ESG scores as more trustworthy after an economic policy uncertainty period, resulting in lower credit risk premiums for those banks.

4.2 Literature Review

4.2.1 CSR and Credit Risk

Sustainability is a growing concern and is also gaining popularity among investors due to its long-term sustainable investment returns. EU-Directive of 2014 also called the Non-Financial Reporting Directive (NFRD), i.e., corporate sustainability reporting that forms the rules on the disclosure of non-financial information on the way firms operate and manage social and environmental challenges and applies to large firms including banks. This EU law aims to enhance information transparency for investors and outsiders to evaluate the non-financial performance of those firms. Although they are made mandatory firms have been disclosing their social, environmental and governance (ESG) scores for more than a decade, particularly their governance scores.Non-financial

information disclosures such as ESG scores imply firms' engagement in corporate social responsibility (CSR) activities and those scores are monitored by stakeholders. Mathews (1997) states that firms report their environmental and social records to improve their legitimacy and financial performance.

Relatively recent but there is burgeoning literature on the effect of corporate social responsibility (CSR) on firm value (Brooks & Oikonomou (2018)), stock price crash risk (Kim et al. (2014)) and cost of equity (Ng & Rezaee (2015)). However, limited literature focuses on the relationship between CSR activities and bank risk taking. Compared with numerous CSR studies on non-financial firms (Servaes & Tamayo (2013), Stellner et al. (2015)), banking CSR studies are scarce, particularly those investigating its effect on banks' risk-taking behaviours (Chiaramonte et al. (2021), Aevoae et al. (2022)).

Recent research examined the beneficial effect of CSR on bank risk oversight and firm value. (Di Tommaso & Thornton (2020), Chiaramonte et al. (2021)) provided evidence on the effect of ESG score which suggests that ESG scores help to mitigate the negative effect of shareholder related governance and that avoids banks to take excessive risk. Gillan et al. (2021) states that regarding the with a few exceptions, the empirical evidence generally supports that higher sustainability disclosure reporting generates lower risk and cost of capital.

The relationship between firm risk taking and ESG scores can be explained with two perspectives: i) the stakeholder theory states that investments in CSR activities have

the potential to generate moral capital or goodwill (i.e. intangible assets) among stakeholders, acting like insurance protection mechanisms that lessens firms' risk exposure, alleviate operational, environmental and social risks (i.e. risk mitigation view) (ii) the second view originates from the agency theory and focuses on opportunistic managerial behaviour: managers may improve sustainability scores to sound as responsible social citizens and increase their reputation (Chiaramonte et al. (2021)). Therefore, according to risk mitigation theory investment in ESG scores are associated with less exposure to credit risk and over investment view on the other hand suggests that an increase in ESG investment is higher correlation with managerial opportunism and higher credit risk.

This study contributes to scarce literature examining the relationship between bank risk and CSR activities and it differentiates from the prior literature by providing evidence from the market participants perspective through looking at the sustainability disclosures particularly focusing on using governance pillars that reflects bank management ability to mitigate long term risks and as well as their effort to be transparency in their policies and its reflection on credit risk.

H_1: There is a negative association between ESG scores and credit risk.

4.2.2 CSR and Credit Risk In Times of Economic Policy Uncertainty

We describe economic policy uncertainty which is limited but gaining interest in the literature and investigate its importance of economic policy uncertainty periods on the

firm performance and decision marking mechanisms of economic entities. Development of EPU index by Baker et al. (2016), enabled literature to quantify the EPU and analyze its impact on many distinct areas. EPU index is based on newspaper coverage frequency and proxies for movements in policy-related economic uncertainty. EPU index for US index spikes near tight presidential elections, Gulf Wars I and II, the 9/11 attacks, the failure of Lehman Brothers, the 2011 debt ceiling dispute, and other major battles over fiscal policy. Also, using firm-level data, Baker et al. (2016) find that policy uncertainty is associated with greater stock price volatility and reduced investment and employment in policy-sensitive sectors like defense, health care, finance, and infrastructure construction.

Similarly to economic policy uncertainty index, developed by Ahir et al. (2022), world uncertainty index incorporated quarterly indices of economic policy uncertainty for 143 countries since 1996 through use of frequency of "uncertain" in the quarterly economist intelligence unit country reports. Those reports discuss topics on the political and economic developments in the countries. Using those inputs, WUI shows considerable divergence from its trend during specific periods: 9/11 attacks, the SARS outbreak, Gulf War II, the European debt crisis, El Niño, Europe border-control crisis, UK's vote for Brexit, and the 2016 US presidential election. Uncertainty index reveals several similarities between countries have certain level of trade and financial linkages. Also, uncertainty is found lesser in advanced counties in a cross-country analysis. Higher values in WUI indicates greater economic uncertainty, stock market volatility, risk and

decrease in GDP.

There is growing interest in the use of economic policy uncertainty in the financial studies. Ashraf & Shen (2019) investigates the effect of EPU on interest rates on bank gross loans and find that economic policy uncertainty boosts banks' loan prices by increasing the borrowers' default risk which suggests that EPU is an important factor in the pricing of bank loans. Brogaard & Detzel (2015) present evidence on the effect of EPU on the asset price and find that an increase of one standard deviation in EPU is associated with a 1.5% increase in forecasted three-month abnormal returns. Chan et al. (2021) study the effect of economic policy uncertainty (EPU) on the cost of raising equity capital and show that one standard deviation increase in the EPU index developed is associated with a 43 basis point increase in the price discount of seasoned equity offerings (SEOs) during the 20002014 period. Bordo et al. (2016) examine the impact of economic policy uncertainty on the aggregate bank credit growth and find that policy uncertainty has a significant negative effect on the bank credit growth. Kaviani et al. (2020), on the other hand, find a significant positive relation between the changes in policy uncertainty and credit spreads which implies that economic policy uncertainty has an important effect on banks' borrowing costs. Attig et al. (2021), on the other hand, provide first evidence of the impact of economic policy uncertainty (EPU) on the banks 'dividend policy and find that a high level of EPU is positively associated with dividend payouts. Wang et al. (2019) examines the relationship between news based EPU of US

firms and CDS spreads and find that is positively associated with credit default swap (CDS) spreads. Matousek et al. (2020) examines how economic policy uncertainty affects financial firms' capital shortages in the event of a new crisis and employing a global economic policy uncertainty index and authors show that an increase in policy uncertainty leads to future capital shortfall increases in the event of a severe market decline.

Although economic and political uncertainty is gaining interest in the literature, research on its impact on the financial information disclosure is rather limited. Economic policy uncertainty is an important component of firms' information environments and managers' voluntary disclosure decisions (Baker et al. (2016)). Nagar et al. (2019) find that uncertainty is associated with increased bid-ask spreads and decreased stock price reactions to earnings surprises. Managers respond to this uncertainty by increasing their voluntary disclosures, but these disclosures only partly mitigate the bid-ask spread increase. Ng et al. (2020) examine the effect of economic policy uncertainty on banks' accruals for loan losses and find that in times of higher policy uncertainty, banks make more loan loss provisions and this positive association is more pronounced for banks that were previously less prudent in their risk-taking and loan loss reserving, indicating that less prudent banks are harmed more by loan losses in difficult times. Jin et al. (2019) investigates whether economic policy uncertainty is systematically related to bank earnings opacity and show that uncertainty in economic policy is positively related

to earnings opacity, proxied by the magnitude of discretionary loan loss provisions and the likelihood of just meeting or beating the prior year's earnings, and negatively related to the level of accounting conservatism.

Relatively new but scant literature examines the effect of non-financial disclosures (i.e. CSR activities) on the credit risk, but none explores its impact during the volatility periods such as the European debt crisis, Brexit Referendum. During economic policy uncertainty periods, the decision-making mechanism of firms become less secure as they cannot evaluate details in full and due to that reason they might choose to disclose full and stay silent (Bond & Zeng (2022)). But how do investors value non- financial information disclosures during escalating economic policy uncertainty?

In the face of policy uncertainty, banks might conceal potential risks or prefer to be less about their disclosures to their stakeholders and investors. We, therefore, argue whether investor perceptions change during the uncertainty periods. Previous literature generally focuses on financial disclosure through measuring bank opacity based on banks' discretionary loan loss provisioning model that is used to measure banks' hidden risk-taking incentives. We differentiate from the previous literature and concentrate on the non-financial disclosure of banks, mainly focusing on the sustainability reporting in which they disclose their environmental matters, social matters and treatment of employees, respect for human rights, anti-corruption and bribery, diversity on company boards[1]. Banks disclose their financial and non-financial reporting but how do investors

[1]In terms of age, gender, educational and professional background.

value them? Does financial reporting disclosure where we measure using bank opacity expected to increase bank CDS premiums as investors put more risk premiums on the banks who are more opaque in their financial disclosures? On the other hand, we expect the opposite effect on the non-financial reporting on the bank risk premiums. In other words, we argue that investors find it less risky if banks have higher non-financial information disclosure measures and this is due to an investor looking for long-term investment goals that would generate a long-term sustainable return. Banks might disclose less information or be found to be riskier through concealing information or concealing potential risk, and due to that reason, investors' opinions on the bank disclosures might be affected during the economic uncertainty periods. We argue that investor behaviour shows an anomaly regarding the banks' non-financial disclosures since an increase in the non-financial disclosure, i.e, sustainability reporting increases the CDS spreads during economic or political uncertainty. Further, using the European debt crisis as an uncertainty period in the European Union, particularly for banks that faced bail-out risks, we ask that does uncertainty stemming from the sovereign debt crisis altered the investor behaviour on the non-financial disclosures while pricing bank risks. We hypothesize that investors lessen their trust in information disclosures even from the sustainability disclosures during the uncertainty periods.

H_2: After the European debt crisis, investors found banks with superior ESG scores more creditworthy.

Following the European debt crisis when problematic banks are bailed out, the banking sector underwent a significant process, i.e. bail-in mechanism which aims to restore banks using bank's own resources rather than taxpayers' or deposit holders' money. Banks' information sharing environment might differ during the bail-in mechanism and after the implementation of the bail-in mechanism. Investors' reaction to the bail-in mechanism is significant as this period reflects banks' adaption to rescue at times of stress and bank management's ability to govern and manage long-term risks. First, this study examines the during bail-in process (1 January 2011- 6 July 2012) and secondly the after bail-in process (14 April 2014-1 January 2016) separately.

H_3: During the bail-in process, investors' trust increased for banks with superior governance capacity, i.e. with higher ESG-governance pillar scores.

H_4: After the bail-in process, investors' trust increased for banks with superior governance capacity, i.e. with higher ESG-governance pillar scores.

4.3 Data and Methodology

4.3.1 Data

Our sample includes 79 banks with quoted quarterly CDS spreads in European Union (Austria, Belgium, Denmark, Finland, Germany, France, Greece, Ireland, Italy, Netherlands, Norway, Spain and Sweden), United States, United Kingdom, Japan and China. We obtain bank-level yearly data of ESG scores and other control variables from the

Bloomberg database. We extract historical quarterly series of world uncertainty index from Ahir et al. (2022)'s website. Our macroeconomic variables such as 5-year treasury bond interest rate are also from Bloomberg. We keep banks with liquid data. We present definition of variables used in this study in Table 4.1.

[Insert Tables 4.1 Here.]

To capture market participants' perception of bank corporate social responsibility (CSR) activities during economic policy uncertainty periods, we use quarterly CDS spread as a proxy for credit risk measure as CDS spread provide more accurate measure for the market risk (Pan & Singleton (2008), Longstaff et al. (2011)) compared to bond market and they are standardized and more liquid (Longstaff et al. (2005), Acharya et al. (2014)) than the bond market obtained from Bloomberg. We select CDS quotes on senior unsecured debt with modified restructuring and five-year maturity to ensure liquidity as majority of CDS contracts are with five-year maturity. Longstaff et al. (2005) states that CDS spreads are measures of credit risk as they do not reflect interest rate risk, currency risk suggested by Griffin et al. (2016). We calculate change in CDS spreads by taking logarithm change between t and t-1. We also use benchmark treasury bond interest rate with 5-year maturity in line with the CDS spread maturity.

During European debt crisis and Lehman Brother crisis are world uncertainty index reached one of it historical peak levels as suggested by Ahir et al. (2022) and those uncertainty periods are also important input to analyse changes in banks' risk-taking

behaviour. This study focuses on the European debt crisis period and we divide European debt crisis period into following sub-periods: pre bail-in, during bail-in and post bail-in period as in Table 4.2 in line with the study on Fiordelisi, Minnucci, Previati & Ricci (2020).Those dates are important announcement dates in terms of bail-in resolution mechanism .

[Insert Tables 4.2 Here.]

Final sample covers data for 2005q2-2021q4: bank-quarter balance sheet data, yearly non-financial disclosures of ESG score, quarterly macro economic indicators and market indicators such treasury bond rate and WUI index. We report variables used in this analysis in the Table 4.3.

[Insert Tables 4.3 Here.]

4.3.2 Preliminary Results

The parallel trend assumption is critical to ensure internal validity of DID setting and it requires that in the absence of treatment, the difference between the 'treatment' and 'control' group is constant over time. Violation of parallel trend assumption will lead to biased estimation of the causal effect. Running t-test for difference in means for the following periods: pre-bail in, post bail-in and bail-in approval confirms that validity of results from difference-in difference setting.

Table 4.4, reports the t-test for ΔCDS, ESG score governance pillar for EU banks (treatment) with those in the control group after the distinct periods bail-in approval on April 15, 2014, pre bail-in (Jan 2010-Jan2011) and post bail in (14 Apr 2014-1 Jan 2016). Results shows that CDS spreads in EU are indistinguishable than that of non-EU banks before the sovereign debt crisis and bail-in periods.

[Insert Tables 4.4 Here.]

