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**Implementing a European Bail-In Regime:
Does the Regulation effectively eliminate Implicit Government Guarantees in
the European Banking Sector?
An Empirical Analysis**

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“Never again”

Former President of the U.S., Barack Obama, at the G20 Summit in Pittsburgh. September 25, 2009

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LIST OF ABBREVIATIONS

AR	Abnormal Return
AZS	Altman z-score
bn	billion
BRRD	Bank Recovery and Resolution Directive
CAR	Cumulated Abnormal Return
CDS	Credit Default Swap
CRR/CRD	Capital Requirements Regulation/Directive
DD	Distance to default
EBIT	Earnings before Interest and Taxes
EC	European Commission
EC COM	European Commission Communication
ECB	European Central Bank
EFA	Europäische Freie Allianz
e.g.	exempli gratia
et al.	et alii
EU	European Union
FSB	Financial Stability Board
G-20	Group of 20
GDP	Gross Domestic Product
G-SIB/G-SIBs	Global Systemically Important Bank/Banks
i.a.	inter alia
i.e.	id est
IGG/IGGs	Implicit Government Guarantee/Guarantees
IMF	International Monetary Fund
JD	Jump diffusion
LT	Long-term
MREL	Minimum Requirement on Eligible Liabilities
OLS	Ordinary Least Squares
p./pp.	page/pages
ROA	Return on Assets
ROE	Return on Equity
SRB	Single Resolution Board
SRF	Single Resolution Fund
SRM-R	Single Resolution Mechanism Regulation
SSM	Single Supervisory Mechanism
SUR	Seemingly Unrelated Regression
SX5E	EuroStoxx 50 index
TBTF	Too Big To Fail
TLAC	Total Loss Absorbing Capacity
U.S.	United States
VIX	Volatility Index
vs.	versus

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Chapter 1. INTRODUCTION

The policy measures adopted in response to the global financial crisis of 2007/08 have, in part, attempted to resolve the serious global economic problem of implicit government guarantees (IGGs) for bank debt. This problem is palpable in various international banking markets. For example, in the wake of a number of bank failures in the European Union during the global financial crisis¹, with few exceptions, no unsecured creditors or depositors incurred losses. We argue that financial institutions deemed too-big-to-fail (TBTF) and/or classified by the FSB as global systemically important banks (G-SIBs) benefit from IGGs as subsidies at the expense of taxpayers and to the detriment of bank competition, resource allocation and economic health. Furthermore, giving banks implicit government subsidies can result in financial distortion and moral hazard because of their ability to refinance at cheaper conditions. This can increase their leverage and tempt them to invest in overly risky assets, leading to lower quality capital funding and severe liquidity mismatches.

Economists and scholars regularly measure the scale of IGGs for different national economies to draw conclusions about the magnitude and impact of these financial distortions. Various methods have been used to quantify the value of IGGs. Schich (2012) notes that empirical studies estimate the magnitude of IGGs in the European banking sector at between €96 bn and €146 bn, but measurement methods vary, estimated volumes are floating and no long-term study including a robust set of control variables have been done so far. Some European banking scholars (e.g. Schäfer, Schnabel and Di Mauro, 2016) identify the need for ongoing measurement and disclosure of IGG magnitude and impact by a transnational EU institution. Some academic

¹ e.g. Denmark – Amagerbanken in 2011; Country of Cyprus in 2013; Portugal - Banco Espírito Santo in 2014.

researchers (e.g. Freixas and Rochet (2008), Noss and Sowerbutts (2012)) warn of the negative effects of IGGs and demand further regulatory bail-in measures to limit or completely eliminate IGGs.

In 2012, the European Commission proposed a first draft on implementing a European Banking Union with a bail-in mechanism in case of bank failures. In Europe, the Bank Recovery & Resolution Directive (BRRD)² and the Single Resolution Mechanism (SRM)³ form the cornerstones of the new regulatory bail-in measures. With these measures, for the first time, unsecured creditors should share legal responsibility for bank failure. However, these regulatory bail-in measures have shortcomings, have not been implemented uniformly in the European Union, and do not go far enough to completely remove the prospect of bail-outs⁴.

To shed light on and contribute to overcoming these shortcomings, this doctoral thesis attempts to provide answers to three overarching research questions: First, what are implicit government guarantees and how do they impact financial stability? Second, how can implicit government guarantees be measured accurately? Third, does the new European bail-in regulation, including the cornerstones BRRD and SRM-R, effectively eliminate implicit government guarantees in the European banking sector? The structure of this thesis follows these three questions.

Chapter 2⁵, *Implicit Government Guarantees. A Literature Review*, reviews the extensive body of literature around implicit government guarantees, identifies how they differ from explicit

² BRRD became applicable since 01.01.2015; Implementation of the Directive has been subject to national law of European Union member states.

³ SRM-R became applicable on 01.01.2015 and became effective from 01.01.2016.

⁴ Benoît Cœuré (2013) says in a speech by the ECB, that the BRRD does not completely exclude the possibility of a bail-out, which is also strictly related to an unaccomplished European Banking Union.

⁵ This chapter builds on an unpublished working paper.

government guarantees, and discusses their economic implications. Chapter 3⁶, *Measuring Implicit Government Guarantees. A Comparative Analysis*, analyses how recent research quantifies the value of implicit government guarantees, categorizes research models, critically reviews the advantages and limitations of each model, and identifies the most suitable models. Chapters 2 and 3 set the foundation for the empirical analysis in chapter 4, which is at the heart of this dissertation.

In Chapter 4⁷, *Evidence from The European Bail-In Regime. An Empirical Analysis*, we assess the market effects of regulatory events associated with the implementation of a bail-in regime for failing European banks. The bail-in regime was designed to make banks efficiently resolvable in order to eliminate implicit government guarantees (IGGs). We use a seemingly-unrelated-regressions framework to estimate the effects on CDS spreads and equity returns of key events associated with the two cornerstones of the European bail-in regime, the Bank Recovery & Resolution Directive (BRRD) and the Single Resolution Mechanism Regulation (SRM-R), and other relevant events. Contrary to the regulations' objectives, we find that regulatory events associated with the implementation of BRRD and SRM-R led to tighter CDS spreads and higher equity returns among identified banking institutions in the period 2009-2017. The pattern varies depending on bank heterogeneity and is particularly pronounced for G-SIBs, suggesting that the regime does not effectively solve the systemic problem of bailout expectations in the European banking sector.

⁶ This chapter builds on an unpublished working paper.

⁷ This chapter is based on an unpublished research paper "Implementing a European Bail-in Regime: Do BRRD and SRM-R Effectively Eliminate Implicit Government Guarantees in the European Banking Sector?", co-authored by Paul P. Momtaz and Axel Wieandt, to which I contributed. The paper is currently under review by the Journal of Banking and Finance (JBF) and can be retrieved via <https://ssrn.com/abstract=3645298>. Our compelling results from this chapter have been presented at the Financial Risk and Stability conference 2020, at a WHU Research Colloquium and in a NYU Stern PhD seminar, and were the basis of a Handelsblatt op-ed from 9 September 2020 as well as a written response to the request for comments on the Financial Stability Board's (FSB) consultative document on the evaluation of the effects of too-big-to-fail (TBTF) reforms dated 6 October 2020.

Chapter 2. IMPLICIT GOVERNMENT GUARANTEES. A LITERATURE REVIEW⁸

2.1 INTRODUCTION

The existence of Implicit Government Guarantees (IGGs) has been the focus of extensive research by many scholars before and after the global financial crisis of 2007/08. Most of the related research studies (Schich, 2012; Schweikhard and Tsesmelidakis, 2012; Acharya et al., 2013; Araten, 2013; Di Mauro, 2014) focus narrowly on quantifying IGGs, emphasizing their importance both in global finances and in academic research. This chapter summarizes a review of extant literature into the nature of IGGs, their potential negative effects on national and global financial stability, how IGGs can be measured and reduced by policy makers. The empirical literature, for the most part, concludes that banks receiving IGGs take on more risk than would in the absence of IGGs because the guarantee provides reliable loss absorption (Duchin and Sosyura, 2012; Gropp, Hakenes and Schnabel, 2010).

The negative implications of IGGs, such as excessive risk-taking and the misallocation of bank resources, as well as the moral hazard affecting banks identified as Too Big To Fail (TBTF) contributed to the global financial crisis of 2007 and renewed debate over government intervention in the financial sector (e.g., Barth and Seckinger, 2018; Moenninghoff et al., 2015). As a result of the crisis, implicit guarantees were made explicit.⁹ With the exception of Lehman Brothers,¹⁰ all

⁸ Based on an unpublished working paper “Implicit Government Guarantees – What are they and how do they impact individual bank behavior, bank competition and financial stability? A Literature Review”, 2020.

⁹ The use of public funds in this sector increased dramatically between 2008 and 2013. The interventions took various forms, ranging from recapitalization to loans and explicit government guarantees.

¹⁰ Lehman Brothers filed for Chapter 11 bankruptcy protection on September 15, 2008. As reported by Tiffany Kary in Bloomberg News, reports filed with the U.S. Bankruptcy Court, Southern District of New York (Manhattan) on September 16 indicated that JPMorgan Chase & Co. provided Lehman Brothers with a total of \$138 billion in “Federal Reserve-backed advances”, including \$87 billion on September 15 and \$51 billion on September 16 (“JPMorgan Gave

large financial institutions, including banks and non-banks, that encountered difficulties were bailed out,¹¹ i.e., they received support from the government. Arguably, this government support may have been needed to avoid financial contagion within a closely interconnected banking system, but there is an inherent risk of moral hazard when financial institutions and their shareholders can expect to be bailed out by governments using public funds. Moreover, in the Euro area, the 2008 bailout caused what became the nexus of the crisis: the fatal doom loop between bank and sovereign creditworthiness (e.g., Acharya et al., 2014). This chapter reviews extant literature on IGGs and provides an overview of IGG valuation approaches, which serve as a foundation for the discussion of different methods for measuring IGGs in Chapter 3.

2.2 ACKNOWLEDGMENT AND DEFINITION OF IGG

Implicit government guarantees (IGGs) are defined as guarantees that are not yet on a bank or government balance sheet and whose value is not disclosed. A variety of studies associate IGGs with political discourse, including evidence that supports and implicitly acknowledges the existence of IGGs and their mechanisms, including the transfer of loss to taxpayers. During the global financial crisis, most bailed out banks resolved their liquidity issues using emergency funds provided by national governments, thus transferring losses in that amount to taxpayers (Bordo and James, 2014). De Grauwe (2011) finds that in most countries, taxpayers are expected to cover the cost of authorized bailouts in certain crisis circumstances, while financial administrators are seldom held responsible for their role in loss-causing activities during a financial crisis. De Grauwe

Lehman \$138 Billion after Bankruptcy,” by Tiffany Kary and Chris Scinta, Bloomberg News, November 11, 2011; “Lehman Brothers files for bankruptcy”, Financial Times, September 16, 2008).