4.3.3 Methodology

We construct the following model to examine the association between bank information sharing and creditworthiness. Following the literature on the information content of CDS spreads that provide evidence on the association between information environment and credit risk (Callen et al. (2009), Chiu et al. (2018)), we construct the following fixed effect panel regression model on a set of country, bank-level control variables coupled with the bank, time and country fixed effects to investigate the association between banks' non-financial information environment (ESG scores) and their credit risk:

$$\begin{aligned} \Delta CDS_{i,t} = \beta_0 + \beta_1 ESG_{i,t-1} + \beta_2 size_{i,t-1} + \beta_3 roa_{i,t-1} + \beta_4 eta_{i,t-1} \\ + \beta_5 \Delta default_{i,t} + \beta_6 \Delta bond_{j,t} + \beta_9 \Delta WUI_{j,t} + \delta_t + \kappa_i + \epsilon_{i,t} \end{aligned} \tag{4.1}$$

where $\Delta CDS_{i,t}$ denotes the natural logarithm change of credit default swap spread between time t and t-1 for bank i. In the scope of this analysis, we examine the bank

information environment using non-financial disclosure measures, namely ESG scores and higher values implying higher compliance with sustainability goals in environmental, social and governance issues. Based on the prior literature (e.g., Collin-Dufresn et al. (2001), Callen et al. (2009), Chiu et al. (2018)), we include control variables that are associated with CDS spreads: capitalization ratio (eta), total equity to assets ratio. In line with the 5-year maturity of CDS data, we include changes in treasury bond interest rate with 5-year maturity ($bond$). Following Callen et al. (2009), we also include return to assets ratio (roa) to control profitability, and natural logarithm of bank total assets ($size$). Based on Duffie & Lando (2001), suggesting that CDS spread are composed of information quality risk and default risk, this study also includes changes in default probability of bank ($\Delta default$) in line with the term structure of the bank. Lastly, we include the world uncertainty index of Hale et al. (2020) to control for economic uncertainty which shows its peaks on dates such as the European Debt crisis, the UK Referendum vote in June 2016 on results. As a robustness check, we control for term premium ($slope$) impact by including the difference between risk-free interest rate with 2-years and 10-years and as well as liquidity premium $liqu_{i,t}$ by taking the difference between the bid and ask spread of CDS spread with 5-year maturity in line with Chiu et al. (2018).

In our second analysis, we examine the investors' perception of banks' non-financial information environment after the uncertainty periods. To investigate potential investor

behaviour anomalies, this study investigates the European debt crisis period, which is referred to as one of the peaks of the world uncertainty index, (Ahir et al. (2022)) among the 9/11 attacks, the SARS outbreak, Gulf War II, the Euro debt crisis, Europe border-control crisis and the UK's referendum vote in favour of Brexit as shown in Figure 4.1. We base our analysis on the European debt crisis as investors revised their opinions on the banks' creditworthiness due to potential bank bail-outs and following bank bail-in resolution mechanism initiatives to restore the trust in the banking sector.

[Insert Table 4.1 Here.]

To examine the effect of the uncertainty period on the creditworthiness of banks, this study investigates the European debt crisis that occurred between 2010 and 2011 that period followed by the bail-in regulation period. We divide the bail-in period into two periods in line with Fiordelisi, Minnucci, Previati & Ricci (2020): during bail-in (1 January 2011 - 26 July 2012) and post-bail-in (14 April 2014 and 1 January 2016). Using a Differences-in-Differences (DID) analysis, this study examines the effect of the European debt crisis and following bail-in regulation on the investors' perception of banks' non-financial information disclosures that affects their long-term investment goals. We construct the following model:

$$\Delta CDS_{i,t} = \beta_0 + \beta_1 EU * Post * ESG_{i,t-1} + \beta_2 Post * ESG_{i,t-1} +$$
$$\beta_3 EU * ESG_{i,t-1} + \beta_4 EU * Post + \beta_5 ESG_{i,t-1} + \beta_6 size_{i,t-1} + \beta_7 roa_{i,t-1} + \quad (4.2)$$
$$\beta_8 eta_{i,t-1} + \beta_9 \Delta default_{i,t} + \beta_{10} \Delta bond_{i,t} + \Delta_8 \Delta WUI + \delta_t + \kappa_i + \epsilon_{i,t}$$

where EU is equal to 1 for banks in European Union and 0 otherwise; $Post$ equals 1 for the following periods: pre-bail-in, during and post-bail-in reported in Table 4.1 and zero otherwise. The main variable of interest is the $EU * Post * ESG_{i,t-1}$, an interaction term of EU, $Post$ and $ESG_{i,t-1}$. Its coefficient (β_1) shows the magnitude of the effect of the periods analyzed on the association between ESG score and credit risk for EU banks in comparison to non-EU banks. Banks tend to mask their credit risk due to increases in costs to maintain financial resilience during stress and also managerial opportunities to take advantage of uncertain economic environments. We argue that investors look for additional information contained in non-financial disclosures during uncertainty periods and following regulation initiatives (bail-in period) to improve their decision-making mechanism.

The effect of the European debt crisis and following bail-in regulations on the association between ESG disclosures and bank credit risk can explain from two perspectives: (1) risk mitigation based on stakeholder's view and (2) over-investment based on agency theory. If the risk-mitigation view is valid, then after the following periods (European

debt crisis, during and after bail-in), investors lowers credit risk due to higher ESG scores (Bond & Zeng (2022)). The risk-mitigation view shows that banks are incorporating those scores as a credit risk management tool and to create value using moral capital (e.g.,Godfrey et al. (2009), Chiaramonte et al. (2021)). On the other hand, if the over-investment view is valid, after these periods, investors lower (positive effect) the creditworthiness of those banks as they are involved in managerial opportunism rather than for the sake of society.

4.4 Empirical Results

This section reports the results from the baseline model in Eq. 4.1 and 4.2.

Investors put more interest in the ESG disclosures in the recent years due to its potential effect on their long-term investment goals. However, firms have been disclosing those non-financial information of ESG scores particularly its governance pillar more than a decade. ESG-G score, showing the criteria for what comprises a good governance (Tang (2019)). This is why this study employs ESG pillars in the Table 4.4 to show extract governance score and its effect on the credit risk. Table 4.5 depicts the results for association between CDS spread (ΔCDS) and ESG governance score (ESG-G) based on the Eq. 4.1. Results show that there is a negative association between non-financial information sharing (ESG) and credit risk (ΔCDS) in line with the risk-mitigation view (Aevoae et al. (2022)), suggesting that investors are inclined to lower credit risk premium

on banks those with superior ESG governance scores.

[Insert Tables 4.5 Here.]

Table 4.6 reports the results from double interactions of $ESG-G$ scores with different sub-periods $ESG - S * Post$ specified in Table 4.2. Results from sub-periods show that during high certainty periods of European debt crisis (pre-bail-in), during bail-in period, and post bail-in period, an increase in ESG governance pillar (ESG-G) lowers banks' credit risk. This suggests that investors find banks with ESG governance scores as more trustworthy after the uncertainty periods. This negative effect of ESG governance score on the credit risk is valid for pre bail-in and post bail-in periods except for the during bail-in period.

[Insert Tables 4.6 Here.]

4.4.1 Results for the Effects of Pre, During and Post Bail-in Periods

In this section, we repeat the baseline analysis based on the differences-in-differences setting. This method allows us to confirm the results from the previous baseline analysis on whether investors respond EU treated banks' (EU banks) after the European debt crisis and following bail-in regulation. In other words, this analysis examines the investors' judgement of bank creditworthiness after the European debt crisis (pre-bail-in), during and post-bail-in periods through assessing the non-financial disclosures of governance

pillar, a criterion for management governance capacity to be transparent and govern risks.

Table 4.7 shows the results from the DID analysis and nexus between $EU * Post * ESG-G$ and CDS spread for the following periods: pre-bail-in, during bail-in and post-bail-in periods. $EU*Post*ESG-G$ is the variable of interest and its coefficient reflects the nexus between ESG governance score and its coefficient is statistically significant and negative for all periods. This shows the importance of bank management governance capacity ($ESG - G$) in investors' decision-making mechanisms after the uncertainty periods in the economy stemming from the European debt crisis and as well as bail-in regulation which initiates the share of the burden of potential losses among stakeholders, debtors and investors. Another important point is that bank bail-in regulation is an important input for the investor decision-making mechanism and although bank bail-in regulation had the potential to restore the confidence and stability in the economy and banking sector, it also increased the effectiveness of $ESG-G$ further in the post-bail-in period compared to pre-bail-in process after when regulation implemented. This also reflects the investors' trust in banks' management capacity to manage risks under a stressful period and following bail-in regulations.

[Insert Tables 4.6 Here.]

4.5 Robustness Checks

We make several robustness checks to examine the effect of $ESG-G$ on the CDS spread after the uncertainty periods and bail-in regulation. This study repeats the previous analysis by: (1) focusing on a different uncertainty period of the UK Referendum vote on June 23, 2016, (2) incorporating the overall ESG score (3) accounts for Global Financial crisis implications on this association.

4.5.1 Brexit and Economic Policy Uncertainty

UK's referendum vote on June 23, 2016, to exit of European Union i.e. Brexit caused a large and long-lasting uncertainty in the financial markets (Bloom et al. (2019)). UK's Referendum vote initiated the Brexit process and policy uncertainty increased with subsequent events including the resignation of Prime Minister Theresa May, and Theresa May lost the meaningful vote. As in the example of Brexit, policy uncertainty affects the stock markets, and its impact is prone to be large if there also exists an uncertainty to a similar extent regarding the government policy (Pastor & Veronesi (2012)). The referendum vote caused tremendous uncertainty in the financial markets for the future relationships between the UK and the European Union that in the end affected the market price of the prominent financial institution.

Brexit-induced uncertainty not only affects the financial markets, but it also has an impact on the economy as it disrupts the main macroeconomic balances such as

economic output, employment and investment sentiment in the economy.

This analysis uses Brexit Referendum since it is one of peaks of World Uncertainty Index (Ahir et al. (2022)). UK's Referendum vote is a period that initiated volatility on the economy,trade and economics. Therefore, this period unique in its setting as banks in UK are highly affected due to negotiations and that resulted in questioning of creditworthiness of UK banks. Due to that reason, we use Brexit as a period of uncertainty to study the effect of uncertainty on the nexus between credit risk and ESG disclosures.

Using UK's Brexit Referendum vote on 23 June 2016 as the beginning of the policy uncertainty period, this analysis investigates the effect of the ESG governance score (ESG-G) on the bank credit risk premium after the UK's Referendum vote.

Table 4.8 shows the findings from the alternative economic policy uncertainty period of the UK's Brexit Referendum on June 23, 2016, and the results are similar to the European debt crisis period when uncertainty reached one of its historical highest. Results from the analysis show that after the Brexit referendum vote which pumped uncertainty into markets, investors find UK banks more trustworthy than those with a higher capacity to govern under uncertainty. The results confirm that after Brexit, a volatility period, the investors increase their trust in banks with superior ESG-G scores.

[Insert Tables 4.8 Here.]

4.5.2 ESG Overall

This study examines the bank governance's capacity to manage risks after an uncertainty or regulation. Thus, this study first employs the ESG governance pillar to examine banks' sole governance capacity. Although the ESG governance pillar has particular importance in this study, I employ an overall ESG score. the ESG-G pillar is one of the components of the ESG overall score with social and environmental pillars and we expect a similar effect.

That is why this study also provides evidence using the overall ESG score. Following Table 4.9 shows results from the overall ESG score. Findings are consistent with those from the ESG governance pillar (ESG-G).

[Insert Tables 4.9 Here.]

4.5.3 The Effect of Global Financial Crisis

The Global Financial crisis has long-term implications on the financial markets. Global Financial Crisis is one of the periods when uncertainty in the financial markets reached one of its peaks. This study analyses the effect of sovereign debt crisis and bank bail-out periods that are also a continuation of Global Financial Crisis periods. Since the main goal of this study is to examine banks' governance capacity during bank bailouts, this study also solely focuses on the sovereign debt crisis by excluding the Global Financial Crisis period. Table 4.10 reports results from the DID setting while excluding the

Global Financial Crisis period. Therefore, the treatment period includes the European debt crisis but control period excludes the Global Financial crisis period in this analysis. The results are in line with those from the previous findings.

[Insert Tables 4.10 Here.]

4.6 Conclusion

Information content in CDS spread reveals investors' perception of banks' creditworthiness due to their probability of defaults and information risks. Although non-financial disclosures have gained extra importance during the last years, firms have been disclosing them for more than a decade and it has a role in the decision-making mechanism of investors, particularly on their long-term investment goals.

This study focuses on ESG scores to study the effect of non-financial disclosures on the banks' credit risk premiums. In particular, this study focuses on the ESG-governance score which has a liquid record compared to other ESG pillars. Also, this study investigates the uncertainty period of the European debt crisis when uncertainty reached one of its historical maxima and when troubled banks bail out using the deposit holders' money. This study focuses on the European debt crisis as systemic risk failures resulted in bail-outs and also a period followed by a bail-in regulation which proposes the share of bank losses between stakeholders, debtholders and deposit holders. Therefore, the European debt crisis affected banks to a great extent due to systemic risk implications

and following bail-in regulation also raised questions about the investors' potential burden to new bail-in regulation.

Using those periods as a shock, this study examined the nexus between the banks' information environment and their credit risk due to non-financial information disclosures of ESG governance scores. This study shows that there exists a negative association between banks' ESG disclosures and credit risk and it is in line with a risk-mitigation view. Namely, a superior governance capacity to govern risks implies a decrease in the CDS spread, implying a higher trust i.e. a lower credit risk for banks with a higher ESG score. Particular availability of ESG-governance pillar enables us to evaluate the bank creditworthiness due to bank governance capacity to tackle uncertainties and their approach to a new bail-in mechanism. The results provide evidence on the investors' trust in bank governance capacity is higher for banks with higher ESG-governance scores after an uncertainty environment and following regulatory change.

4.7 Policy Implications

Along with the increased focus on environmental issues and climate change, there is a conversion to be more transparent about firms' non-financial steps. These non-financial information sets including their engagement in social, governance and environmental issues are important as they enable stakeholders, investors and other outsiders to value firms in generating value through moral capital. Previous literature has focused on

corporate transparency but nascent literature examines the effect of bank information environment on their creditworthiness using their non-financial disclosures, particularly their governance capacity under an uncertain environment.

The main goal of this study is to examine investors' perception of non-financial disclosures and their trust using the non-financial information environment, particularly their ESG scores after an uncertain period such as the European debt crisis which ended up with a bail-out process for banks and followed by a bail-in regulation. One of the contributions of this study is to show market participants' perception of banks after an uncertain period (European debt crisis) and following bail-in regulation initiatives using non-financial disclosures such as ESG scores, particularly their governance capacity. This study is also important in reflecting investors' perception of ESG scores while assessing credit risks against a regulation change (i.e. bail-in regulation) that affects investors' investment goals. In addition, this study has the potential to support arguments on the moderating effect of ESG scores on the investors' decision-making mechanism while assessing banks' credit risks under an economic uncertainty period of the European debt crisis. Overall, this study has important feedback for policymakers, investors and debt-holders.

Table 4.1: Definition of Variables

This table shows definitions of variables used in this study. Changes are in percentage points. All ratios are winsorized at %1 level.

Acronym	Description	Source
ΔCDS	Logarithm change in CDS spread	Bloomberg
ESG	Environmental, social and governance scores	Bloomberg
WUI	Quarterly world uncertainty index	Ahir et al. (2022)
size	Natural logarithm of total asset	Bloomberg
roa	Total return on total assets	Bloomberg
eta	Total equity to total assets	Bloomberg
default	Change in probability of default within 5-year	Bloomberg
bond	Change in treasury bond interest rate with 5-year maturity	Bloomberg
ESG-G	ESG governance pillar	Bloomberg
ESG-S	ESG social pillar	Bloomberg
ESG-E	ESG environment pillar	Bloomberg
EU	Dummy variable if country is in European Union,zero otherwise.	Author
Post	Dummy variable equal to 1 if date is one of the sub-periods (European Debt Crisis (pre-bail-in), during bail-in and after bail-in), zero otherwise.	Author

Table 4.2: Timeline for European Debt Crisis and Bail-in Mechanism

This table shows important dates for European debt crisis (pre bail-in), during bail-in and post bail-in periods.

Sub-Period	Period
European Debt Crisis (Pre Bail-in)	1 Jan 2010-1 Jan 2011
During Bail-in	1 Jan 2011-26 Jul 2012
Post Bail-in	14 Apr 2014-1 Jan 2016

Table 4.3: Summary Statistics

This table shows summary statistics for (number of observations, median, mean, %25 and %75 and standard deviation of variables used in the analysis specified in Eq. 4.1. This table includes total 79 banks used in this analysis.

	N	Median	Mean	p25	p75	St. Dev.
ΔCDS	5372	-0.0189	0.0000	-0.1631	0.1407	0.3513
ESG	5372	43.9392	42.6798	32.8337	52.7211	12.7439
ESG-S	5372	23.8815	24.9531	14.1475	34.8851	13.2789
ESG-E	5372	28.3298	24.8576	12.4736	37.5415	16.3008
ESG-G	5372	83.0223	78.0950	72.2456	89.8555	16.6095
size	5372	13.6462	13.6600	12.0002	14.8856	2.1400
default	5372	-0.0001	0.0000	-0.0013	0.0010	0.0206
roa	5372	0.6531	0.9277	0.3191	1.0168	3.8000
eta	5372	0.0672	0.0756	0.0527	0.0876	0.0443
bond	5372	1.6890	2.7092	0.4730	3.1240	6.2647
WUI	5372	0.1326	0.1763	0.0672	0.2574	0.1645

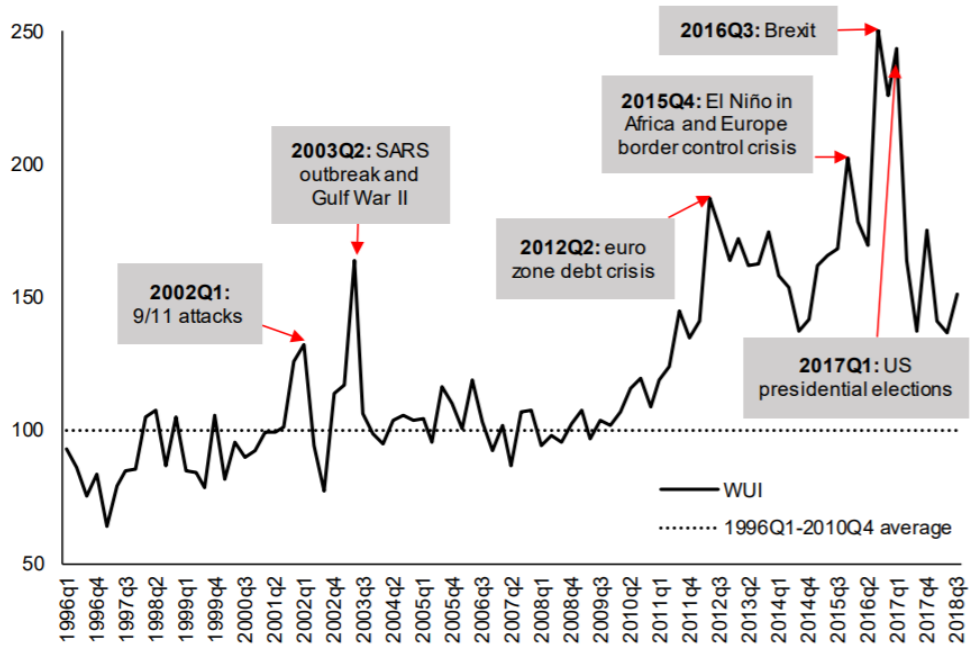
Table 4.4: Summary Statistics for Pre, During and Post Bail-in Periods

This table reports the mean and differences−in means for dependent variables (ΔCDS) and main control variables (ESG−governance pillar (ESG−G)) between treated (EU) and control banks (Non−EU). We implement this test based on specified dates in the Table 4.2

	Non-EU	EU	Diff.	P-Value
ΔCDS				
Pre-Bail-in	-0.0007	0.1772	-0.1779	0.1977
During Bail-in	0.0728	0.1203	-0.0475	0.7636
Post Bail-in	0.0263	-0.0047	0.0310	0.6997
ESG-G				
Pre-Bail-in	70.1031	70.9494	-0.8464	0.4589
During Bail-in	71.9187	71.5976	0.3211	0.5221
Post Bail-in	78.4862	77.4516	1.0346	0.5489

Figure 4.1: World Uncertainty Index

This figure depicts the world uncertainty index measured using county reports on the frequency of word with "uncertainty". Source: (Ahir et al. (2022)).



Note: The World Uncertainty Index (WUI) is computed by counting the frequency of uncertain (or the variant) in EIU country reports. The WUI is then normalized by total number of words, rescaled by multiplying by 1,000. Here is also rescaled by the global average of 1996Q1 to 2010Q4 such that 1996Q1-2010Q4=100. A higher number means higher uncertainty and vice versa.

Table 4.5: The Effect of Sustainability Scores on the Bank Credit Risk

This tables reports the results for the nexus between bank CDS spread and ESG governance score for whole sample as in the Eq.4.1. Columns 1-4 show the nexus between ΔCDS and $ESG-G$ for the whole sample (EU and non-EU banks). Column 1 does not include time and firm FE. Column 2 includes firm FE only. Column 3 time and firm FE only. Column 4 also controls for the interaction of time and firm effects. We cluster standard errors at the bank level.

	(1)	(2)	(3)	(4)
Variables	ΔCDS	ΔCDS	ΔCDS	ΔCDS
ESG-G	-0.0018***	-0.0030***	-0.0014***	-0.0018***
	(0.0003)	(0.0006)	(0.0004)	(0.0005)
size	-0.0055***	-0.0027	0.0022	-0.0081
	(0.0016)	(0.0161)	(0.0136)	(0.0172)
roa	0.0067***	0.0095**	0.0056***	0.0051**
	(0.0017)	(0.0042)	(0.0020)	(0.0022)
eta	-0.5636***	-1.0848**	-0.4737	-0.3674
	(0.1236)	(0.5228)	(0.3116)	(0.4895)
default	2.4202**	2.3838**	1.9779**	1.8520**
	(0.9243)	(0.9146)	(0.7989)	(0.7817)
bond	-0.0119***	-0.0123***	-0.0121***	-0.0131***
	(0.0037)	(0.0039)	(0.0033)	(0.0040)
WUI	0.0449**	0.0436**	0.0540***	0.0421*
	(0.0201)	(0.0201)	(0.0195)	(0.0219)
Constant	0.2537***	0.3420*	0.1089	0.2766
	(0.0348)	(0.1985)	(0.1783)	(0.2268)
Observations	5,372	5,372	5,372	5,372
R-squared	0.0417	0.0491	0.2309	0.2827
Firm FE	NO	YES	YES	YES
Time FE	NO	NO	YES	NO
Country*Time FE	NO	NO	NO	YES
Cluster	YES	YES	YES	YES

Table 4.6: ESG Score and Bank Credit Risk During Uncertainty Periods

This table reports the results for interaction of ESG-governance pillar ($ESG-G*Post$) and periods (pre bail-in, during bail-in and post bail-in) reported in Table 4.2 only for European banks (42 banks). $Post$ is a dummy variable in this table and denotes different periods. In Column 1, $Post$ is a dummy variable equal to 1 for a pre-bail-in period and zero otherwise. In Column 2, $Post$ is a dummy variable equal to 1 for the during-bail-in period and zero otherwise. In Column 3, $Post$ is a dummy variable equal to 1 for the post-bail-in period and zero otherwise. Column 4 shows the nexus between ΔCDS and $ESG-G$ for the whole period only for EU banks. We cluster standard errors at the bank level.

Variables	(1) Pre Bail-in ΔCDS	(2) During Bail-in ΔCDS	(3) Post Bail-in ΔCDS	(4) Whole ΔCDS
ESG-G	-0.0081***	-0.0010**	-0.0081***	-0.0082***
	(0.0023)	(0.0004)	(0.0023)	(0.0023)
ESG-G*Post	-0.0009**	-0.0006	-0.0014***	
	(0.0004)	(0.0004)	(0.0004)	
size	-0.0913	0.0431**	-0.0897	-0.0909
	(0.0869)	(0.0175)	(0.0870)	(0.0868)
roa	0.0245	0.0007	0.0246	0.0245
	(0.0159)	(0.0008)	(0.0159)	(0.0159)
eta	-1.3448	0.2302	-1.3515	-1.4418
	(2.8869)	(0.3319)	(2.8790)	(2.8810)
default	1.0010*	0.5155	1.0046*	1.0018*
	(0.5280)	(0.3867)	(0.5288)	(0.5296)
bond	-0.0102***	-0.0043***	-0.0105***	-0.0105***
	(0.0026)	(0.0009)	(0.0025)	(0.0025)
WUI	-0.0008	-0.0310*	-0.0062	-0.0004
	(0.0222)	(0.0173)	(0.0225)	(0.0223)
Constant	1.8879*	-0.4984**	1.8862*	1.8902*
	(1.0738)	(0.2230)	(1.0731)	(1.0719)
Observations	2,856	2,856	2,856	2,856
R-squared	0.3094	0.6515	0.3102	0.3091
Bank FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Cluster	YES	YES	YES	YES

Table 4.7: Results From The Differences-in-Differences Setting

This table reports the results from the DID approach for the nexus between bank CDS spread and ESG-G pillar after the following periods: European Debt Crisis, during and post bail-in based on specified periods in Table 4.2. The variable of interest is $EU * Post * ESG - G$ which is an interaction term of EU. ESG and $Post$. We cluster standard errors at the bank level.

	Pre Bail-in				During Bail-in				Post Bail-in			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Variables	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS
EU*Post*ESG-G	-1.1133**	-0.9074**	-0.9074**	-0.9074**	-0.8825**	-0.7881**	-0.7881**	-0.7881**	-2.6621***	-1.8464***	-1.8464***	-2.5384***
	(0.4439)	(0.3848)	(0.3865)	(0.3926)	(0.4351)	(0.3538)	(0.3552)	(0.3945)	(0.4516)	(0.3978)	(0.3978)	(0.4684)
ESG-G	-0.0027***	-0.0013**	-0.0013**	-0.0013**	-0.0021***	-0.0007	-0.0007	-0.0007	-0.0020***	-0.0014**	-0.0014**	-0.0008
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0005)	(0.0006)	(0.0006)	(0.0006)
Post*ESG-G	0.3304**	0.3220*	0.3220*	0.3220	-0.2064	-0.2720	-0.2720	-0.2720	0.3189**	0.0519	0.0519	0.1532
	(0.1650)	(0.1829)	(0.1837)	(0.1964)	(0.2615)	(0.2056)	(0.2064)	(0.2373)	(0.1479)	(0.1680)	(0.1680)	(0.1495)
EU*ESG-G	1.1059***	1.0312***	1.0312***	1.0312***	1.3813***	1.2891***	1.2891***	1.2891***	1.8604***	0.9740***	0.9740***	1.6993***
	(0.2388)	(0.2097)	(0.2106)	(0.2168)	(0.2293)	(0.2095)	(0.2103)	(0.2290)	(0.3755)	(0.2811)	(0.2811)	(0.3750)
EU*Post	1.1939***	0.9883**	0.9883**	0.9883**	0.9327**	0.8432**	0.8432**	0.8432**	2.6401***	1.8009***	1.8009***	2.5182***
	(0.4422)	(0.3815)	(0.3831)	(0.3899)	(0.4385)	(0.3546)	(0.3560)	(0.3945)	(0.4571)	(0.4009)	(0.4009)	(0.4725)
EU	-1.1194***				-1.4234***				-1.9046***			
	(0.2414)				(0.2350)				(0.3770)			
Post	-0.5023***				0.2385				-0.3161**			
	(0.1689)				(0.2651)				(0.1514)			
size	-0.0121***	-0.0099	-0.0099	-0.0099	-0.0105**	-0.0033	-0.0033	-0.0033	-0.0115***	-0.0051	-0.0051	-0.0027
	(0.0039)	(0.0196)	(0.0197)	(0.0184)	(0.0041)	(0.0196)	(0.0196)	(0.0195)	(0.0039)	(0.0129)	(0.0129)	(0.0191)
roa	0.0026	0.0091*	0.0091*	0.0091	0.0078**	0.0142***	0.0142***	0.0142**	0.0058**	-0.0006	-0.0006	0.0076
	(0.0028)	(0.0048)	(0.0048)	(0.0092)	(0.0033)	(0.0052)	(0.0053)	(0.0064)	(0.0023)	(0.0037)	(0.0037)	(0.0051)
eta	-0.5205	-0.9677	-0.9677	-0.9677	-1.1950**	-1.2455**	-1.2455**	-1.2455*	-1.0002***	-0.3965	-0.3965	-0.6558
	(0.4480)	(0.6916)	(0.6945)	(0.7662)	(0.5492)	(0.6200)	(0.6224)	(0.7331)	(0.3599)	(0.7301)	(0.7301)	(0.7154)
default	10.4413***	9.2700***	9.2700***	9.2700***	5.9156***	4.9526***	4.9526***	4.9526***	2.1495	2.4961*	2.4961*	1.2896
	(2.2333)	(1.8689)	(1.8769)	(1.9209)	(1.6879)	(1.3424)	(1.3477)	(1.2367)	(1.8919)	(1.5035)	(1.5035)	(2.0285)
bond	-0.1542***	-0.1302***	-0.1302***	-0.1302***	-0.0162**	-0.0146**	-0.0146**	-0.0146***	-0.0243***	-0.0182**	-0.0182**	-0.0228***
	(0.0240)	(0.0194)	(0.0194)	(0.0210)	(0.0069)	(0.0059)	(0.0059)	(0.0054)	(0.0080)	(0.0071)	(0.0071)	(0.0081)
WUI	-0.0295	0.0303	0.0303	0.0303	0.1244**	0.1569***	0.1569***	0.1569***	-0.0043	0.0149	0.0149	0.0174
	(0.0666)	(0.0597)	(0.0599)	(0.0695)	(0.0568)	(0.0535)	(0.0537)	(0.0606)	(0.0410)	(0.0515)	(0.0515)	(0.0513)
Constant	0.4974***	-0.3349	-0.3349	-0.3349	0.4243***	-0.4139	-0.4139	-0.4139	0.4251***	-0.2015	-0.2015	-0.7780**
	(0.0941)	(0.2962)	(0.2975)	(0.2811)	(0.0976)	(0.2869)	(0.2881)	(0.2922)	(0.0889)	(0.2202)	(0.2202)	(0.3308)
Observations	1,896	1,896	1,896	1,896	2,054	2,054	2,054	2,054	2,133	2,133	2,133	2,133
R-squared	0.2470	0.3921	0.3921	0.3921	0.1330	0.3260	0.3260	0.3260	0.0733	0.3086	0.3086	0.2676
Bank FE	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
TIME FE	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
Country FE	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES
Cluster	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 4.8: Alternative Uncertainty Periods: Brexit Referendum