¹¹ This led, among others, to a substantial disbursement for many governments and threatened the solvency of various European countries, such as Ireland and Spain.

finds that the value of the implicit subsidy during a global economic crisis is influenced by the ability of the responsible political supervisor to evade loss coverage, which might contribute to bank insolvency and the deterioration of taxpayers' financial credibility.

Most scholars consider IGGs a funding advantage to banks.¹² Merton and Tsesmelidakis (2013) describe this funding advantage as the belief among market participants about the future involvement of the government in the case of a bank failure. A debt secured by an issuer who is deemed less likely to default on his liabilities than under different circumstances will bear a lower risk-adjusted spread over the risk-free rate. This funding advantage can translate into tangible monetary benefits. Zhao (2014) also defines IGGs as an expectation that the government will rescue troubled financial firms even if there is no explicit, ex ante commitment to do so. Kacperczyk and Schnabl (2011) go slightly further and describe IGGs as the government's ability and willingness to bail out an institution, which is according to Brunnermeier et al. (2016) one reason why it is challenging to develop an efficient, harmonized resolution regime and break the bank-sovereign doom loop.

Although IGGs provide a funding advantage for banks, they can also make economies less efficient. Mariathasan, Merrouche and Werger (2014) find that expectation of an implicit guarantee creates moral hazard. They show that when banks and their competitors benefit from implicit guarantees, they have greater leverage, are more likely to fund themselves with lower quality capital, and have greater risk exposure and liquidity mismatch.¹³ Noss and Sowerbutts (2012) identify three types of financial distortion caused by IGGs. First, implicitly subsidized

¹² Describing IGGs as a funding advantage for a bank raises the question of who benefits and who is harmed. Most scholars agree that large financial institutions declared too-big-to-fail benefit from and therefore favor this funding advantage (see also Acharya, Anginer, and Warburton, 2015).

¹³ Mariathasan et al. (2014) also show that the failure of Lehman Brothers in 2008 created a short-term reduction in moral hazard, but in the long run, the moral hazard issue became apparent again due to the consequences of Lehman's failure.

banks have a competitive advantage over banks that are not perceived as implicitly subsidized and can expand at the cost of other banks (see also Freixas and Rochet, 2008). Secondly, IGGs increase bank risk-taking and reduce market discipline. Investors allow banks with IGGs to take more risk without demanding justification of that risk. This may result in a vicious cycle, where increased risk-taking causes a higher probability of failure and bankruptcy cost and a potential decrease of economic wealth and GDP (see also Angelini et al., 2011). Thirdly, the IGGs increase the volume of the financial sector at the expense of other sectors and total GDP allocation.

Marques, Correa, and Sapriza (2013) emphasize the ambiguous effect of providing implicit and explicit government guarantees on bank risk-taking behavior. The authors propose two hypotheses: 1) by providing support, governments encourage banks to take more risk because of a moral hazard effect, i.e., the market discipline hypothesis and 2) government support can make banks more conservative because it increases their charter value, i.e., the charter value hypothesis (see also Bliss 2001 and 2004). The charter value hypothesis is less widely supported and contradicts the research findings of Acharya, Anginer and Warburton (2015), which may show the positive correlating effect of IGGs on a bank's risk-taking.

2.3 THE NEGATIVE IMPLICATIONS OF IGG

A contingent guarantee without a price, as IGGs are commonly described in literature, creates safety for some stakeholders but can also have negative effects. The following sections discuss the effect of IGGs on banks' balance sheets, related cost of debt and policy issues, and the fatal sovereign-bank doom loop.

2.3.1 *Effect on a bank's balance sheet and related cost of debt*

Extant literature shows that IGGs create incentives for banks to become more aggressive and to increase their affinity for risk. In terms of a simplified bank sheet, this behaviour leads to a variety of structural changes in banks' assets and financing. With regard to assets, the IGGs protect against failure and therefore encourage banks to grow faster and increase their asset size. Likewise, the 'financing' side of the balance sheet is also subject to distortion. Debt can be acquired with lower funding costs, which allows banks to increase their leverage cheaply. In addition, equity is granted by the bank's shareholders. Higher risks are compensated by higher average returns, as demonstrated by empirical research (IMF, 2014, pp. 102-103). Therefore, significant impact of IGGs can be assumed on all areas of banks' balance sheet. These balance sheet dynamics are illustrated in the following Figure 1.¹⁴

¹⁴ See also IMF (2014, p. 103)

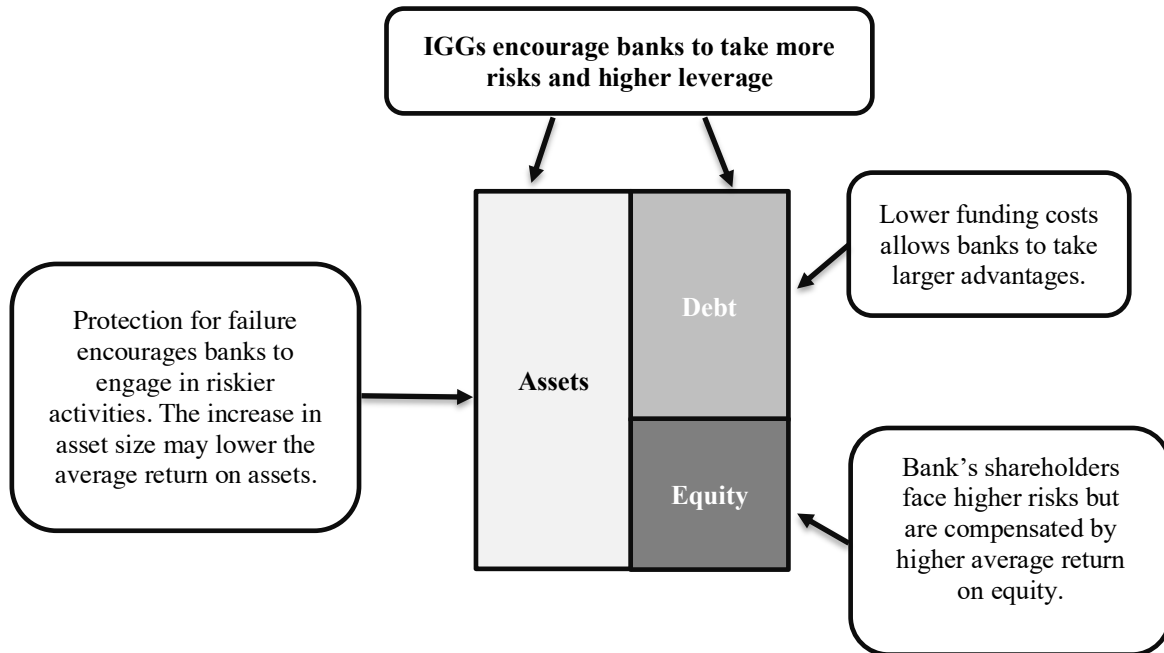


Figure 1: Impact of IGGs on a bank's simplified balance sheet.

As a result, a significant body of research focuses specifically on the impact of IGGs on the related cost of debt. The underlying mechanism is that the perception by banks' creditors that the government will intervene to protect them from the risk of bank failure reduces the compensation they demand for bearing banks' risk and therefore lowers the banks' cost of funding (Noss & Sowerbutts, 2012, p. 4). Several empirical studies quantify the impact of IGGs on the cost of debt. For example, Cutura (2018) estimates the premium that bondholders receive, identifying a significant premium driven mainly by cheap capital. Other empirical studies are referring to this phenomenon as 'funding advantage', where debt securities that are deemed less likely to default will bear a lower risk-adjusted spread over the risk-free rate (Tsesmelidakis & Merton, 2013, p. 1). However, this impact appears to be tightly linked to the systemic relevance of a bank. Since risk-adjusted spreads are only reduced by investors who are certain that a bank will receive

subsidies, this expectation leads to the hypothesis that global systemically important banks (G-SIBs) receive a competitive advantage over non-G-SIBs (Noss & Sowerbutts, 2012).

Elliott (2014) discusses the implications of this relationship by stating certain propositions that highlight how the reduction in funding costs is dependent on a variety of factors. Based on a theoretical calculation, the author states that funding cost advantage (i. e. reduction of related cost of debt) is tied to investor and depositor perceptions. In addition, the impact of the subsidy on related cost of debt can vary over time. This is because it is based on the perceived likelihood of a bank's necessity for rescue. Therefore, the impact of IGGs on related cost of debt can differ significantly between times of crisis and times of non-crisis (Elliott, 2014).

Even more important, this reduction in cost of debt can be linked to the change in banks' default probability as well as banks' incentive to acquire equity financing. The underlying mechanism for this link is highlighted by Admati and Hellwig (2019): If a bank is almost entirely funded with debt, the default probability will increase. This can be attributed to the fact that a greater obligation to debt holders represents a higher probability of default, since default can only happen in a scenario where a debtor is present. By definition, a bank cannot default on shareholders, who provide equity only. However, this increase in default risk leads to a smaller chance of benefiting from the corresponding liquidity that is provided by additional financing. Therefore, investors will ask for a higher interest to compensate for this loss. In this scenario, banks are faced with a trade-off: while the funding of debt seems like an inexpensive source of funding for fixed liquidity benefits, the per-dollar cost of debt funding itself may be lower if the bank has issued more equity, "because the increase in expected liquidity benefit provides additional compensation to the bank's creditors" (Admati & Hellwig, 2019, p. 7). In summary, this

mechanism demonstrates paradoxically how a decrease in the related cost of debt can create incentives for banks to increase their equity holdings as well.

Groenewegen and Wiertz (2017) discuss the impact of IGGs on the related cost of debt as well as the possible effects on balance sheet structures. More precisely, two fundamental distortions can be identified, which increase the banks' affinity for debt: First, the tax deductibility of interest payments. Second, the implicit funding subsidy itself. The authors state due to these distortions, one must expect banks to expand their balance sheets (mostly by increasing their debt) and therefore obtain higher after-tax earnings (by subsequently increasing their gross earnings), which is consistent with other empirical findings such as Morrison (2011). In addition, the authors conclude that passing on the funding subsidy to equity holders will lead to higher taxation. Therefore, banks have the incentive to pass the benefits on to creditors, which in turn increases their affinity for debt and also increases their corresponding tax shields.

This discussion of related cost of debt as well as the resulting funding advantage gives rise to a whole new set of methodologies that will be discussed in detail in Chapter 3.

2.3.2 *Effect on financial stability*

There are a variety of key issues that regulatory frameworks have to consider in order to cope with critical situations such as systemic failures and achieve the goal of limiting IGGs. Freixas (2010) points out that there are two fundamental approaches in dealing with the controversy of implicit subsidies. The first approach tries to formulate a regulatory framework that views banking crises as an unavoidable phenomenon and must therefore provide solutions to cope with the impact of such an event. The second approach regards crisis as an avoidable event. Therefore, regulation must reduce the probability of such an event by providing the right framework (Freixas, 2010, p. 375). Irrespective of the role of regulatory policies, some issues can be identified that confront policy makers with significant obstacles. For example, implicit subsidies have neither transparent terms nor observable prices. This complicates the measurement of IGGs (Noss & Sowerbutts, 2012). Potential solutions to this problem proposed in the literature will be presented in Section 2.4. Apart from this problem, Freixas (2010) highlights that the inherent nature of banks is characterized by the social cost of banks' bankruptcy and the mechanism of financial distress contagion among banks. The latter is a result of the immutable nature of a bank's role to be a holder of illiquid assets and liquid liabilities (Freixas, 2010, p. 380). This inherent characteristic results in a major obstacle for policy makers since regulatory frameworks are not able to change this fundamental mode of bank operations.

Schich and Lindh (2012, p. 3) identify four major policy issues that are posed by implicit guarantees:

- (i) Financial stability: Since subsidies and implicit guarantees are often free of charge, a strong incentive for the utilization of such guarantees/subsidies is created. This issue ties into the problem of lacking methods to determine the prices of IGGs that can eventually be charged and the resulting increase in banks' risk affinity.
- (ii) Competition: The benefit of IGGs varies among banks. As proposed in Section 2.3.1, the benefit depends on factors such as the systemic importance of a bank and the financial strength of the corresponding state/sovereign. Therefore, regulatory frameworks must reflect the uneven banking landscape. The Monopolies Commission (2014) considers systemic relevance as a stability problem and IGGs as a major problem for competition within the European Union. It assumes that the competition principle is rendered ineffective because under real market conditions every market participant must be allowed to leave the market, which is rendered impossible by IGGs. Market participants reckon with ongoing guarantees, which causes funding advantages.
- (iii) Taxation: Implicit guarantees result in the continuous transfer of funds from taxpayers to banks. Therefore, regulatory frameworks must adjust the underlying mechanisms of resource transfer as well.
- (iv) Budgeting transparency and accountability: As a general rule, implicit bank debt guarantees are not expressly recognised in the fiscal budget. It is hence difficult to hold governments accountable for them.

Especially with regard to budgeting transparency and accountability, scholars point out that sovereign balance sheets are neglected in the context of implicit subsidies (Kalaitzake, 2019, p. 237) in a so-called sovereign-bank doom loop.

2.3.3 *The sovereign-bank doom loop*

Sovereigns are exposed to bank risk, and banks are exposed to sovereign risk. At a euro area summit, governments referred to this two-way risk exposure as a “vicious circle”. The phenomenon is also known as a “doom loop” (Farhi & Tirole, 2018) and “diabolic loop” (Brunnermeier, Garicano, Lane, Pagano, Reis, Santos, Thesmar, Van Nieuwerburgh & Vayanos, 2016) owing to its devilish implications for systemic stability. While the doom loop has since been weakened by policy reforms that mitigate the exposures of sovereigns to bank risk,¹⁵ there is still no regulatory incentive for banks to manage their sovereign exposures prudently. Ideas abound on how to change regulation (European Systemic Risk Board, 2015), but there is no consensus on which idea would be most effective, nor even on whether reform is desirable, owing to uncertainty regarding how banks would respond (Visco, 2016).

Acharya, Drechsler and Schnabl (2014) model a loop between sovereign and bank credit risk. According to the authors, a “distressed financial sector induces government bailouts, whose cost increases sovereign credit risk. Increased sovereign credit risk in turn weakens the financial sector by eroding the value of its government guarantees and bond holdings” (Acharya et al., 2014, p. 2689). As described above, this relationship between sovereign credit risk and the value of

¹⁵ In particular, higher capital and bail-in requirements for banks have led to substantial increases in loss absorption capacity. The Bank Recovery and Resolution Directive provides a common framework for restructuring failing banks, and the Single Resolution Mechanism is empowered to execute restructurings, financed by a Single Resolution Fund. The European Stability Mechanism can grant loans to euro area member states that are illiquid or otherwise in need of assistance.

IGGs is often referred to as the bank-sovereign doom loop (Alogoskoufis, & Langfield, 2019). The two constituents of this doom loop are government debt and bank debt, which directly affect each other. For instance, excessive indebtedness in the banking sector can have harmful effects on domestic real activity growth and tax income. In addition, banks are substantial buyers of government debt and a poor performance might indicate a shrinking investor base. Most importantly, implicit guarantees for bank debt boost sovereign liabilities and consequently increase the sum of potential or actual sovereign debt (Schich & Lindh, 2012, p. 3).

Likewise, sovereign debt also affects bank debt. Since banks hold government debt, any decline in value of government debt leads to market-to-market losses. These losses can have a direct impact on banks' ability to raise additional funding, since losses have a negative impact on their collateral. While central banks can apply valuation haircuts to debt securities offered as collateral, they have limited ability to loosen their requirements regarding eligible collateral. Furthermore, deteriorating sovereign debt rating implies a reduced value of the explicit and implicit guarantees from the sovereign for bank debt (Schich & Lindh, 2012, pp. 3-4).

In summary, this simultaneous causality leads to an observable looping effect. The worsening of sovereign creditworthiness lowers the market value of banks' holdings of sovereign debt. In turn, this decreases the perceived solvency of domestic banks and inhibits their lending activity. The resulting bank distress increases the probability that banks would have to be bailed out by their domestic government, which increases the sovereign distress even further (Brunnermeier et al., 2016, p. 508).

The following figure 2¹⁶ summarizes the relationship between sovereign debt and bank debt that constitutes the bank-sovereign doom loop.

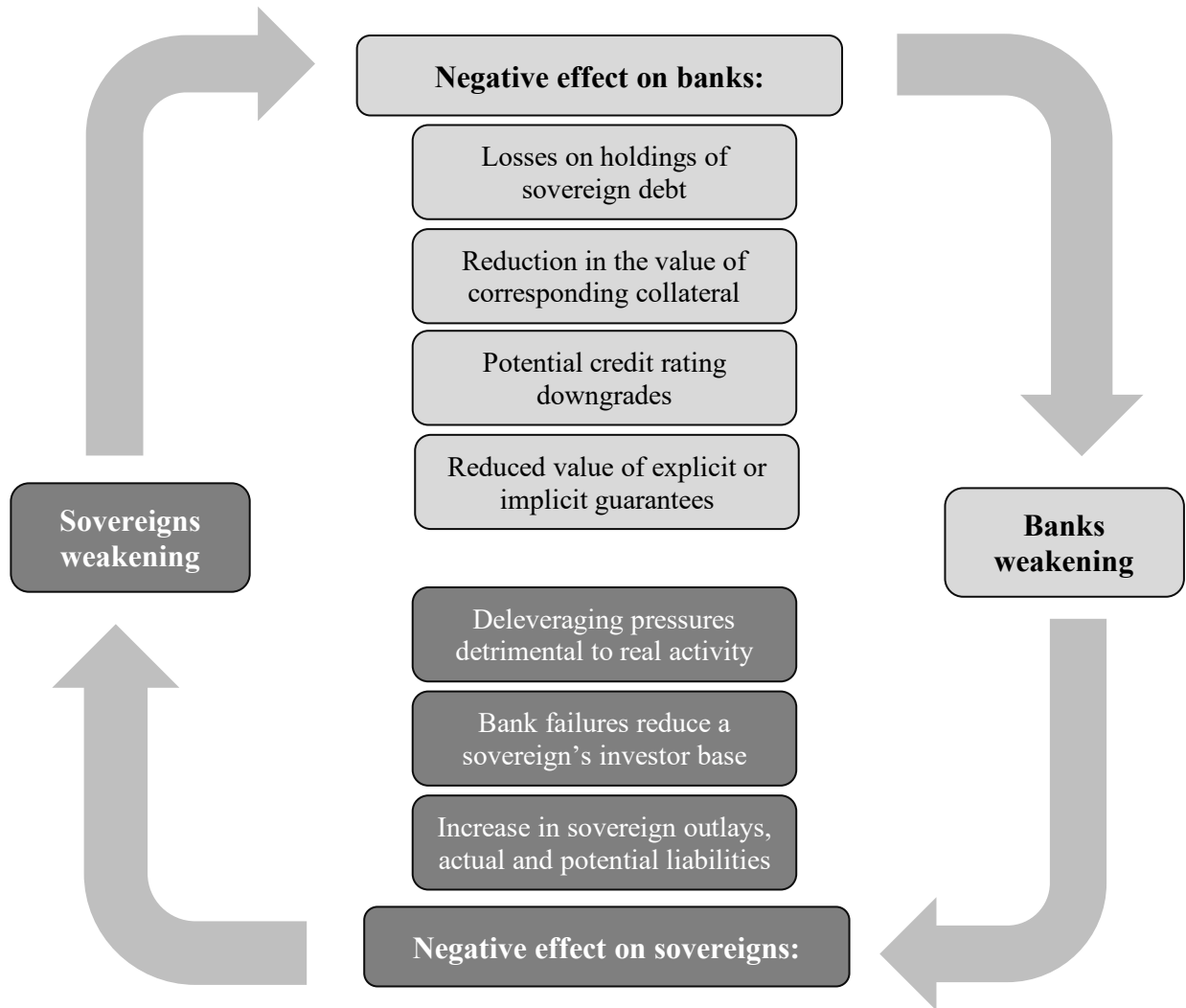


Figure 2: Negative effects from the sovereign-bank doom loop.

Euro area governments committed to breaking the doom loop between banks and sovereigns have established the European Banking Union. But policymakers still disagree on how to treat sovereign exposures in bank regulation. A finalized Banking Union, then, must include a policy framework

¹⁶ See also Schich & Lindh (2012, p. 4.)

in which the bank-sovereign vicious circle is broken. This is evidently not yet the case, as many of the above-mentioned linkages have remained essentially intact since the start of the Banking Union. Deposit insurance is still national, as have been ad hoc schemes to support failing banks and their creditors. In recent years, gaps of a not finished banking union were used via national liability guarantees (Hogan Lovells, 2017), the precautionary recapitalisation of one major bank (European Parliament, 2017), and the reimbursement of losses incurred by retail savers (Grant, 2017) as well as investors in senior debt. Meanwhile, most euro area banks still exhibit significant home bias in their sovereign exposures (Altavilla et al., 2016), namely, the fact that their direct credit exposures to euro area sovereigns remains concentrated in their home country.