This table reports the results from the DID approach for the co-movement between bank CDS spread and ESG-G pillar score after the Brexit Referendum vote on June 23, 2016. The variable of interest is $UK * Ref * ESG-G$, an interaction term for UK, Ref and $ESG-G$. Ref is a dummy variable equals to 1 for periods after June 23, 2016 and zero otherwise. UK is a dummy variable equals to 1 for banks in UK and zero otherwise. ESG-G is ESG governance score. We cluster standard errors at the bank level.

	(1)	(2)	(3)	(4)
Variables	ΔCDS	ΔCDS	ΔCDS	ΔCDS
UK*Ref*ESG-G	-1.0564	-1.6606**	-1.6606**	-1.6606*
	(0.6370)	(0.7070)	(0.7089)	(0.9272)
ESG-G	-0.0020***	-0.0015**	-0.0015**	-0.0015**
	(0.0006)	(0.0007)	(0.0007)	(0.0006)
Ref*ESG-G	-0.3562	-0.4498	-0.4498	-0.4498
	(0.2643)	(0.3499)	(0.3509)	(0.3479)
UK*ESG-G	1.5882**	1.0920*	1.0920*	1.0920
	(0.6869)	(0.5658)	(0.5674)	(0.7043)
UK*Ref	1.0527	1.6656**	1.6656**	1.6656*
	(0.6392)	(0.7091)	(0.7111)	(0.9292)
UK	-1.5639**			
	(0.6880)			
Ref	0.3324	0.1358	0.1358	0.1358
	(0.2635)	(0.3437)	(0.3447)	(0.3487)
size	-0.0068	-0.0166	-0.0166	-0.0166
	(0.0060)	(0.0270)	(0.0270)	(0.0259)
roa	0.0077***	0.0045***	0.0045***	0.0045
	(0.0022)	(0.0015)	(0.0015)	(0.0038)
eta	-0.8367***	-0.8779	-0.8779	-0.8779
	(0.1878)	(0.6734)	(0.6753)	(0.6798)
default	1.4261*	0.8271	0.8271	0.8271
	(0.7401)	(0.6242)	(0.6259)	(0.7610)
bond	-0.0087***	-0.0103***	-0.0103***	-0.0103***
	(0.0021)	(0.0021)	(0.0021)	(0.0028)
WUI	-0.0401	0.0037	0.0037	0.0037
	(0.0350)	(0.0293)	(0.0294)	(0.0325)
Constant	0.3002***	0.3007	0.3007	0.3007
	(0.0729)	(0.3503)	(0.3513)	(0.3472)
Observations	2,352	2,352	2,352	2,352
R-squared	0.0376	0.2477	0.2477	0.2477
Bank FE	NO	YES	YES	YES
TIME FE	NO	YES	YES	YES
Country FE	NO	NO	YES	NO
Country*Time FE	NO	NO	NO	YES
Cluster	YES	YES	YES	YES

Table 4.9: ESG-Overall Score

This tables reports the results from the DID approach for the co-movement between bank CDS spread for the ESG overall score. $EU * Post * ESG$ is variable of interest and depicts interaction of EU, ESG-overall score and periods specified in Table 4.2. We cluster standard errors at the bank level.

	(1)	(2)	(3)
	Debt Crisis	During Bail-in	Post Bail-in
Variables	ΔCDS	ΔCDS	ΔCDS
EU*Post*ESG	-0.8679**	-0.7658**	-1.9594***
	(0.3823)	(0.3533)	(0.3236)
ESG	-0.0026***	-0.0025***	-0.0023***
	(0.0008)	(0.0008)	(0.0008)
Post*ESG	0.3098*	-0.2980	-0.0207
	(0.1841)	(0.2087)	(0.0921)
EU*ESG	1.0019***	1.2424***	1.2648***
	(0.2051)	(0.2068)	(0.2055)
EU*Post	0.9591**	0.8307**	1.9515***
	(0.3801)	(0.3547)	(0.3274)
size	-0.0066	0.0034	0.0019
	(0.0196)	(0.0201)	(0.0206)
roa	0.0095*	0.0144***	0.0080**
	(0.0048)	(0.0052)	(0.0036)
eta	-0.9479	-1.1997*	-0.4344
	(0.7114)	(0.6315)	(0.6904)
default	9.2542***	4.9396***	1.3283
	(1.8745)	(1.3458)	(1.7303)
bond	-0.1284***	-0.0145**	-0.0221***
	(0.0193)	(0.0059)	(0.0063)
WUI	0.0281	0.1569***	0.0145
	(0.0600)	(0.0537)	(0.0420)
Constant	-0.3585	-0.4364	-0.5498*
	(0.2972)	(0.2931)	(0.2941)
Observations	1,896	2,054	2,133
R-squared	0.3934	0.3279	0.2796
Firm FE	YES	YES	YES
TIME FE	YES	YES	YES
Cluster	Firm	Firm	Firm

Table 4.10: Accounting for Global Financial Crisis Spillovers

This table reports the results from the DID approach for the co-movement between bank CDS spread and ESG-G pillar score for sovereign debt crisis while accounting for Global Financial Crisis period. The variable of interest is $EU * Post * ESG-G$, an interaction term for EU is equals to 1 for EU banks (42 out of 79) and zero otherwise, $Post$ equals to 1 after the sovereign debt crisis based on periods specified in Table 4.2 and zero otherwise and ESG-G pillar.We cluster standard errors at the firm level.

	(1)	(2)	(3)
Variables	ΔCDS	ΔCDS	ΔCDS
EU*Post*ESG-G	-1.0427**	-0.8862**	-0.8862**
	(0.4596)	(0.4327)	(0.4327)
ESG-G	-0.0032***	-0.0014**	-0.0014**
	(0.0008)	(0.0007)	(0.0007)
Post*ESG-G	0.3395	0.4109	0.4109
	(0.2749)	(0.2564)	(0.2564)
EU*ESG-G	1.0620***	0.9965***	0.9965***
	(0.2416)	(0.2178)	(0.2178)
EU*Post	1.2155***	1.0635**	1.0635**
	(0.4546)	(0.4287)	(0.4287)
EU	-1.1100***		
	(0.2483)		
Post	-0.4347		
	(0.2733)		
size	-0.0164**	-0.0284	-0.0284
	(0.0065)	(0.0200)	(0.0200)
roa	0.0087**	0.0102	0.0102
	(0.0033)	(0.0076)	(0.0076)
eta	-1.4045***	-2.1155**	-2.1155**
	(0.4931)	(0.9470)	(0.9470)
default	16.0361**	12.8896**	12.8896**
	(7.1574)	(5.8620)	(5.8620)
bond	-0.1363***	-0.1211***	-0.1211***
	(0.0339)	(0.0295)	(0.0295)
WUI	-0.1091	-0.0841	-0.0841
	(0.0918)	(0.1062)	(0.1062)
Constant	0.6615***	-0.0602	-0.0602
	(0.1303)	(0.3141)	(0.3141)
Observations	1,260	1,260	1,260
R-squared	0.2304	0.3737	0.3737
Bank FE	NO	YES	YES
TIME FE	NO	YES	YES
Country FE	NO	NO	YES
Cluster	YES	YES	YES

Chapter 5

Are Investors Convinced? Green Washing Implications in ESG Scores After Covid-19 Crisis [1]

"The Covid-19 crisis has not only brought on the greatest recession since World War II, but investors are also calling it the 21st century's first "*sustainability*" crisis" (Morgan (2020)).

Covid-19 accelerated the increasing interest in sustainability and particularly in Environmental, Social and Governance (ESG) scores. After the Covid-19 crisis, sustainability became a hot topic and investors included sustainability scores (i.e., ESG scores) in their credit risk assessments. Firms with higher (ESG) scores are considered to be more sustainable and less risky from the investors' perspective. Despite its highly debated effect, it has a partial effect on the credit risk decision-making of investors. This study uses the unique Covid-19 crisis as a shock to examine the effect of the Covid-19 crisis on the nexus between ESG scores and the credit risk assessment of investors.

[1] A version of the study was presented at EFiC Conferences in July 2022.

Using CDS spreads as a measure for credit risk spreads, this study examines the nexus between corporate credit risk and ESG disclosures after the Covid-19 crisis from the investors' perspective. This study focuses on non-financial firms operating in different sectors including energy, basic material, consumer-cyclical, industrial, consumer non-cyclical and communications. We first analyze the overall effect between ESG scores and credit risk after the Covid-19 crisis for the whole sample. Later, this study examines this association at the sector breakdown using sector-level increases in ESG scores. The main research question in this study is: Are investors more convinced in firms that increase their ESG scores after the Covid-19 crisis compared to their peers?

The transmission mechanism from ESG scores to credit risk can be explained using two perspectives: risk mitigation and over-investment. From a risk-mitigation perspective, higher engagement in ESG practices makes the information environment more transparent and investors decrease their credit risk premiums on those firms (Goss & Roberts (2011), Col & Patel (2019), Dunbar et al. (2020), Kim et al. (2021), Lu et al. (2021)). From the over-investment perspective, firms engage in ESG practices to sound social, and environmentally more responsible at the expense of over-investment in ESG activities. Over-engagement in ESG activities makes the information environment opaque, thereby increasing investors' credit risk premiums (Godfrey et al. (2009), Barnea & Rubin (2010), Cui et al. (2012), Rossi & Harjoto (2020)). If over-investment is valid, this study expects to find an increase (riskier firms) in credit spreads of firms increasing

their ESG scores after the Covid-19 crisis. On the other hand, if the risk-mitigation view is valid, we expect investors to decrease (less risky firms) their credit risk premiums of firms increasing their ESG scores after the Covid-19 crisis.

This study shows that there is a negative association between ESG scores and credit risk spreads. Results from the effect of the Covid-19 crisis on this nexus show that an improvement in ESG scores is associated with an increase in credit risk premiums of non-financial firms after the Covid-19 crisis which is in line with the over-investment view. The results from the sector-level analysis indicate a similar positive but varying effect among sectors. Our results are consistent based on sub-sector analysis and further robustness checks.

This study contributes to the literature in several strands: to our knowledge, this study is the first to provide evidence on the investors' reaction to ESG scores of non-financial firms after the Covid-19 crisis. This study also contributes to research analysing the association between credit risk and ESG scores (Hoepner et al. (2018), Chiaramonte et al. (2021), Aevoae et al. (2022)) and relatively new few studies on Covid-19 (Broadstock et al. (2021), Demers et al. (2021), Ilhan et al. (2021)).

This chapter provides invaluable insights from the market participants' perspective. We provide evidence on investors penalizing firms with superior ESG scores after the Covid-19 crisis that might imply green-washing behaviour to sound more responsible to gain opportunistic income.

5.0.1 Literature Review and Hypothesis Development

Due to increasing concerns about climate issues, more non-information disclosure is demanded to evaluate the firms' position in their non-financial activities. An example is the EU's Directive of 2014 also called the Non-Financial Reporting Directive (NFRD), i.e., corporate sustainability reporting that venues the rules on the disclosure of non-financial information on the way firms operate and manage social and environmental challenges and this EU law applies to large public firms[2] including the banks. This EU law aims to enhance information transparency for investors and outsiders to evaluate the non-financial performance of those firms.

The recent and growing literature on the non-financial disclosures employs the environmental, social and governance scores (ESGs) to analyze the effect of sustainability disclosures from various perspectives (Bond & Zeng (2022)): the effect of sustainable reporting on the firm performance (Brooks & Oikonomou (2018)), cost of equity (Ng & Rezaee (2015); Gillan et al. (2021)), stock market performance (Garel & Petit-Romec (2021)) and as well as investors portfolio choice preferences (Pedersen et al. (2020)). However, literature investigating the effect of ESG activity on credit risk management is limited (Chiaramonte et al. (2021), Aevoae et al. (2022)) and shows a negative effect of ESG scores on the firm credit risk. ESG risks are related to the mitigation of risks in environmental, social and governance issues. However, its impact on the credit risk

[2]with more than 500 employees

management applied by the investors might be partial or full. Although still discussed (Pedersen et al. (2020)), general acceptance is that sustainability disclosure has a positive effect on the firm performance by revealing more information on the non-financial activities which support investors' long-term sustainable investment goals.