Furthermore, most euro area banks retain a largely domestic footprint, implying powerful indirect linkages through the domestic economy. In addition, a surprisingly large number of them are controlled or otherwise influenced by national governments and/or politics (Véron, 2017a), which reinforces the bank-sovereign nexus. For example, a very significant share of the German banking system is directly controlled by local or state governments.

2.4 DETERMINANTS AND VALUATION APPROACHES OF IGG

As mentioned in Section 2.3.2., the lack of a concrete method for assessing the value of IGGs can lead to a number of issues that policymakers have to deal with. However, the literature presents a variety of methods to determine how IGGs can be valued appropriately. This chapter presents some of the established methods of valuation and selected determinants of IGGs.

2.4.1 *Selected determinants of IGG*

The goal of valuation methods is to fundamentally estimate an evaluation that represents the monetary unit value of IGGs. Such methods rely on determinants that drive the value of IGGs. Elliott (2014) presents a theoretical determination of IGGs by stating that gross subsidy is based on

- the probability of the need for a rescue,
- the probability that the government would actually provide such a rescue if needed, and
- the portion of the security's value that would be spared a loss by the rescue (Elliott, 2014).

The probability of an actual rescue strongly correlates with the size and systemic relevance of a bank, characterizing bank size and interconnectedness as relevant determinants of IGGs value. The determinants of IGGs can themselves be influenced by a broad spectrum of other variables, such as the differences in banks' business models, economics of scale and economies of scope, established practices of risk diversification, differences in funding sources, litigation risks and other idiosyncratic factors and differences in liquidity (Elliott, 2014, p. 3). This is the reason why studies such as Zhao (2018), Schäfer et al. (2016), Fischer et al. (2014), Tsesmelidakis and Merton

(2013), Borisova et al. (2015) incorporate similar control variables into their multivariate analysis to control for these sorts of determinants.

Gudmundsson (2014) points out that the rise in market volatility seen in 2008 and 2009 merits higher estimates of the value of implicit subsidies because the subjective likelihood of a crisis and the potential shortfall in the event of such a crisis can lead to fluctuating estimates. Gudmundsson (p. 21) therefore posits a hypothetical correlation between the subjective likelihood of a crisis and market volatility, thus identifying these factors as further determinants of subsidy value.

Another determinant that potentially reflects the level of implicit subsidies are credit ratings. For instance, a bank's all-in credit rating can reflect assumptions about potential external support for the debtor (Schich & Lindh, 2014, p. 2). For this reason, scholars such as Bijlsma and Mocking (2013) measure the size of funding advantages as a private value of TBTF by using a series of estimation methods like rating agencies' bank assessments.

Berger et al. (2019) argue that determination of the value of IGGs should be carefully analysed for distressed banks and that external factors such as ratings should be taken into account when estimating the value of implicit guarantees within European banking system. Lapteacru (2019) warns that the estimated value of the implicit subsidy could not be measured directly and currently if the data used to calculate the value of the subsidy is collected ex post by credit rating agencies. The author suggests that the value of the implicit subsidy can also be measured by observing the financial market prices of a bank like the underlying CDS spread. Epstein and Rhodes (2018) maintain that additional factors such bank size and risk limits can be used to identify the cost of bank funding and the level of implicit guarantees required to ensure the stability of the

bank if it should fail. Lapteacru (2019) asserts that the value of a bank should be considered as an asset in estimating implicit subsidies, while Cutura (2018) recommends factoring in the country's GDP to calculate the potential value of a bank in measuring the implicit guarantee.

Leaving other factors impacting the value of IGGs aside, Bai and Collin-Dufresne (2011) recommend that policy makers should focus primarily on bank-specific determinants in estimating IGGs, including interconnectedness and capital strength. Lapteacru (2019) stresses that the risk component of government guarantees ultimately determines to what degree a bank can minimize its funding costs. Thus, estimating the value of implicit subsidies must include the probability of failure and premium risk (Avgouleas, and Goodhart, 2015). Since the guarantor bears the risk and uncertainty stemming from the IGG and since the premium attached to that guarantee is comparatively low, the guarantee is more effective (Lapteacru, 2019). This is supported by Berger et al.'s (2019) conclusion that the premium attached to guarantees by defaulted banks may be zero if the European banking systems adopts an efficient bail-in policy.

To present a holistic and structured overview over the valuation approaches for IGGs in general, the following section differentiates between two fundamental approaches: funding advantage-based models and contingent claims-based models.

2.4.2 *Funding advantage vs. contingent claims approach*

As discussed in Section 2.3.1. above, IGGs can have a direct impact on a banks' related cost of debt as well as the corresponding annual cost of funding. Funding advantage approaches rely on this fact by calculating the value of the implicit subsidy in terms of the resulting reduction in funding costs. In other words, the cost of issuing debt with government support is compared to the

cost it would face in the absence of government support (Noss & Sowerbutts, 2012, p. 5). The estimated value of implicit bank debt guarantees are often reported in terms of basis points derived from interest rates, from funding advantages or total funding advantages in local currencies, or from GDP (Schich & Lindh, 2014, p. 11). Generally speaking, funding advantage models can be subdivided into two approaches: size-based and ratings-based approaches (Noss & Sowerbutts, 2012, p. 5):

- (i) Size-based approaches presume that only larger banks are backed by governments in the event of their failure, and thus benefit from lower cost of funding than smaller banks. It is assumed that, in the counterfactual case where government support is revoked, large banks would confront the same cost of funding as smaller banks. Two size-based approaches (bonds spread and CDS spread analyses) will be discussed in Chapter 3.3.1. below.
- (ii) Ratings-based approaches rely on third-party evaluations such as credit ratings to determine the likelihood of a bank defaulting on its debt. However, only ‘support’ ratings reflect the possibility of a bank getting government aid. This approach analyses support ratings as an approximation of the higher cost of funding a bank would face in the absence of the implicit guarantee, using market prices of bank debt to estimate the cost of funding.

In contrast, contingent claims models compute the implicit subsidy throughout all banks in total. It is computed as the anticipated annual payment from the government to support banks, which is necessary to avoid their failure to repay their debts. This is modelled as the shortfall between the value of banks’ assets and some ‘threshold’, based on their minimum capital requirements at some future time. Failure is when the total assets of all banks fall below this minimum requirement. The value of government support is the sum necessary to restore the value of assets to this minimum amount, weighted by the likelihood that the value of assets will drop below the threshold. It is

represented as a ‘claim’ that banks have on the government contingent on their failure, the exercising of which restores their assets to a value necessary to prevent their default (Noss & Sowerbutts, 2012, p. 7). This approach can be subdivided into option-price approaches and historical approached, which will be discussed in Chapter 3.3.1.

2.5 POLICIES TO REDUCE AND ELIMINATE IGG

Extant literature suggests different types of solutions to deal with the problem of implicit subsidies. These solutions differ in terms of their perception on whether a crisis can be avoided (i.e. solutions to reduce the probability of a crisis) or whether a crisis cannot be avoided (i.e. solutions that try to minimize damage during critical times). Solutions typically include the following categories of regulatory recommendations (IMF, 2014, p. 120):

- Restrict bank size and activities to prevent institutions from becoming too important to fail,
- Reduce the probability that a G-SIB becomes distressed,
- Lower the probability of a bailout if a bank becomes distressed, and
- Minimize public transfers in the case of bank restructuring.

In the context of European banking regulation, most financial researchers and policy makers agree that risk prevention involves ensuring effective risk management among systematically important banks (Berger, et al., 2019). Schich and Aydin (2014) discuss a variety of solutions such as the attempt to make banks more resolvable, as proposed by BRRD. In 2014, the BRRD and the regulation establishing the Single Resolution Mechanism (SRM) was adopted by the European Parliament. According to the authors “the SRM is a system involving the European Central Bank, European Commission, a new Single Resolution Board (SRB) and

national authorities for deciding on the timing and details of bank recovery and resolution” (Schich & Aydin, 2014, p. 18).

Furthermore, the BRRD instructs the concerned resolution authorities to apply the regulatory requirement of MREL (Minimum Requirement for own funds and Eligible Liabilities) to ensure that the conditions attached to the bail-in process are credible and practicable in case of resolution of a defaulted institution (Binder, 2015). However, this process of applying the framework of MREL and the bail-in process can be unpredictable (Lapteacru, 2019). The policies of the SRM are only directly applicable within the banking sector of the European region (Epstein and Rhodes, 2018). The Single Resolution Board (SRB) is the primary authority within the European banking regulation system with the authority to guide the resolution planning of failed banks and financial institutions in Europe (Avgouleas and Goodhart, 2015). It determines what resolution actions should be taken by the distressed bank to limit any bail-out expectations in the market.

Apart from the BRRD and the SRM, the literature also points to other solutions such as the restriction of bank business lines and the attempt to make implicit guarantees explicit. For example, charging a direct or indirect fee for the provision of the guarantee function is one potential way to make implicit guarantees explicit. Similarly, withdrawing the guarantee function can make it easier to resolve failed banks, since guarantees would have to be invoked less frequently. Strengthening banks is perhaps the most fundamental approach, since the value of any debt guarantee is lower if debtors are stronger on a stand-alone basis (Schich & Aydin, 2018, p. 22).

Researchers also advise policy makers to measure and monitor the size and impact of IGGs in the banking sector on an ongoing basis in order to evaluate the efficiency of implemented bail-

in regimes. Cutura (2018) stresses that the European Bail-in regime must include the ability to monitor risk-taking factors and observe the incentives provided to failing banks in determining the value of implicit subsidies.

2.6 CONCLUSION

This chapter discusses the existence of IGGs, their potential negative effects on bank behaviour and national and global financial stability and the sovereign doom-loop, as well as the key determinants of IGGs value and implications for policy makers. It explores the roots of IGGs why regulation is needed to limit or eliminate IGGs and increase efficiency in the banking sector. As discussed above, the IGG nexus must be measured accurately and communicated transparently to facilitate an accurate assessment of the efficiency of regulatory regimes aimed at limiting or eliminating the nexus. Although many researchers measure IGGs, a shared understanding of best practice measurement methods is lacking. To monitor and disclose the development of IGGs regularly and transparently, regulatory bodies need a uniform, precise and accurate measurement method. Chapter 3 discusses various IGG measurement methods applied in recent studies and assesses their limitations, serving as a basis for the empirical analysis presented in Chapter 4.