"The COVID-19 crisis has not only brought on the greatest recession since World War II, but investors are also calling it the 21st century's first "*sustainability*" crisis... (Morgan (2020)).

Coupled with non-financial information disclosure initiatives such as NFRD of EU after 2014, investment in ESG scores has gained increasing attention. In recent years, this trend increased further due to the Covid-19 crisis. The Covid-19 crisis increased investors' attention to sustainability issues such as mitigation of environmental issues. Literature analysing the effects of Covid-19 crisis relatively new (Broadstock et al. (2021), Yoo et al. (2021), Srivastava et al. (2022)). Particularly, those investigating its effect on the risk are also limited (Hoepner et al. (2018), Ilhan et al. (2021)).

Using investor's credit risk premiums, this study first investigates the creditworthiness of non-financial firms using their non-financial information disclosures (i.e ESG scores) and secondly, this study investigates this association after a sustainability crisis (i.e. after the Covid-19 crisis) And this study asks the following question: Are firms engaging more in ESG practices more creditworthy after the Covid-19 crisis? We form our hypothesis in the following way:

H_1: There is a negative association between ESG scores and credit risk. H_2: Investors increased their risks on firms that increased their ESG scores after the Covid-19 crisis.

The association between credit risk and engagement in ESG activities are explained with two views: (1) the risk mitigation view is based on stakeholders' theory and (2) the risk over-investment view is based on agency theory. Both sides provide an opposite explanation of this association. The former, risk-mitigation view is based on value creation through moral capital (e.g.,Godfrey et al. (2009), Chiaramonte et al. (2021)). If this view is valid, investor decreases their credit risk premiums on banks with higher ESG performance as those banks creates value at the same time contributes to the sake of society and long-term sustainability goals. Therefore, investing in ESG activity increases their resilience under stressful events and thus increases their creditworthiness (Dunbar et al. (2020), Kim et al. (2021), Lu et al. (2021)). On the other hand, according to the over-investment view (Barnea & Rubin (2010), Chiaramonte & Casu (2013)), based on agency theory, firm management acts as an agent of its shareholders and take opportunistic engagement in ESG activities to sound more responsible in the sake of its own rather than the society. Therefore, from the over-investment view, banks with superior ESG scores are associated with opportunistic behaviours rather than risk management goals. This results in higher credit risk premiums (Godfrey et al. (2009), Barnea & Rubin (2010), Cui et al. (2012), Rossi & Harjoto (2020)) as according to the over-investment view, superior ESG performance does not increase banks' resilience

under shocks or any economic downturns.

Using a cross-country sample of non-financial firms in the European Union between 2013-2021, this study analyses the effect of ESG activities of firms on their credit risks from the market participants' standpoint. In the baseline model, this study examines the association between credit risk and ESG scores. In line with a risk-mitigation view, we expect to find a negative relationship between credit risk and superior ESG performance. To investigate the effects of the Covid-19 crisis on this relation, this study implements a Differences-in-Differences setting to investigate the effect of the Covid-19 crisis on the nexus between investors' credit risk premiums and firms' ESG disclosures. Our main goal is to explain whether investors' perceptions of firms with superior ESG performance differed after the Covid-19 crisis. To answer that, this study first looks at firms with ESG scores that improved their ESG scores compared to their pre-crisis level, i.e. 2019. Those firms can be called firms with superior ESG performance and we analyze whether the nexus between credit risk and ESG scores is still negative after the Covid-19 crisis. To further investigate the investors' reaction to firms with superior ESG performance, this study examines the changes in firms' ESG scores at the sector breakdown (basic materials,consumer-cyclical, consumer-non-cyclical, energy, industrial etc.). This enables us to compare firms' engagement in ESG activities in a more homogeneous way: based on the same sector. Our research question is still the same: Are firms with better ESG scores more creditworthy after the Covid-19 crisis?

Baseline results show that investors decrease the credit risk of firms with superior ESG performance in line with the risk-mitigation view. However, when I take into account of Covid-19 crisis, we have a contradictory result: non-financial firms with superior ESG scores are associated with higher credit risk premiums after the Covid-19 crisis which is in line with the over-investment view. This study also performs sector analysis and the results confirm previous findings. Although the nexus between ESG scores and credit risk is expected to be negative for the banking sector (Chiaramonte et al. (2021)), results from this study suggest a different perspective from the investors' risk perception of non-financial firms. Results from this study suggest the first evidence of the investor's penalization of non-financial firms with superior ESG scores, implying that firms that engage in ESG activities to sound more responsible are less creditworthy after the Covid-19 from the investors' standpoint.

This study has contributions to literature in several strands: to our knowledge, his study is the first to provide evidence on the financial market participants' reaction to ESG activities of non-financial firms after the Covid-19 crisis. This study also contributes to research analysing the nexus between credit risk and ESG investment (Hoepner et al. (2018), Chiaramonte et al. (2021), Aevoae et al. (2022)) and relatively new few studies on Covid-19 (Broadstock et al. (2021), Demers et al. (2021), Ilhan et al. (2021)).

This study also performs several robustness checks: first, this study confirms results by controlling for sector fixed effects. Secondly, this study controls for the strictness of

government measures to fight against Covid-19. Thirdly, rather than taking firms that improved their ESG performance compared to its 2019 level, this study considers taking the median level ESG score between 2014-2019 (the period after the introduction of the EU's Directive of NFRDs). The results from the robustness checks confirm prior findings in that investors find firms with superior ESG scores as less creditworthy after the Covid-19 crisis and increase their credit risk premiums for those non-financial firms.

5.1 Data and Methodology

5.1.1 Data

We collect non-financial firms' CDS spread data, firm- and country-level control variables from Bloomberg database. Our sample period spans from 2013Q1 to 2021Q4.

Regarding the CDS spreads, we collect quarterly CDS quotes written on senior unsecured debt with modified restructuring and with a five-year maturity to ensure liquidity. Also, I extract the main variable of ESG score from the Bloomberg database. In line with previous studies (Scholtens & van't Klooster (2019), Chiaramonte et al. (2021)), I use overall ESG scores as a proxy for corporate social responsibility activities. We include distinct control variables that might influence the nexus between ESG activity and CDS spread. Specifically, we control for the macroeconomic factors (Remolona et al. (2008), Basurto et al. (2010), Aizenman et al. (2013)) to control for systematic effects and firm-specific determinants to capture idiosyncratic factors to control for the changes in

CDS spreads. Firm-level control variables include the logarithm of total assets ($asset$), the equity to assets ratio (eta), the return on equity (roe) and the natural logarithm of the total number of employees ($employee$) to control for business scale that is also one criterion for the EU's NFR Directive of 2014. Macroeconomic control variables include lagged 5-year Treasury bond risk-free interest rate ($bond$). All variables used in our investigation are described in Table 5.1 and summary statistics are reported in Table 5.2.

[Insert Table 5.1 Here.]

[Insert Table 5.2 Here.]

The purpose of this study is to present evidence from the non-financial firms, after matching data and dropping financial firms, we have 233 firms operating in different sectors (energy, industrial, consumer-cyclical, consumer non-cyclical, basic materials and communications).

5.1.2 Identification Strategy

Our identification strategy is based on two stages. In the first step, we examine the association between credit risk and ESG scores in our baseline model using using the following panel data model:

$$\Delta CDS_{i,t} = \beta_0 + \beta_1 \Delta ESG_{i,t} + \kappa CONT_{i,t-1} + \delta_t + \mu_k + \sigma_j + \kappa_i + \epsilon_{i,t} \tag{5.1}$$

where ΔCDS_{it} is the change in the CDS spread of firm *i*, between time *t* and *t-1*, and $\Delta ESGit$ depicts change in ESG scores of firms *i* from *t* and *t-1*. This study includes lagged firm-level control variables,$\sum CONT_{it-1}$, like logarithm of total assets ($size$)return on asset (roa) to control for the firms' profitability, natural logarithm of number of employees ($employee$) to control for the firms' business scale and their compliance with the EU's 2014 Directive for non-financial reporting which is targeted for firms with more than 500 employees, and total equity to total assets ratio (eta) to control for capitalization. We also include country level control variables such as lagged treasury bond interest rate with 5-year maturity ($bond$). Similarly, our model is also saturated including firm- ,time-, country and sector- fixed effects ($\delta_i \& \nu_t \& \nu_j \& \mu_k$) to account for unobservable firm, time, country and sector invariant factors, respectively. In addition, this study clusters standard errors at the firm level.

The model in Eq.5.1 is estimated various times. First, we study the relationship between credit risk and ESG scores over the whole period (2013Q1-2021Q4). Then, we repeat this analysis where we analyze the effect of the Covid-19 crisis on this association.

$$\begin{aligned}\Delta CDS_{i,t} = \beta_0 + \beta_1 \Delta ESG_{i,t} * High * Covid + \beta_2 \Delta ESG_{i,t} + \beta_3 High * Covid + \\ \beta_4 \Delta ESG_{i,t} * High + \beta_5 Covid * \Delta ESG_{i,t} + \beta_6 High * \Delta ESG_{i,j,s,t} + \beta_7 Covid + \\ \beta_8 High + \beta_9 \kappa CONT_{i,t-1} + \delta_t + \mu_k + \sigma_j + \kappa_i + \epsilon_{i,t}\end{aligned} \tag{5.2}$$

In model in Eq.5.2, this chapter constructs a Differences-in-Differences framework to examine the effect of Covid-19 crisis on the nexus between credit risk and ESG score. The variables of interest is $\Delta ESG_{i,t} * High * Covid$ and it is an interaction term of (ΔESG: change in ESG scores between t and t-1, ($High$): a dummy variable equals to 1 for firms those improves their ESG scores from 2019 to 2020, zero otherwise. and Covid-19 crisis ($Covid$) where Covid-19 is equals to 1 for years 2020 and 2021 and zero otherwise. We are interested in the coefficient of this variable and our expectation is to find a positive significant coefficient (β_1) after the Covid-19 sustainability crisis. A positive coefficient would show an increase in credit risk due to superior performance in ESG scores which is in line with agency theory (over-investment view). Also, that would also imply that a superior ESG scores are not prized with a lower credit risk, on the other hand, investors penalizing firms with superior ESG scores that might imply green-washing behavior to sound more responsible to gain opportunistic income.

$$\begin{aligned}\Delta CDS_{i,s,t} = \beta_0 + \beta_1 \Delta ESG_{i,s,t} * High * Covid + \beta_2 \Delta ESG_{i,s,t} + \beta_3 High * Covid + \\ \beta_4 \Delta ESG_{i,s,t} * High + \beta_5 Covid * \Delta ESG_{i,s,t} + \beta_6 High * \Delta ESG_{i,s,t} + \beta_7 Covid + \\ \beta_8 High + \beta_9 \kappa CONT_{i,t-1} + \delta_t * \sigma_j + \kappa_i + \epsilon_{i,t}\end{aligned} \tag{5.3}$$

Eq. 5.3 replicates the DID model in the Eq. 5.2 by providing evidence at the sector level. Although we control for sector fixed effects in the previous model, Eq. 5.3 determines firms that increase their ESG scores in 2020 at the sector level (e.g., in

the energy sector or in the materials sector). To determine those individual firms have superior performance in ESG activities, first, we generate a change variable for ESG score ($\Delta ESG_{i,s,t}$), change in ESG score between 2020 and 2019 and identify individual firms in sector j whose ESG scores increased among their peers. The variable of interest is similar to previous equation in the Eq. 5.2 ($\Delta ESG_{i,s,t} * High * Covid$). $\Delta ESG_{i,s,t}$ is a change in ESG scores of firms in sector j between t and t-1. However, the calculation of $High$ is at the sector level, i.e. High is still a dummy variable and it is equal to firms that increased their ESG scores compared to the 2019 level and zero for firms that decreased or stayed constant. $Covid$ is a dummy variable equal to one for the years 2020 and 2021 otherwise. Similarly, an increase in its coefficient (β_1) is to confirm whether investors find NFCs with higher ESG scores less trustworthy after Covid-19.

5.1.3 Preliminary investigation

The validity of the econometric model relies on the parallel trends assumption to examine the implied counterfactual. Assumption states that the untreated units provide the appropriate counterfactual of the trend that the treated units would have followed if they had not been treated that is, in other words, the two groups would have had parallel trends. We test this assumption by testing the significance of the main variables used in this chapter between the treatment end and control groups before the Covid-19 crisis. We test this assumption for the years between 2013-2019, i.e. years before the Covid-19

crisis. We expect to find an insignificant effect before 2020 which implies that before the treatment date (Covid-19 crisis), control and treatment groups do not diverge from each other which provides a good foundation for further analysis.

Table 5.3 shows that reports the results from the parallel assumption and results from those show that prior to treatment data of Covid-19 crisis, difference between treatment and control groups for main variables (ΔCDS) and (ΔESG) and sub-sectors for ESG score (basic, materials,..etc.) are similar which is supported with insignificant p-value.

[Insert Table 5.3 Here.]

5.2 Empirical Results

In this section, we report the results from the baseline model in the Eq.5.1, DID setting introduced in the Eq. 5.2 and DID analysis at the sector level as in the Eq. 5.3.

Table 5.4, depicts the results for the association between ESG scores and credit default risk premium based on the baseline model in the Eq. 5.1. Baseline model results show that ESG scores have a negative impact, i.e. lowering credit risk premiums by the investors in line with stakeholders theory (risk-mitigation theory).

[Insert Table 5.4 Here.]

Some might argue improvement in ESG scores might differ among the sectors, thus nexus between ESG score and credit risk might differ between different sectors. Rather

than controlling for sector fixed effects, this study replicates the baseline analysis at the sector level. Table 5.5 shows the results from the nexus between ESG activities and credit risk at the sector leve and findings show that the nexus between credit risk and ESG scores is still negative as in Table 5.4 which is still in line with stakeholders' theory but with a varying effect on the credit risk.

[Insert Table 5.5 Here.]

Table 5.6, depicts the results for the association between ESG scores and credit risk premium using the DID model based on the Eq. 5.2. This variable of interest is $\Delta ESG * High * Covid$ which is an interaction terms of dummy variables of $High$, $Covid$ and change in ESG-overall score (ΔESG). Firms those in treatment units are considered as those increased their ESG disclosures in 2020 compared to their 2019 levels. Firms in control groups are whose ESG scores either stayed constant or decreased in 2020 in comparison to their 2019 level. Covid is the treatment period and equal to 1 for years 2020 and 2021. ΔESG is the change in ESG-overall score between t and t-1.

[Insert Table 5.6 Here.]

Results from 5.6 shows that investors increased credit premiums on firms those increased their ESG scores compared to its 2019-level. This implies a decrease in the creditworthiness of firms from the investors' perspective in line with agency theory (over-investment view.)

5.2.1 Empirical Results From the Sector Analysis

In this section, we report results from the DID analysis based on non-financial sectors: basic materials, energy, industrial, communications, consumer cyclical, and consumer non-cyclical. The total number of firms (233) analysed is the same as in Table 5.6. Similar to analysis in 5.6, the variable of interest is $High * Covid * \Delta ESG$ which is an interaction term of $High$, $Covid$ and ΔESG. $Covid$ is a dummy variable and equal to 1 for the years 2020 and 2021, zero otherwise. ΔESG is a change in ESG-overall score.

Differently from Table 5.6, Table 5.7 generates a distinct dummy variable of $High$ which is a dummy variable at the sector level and equals to one for firms whose ESG scores improved from 2019 to 2020 and zero otherwise. For the industrial sector, $High$ is equal to 1 for 31 firms in the industrial sector that increased their ESG scores between 2019 and 2020 and zero for 23 firms. For the energy sector, $High$ is equal to 1 for 6 NFCs in the energy sector who increased their ESG scores from 2019 to 2020 and zero for 6 NFCs otherwise. For the basic materials sector, $High$ is equal to 1 for 19 NFCs who increased their ESG scores in 2020 and equal to zero for 10 NFCs in the energy sector whose ESG score stayed constant or decreased between 2019 and 2020. For the consumer-cyclical sector: $High$ is equal to 1 for 34 NFCs those increased their ESG score and equal to zero for 15 NFCs who decreased or kept their ESG scores constant between 2019 and 2020. For the consumer-non-cyclical sector, $High$ is equal to 1 for 34 NFCs in this sector which increased their ESG score in 2020 and zero for 29 NFCs in this

sector. Finally, for the communications sector, out of 24 NFCS, $High$ is equal to 1 for 17 firms that increased their ESG score from 2019 to 2020 and zero for 9 firms otherwise. After determining firms ($High$) in each sector improving their ESG scores between 2019 and 2020, Table 5.7 reports an interaction term for each sector ($High * Covid * \Delta ESG$).

[Insert Table 5.7 Here.]

Results from Table 5.7 based on sector analysis, show that investors increase credit risk premiums on firms that improve their ESG scores after the Covid-19 crisis which is in line with an over-investment view.

5.2.2 Robustness Checks

In this section, I present the results from the several robustness checks.

After the Covid-19 crisis, governments took some serious measures including lock-downs, business supports those varied in severity in among countries and therefore affected investor sentiment that might affect the investors' credit risk premiums on the firms. In the following table 5.8, I replicate the DID analysis in Table 5.6 while I control for country level Covid-19 government response tracker of the University of Oxford (Hale et al. (2021)). The variable ($stringency$) reflects the strictness of 'lockdown style' policies that primarily restrict people's behaviour [3]).

[3]This stringency index is calculated using all ordinal containment and closure policy indicators, plus an indicator recording public information campaigns (Hale et al. (2021)

In Column 1 of Table 5.8, we control for firm FE; Column (2) control for firm and time FE; Column (3) control for firm, time and country FE and Column (4) control for firm, year, country and sector FEs. Results confirm previous findings in that an increase in ESG scores after the Covid-19 crisis increased credit risk premiums, i.e., lowering creditworthiness of those firms.

[Insert Table 5.8 Here.]

Results from the Table 5.8 show that after controlling for stringency of country-level Covid-19 measures, investors still increases the credit risk of firms those increases their ESG scores after the Covid-19 crisis. Our findings are in line with our previous findings.

In the following table, I replicate the DID analysis based on a sample of treated firms those have ESG scores above the median of 2014-2019. The reason is that this analysis calculate median based on 2014-2019 is that EU's NFR Directive was launched in 2014 and that triggered increases in non-financial disclosures and higher engagement in ESG activities. Thus, this analysis accounts for the compliance with the EU's NFR Directive of 2014 that might strengthen the nexus between credit risk and ESG score. That is why in the following analysis in Table 5.9, dummy variable of $High$ is equal to 1 for firms above the median of 2014-2019 and zero otherwise.

In column 1 of Table 5.9, we do not include any fixed effects, Column (2): control for firm FE; Column (3) control for firm and time FE; Column (4) control for firm, time and country FE and Column (5) control for firm, year, country and sector fixed-effects.

Results confirm previous findings in that an increase in ESG scores after the Covid-19 crisis increased credit risk premiums, i.e., lowering creditworthiness of those firms.

[Insert Table 5.9 Here.]

Table 5.9 shows that after considering firms whose ESG scores improves after Covid-19 crisis above the 2014-2019 median are still discredited by the investors which is in line previous findings.

5.3 Conclusion

Covid-19 is the most unanticipated large and widespread exogenous economic shock of all time and it was even more global than the global financial crisis as it is influencing developed and developing economies alike (Berger & Demirgüç-Kunt (2021)). Covid-19 has had a dramatic effect on the world since the beginning of 2020 and its impact varied in different economic agents' behaviour including investors.

Using the Covid-19 crisis as a shock, this chapter examines the effect of the Covid-19 crisis on the creditworthiness of non-financial firms that increase their ESG scores compared to their peers. Results from this study show that investors increase credit risk premiums on firms who have superior ESG performance after Covid-19, suggesting that firms with superior ESG scores are found to be less creditworthy after the Covid-19 crisis. This chapter provides the first insights into how investors' this behaviour can alter after the Covid-19 crisis. In comparison to the baseline model which states that there

exists a negative nexus between credit risk and ESG activities after Covid-19 investors increase their risk premiums on firms that engage more in ESG activities. This suggests that firms engaging more in ESG scores to sound more responsible are also taking advantage of opportunistic income which is in line with the over-investment view.

5.4 Policy Implications

Along with the increased focus on environmental issues and climate change, there is a conversion to be more transparent about firms' non-financial disclosures which enable investors, stakeholders and outsiders to value firms and improve their decision-making regarding the firms. Previous literature has focused on corporate transparency but nascent literature examines bank information environment (information transparency) using their sustainability reporting of ESG scores. Being more transparent about environmental, social and governance issues is increasingly given importance with the increased focus on climate change issues and sustainability issues, particularly after the Covid-19 crisis, the so-called sustainability crisis (Morgan (2020)).

This study is important in reflecting investors' perception of ESG scores after a sustainability crisis such as Covid-19. This study provides the first insights into the investors' pricing of risks that might be associated with a change in ESG scores after a sustainability shock. This study is important for policymakers in assessing the risks of firms due to engagement in ESG activities. In particular, investors might behave

differently after uncertainty periods such as after Covid-19, and the sustainability crisis. Therefore, policymakers need to take into account that these non-financial information disclosures might still lack increasing transparency and lowering credit risk after the uncertainty periods. Results from this study show that firms that improve their scores are penalized after the Covid-19 crisis which suggests credit risks in non-financial firms still exist and even further increases that might signal green-washing behaviour after the Covid-19 crisis to sound more responsible and gain opportunistic income. Overall, this study has important feedback for policymakers and investors in showing promoting ESG activities is found to be less creditworthy after a sustainability shock.

Table 5.1: Variable Definitions

This table reports definition of variables and their calculation used in the analysis.

Variable	Definition	Source
ΔCDS	Change in CDS spread in % points.	Bloomberg
ΔESG	Change in ESG overall score in % points.	Bloomberg
size	Natural logarithm of total asset	Bloomberg
roa	Return on total asset. Winsorized at %1.	Bloomberg
default	Change in probability of default in % points.	Bloomberg
employee	Natural logarithm of number of employees	Bloomberg
bond	Treasury bond interest rate with 5-year maturity	Bloomberg

Table 5.2: Summary Statistics

This table reports the summary statistics of variables used in Chapter 5.Firms operating in European Union are included in this sample. 233 firms: Austria (3), Belgium (8), Britain (63), Denmark (12), Finland (11), Germany (29), Ireland (8), Italy (6), Netherlands (11), Norway (7), Spain (9), Sweden (25).

Variable	Obs	Mean	Std. dev.	Min	Max
ΔCDS	8,155	-0.0061	0.1863	-0.3023	0.4250
ΔESG	8,155	0.0075	0.0310	-0.0506	0.1933
size	8,155	9.5927	1.4989	3.6518	13.1780
roa	8,155	6.5263	6.6366	-7.9419	33.9733
default	8,155	0.1207	0.7281	-0.8140	4.8011
employee	8,155	10.1222	1.4208	3.4012	13.4192
bond	8,155	0.2994	0.7105	-0.7420	2.7150

Table 5.3: Testing For Parallel Trends

This table shows differences in means between treatment and control groups after the Covid-19 crisis. Using the whole sample, we classify firms in the treatment group as those that increase their ESG scores in 2020 compared to the 2019 level and firms in the control group are firms those decrease (stay constant) their ESG scores in 2020 compared to their 2019 level. We report parallel trend results for the dependent (ΔCDS) and main variable of interest (ΔESG).

	ΔCDS				Overall ESG score			
	Control	Treated	Diff.	P-Value	Control	Treated	Diff.	P-Value
2014	-0.0026	-0.0041	0.0014	0.9097	0.0107	0.0132	-0.0025	0.4381
2015	0.0085	0.0217	-0.0132	0.3191	0.0191	0.0203	-0.0012	0.7149
2016	-0.0685	-0.0676	-0.0009	0.9319	0.0069	0.0055	0.0021	0.4416
2017	-0.0517	-0.0564	0.0047	0.6094	0.0114	0.0094	0.0021	0.3598
2018	0.0649	0.0831	-0.0182	0.0813	0.0059	0.005	0.0009	0.5916
2019	-0.0834	-0.0781	-0.0052	0.5542	0.0028	0.0017	0.0022	0.1063
	Communications				Basic Materials			
	Control	Treated	Diff.	P-Value	Control	Treated	Diff.	P-Value
2014	0.01	0.0164	-0.0064	0.4769	0.0062	0.0111	-0.0049	0.4401
2015	0.0355	0.016	0.0195	0.092	0.0324	0.0205	0.0119	0.2712
2016	0.0135	0.0116	0.0019	0.8283	0.0034	0.0073	-0.0039	0.477
2017	0.0211	0.0065	0.0146	0.0571	0.0092	0.0145	-0.0054	0.4923
2018	0.001	0.0027	-0.0017	0.7306	0.0037	0.0031	0.0006	0.8732
2019	0.0101	0.0028	0.0073	0.1285	0.0046	0.0012	0.0034	0.4093
	Consumer-Cyclical				Consumer-Non-Cyclical			
	Control	Treated	Diff.	P-Value	Control	Treated	Diff.	P-Value
2014	0.0085	0.011	-0.0025	0.6529	0.0131	0.0102	0.0029	0.5487
2015	0.011	0.0217	-0.0108	0.1604	0.0217	0.0151	0.0066	0.2591
2016	0.0018	0.0051	-0.0033	0.3434	0.0039	0.0107	-0.0068	0.0781
2017	0.0082	0.0115	-0.0033	0.5323	0.0104	0.0101	0.0002	0.9563
2018	0.0091	0.005	0.004	0.3425	0.005	0.0087	-0.0038	0.2936
2019	0.0095	0.0067	0.0029	0.4635	0.0044	0.0074	-0.003	0.3785
	Energy				Industrial			
	Control	Treated	Diff.	P-Value	Control	Treated	Diff.	P-Value
2014	0.0044	0.0057	-0.0037	0.6828	0.0121	0.0135	-0.0013	0.8233
2015	0.0156	0.0212	-0.0056	0.6596	0.0185	0.0192	-0.0006	0.927
2016	0.0015	0.0043	-0.0027	0.5549	0.0071	0.004	0.0031	0.4038
2017	0.0102	0.0137	-0.0035	0.6491	0.0086	0.0096	-0.001	0.8181
2018	0.0002	0.0152	-0.015	0.0968	0.0073	0.0034	0.0039	0.2789
2019	0.0101	0.0033	0.0068	0.3109	0.0065	0.0084	-0.0018	0.6412

Table 5.4: The nexus between ESG score and firm credit risk

This table reports results from the effect of sustainability disclosures of non-financial firms (ΔESG) on the investor's credit risk premiums (ΔCDS). In Column 1, no fixed effects are included; in Column 2, only firm fixed effects are included; in Column 3, firm and time fixed effects are included; in Column 4, firm-, time- and country- fixed effects are included; in Column 5, firm, time, country and sector- fixed effects are included. In all columns, we cluster standard errors at the firm level.)