Chapter 3. MEASURING IMPLICIT GOVERNMENT

GUARANTEES. A COMPARATIVE ANALYSIS¹⁷

3.1 INTRODUCTION

This chapter presents and assesses various models for measuring the magnitude of implicit government guarantees (IGGs), supported by empirical evidence. We first provide a short overview of research goals and summarize the empirical findings. We then present a systematic summary of methodological approaches in the literature to derive the limits of current and past methodological approaches with regard to measuring IGGs and their impact on relevant variables.

3.2 RESEARCH GOALS AND EMPIRICAL FINDINGS

This section assesses the goals driving representative research in the field of IGGs. One stream of research investigates the impact of IGGs on the risk-taking incentives of recipient banks. For example, Allen et al. (2015) explore explanatory variables that depict the relationship between IGGs and excessive risk taking based on an analysis of current theoretical research. Fischer et al. (2014) investigate the relationship between IGGs and banks' risk-taking incentives based on the loan provision behaviour of banks within the sample, extrapolating from that the influence of the elimination of IGGs on bank risk-taking. Similarly, Gropp and Guettler (2014) assess the impact of IGGs on the risk-taking ability of banks, partly motivated by the discontinuation of IGGs for savings banks in 2001 caused by a lawsuit in Germany. Prabha and Wihlborg (2014) examine the degree to which banks' risk-taking can be explained separately by elements that play a crucial role

¹⁷ Based on an unpublished working paper "Measuring Implicit Government Guarantees. A Comparative Analysis", 2020.

in implicit guarantees and by elements relevant to business models of banks. Along similar lines, Oxera (2011) investigates the support of states for banks in the United Kingdom, assessing the connection between banks' risk-taking patterns and implicit state support.

Other studies focus on bank behaviour and operations more generally. For example, Noss and Sowerbutts (2012) assess the impacts of implicit subsidies on the economies of scale among large banks in the United Kingdom, with a major focus on identifying the role and impact of too-big-to-fail (TBTF) status on bank operations efficiency and a minor focus on risky behaviour. Similarly, Elliott (2014) redefines the concepts of implicit subsidies for large banks and looks at the impact of such subsidies on bank functionality.

Other streams of research focus on various relevant aspects of bank balance sheets, especially on the debt valuation and sensitivity and subsidy valuation. For example, Acharya and Warburton (2016) investigate the overall sensitivity and risk of debt in the non-financial and financial industries in the U.S. Similarly, Schich and Aydin (2014) measure and assess IGGs for bank debt, whereas Schich and Lindh (2012) align IGGs and bank debt, including determinants and estimates of their value. Borisova et al. (2015) examine how government equity possession impacts corporate debt cost in publicly traded firms. Cost of debt as well as changes in bank equity were also investigated by Siegart and Willison (2015). Their study assesses the TBTF problem by conducting a comprehensive review of extant cost of debt valuation approaches. The study also aims to identify changes in bank equity and debt due to an external crisis followed by a new perception of implicit subsidies. Some papers also consider the cost of funding. For example, Araten and Turner (2012) examine the extent and sources of funding cost variation between global systemically important banks (G-SIBs) and non-G-SIBs across the US. Ueda and di Mauro (2012) measure the structural subsidy and identify variations in the market valuation of government

support and the structure of such support. Likewise, Bijlsma and Mocking (2013) measure the size of funding advantages as a private value of TBTF guarantees using a series of estimation methods, including rating agency bank assessments.

Another category of publications in this field deals with the impact of IGGs on the financial market and/or on privately or publicly traded financial instruments. Li and Zhang (2011) review price implications along two dimensions, comparing the financial statements of large and small financial institutions and comparing credit default swaps on the credit market with fair value spread extracted from equity markets. Bai and Collin-Dufresne (2011) investigate cross-sectional variation and variation over time of credit default swap and bonds, measuring variation across CDS spreads and the implied spread of credit of cash bonds for a relevant sample of different organisations during a period of financial turmoil. Hett & Schmidt (2017) develop a novel test for estimating changes in the financial markets, identifying bailout expectations during the financial crisis based on the interrelationships among firm-specific risks, equity returns, and credit spreads. Beck et al. (2017) identify the impact of bailout expectations on a yield spread for bonds issued by sub-sovereign bodies or banks. Jin and Zhang (2018) studied the impact of IGGs on corporate investment by manipulating a series of debt evasions in the Chinese bond market. Kelly and Van Nieuwerburgh (2016) study the reaction of option markets to sector-wide IGGs, focusing on insurance pricing during the financial crisis period 2007 to 2009. Schnabel et al. (2016) examine market reactions to the bail-in policy as a replacement for existing bail-out expectations, i.e. IGGs. In an event-based study, Chabot and Moul (2014) track the consequences of broken guarantees in the Indiana-centred Panic of 1854 compared with the Panic of 1857, when regulatory guarantees were honoured. Similarly, Schweikhard and Tsesmelidakis (2011) consider the consequences of targeted capital injection by the governments of major economies during the financial crisis.

A further stream of research focuses on the mechanisms of loss transfer and the measurable benefits of IGGs. Tsesselidakis and Merton (2012) estimate the monetary value of IGGs extended to the financial industry during the global financial crisis, showing which institutions benefited from the subsidies and to what extent and how much benefit is split between creditors and shareholders. Schich (2009) evaluate the benefits, costs and exit issues for large banks resulting from expanded government guarantees. Similarly, Haldane (2010) discusses the costs of bailouts and associated costs to national economies during the global financial crisis, performing a qualitative analysis based on extant literature. Haldane highlights categorical losses and identifies the need for regulatory and legislative measures to lower the likelihood of further financial crisis and ways to increase the tolerance of the economy during financial crises. Some researchers in this stream formulate recommended actions for policy makers. For instance, Lucchini et al. (2017) proposes a financial strategy involving bank federations and loss transfer to avoid bailouts and help financial institutions without burdening taxpayers.

With regard to regulatory policies, some scholars consider the impact of IGGs from the perspective of the corresponding regime or identify more sophisticated categories of IGGs. Schich and Kim (2013) measure the (negative) impact of IGGs on sovereign credit strength, actual bank failure and regime variations. Zhao (2018) focuses on the relationship between implicit government support and financial authorities. Zhao investigates how information from various segments of the CDS market can be used to measure the value of IGGs at an aggregate level and on an individual basis. Toader (2014) compares the ability of single state regulators to grant IGGs in the domestic economic environment with the ability of transnational regulatory bodies to do so. Zhao (2019) identifies the methods of regulating implicit government guarantees and the

magnitude of IGGs based on price differentials of credit default swap (CDS). Finally, Klaus and Schäfer (2013) identify suitable alternatives to IGGs during financial crises.

A further stream of research examines systemic risks and the systemic relevance of IGGs. Eisert and Eufinger (2019) theorize the advantages for banks to be interconnected on the interbank market. Kloeck (2014) identifies the nature and types of implicit subsidies in the EU and identifies their potential impacts on banks and economies. Likewise, Mengus (2019) develops a theory of endogenous implicit guarantees to explain the procedure of and need for IGGs. Mengus also explores how his theory impacts the systematic assets of financial institutions.

Finally, narrower streams of literature discuss completely different aspects of the economy, thus contrasting with the remaining body of research in this field. For example, Brou and Ruta (2013) identify the applicability and need for and commitment to providing subsidies and applying tariffs strategically. In contrast, Armendáriz et al. (2013) identify the impact of subsidy uncertainty on microfinance mission drift.

In summary, we identify the following broad streams of research related to IGGs and IGG measurement:

- The impact of IGGs on bank behavior and incentives on a bank's affinity for risk.
- Quantification and measurement of the impact of IGGs on debt and subsidy valuation.
- The impact of IGGs on publicly or privately traded financial markets and instruments.
- Mechanisms of loss transfer and the measurable benefits of IGGs, including from the investors/creditor point of view.
- Regulatory policies and recommended actions, including the regime perspective, and potential alternatives to IGGs.
- The systemic risks and systemic relevance of IGGs.
- Less common economic aspects requiring a different theoretical framework.

Some of these streams share common ground. For example, most scholars who study the impact of IGGs on bank behavior also formulate practical implications and recommend actions for policy makers. However, the different research goals often require different methods of measuring and interpreting past events. Nevertheless, these streams of research constitute the basis of research that motivates a more intense investigation into implicit subsidies and guarantees, which is the objective of this work.

3.3 METHODOLOGICAL APPROACHES

This chapter presents and discusses the methodological the approaches adopted in relevant extant research into implicit subsidies and guarantees to banks and financial institutions, providing a systematic overview of the methods and data and an exploration of their limitations.

3.3.1 *Methods and data*

Generally speaking, there are three major categories of methodological approach:

- (i) Purely quantitative methods, including all forms of statistical analysis of empirical data, such as regression or correlation analysis.
- (ii) Purely qualitative methods, which do not use statistical methods to analyse empirical data. Instead, conclusions are formulated on the basis of empirical results or theoretical models from previous literature. Research designs commonly consists of a meta-analysis or a general discussion of recent events incorporating theoretical models.
- (iii) Mixed methods, which combine quantitative and qualitative elements.

Since this work is based on quantitative analysis, the following overview focuses primarily on purely quantitative methods used in relevant extant research.

3.3.1.1 CDS spreads

A large share of scholars analyse CDS spreads to measure the volume and impact of implicit subsidies and guarantees. CDS spreads measure “the risk level of a bank due to its economic fundamentals, as assessed by equity market participants and not distorted by government intervention” (Li & Zhang, 2011, p. 7). The methods used to analyse CDS spreads as a relevant variable vary significantly. A common method is descriptive analysis of event-based development of CDS spreads over time. Such an approach was adopted by Li and Zhang (2011), who calculate the increase and decrease in CDS spreads by disclosing the change in basis points.

In general, the CDS-based approach is supported by regression analysis and commonly includes control variables such as equity prices of the firm, estimated TBTF premium, total liability, assumed fraction of debt guarantees issued by government and market support (Li & Zhang, 2011, p. 14). Based on his own regression analysis of CDS spreads, Zhao (2018) concludes that IGGs benefit the financial institutions of Europe by exploiting the differential price contracts of CDS that are written based on debts at various levels. Zhao distinguishes between subordinated and senior CDS market segments to derive the IGG implied in the market, and he uses the Monte Carlo simulation technique to calculate IGGs. He then conducts a regression analysis to determine the implicit guarantees’ determinants. Zhao incorporated information about 100 financial firms across Europe, incorporating control variables including firm risk and characteristics, general market conditions, liquidity and bond maturities to ensure estimation accuracy. Schweikhard and Tsesmelidakis (2012) also conduct a regression analysis using CDS spreads as the dependent

variable and macroeconomic variables including business climate, interest rate term structure and illiquidity, as well as firm-specific factors including ratings, firm condition and firm size as independent variables. The authors use this model in this study because it effectively and efficiently predicts the levels of observation and because it offers closed solutions and transparency. Schnabel et al. (2016) identify market reactions to the announcement of the bail-in policy as a replacement for bail-out expectations in the market. The authors also measure the categorical impacts of the regulatory announcement on stock returns and CDS spreads, creating a system of equations combining a number of different regressions. The regression models incorporate the difference-in-difference of CDS spreads as the dependent variable and a vector of event-based dummy variables as independent variables. No other control variables were included in the regression analysis.