	(1)	(2)	(3)	(4)	(5)
Variables	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS
ΔESG	-0.4755***	-0.4744***	-0.6144***	-0.6744***	-0.6860***
	(0.0690)	(0.0699)	(0.0741)	(0.0775)	(0.0819)
size	0.0020**	0.0670***	0.0622***	0.0649***	0.0688***
	(0.0009)	(0.0085)	(0.0097)	(0.0095)	(0.0100)
roa	0.0008***	0.0018***	0.0012**	0.0012**	0.0013**
	(0.0002)	(0.0005)	(0.0005)	(0.0005)	(0.0006)
default	0.0780***	0.0776***	0.0653***	0.0598***	0.0561***
	(0.0026)	(0.0025)	(0.0030)	(0.0032)	(0.0034)
employee	0.0007	-0.0113*	-0.0086	-0.0109	-0.0157**
	(0.0009)	(0.0067)	(0.0073)	(0.0066)	(0.0072)
bond	0.0039*	0.0217***	0.1003***	0.1471***	0.1506***
	(0.0020)	(0.0036)	(0.0088)	(0.0108)	(0.0112)
Constant	-0.0452***	-0.5591***	-0.5574***	-0.5729***	-0.5622***
	(0.0100)	(0.0774)	(0.0848)	(0.0834)	(0.0827)
Observations	8,155	8,155	8,155	8,155	8,155
R-squared	0.0959	0.1089	0.1680	0.1903	0.2160
Firm FE	NO	YES	YES	YES	YES
TIME FE	NO	NO	YES	YES	YES
Country FE	NO	NO	NO	YES	YES
Sector FE	NO	N0	NO	NO	YES
Cluster	YES	YES	YES	YES	YES

Table 5.5: The nexus between ESG score and Credit risk:Sector Analysis

This table reports results from the effect of sustainability disclosures of non-financial ΔESG, on the investor's credit risk premiums (ΔCDS). In Column 1, the whole sample is included. Columns 2-7 report at the sector level: in Column 2, the industrial sector is reported; in Column 3, the energy sector is reported; in Column 4, the basic materials sector is reported; in Column 5, the consumer-cyclical sector is reported; in Column 6, consumer non-cyclical sector is reported; in Column 5, communication sector is reported. Time-, firm-, country and sector- fixed effects are included in Column I and Time-, firm-, and country fixed effects are included in Columns between 2-7. In all columns, we cluster standard errors at the firm level.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	All	Industrial	Energy	Basic Materials	Consumer-Cyclical	Consumer-non-cyclical	Communications
ΔESG	-0.6860***	-0.6958**	-0.5801**	-0.4648***	-0.5753***	-0.8455*	-0.7291***
	(0.0819)	(0.2557)	(0.2602)	(0.1348)	(0.1433)	(0.4621)	(0.1343)
size	0.0688***	0.1086**	0.0276	0.0613***	0.0673***	0.0639	0.0739***
	(0.0100)	(0.0449)	(0.0220)	(0.0222)	(0.0167)	(0.1042)	(0.0262)
roa	0.0013**	0.0024*	0.0024*	0.0022**	-0.0004	0.0002	0.0017
	(0.0006)	(0.0013)	(0.0014)	(0.0010)	(0.0011)	(0.0034)	(0.0013)
default	0.0561***	0.0544***	0.0824***	0.0514***	0.0685***	0.0566***	0.0760***
	(0.0034)	(0.0111)	(0.0095)	(0.0064)	(0.0057)	(0.0106)	(0.0053)
employee	-0.0157**	-0.0480**	-0.0186	-0.0094	-0.0075	0.0315	0.0006
	(0.0072)	(0.0220)	(0.0480)	(0.0096)	(0.0108)	(0.0959)	(0.0261)
bond	0.1506***	0.2004***	0.0648**	0.0626***	0.0966***	0.0742**	0.1221***
	(0.0112)	(0.0282)	(0.0234)	(0.0167)	(0.0146)	(0.0303)	(0.0197)
Constant	-0.5622***	-0.6237**	-0.1323	-0.5299**	-0.5977***	-1.0274**	-0.7649***
	(0.0827)	(0.2910)	(0.3610)	(0.2072)	(0.1491)	(0.3855)	(0.2414)
Observations	8,155	1,015	840	1,715	2,275	420	1,890
R-squared	0.2160	0.1768	0.1623	0.1497	0.1623	0.2169	0.2374
Firm FE	YES	YES	YES	YES	YES	YES	YES
TIME FE	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES
Sector FE	YES	NO	NO	NO	NO	NO	NO
Cluster	YES	YES	YES	YES	YES	YES	YES

Table 5.6: Covid-19 Crisis and Nexus Between Credit Risk and ESG Score

This table reports results from the effect of sustainability disclosures of non-financial firms ΔESG, on the investor's credit risk premiums (ΔCDS). The variable of interest is $High * Covid * \Delta ESG$, an interaction term of High, Covid and ΔESG. High is a dummy variable those above increased their ESG scores in 2020 and zero otherwise. $Covid$ is a dummy variable equal to 1 for the years 2020 and 2021 and zero otherwise. In Column 1 no fixed effects are included; in Column 2, only firm fixed effects are included; in Column 3, firm and time fixed effects are included; in Column 4, firm, time and country fixed effects are included; in Column 5, firm, time, country and also sector fixed effects are included. In all columns, we cluster standard errors at the bank level between Columns 1-5.)

	(1)	(2)	(3)	(4)	(5)
Variables	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS
High*Covid*ΔESG	1.4523***	1.4479***	1.3833***	1.3833***	1.3833***
	(0.5012)	(0.5080)	(0.5099)	(0.5103)	(0.5105)
ΔESG	-0.4881***	-0.5057***	-0.6956***	-0.6956***	-0.6956***
	(0.0830)	(0.0830)	(0.0881)	(0.0882)	(0.0882)
High*ΔESG	-0.3756**	-0.3687**	-0.3136*	-0.3136*	-0.3136*
	(0.1579)	(0.1588)	(0.1625)	(0.1626)	(0.1626)
Covid*ΔESG	0.7000**	0.6965*	0.9672***	0.9672***	0.9672***
	(0.3535)	(0.3584)	(0.3699)	(0.3701)	(0.3703)
High*Covid	-0.0056	-0.0044	0.0043	0.0043	0.0043
	(0.0060)	(0.0064)	(0.0064)	(0.0064)	(0.0064)
High	0.0057*	0.0158**	0.0041	0.0041	0.0041
	(0.0031)	(0.0065)	(0.0061)	(0.0061)	(0.0061)
Covid	0.0149***	0.0108**			
	(0.0049)	(0.0054)			
size	0.0020**	0.0550***	0.0605***	0.0605***	0.0605***
	(0.0009)	(0.0085)	(0.0095)	(0.0095)	(0.0095)
roa	0.0009***	0.0020***	0.0013**	0.0013**	0.0013**
	(0.0002)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
default	0.0755***	0.0753***	0.0639***	0.0639***	0.0639***
	(0.0026)	(0.0026)	(0.0031)	(0.0031)	(0.0031)
employee	0.0008	-0.0090	-0.0083	-0.0083	-0.0083
	(0.0009)	(0.0070)	(0.0072)	(0.0072)	(0.0072)
bond	0.0083***	0.0271***	0.1019***	0.1019***	0.1019***
	(0.0023)	(0.0040)	(0.0087)	(0.0087)	(0.0087)
Constant	-0.0524***	-0.4772***	-0.5462***	-0.5462***	-0.5462***
	(0.0107)	(0.0786)	(0.0855)	(0.0856)	(0.0856)
Observations	8,155	8,155	8,155	8,155	8,155
R-squared	0.1037	0.1162	0.1759	0.1759	0.1759
Firm FE	NO	YES	YES	YES	YES
TIME FE	NO	NO	YES	YES	YES
Country FE	NO	NO	NO	YES	YES
Sector FE	NO	NO	NO	NO	YES
Cluster	YES	YES	YES	YES	YES

Table 5.7: Evidence From The Sector Analysis

This table shows results from the DID analysis in Table 5.6 at the sector level: industrial, energy, basic materials, consumer-cyclical, consumer non-cyclical, and communications. The variable of interest is $High * Covid * \Delta ESG$, an interaction term of High, Covid and ΔESG. High is a dummy variable those above increased their ESG scores in 2020 and zero otherwise. $Covid$ is a dummy variable equal to 1 for the years 2020 and 2021 and zero otherwise. Firm, time, country and also sector fixed effects are included in all columns between 1-6. We cluster standard errors at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Industrial	Energy	Basic Materials	Consumer-Cyclical	Consumer-non-cyclical	Communications
High*Covid*ΔESG	3.9567***	16.5478***	8.6998***	4.6699***	4.2900***	3.5863***
	(0.9617)	(2.9211)	(1.9833)	(1.4349)	(1.0629)	(0.5337)
ΔESG	-0.9211***	-0.6473	-1.1221***	-0.7790***	-0.7335***	-0.4573
	(0.2402)	(0.8860)	(0.3813)	(0.2508)	(0.1918)	(0.2999)
High*ΔESG	0.1084	-0.3209	0.3925	-0.0961	0.1833	-0.1295
	(0.2867)	(0.9812)	(0.4591)	(0.2625)	(0.2648)	(0.1201)
Covid*ΔESG	-1.9082**	-6.8793***	-4.5528***	-1.6574	-1.0762*	-3.3508***
	(0.7679)	(1.0761)	(1.2525)	(1.2846)	(0.6337)	(0.4487)
High*Covid	0.0076	-0.0211	-0.0404***	-0.0254*	-0.0186	0.0158
	(0.0136)	(0.0330)	(0.0141)	(0.0137)	(0.0137)	(0.0153)
size	0.0641**	0.0664	0.1145**	0.0498**	0.0626***	0.0296
	(0.0257)	(0.0951)	(0.0418)	(0.0226)	(0.0157)	(0.0223)
roa	0.0016	-0.0017	0.0020	0.0021*	-0.0002	0.0028*
	(0.0013)	(0.0031)	(0.0012)	(0.0010)	(0.0011)	(0.0014)
default	0.0702***	0.0383***	0.0371***	0.0448***	0.0622***	0.0793***
	(0.0059)	(0.0113)	(0.0119)	(0.0067)	(0.0062)	(0.0111)
employee	0.0042	0.0266	-0.0541**	-0.0066	-0.0044	-0.0230
	(0.0225)	(0.0844)	(0.0200)	(0.0101)	(0.0110)	(0.0484)
bond	0.1213***	0.0655*	0.1881***	0.0588***	0.0913***	0.0691**
	(0.0198)	(0.0318)	(0.0294)	(0.0173)	(0.0142)	(0.0249)
Constant	-0.7093***	-0.9997**	-0.6123**	-0.4425**	-0.5841***	-0.1155
	(0.2094)	(0.4196)	(0.2729)	(0.2143)	(0.1395)	(0.3654)
Observations	1,890	420	1,015	1,715	2,275	840
R-squared	0.2507	0.2638	0.2152	0.1809	0.1728	0.1773
Firm FE	YES	YES	YES	YES	YES	YES
TIME FE	YES	YES	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES	YES	YES
Cluster	YES	YES	YES	YES	YES	YES

Table 5.8: Robustness: Controlling for Country-Level Covid-19 Measures

This table shows results from the DID analysis as in Eq. 5.2 while controlling for the stringency index retrieved from the Oxford's government response tracker database (Hale et al. (2021)).$High$ is equal to one for firms that increased their ESG scores from 2019 to 2020 and zero otherwise. $Covid$ is equal to 1 for the years 2020 and 2021 and zero otherwise. ΔESG is a change in ESG score between t and t-1. In all columns 1-5, standard errors are clustered at the firm level. In Column 1, no fixed effects are included; in Column 2, only firm fixed effects are included; in Column 3, firm and time fixed effects are included; in Column 4, firm, time and country fixed effects are included; in Column 5, firm, time, country and also sector fixed effects are included. In all columns, we cluster standard errors at the bank level between Columns 1-5.

	(1)	(2)	(3)	(4)	(5)
Variables	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS
High*Covid*ΔESG	0.8835***	0.8604**	0.8431**	0.8431**	0.8431**
	(0.3377)	(0.3445)	(0.3616)	(0.3619)	(0.3631)
ΔESG	-0.4233***	-0.4393***	-0.5811***	-0.5811***	-0.5811***
	(0.0809)	(0.0815)	(0.0865)	(0.0866)	(0.0869)
High*ΔESG	-0.3464**	-0.3314**	-0.3024**	-0.3024**	-0.3024**
	(0.1482)	(0.1491)	(0.1524)	(0.1525)	(0.1530)
Covid*ΔESG	0.1834	0.1726	0.3678	0.3678	0.3678
	(0.2448)	(0.2481)	(0.2680)	(0.2682)	(0.2691)
High*Covid	-0.0034	-0.0036	0.0009	0.0009	0.0009
	(0.0062)	(0.0067)	(0.0070)	(0.0070)	(0.0071)
High	0.0054*	0.0136**	0.0057	0.0057	0.0057
	(0.0032)	(0.0065)	(0.0059)	(0.0059)	(0.0059)
Covid	0.2386***	0.2320***			
	(0.0105)	(0.0105)			
size	0.0002	0.0471***	0.0554***	0.0554***	0.0554***
	(0.0008)	(0.0079)	(0.0086)	(0.0086)	(0.0087)
roa	0.0006***	0.0014***	0.0006	0.0006	0.0006
	(0.0002)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
default	0.0427***	0.0426***	0.0320***	0.0320***	0.0320***
	(0.0027)	(0.0027)	(0.0031)	(0.0031)	(0.0031)
employee	0.0019**	-0.0081	-0.0087	-0.0087	-0.0087
	(0.0009)	(0.0065)	(0.0063)	(0.0063)	(0.0063)
bond	0.0050**	0.0172***	0.0681***	0.0681***	0.0681***
	(0.0023)	(0.0039)	(0.0080)	(0.0080)	(0.0080)
stringency	-0.0040***	-0.0040***	-0.0043***	-0.0043***	-0.0043***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Constant	-0.0405***	-0.3992***	-0.4233***	-0.4233***	-0.4233***
	(0.0106)	(0.0780)	(0.0845)	(0.0846)	(0.0849)
Observations	8,092	8,092	8,092	8,092	8,092
R-squared	0.1507	0.1614	0.2247	0.2247	0.2247
Firm FE	NO	YES	YES	YES	YES
TIME FE	NO	NO	YES	YES	YES
Country FE	NO	NO	NO	YES	YES
Sector FE	NO	N0	NO	NO	YES
Cluster	YES	YES	YES	YES	YES

Table 5.9: Robustness: Considering the Effect of EU NFR Directive

This table shows results from the DID analysis as in Eq. 5.2. The variable of interest is $High * Covid * \Delta ESG$, an interaction of $High$, $Covid$ and ΔESG:$High$ is a dummy variable and equals to one for firms above the median of 2014-2019 and zero otherwise. $Covid$ is a dummy variable and equals to one for years 2020 and 2021 and zero otherwise. ΔESG is change in ESG score between t and t-1. In all columns 1-5, standard errors are clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)
Variables	ΔCDS	ΔCDS	ΔCDS	ΔCDS	ΔCDS
High*Covid*ΔESG	1.4986***	1.4986***	1.4102***	1.4102***	1.4102***
	(0.4895)	(0.5010)	(0.5089)	(0.5093)	(0.5094)
ΔESG	-0.4452***	-0.4543***	-0.6533***	-0.6533***	-0.6533***
	(0.0868)	(0.0872)	(0.0921)	(0.0921)	(0.0922)
High*ΔESG	-0.4407***	-0.4402***	-0.3790**	-0.3790**	-0.3790**
	(0.1470)	(0.1494)	(0.1518)	(0.1519)	(0.1519)
Covid*ΔESG	0.5795	0.5787	0.8660**	0.8660**	0.8660**
	(0.3754)	(0.3870)	(0.3998)	(0.4001)	(0.4002)
High*Covid	-0.0109*	-0.0089	-0.0024	-0.0024	-0.0024
	(0.0064)	(0.0068)	(0.0070)	(0.0070)	(0.0070)
High	0.0018	0.0038	-0.0025	-0.0025	-0.0025
	(0.0028)	(0.0061)	(0.0056)	(0.0056)	(0.0056)
Covid	0.0190***	0.0146**			
	(0.0056)	(0.0062)			
size	0.0024**	0.0564***	0.0600***	0.0600***	0.0600***
	(0.0009)	(0.0087)	(0.0095)	(0.0095)	(0.0095)
roa	0.0009***	0.0020***	0.0013**	0.0013**	0.0013**
	(0.0002)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
default	0.0756***	0.0754***	0.0640***	0.0640***	0.0640***
	(0.0027)	(0.0026)	(0.0031)	(0.0031)	(0.0031)
employee	0.0009	-0.0090	-0.0084	-0.0084	-0.0084
	(0.0010)	(0.0071)	(0.0073)	(0.0073)	(0.0073)
bond	0.0080***	0.0250***	0.1012***	0.1012***	0.1012***
	(0.0023)	(0.0040)	(0.0087)	(0.0087)	(0.0087)
Constant	-0.0560***	-0.4857***	-0.5370***	-0.5370***	-0.5370***
	(0.0108)	(0.0789)	(0.0852)	(0.0853)	(0.0853)
Observations	8,155	8,155	8,155	8,155	8,155
R-squared	0.1040	0.1161	0.1760	0.1760	0.1760
Firm FE	NO	YES	YES	YES	YES
TIME FE	NO	NO	YES	YES	YES
Country FE	NO	NO	NO	YES	YES
Sector FE	NO	N0	NO	NO	YES
Cluster	YES	YES	YES	YES	YES

Chapter 6

Concluding Remarks

In this thesis, I combine four different studies by investigating the creditworthiness of firms by using CDS spreads under various environments ranging from the UK referendum vote, Single Supervisory Mechanism and European Debt crisis and the Covid-19 crisis. I focus on the investors' perception of firms (i.e. creditworthiness) by assessing their information environment embedded in CDS spreads. In line with this view, this thesis first investigates the nexus between the default probability of firms with sovereign default risks and then this thesis puts a similar emphasis on the information content in CDS spreads that might feeds from financial and as well as non-financial information disclosures such as ESG scores.

Chapter 2 of this thesis contributes to relatively limited literature examining the link between sovereign and non-financial corporate risk by exploiting a gap in the literature and using Brexit to examine the credibility of government actions. In addition, by using a sophisticated econometric technique to carry out the empirical investigation to

measure government credibility, this study employs an objective approach based on a comparative analysis of the nexus between sovereign and firm credit risk. Using non-financial firms' CDS spread data in the EU and UK, this study first analyses the nexus between sovereign and corporate credit risk over the twelve highlighted Brexit stages that shaped the Brexit process in which we argue the effect of each Brexit stage on the successful Brexit completion was different. Then, this study relies on a DID framework to establish a causal link between the Brexit stages and the change in the co-movement between sovereign and corporate CDS spread. Results from Chapter 2 show a varying impact depending on the uncertainty of each Brexit stage on the accomplishment of the Brexit goal. As expected, Brexit stages with higher uncertainty regarding the Brexit goal appear to contribute to disrupting investors' trust in UK government actions and to end up with a lower impact on the nexus between sovereign and corporate CDS spread. On the other hand, Brexit stages with lower disruption in Brexit goal show an increase in the co-movement in sovereign and corporate CDS spread implying an increase in trust in UK government actions to achieve its goal of Brexit. Among all Brexit stages, we find the strongest positive impact of UK sovereign credibility on corporate CDS spread after the Brexit day on January 31, 2020, when the UK officially exits the EU. This study provides empirical evidence that investors consider the UK government credible over the entire Brexit process, i.e., starting the UK's Referendum day on June 23 2016 until the end of the transition period on December 31 2020.

In Chapter 3 of this thesis, I contribute to several strands of the literature: first, this chapter voids the gap in the literature by bridging the bank opacity and credit risk premium and analysing this nexus under a counterfactual effect of centralized supervision, secondly, this chapter complements limited literature investigating the market reaction to bank information disclosures (Chiu et al. (2018), Altunbaş et al. (2022)) and finally while this study complements to discretionary loss provisioning literature in accounting (e.g., Bushman & Williams (2012), Beltrame et al. (2016), Valverde et al. (2016)) through measuring bank opacity to investigate its implications on the investors' credit risk premiums. This study contributes to the literature investigating the effect of a launch of supervision on the stock market return (Andrieş et al. (2020)) and bank risk disclosure (Altunbaş et al. (2022)). Finally, this study provides a model based on accounting literature to study the risk transfer from bank opacity to credit risk premiums under a change in the supervision mechanism.

I present evidence on bank opacity as a determinant of bank credit risk, particularly for more significant banks. Also, this study shows that after the launch of SSM, investors increase their credit risk premiums on opaque and systemically-important banks. This finding is in line with the stakeholder's view: Single Supervisory Mechanism increases the costs on the SSM-supervised banks compared to non-SSM banks as it puts pressure on the future profitability of SSM-supervised banks and gives rise to managerial discretion and a potential increase in bank opacity (less transparent banks) that is reflected as

an inflated credit risk premium by the investors. Thus, findings suggest that investors penalise centrally supervised banks due to additional cost pressures resulting from the implementation of tighter direct supervision.

In Chapter 4, I contribute to the burgeoning literature (Bond & Zeng (2022)) on corporate sustainability disclosures, particularly those employing ESG metrics. This study is the first to provide evidence showing the effect of banks' management ability to cope with economic policy uncertainty, i.e., the European debt crisis and subsequent bail-in mechanism. This study contributes to the recent growing literature on economic policy uncertainty (Ahir et al. (2022)) by investigating the European debt crisis period where the world uncertainty index reached one of its peaks and presents the first evidence of the investors' perception of credit risk due to banks' corporate governance capacity during economic uncertainty periods. Finally, this study adds to the literature by focusing on bank regulation (e.g., Fiordelisi et al. (2017), Banerjee & Mio (2018), DeYoung et al. (2018)) from a bank-bail out and bail-in regulation.

Using a comprehensive sample of European, US, Japan, China and UK banks between 2005Q1-2021Q4, Chapter 4 explores one of the economic policy uncertainty periods of the European debt crisis that significantly affected the banking sector and subsequent bail-in regulation: by looking at the periods of pre-bail (1 January 2010- 1 January 2011), during bail-in (1 January 2011- 6 July 2012) and post-bail-in periods (14 April 2014-1 January 2016) similar to the analysis of (Fiordelisi, Girardone, Minnucci

& Ricci (2020)). Then, this study applies a DID setting to analyse the causal effects of this association after those periods.

The main goal of Chapter 4 is to understand investors' reaction to bank management's capability to manage risk during uncertainty periods. Therefore, this study particularly uses corporate governance ESG scores (ESG-G) to investigate the persuasiveness of bank management to maintain creditworthiness of banks during uncertainty periods and we test our results through the employment of ESG governance score (ESG-G). Results from Chapter 4 show that banks' information environment due to their non-financial disclosures have a negative effect on the their credit credit risk which suggests that investors charge lower credit risk to banks with higher ESG scores which is in line with the risk mitigation view. The second analysis examines the effect of the European debt crisis and bail-in regulation, the effect of ESG scores on credit risk is valid after an economic policy uncertainty period i.e. the European debt crisis. These results show that investors lower the credit risk of banks with better ESG scores after the European debt crisis (or pre-bail-in period) which presents evidence of the investors' confidence in banks' management to manage risks during economic uncertainty periods and, maintain their creditworthiness in the long run. Results from the during-bail-in mechanism are similar to the European debt crisis period, investors find banks with higher ESG scores more trustworthy and lower their credit risk of those banks. Finally, results from the post-bail-in mechanism are higher compared to the previous periods (European debt

crisis (pre-bail in) and during bail-in periods) which implies investors' confidence in the bail-in regulation is higher for banks with higher ESG scores.

In Chapter 5 of this thesis, I contribute to several strands of the literature: first, this chapter voids the gap in the literature by providing first evidence from the market participant's perspective on the pricing of the credit risk of the non-financial corporation's engagement in ESG activities, secondly, this chapter complements the limited literature investigating the Covid-19 crisis, particularly those investigating credit risk (Broadstock et al. (2021), Demers et al. (2021), Ilhan et al. (2021)). Also, this study contributes to research analysing the new and relatively limited literature examining the nexus between credit risk and ESG investment (e.g.,Hoepner et al. (2018), Di Tommaso & Thornton (2020), Aevoae et al. (2022)). Also, to our knowledge, this study is the first to give the first insights about NFC's engagement in ESG activities signals green-washing behaviour that can be associated with agency theory (over-investment view). Lastly, this study presents the first evidence from the sector breakdown to investigate the nexus between credit risk and ESG activities.

Results from Chapter 5 show that investors penalize NFCs who increased their ESG activities after the Covid-19 crisis, i.e. investors found those NFCs less creditworthy due to their over-engagement in ESG activities. This view is in line with agency theory (over-investment view) (e.g.,Godfrey et al. (2009), Barnea & Rubin (2010), Cui et al. (2012), Rossi & Harjoto (2020)), NFCs over-invest in ESG activities to sound responsible to

minimize credit risks under a stress or economic downturn. However, this behaviour is penalized by a loss of trust of investors.

The analyses in this thesis are subject to some limitations. First, the credibility of government actions has been investigated by using an objective approach. Some might argue there might be simultaneous spillovers on the sovereign and corporate CDS spread. In addition to the robustness checks we applied in this thesis, this study tries to overcome this problem with the use of daily CDS spread data which aims to minimize the effects of market inefficiencies on the nexus between sovereign and corporate CDS spread. Chapter 3 measures bank opacity using the widely used bank opacity model (Chiu et al. (2018), Nguyen et al. (2022)) and also in the accounting literature (Beatty & Liao (2014)). Calculation of bank opacity varies due to differences in the model employed. I calculate bank opacity using an accounting model based on explaining changes in banks' loan loss provisions. To overcome potential this, I use Lasso (Least Absolute Shrinkage and Selection Operator) model in a discretionary loan loss provisioning model to calculate bank opacity where the model focuses on the minimization of over-fitting of the model. Chapter 4 this study focuses on the non-financial information content in CDS spreads under an uncertain environment and this study employs ESG scores using its pillar of governance. In Chapter 5 this study, I focus on the non-financial information content in CDS spreads for the non-financial firms after the Covid-19 crisis and this study employs ESG scores to investigate the nexus between credit risk and ESG scores

after the Covid-19 crisis. However, firms active in different sectors react differently to sustainability issues. For instance, a reaction in the communications and industrial sectors differ as their exposure to environmentally, social issues are not the same. To overcome this problem, this chapter drills down to sub-sectors and presents evidence from the sub-sectors.

My analyses provide valuable insights for the policymakers, especially from the market participants' perspective which is generally lacking in the literature. Firstly, Chapter 2 draws new attention to government guarantees (to support the corporate sector and as well as economic activity) from a contagion context (risk transfer from sovereign to firms) in that government actions might signal potential government guarantees. Also, this study has potential implications for policymakers in assessing the credibility of government actions from the investors' standpoint. Secondly, Chapter 3 forms a close connection with Duffie's incomplete accounting model (Duffie & Lando (2001)) and provides a way to explore the effect of bank opacity on the investor's risk premiums as it helps to examine the information transparency as a determinant of credit risk. Policymakers might benefit from the study as this work provides a different perspective to analyse the implications of the launch of single supervision on the association between banks' information environment (by constructing bank opacity measure) and investors' reactions. Chapter 4 contributes to showing market participants' perception of banks after an uncertainty period (European debt crisis) and associated bail-in regulation using

non-financial disclosures such as ESG scores, particularly their governance capacity. Also, this study has important feedback for policymakers, investors and debt-holders as it has the potential to support arguments on the moderating role of ESG scores on the investors' decision-making mechanism (in favour of the risk mitigation view) while assessing banks' credit risks under an economic uncertainty period of the European debt crisis. Lastly, Chapter 5 brings new evidence on the dysfunction of engagement in ESG activities after a sustainability crisis, i.e. the Covid-19 crisis. Also, this study is important in showing investors' reactions to the creditworthiness of firms due to their superior ESG performance. Finally, this study also provides first insights to policymakers that improvement in ESG scores can be associated with green-washing behaviour and resulting in penalization of banks' creditworthiness after the Covid-19 crisis.

Although I provide a complete picture in this thesis, all chapters are subject to development as future research. An immediate avenue for further research for Chapter 2 is to extend the analysis by applying this framework to another country's (both emerging and advanced economy) experience. Chapter 3 is suitable to be developed by deriving a bank opacity measure from accounting disclosures using another metric apart from loan loss provisioning such as expected loan losses which reflects banks' expectations on losses and as well as their expectations regarding the economy. Another potential research for 4 can be produced by questioning the role of the country's attempts to increase corporate social activities on the nexus between ESG scores and credit risk

management. Lastly, although reporting in different databases is not unique and differs in methodologies, Chapter 5 can be extended by incorporating a financial disclosure item that accounts for the investment expenditures in ESG activities of firms.

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