Some scholars also use data considered an equivalent of CDS spreads. For example, Bai and Collin-Dufresne (2011) investigate cross-sectional variation and time-series of CDS spreads to measure variation in CDS spreads and to determine the implied spread of credit of cash bonds for an extensive sample of different organisations during the global financial crisis. The authors took survival-based valuation approach to evaluate the CDS-bond basis, which is also known as the Par Equivalent CDS methodology. This approach enables reasonable comparison and measurement across the spread of cash bonds and the swap spread of credit default accordingly. Regression analysis is utilized to predict average levels of investment-grade and high yield bonds.

In summary, many scholars take CDS-based approaches to measure the value and impact of implicit subsidies and guarantees. CDS-based approaches often incorporate some type of regression analysis, but control variables vary across studies, likely because the underlying focus or research question varies across studies. For example, event-based regressions are selected to

estimate the effect of a specific event, while general market regressions are selected when there is no event-driven purpose.

3.3.1.2 Bond credit spreads

A smaller share of scholars analyse bond credit spreads to measure the extent and impact of implicit subsidies and guarantees. For example, Acharya and Warburton (2016) quantitatively analyse the numeric data associated with bond credit spreads. They extract the data from all unsecured bonds issued in the U.S. between 1990 and 2012 associated with 64 banks and 67 financial institutions, including asset management and insurance firms. They analyse the data using the cross-sectional regression of equity, adjusted volatility and adjusted market leverage to estimate a bank's specific adjusted distance to default measure. The authors use the Merton DD (Distance-to-default) model to analyse and depict the credit risk of debt of the company and total asset as a measure of the size of the company. The study is based on eleven variables: time to maturity, seniority, spread, size, return on assets, mismatch, market-to-book ratio, leverage, z-score, the coefficient on the distance to default, and volatility, which indicates that the study is based on multivariate analysis. A similar approach was implemented by Acharya, Anginer and Warburton (2015).

3.3.1.3 Rating-based approaches

Rating-based approaches assume that credit ratings reflect the relationship of IGGs on banks' credulity and financial strength. Schich and Lindh (2012) perform multivariate quantitative analysis of credit rating data on 123 banks using regression and correlation techniques. The authors extract data in seventeen European countries from 2007 to 2012. Their variables include issuer bank stand-alone credit rating, domestic sovereign credit rating and relative size compared to other

domestic banks. Similarly, Fischer et al. (2014) analyse how the removal of IGGs affected credit ratings, cost of funding and franchise value. They analysed quantitative data using z-score and regression analysis. The sample size for the study is 1,578 syndicated loans offered by the group of German state-owned banks called *Landesbanken* between 1997 to 2008. Variables of the study controlled for borrower risk, total assets, profitability, tangible assets, interest coverage, leverage and current ratio, which makes it multivariate analysis.

A rating-based approach was also implemented by Tsesmelidakis and Merton (2012). In their work, the authors conducted regression analysis on control variables associated with business climate, liquidity and ratings. The multiple variables characterize the study as a multivariate analysis. The overall analysis of IGGs is ratings-based. The study was conducted in the US and includes a sample of 74 financial institutions. Data included in the study is associated with the bulk of subsidies that arose during the years 2008 and 2009. Similarly, Schich and Kim (2013) relied mainly on IGGs computed based on credit rating assessments. The study's main data comprise of time series of the financial strength rating of the bank and bank's long-term issuer credit rating. The study used the difference between the two which is called "uplift" as IGGs' proxy measure for bank debt. The study included cases of bank failures in sixteen countries between 2008 and 2012. The variables of the study are stand-alone ratings and uplift variables, characterizing the study as a multivariate analysis.

Ratings are also used by Borisova et al. (2015) to control for influencing factors on corporate debt cost. The authors estimate standard errors adjusted for double clustering on panel dimensions at the bond. In addition, the study performed regression analysis of firm- and year-fixed effects. Firm-fixed effects include time-invariant features allowing exploration of firm differences, while year-fixed effects look at macro-level elements. The authors analyse data from

a sample of 43 nations between 1991 and 2010. Other variables of the study include government ownership, bailout, rating, maturity, callable bond, secured bond, ROE, size of the firm, GDP growth, individual and institutional ownership.

Toader (2014) utilises an empirical analysis based on a rating-based model to estimate the implicit guarantees to private banks. In the comprehensive investigation, he assesses various forms of risk and the conditions for receiving government protection. The study's variables include Moody's sovereign ratings, intrinsic ratings, frequency distribution, condition variance, conditional mean, and Poisson regression. The time horizon utilised for the estimation purpose ranges from 1997 to 2012 and the sample includes 45 different European banks located in 17 different countries. The ratings used in this study permit the measurement (or at least quantification) of the impact of implicit guarantees on creditor credibility.

In their rating-based approach, Noss and Sowerbutts (2012) differentiate between 'stand-alone-ratings' and 'support-ratings', concluding that both ratings "reflect external assessment of the probability of a bank defaulting on its debt, but only the latter includes the possibility of a bank receiving government support" (p. 5). In their approach, they analyse the difference between a bank's actual funding cost, reflected by the 'support rating' and the 'stand-alone rating', which represents the higher cost of funding that a bank would face in the absence of IGGs. The authors draw on secondary datasets from historical bank records, performing a quantitative analysis involving a series of quantitative factors like equity prices and credit risk values. Their study was a multivariate analysis because the bank costs they analysed were further comprised of a series of factors. The basic categories involved in the analysis were the scale economies of banks and implicit subsidies. In the first step of their study, the scholars employed an augmented model of bank production to estimate the counterfactual prices of debts in the absence of TBTF funding, not

considering the costs of implicit subsidies. In the second step of their study, they developed a model of bank production based on data from the banks under consideration to estimate the economies of scale in the presence of TBTF funding costs.

Bijlsma and Mocking (2013) also use ratings in a secondary quantitative analysis using secondary datasets of historical bank records between 2008 and 2012. This study was published in 2013 and involved 150 banks from cross-regional European countries. Their quantitative study involved a series of quantitative factors and is multivariate in that it involved a series of variables, including issuer ratings, market prices and mergers.

Ueda and di Mauro (2012) used ratings to value the structural subsidy. The quantitative study identifies variations in the market valuation of government support and the structure of such support based on the datasets of credit rating from different banks, characterizing the study as secondary analysis. Datasets from 2007 to 2009 were analysed in order to estimate the variables before and during the global financial crisis. The variables of the multivariate study include LT ratings, individual ratings, support ratings and support rating floors.

Noss and Sowerbutts (2012) describe multiple advantages of ratings-based approaches over conventional size-based approaches:

“First, it goes some way in controlling for the relative risk of different banks’ business models as this is incorporated into rating agencies’ judgement. Second, its consideration of the difference between banks’ ‘support’ and ‘stand-alone’ ratings takes account of their likelihood of receiving government support. By contrast, the size-based approach includes no such control for banks’ relative risk, and instead makes the crude assumption that only large banks will receive government support” (p. 5).

Section 3.3.2 below discusses the limitations of ratings-based approaches in more detail.

3.3.1.4 Cash equity-based approaches

Cash-equity based approaches measure the impact of IGGs on equity-related indicators. The relevant variables include equity returns, equity value and asset valuation. Lucas and McDonald (2010) research Fannie and Freddie, which were developed by the US Congress as government-sponsored corporations to provide stability and liquidity in the US home mortgage market. These enterprises are required to provide low-income lending. The authors focus on the Fannie and Freddie in terms of regulatory environment and risk exposure, as well as the impact of IGGs on the dynamic association between equity value and underlying assets. The authors examine the value of debt and equity based on equations of growth rates, expectations and present values, making the study a multivariate analysis. These equations also incorporate dividends, which are an important part of equity, and interest rates, which is the cost of debt. The overall analysis of IGGs is equity-based. Prepayment risk is also considered, while finance cost and prepayment risk are hedged partially using derivatives. The data about Freddie and Fannie is extracted for a 20-year period through 2005 for the US. The study's variables include operating asset value, market asset value, debt and equity value, the value of debt guarantee, dividend equity value, and bankruptcy condition.

Similarly, Hett and Schmidt (2017) identify bailout expectations during the financial crisis based on equity returns. The datasets for the study are from 2004 to 2014, defining the time horizon. The authors use secondary data extracted by someone other than themselves and available in third-party databases. The quantitative study employs a series of analytical tests to develop an estimation design. Furthermore, study was carried out in the United Kingdom using relevant inclusion and exclusion criteria. The authors estimated costs based on hedge ratios employing a

two-stage OLS¹⁸ procedure to conduct linear estimations of structural parameters of variables. The variables of this multivariate study include bailout expectations, volatility, leverage, firm-specific risks and credit spreads.

3.3.1.5 Equity options-based approaches

Measuring the impact of IGGs based on equity-related indicators is similar to utilizing option-based indicators because the rise and fall of equity is partially, but significantly, correlated with the rise and fall of prices of equity-options. Noss and Sowerbutts (2012) identify two basic options-based approaches:

- (i) Option-price approach: This approach models the future distribution of a bank's equity value based on the prices of corresponding equity options. The pay-off of equity options is conditional on the future bank's equity prices. Therefore, their prices "yield an estimate of the likelihood of the risk of bank failure as perceived by investors" (Noss & Sowerbutts, 2012, p. 8).
- (ii) Historical approach: The option-price approach can yield distorted results because implicit subsidy estimates are "likely to be affected by how the prices of equity options reflect risk-averse investors' desire to protect themselves against adverse events" (Noss & Sowerbutts, 2012, p. 8). In order to circumvent this potential distortion, the likelihood of a bank failure can be calculated based on the historical distribution of observed equity price movements.

¹⁸ Ordinary least squares (OLS) is a type of linear least squares method for estimating the unknown parameters in a linear regression model.

Oxera (2011) takes an option-price approach, which assumes that once the systemic shock is defined (including probability estimations and assessments of required payments to the financial system), state support can be valued as the discounted expected payment from the state “if it is require to prop up the system to avoid a systemic failure” (Oxera, 2011, p. 9). This approach is similar to the valuation of options, where the state support is represented as a put option on system assets. Oxera asserts that a valuation of state support should only consider only events that lead to systemic failure, while other events that impact the asset value of a specific bank but not the whole system in general should not be considered systemic and therefore do not warrant state support.

Kelly and Van Nieuwerburgh (2016) analyze historical options market data to determine what their reaction to sector-wide IGGs. Specifically, they investigate the pricing of insurance during the global financial crisis for the period 2007 to 2009 in the US options market. The authors apply a JD model¹⁹ with and without bailout to test the generalized method of movement of the gap between restricted and unrestricted bailout. The authors find that in the financial industry, a bailout decreases the sum of squared pricing misstatements by 37%, from 18.8 in restricted to 11.9 in unrestricted. The variables of this multivariate analysis include option market evidence and cost of insurance.

Option-based data is often used in regression analysis as well. While Araten and Turner (2012) do not take a primarily option-based approach, they include a variety of different variables that are partly options-adjusted. Since previous studies do not control for the particular credit risks

¹⁹ The jump diffusion model, introduced in 1976 by Robert Merton, is a model for stock price behavior that incorporates small day-to-day “diffusive” movements together with larger, randomly occurring “jumps”. The inclusion of jumps allows for more realistic “crash” scenarios and means that the standard dynamic replication hedging approach of the standard Black-Scholes model no longer works. This causes option prices to increase compared to the Black-Scholes model and to depend on the risk aversion of investors. This Demonstration explores how the price of European call and put options varies with the jump diffusion model parameters. See also Kou (2002).

of firms and macroeconomic elements, the authors evaluate various channels of cost funding in several US banks that influence macroeconomic and specific credit factors, focusing on various funding sources for small and large banks of the US and their contribution to the overall cost of funding. After establishing criteria for G-SIBs, the authors examine the relative influence of a wide variety of variables to explain the cost difference in funding, consisting of credit risk and economic indicator variables. These factors are useful in evaluating the benefits associated with the status of G-SIBs with regard to funding costs in a defined banking sector. The dependent and independent variables used in this study include the cost of domestic interest, interest expense, asset quality, funding liquidity, capital adequacy, earnings stability, and profitability, and the study also considers option-adjusted spreads (OAS).

The Merton DD model is used by Acharya and Warburton (2016), Schweikhard and Tsesselidakis (2011) and Gudmundsson (2016) to depict the credit risk of banks' debt. The equity of a company, such as a bank, or of government assets is modelled as a call option on the underlying value of the company or government asset, where the strike price is the value of the company's debt. An estimation of this kind is often complementary to further analysis assigning a numeric value to the credit risk of debt.

For instance, Gudmundsson (2016) identifies the levels of implicit subsidies for large banks using Merton's model of estimation within the period of regulatory reform's for limiting IGGs after the global financial crisis. Gudmundsson extracted empirical evidence from secondary data sources including data on G-SIB classification, bank's leverage and market volatility. He adopts a contingent claim method and option pricing methods to assign values to the credit insurance risks. Gudmundsson also applies the jump diffusion model to avoid the exclusion of observable non-normal asset price assumptions. The author finds that the costs of implicit subsidies decreased

significantly during the post-crisis period but is still large enough to be considered important. He identifies decreasing market volatility and increasing capital asset levels as major causes of changes in the trends. A limitation of this study is that its results are affected by fluctuations in the likelihood and cost of crises. Nevertheless, Gudmundsson's use of non-normal pricing options indicates that this method can also be used to estimate the values of implicit subsidies.

3.3.2 *Limitations*

This section discusses the limitations of funding advantages and contingent claims models for measuring IGGs. Rating-based, bond spreads and CDS spread approaches fall into the category funding advantage models, which estimate the "implicit subsidy as the reduction a bank enjoys in its annual cost of funding due to the presence of the implicit government guarantee" (EFA, 2013, p. 3). As demonstrated above, rating-based approaches reflect the observable and causal relationship between ratings and funding costs. There are several methodological problems. First, funding advantage models (especially rating-based approaches) do not anticipate future developments as reliably as contingent claims models because agencies' assessment methods are based on a statistical analysis of past bailout episodes and are therefore slow in reflecting changes in financial policies (IMF, 2014). Rating agencies have been criticised in the past (and especially during the financial crisis of 2007/08) for their subjective and partially biased ratings (EFA, 2013), which makes rating-based approaches subject to distortion.

CDS-spread based approaches are limited with regard to the underlying data. Such approaches rely on observed CDS spreads and estimated fair-value CDS spreads. Since the available data on liquid and reliable CDS spreads are available only from 2005 onward and only for the largest banks, the sample size is limited and excludes smaller banks (IMF, 2014). In

addition, Bao and Pan (2013) suggest that CDS prices often include an illiquidity premium and a counterparty risk premium, which may affect results. Finally, the underlying assumptions that enable the use of CDS spreads may be violated during times of heavy financial distress. Therefore, this method provides only a lower bound for the subsidy estimates if equity holders may also be partially bailed out (IMF, 2014).

In contrast, contingent claims approaches, especially the cash-equity approach and equity option-price approach, are highly relevant. A major advantage of the equity option-based approach is its forward-looking character. By anticipating future changes in option value (as represented in option pricing theory), these models can be used as early warning indicators (EFA, 2013). However, equity-option prices can be biased because investors' risk preferences change over time, resulting in higher variance of equity prices. Furthermore, option prices are sensitive to underlying model assumptions. Violations of any kind can result in significant biases as well (EFA, 2013).

Cash-equity based approaches that analyse historical data of equity prices are also limited from a methodological perspective because they are sensitive to underlying model assumptions. However, since no assumptions are required about the future evolution of bank assets, this is an advantage over the equity option approach (EFA, 2013).

3.4 CONCLUSION

This chapter analytically compares various models for measuring the magnitude of implicit government guarantees (IGGs), supported by empirical evidence. Although, there is still no centralized and commonly agreed measurement method to evaluate IGGs, only few methods show comparative advantages in terms of consistency, accuracy and data availability. It is necessary to reflect existing measurement methods and assess their limitations before deciding for a method in order to give IGGs a value over time. During our empirical analysis, which is presented in chapter 4 below, we decide to combine data from cash equity returns and CDS spreads along different tenors and seniorities to estimate abnormal returns and the value development of IGGs accordingly. We combine two measurement approaches in one empirical study in order to allow for a more comprehensive analysis and more robust conclusions. Moreover, we also observe determining factors of IGG within our multivariate analysis to limit the issue of endogeneity. A detailed explanation of our data and methodology is given in chapter 4.3.

Chapter 4. EVIDENCE FROM THE EUROPEAN BAIL-IN REGIME. AN EMPIRICAL ANALYSIS²⁰

4.1 INTRODUCTION

“Never again” was the collective determination of governments after being forced to bail out banking institutions and provide guarantees and capital to avert systemic collapse as a result of the global financial crisis of 2007/08.²¹ Since then, the responsible international regulatory bodies have developed new regulatory measures consisting of enhanced supervision, capital surcharges, and resolution regimes specifically for banks that would pose high risks to the financial system if they were to fail.²² More than ten years after the crisis, Elke König, chair of the Single Resolution Board (SRB)²³, again reiterated the common objective to the European Council that taxpayers should “never again” have to foot the bill for a bank bailout.

The negative implications of IGGs such as excessive risk-taking and the misallocation of bank resources, as well as the moral hazard affecting banks identified as Too Big To Fail (TBTF)

²⁰ This chapter is based on an unpublished research paper “Implementing a European Bail-in Regime: Do BRRD and SRM-R effectively eliminate Implicit Government Guarantees in the European Banking Sector?”, co-authored by Paul P. Momtaz and Axel Wieandt. The paper is actually under review by the Journal of Banking and Finance (JBF) and can be retrieved via <https://ssrn.com/abstract=3645298>. Our compelling results from this chapter have been presented at the Financial Risk and Stability conference 2020, at a WHU Research Colloquium, at a NYU Stern PhD seminar and were part of an Handelsblatt Op-Ed from 9th September, 2020 as well as a written response to the request for comments on the FSB consultative document on the evaluation of the effects of too-big-to-fail (TBTF) reforms from 6th October, 2020.

²¹ G-20 meeting in Pittsburgh (2009) and the White House “Remarks by the President at G20 Closing Press Conference” (Sept 25, 2009)

²² Affected banks must adhere to this regulation in addition to Basel III standards, which include increased capital and liquidity requirements. See also Moenninghoff, Ongena and Wieandt (2015)

²³ The Single Resolution Board (SRB), the highest authority for bank resolution in Europe, was established in 2014 by Regulation (EU) No 806/2014 on the Single Resolution Mechanism (SRM Regulation) and began work on 1 January 2015. It became fully responsible for resolution on 1 January 2016 and was henceforth the resolution authority for around 143 significant banking groups as well as any cross-border banking group established within participating Member States.

led to the global financial crisis of 2007 and renewed debate over government intervention in the financial sector (e.g., Barth and Seckinger, 2018; Moenninghoff et al., 2015). During this crisis, implicit guarantees were made explicit.²⁴ With the exception of Lehman Brothers,²⁵ all large financial institutions, including banks and non-banks, that encountered difficulties were bailed out,²⁶ i.e., they received support by the government. Arguably, this government support may have been needed to avoid financial contagion within a closely interconnected banking system, but there is an inherent risk of moral hazard when financial institutions and their shareholders can expect to be bailed out by governments using public funds. Moreover, in the Euro area, the 2008 bailout caused what became the nexus of the crisis: the fatal doom loop between bank and sovereign creditworthiness (e.g., Acharya et al., 2014).

In response to the financial crisis, international regulatory bodies developed new mandatory regulatory measures consisting of enhanced supervision, capital surcharges, and the establishment of resolution regimes specifically for banks that would pose high risks to the financial system if they were to fail.²⁷ In Europe, where most countries lacked a resolution framework before the crisis, policymakers designed a completely new regulatory framework. In addition, the EU established the Banking Union, which contains three pillars: the Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM), and a planned common

²⁴ The use of public funds in this sector increased dramatically between 2008 and 2013. The interventions took various forms, ranging from recapitalization to loans and explicit government guarantees.

²⁵ Lehman Brothers filed for Chapter 11 bankruptcy protection on Monday, September 15, 2008. As reported by Tiffany Kary in Bloomberg News, reports filed with the U.S. Bankruptcy Court, Southern District of New York (Manhattan) on September 16 indicated that JPMorgan Chase & Co. provided Lehman Brothers with a total of \$138 billion in “Federal Reserve-backed advances”, including \$87 billion on September 15 and \$51 billion on September 16 (“JPMorgan Gave Lehman \$138 Billion after Bankruptcy,” by Tiffany Kary and Chris Scinta, Bloomberg News, November 11, 2011; “Lehman Brothers files for bankruptcy”, Financial Times, September 16, 2008).

²⁶ This led, among others, to a substantial disbursement for many governments and threatened the solvency of various European countries, such as Ireland and Spain.

²⁷ Existing bank resolution mechanisms were overhauled in many countries following the adoption in 2011 of the Financial Stability Board (FSB)’s Key Attributes for Effective Resolution Regimes.

and harmonized scheme to protect deposits by EU citizens. As part of the SRM, the Single Resolution Board (SRB) is governed by the provisions of the Bank Recovery and Resolution Directive (BRRD)²⁸ and the Single Resolution Mechanism Regulation (SRM-R)²⁹. The recent Banking Package³⁰ is designed to improve the framework for an orderly resolution of financial institutions when they fail or when there are signs of likely failure.

The shortcomings of the 2018 Banking Package include the lack of uniform implementation across EU member states and exceptions allowing member states to influence how bank failure is handled. A specific major legal loophole is the tool of “precautionary recapitalization”³¹. Recent bank failures in Italy³² illustrate that banks can still negotiate with national governments and the competent regulatory agency to avoid complete bail-in if such avoidance is of individual, political and/or national interest. As long as exceptions to the European bail-in regime are permitted, IGGs may not be sufficiently reduced or eliminated.

The purpose of this chapter is to assess how effectively the European bail-in regime eliminates or at least reduces IGGs within the European banking sector. An effective regime would

²⁸ Bank Recovery and Resolution Directive (2014/59/EU) (BRRD) was established by European Directive and therefore, due to national implementation for all SSM member states, acts as a recovery and resolution framework for EU credit institutions and investment firms. It contains requirements relating to recovery and resolution plans, early supervisory interventions and the resolution of firms, including the introduction of a bail-in tool. European Directives such as the BRRD have to be implemented nationally by each member state of the European Union and are not implemented on a harmonized basis at the same time.

²⁹ Single Resolution Mechanism (SRM) applying to banks headquartered in EU member states participating in the single supervisory mechanism (SSM). The SRM, which was established by the SRM Regulation (806/2014) (SRM-R), forms part of the European banking union.

³⁰ The Banking Package of 2018 consists of BRRD II, SRM-R II, CRR II and CRD V, and is aligned with the Basel IV implementation process.

³¹ In 2015, the EU Commission approved the precautionary recapitalization of two Greek banks: Piraeus Bank and National Bank of Greece. In July 2017, the Commission determined that Banca Monte dei Paschi di Siena met the requisite conditions for precautionary recapitalization. Most recently, in December 2019, the Commission approved the precautionary recapitalization of the Norddeutsche Landesbank.

³² The Italian bank Monte Dei Paschi di Siena was exempted from a complete bail-in. Instead, the responsible national resolution authority and the SRB jointly exempted the bank from the BRRD.

widen CDS spreads and reduce equity returns as a consequence of an increased probability of bank failure without bail-out intervention (Schäfer et al., 2014).

Empirically, we scanned press announcements by key institutions trusted with the implementation of the European bail-in regime, such as the European Commission and the Single Resolution Board, and major news outlets, such as the Financial Times, to identify an extensive list of regulatory events that are associated with the regime's implementation.³³ We then measured the market reaction of CDS spreads and equity prices for each bank around the announcement date of each regulatory event in an event-study framework. Specifically, we employed a seemingly-unrelated-regressions framework to measure changes in CDS spreads and equity prices in order to account for the interconnectedness of the European banking sector (Barth and Schnabel, 2013; Schäfer et al., 2014). Our sample period from 2009 to 2017 covers 260 banks and 34 regulatory events, which is, to our best knowledge, the most comprehensive study of IGGs in the European banking sector. We also tested for endogeneity effects and incorporated i.a. the nexus of increasing capital requirements within our multivariate analysis, which still confirms our results.

Contrary to the regime's objectives, we find that CDS spreads tightened and equity returns increased on average, suggesting higher IGG perception in the market. In aggregate, our results estimate that the regulatory events are associated with an increase in IGGs in the amount of EUR30.42 bn³⁴. This is a non-trivial figure given that Schich (2012) estimates that IGGs may be worth between EUR96 bn and EUR146 bn in the European banking sector.

³³ This includes all corresponding policy measures and legal instruments discussed and implemented parallel under the umbrella of the European bail-in regime, such as CRR, CRD, MREL, TLAC, SRF, subordination by amendment of §46f KWG and state aid modernization.

³⁴ The amount is calculated by the mean of our sample's senior long-term financial liabilities times the cumulated abnormal return for Senior CDS spreads across all regulatory event dates. For various banking groups the amount varies, e.g., it is EUR44.11bn for G-SIBs.

Our analyses show that the results partly depend on the regulatory event type. BRRD-related events had a larger impact on CDS spreads, whereas SRM-related events had a large impact on equity returns. For example, the aggregate effect of BRRD-related events on CDS spreads for senior (subordinated) debt is 11.9% (13.4%), while the analogue for SRM-related events is 5.0% (6.2%). The comparison illustrates that the implementation of the BRRD framework is to a greater extent responsible for the increased perception of IGGs among CDS investors than that of the SRM framework. In contrast, we find that BRRD-related events are associated with an increased equity return of 2.2%, which is less than half of that of SRM-related events (4.8%). It would be interesting to test for law enforcement events as well, but due to a limited number of European bail-in measures so far, there is not enough evidence to statistically test for.

The results also vary by bank type. For example, the results vary for low- vs. high-z-score banks. The CDS spreads on senior (subordinated) debt for low-z-score banks is 18.5% (10.5%) higher than that for high-z-score banks. Similarly, the regulatory events' aggregate effect on G-SIBs is much more pronounced than that on non-G-SIBs. The difference in changes in CDS spreads on senior (subordinated) debt is 17.3% (19.4%) for G-SIBs vs. non-G-SIBs, statistically significant at the 1% level. Overall, the results suggest that investors did not believe in the regime's efficacy. This appears to apply most strongly to the subsample of G-SIBs. Banks which received the strongest IGGs during the too-big-to-fail dilemma of the financial crisis appear to benefit most from an ineffectual European Commission bail-in regime.

The remainder of chapter 4 is organized as follows: Section 2 briefly describes the evolution of the European Commission bail-in regime and presents our hypotheses, section 3 discusses our dataset and methodology, section 4 presents and discusses our results, and section 5 concludes.

4.2 IGG, BAIL-IN REGULATION AND HYPOTHESES

In this section, we discuss the concept of IGGs and recap relevant literature, including IGG measurement, for our empirical framework. We then outline the development of the European bail-in regime and formulate our hypotheses regarding the impact of the regime on the value of IGGs reflected by event-based changes in CDS spreads and equity returns.

4.2.1 *Implicit Government Guarantees*

Implicit government guarantees (IGGs) are guarantees that are not yet on a bank or government balance sheet and whose value is not disclosed. IGGs are commonly considered a funding advantage to banks.³⁵ Merton and Tsesmelidakis (2013) describe this funding advantage as a belief of market participants about the future involvement of the government in the case of a bank failure. A debt secured by an issuer who is deemed less likely to default on his liabilities than under different circumstances will bear a lower risk-adjusted spread over the risk-free rate. This funding advantage can translate into tangible monetary benefits. Zhao (2014) also defines IGGs as an expectation that the government will rescue troubled financial firms even if there is no explicit, ex ante commitment to do so. Kacperczyk and Schnabl (2011) go slightly further and describe IGGs as the government's ability and willingness to bail out an institution, which is according to Brunnermeier et al. (2016) one reason why it is challenging to develop an efficient, harmonized resolution regime and break the bank-sovereign doom loop. The negative effects resulting from the IGG nexus have already been deeply discussed in chapter 2.3.

³⁵ Referring to chapter 2 and the discussed literature. Describing IGGs as a funding advantage for a bank raises the question of who benefits and who is harmed. Most scholars agree that large financial institutions declared too-big-to-fail benefit from and therefore favor this funding advantage (see also Acharya, Anginer, and Warburton, 2015).

Given these potentially detrimental impacts of IGGs on the economy, it is of great importance to quantify the impact of IGGs. Scholars have taken various approaches to quantifying the impact of IGGs in the market. Noss and Sowerbutts (2012) compare various approaches to measure the size of IGGs within the UK banking sector and explain why estimates vary. Estimates of IGGs to major UK banks vary from around £6 bn (Oxera, 2011) to over £100 bn (BoE, 2010). Recent studies on IGGs for the European Union have shown a value between €96 bn and €146 bn (Schich, 2012). Noss and Sowerbutts (2012) and Kloeck (2014) distinguish between “funding advantage” models, which measure IGGs as a reduction in the cost of bank funding, and “contingent claims” models, which measure IGGs in terms of payments made by the government in order to prevent bank failure. We presented an overview of the various methods of measuring IGGs and the corresponding papers in chapter 3. The following table summarizes the assessed theoretical approaches from chapter 2 and measurement methods from chapter 3.

Table I: Empirical Approaches to measure IGG

Funding Advantage	
<i>Rating-based</i>	Haldane (2011); Schich et al. (2012); Araten et al. (2013); Toader (2014)
<i>Bonds Credit spreads</i>	Acharya, Anginer and Warburton (2015)
<i>CDS spreads</i>	Schweikhard and Tsesmelidakis (2012); Schäfer, Schnabel and Di Mauro (2016); Zhao (2014)
Contingent Claims	
<i>Cash Equity-based</i>	Nystrom and Skoglund (2002); Noss and Sowerbutts (2012); Moenninghoff, Ongena and Wieandt (2015)
<i>Equity Options-based</i>	Oxera (2011); Kelly and Lustig (2011); Noss and Sowerbutts (2012)

Following Zhao's (2014) observation that the ratings-based approach only reflects long-term effects and the contingent-claims approach may underestimate the effects of an implicit subsidy, we have decided to take the funding advantage approach including CDS spreads and equity returns to measure IGG value, as did Zhao (2014), Schäfer, Schnabel and di Mauro (2016), and Schweikhard and Tsesmelidakis (2012). Zhao (2014) analyzes CDS contracts within the European banking sector, but with a focus on differences between the seniority of bank debt. His main assumption is that Eurozone banks benefit more from IGGs than banks outside the Eurozone. The author conducts an event study and finds that Basel III as a capital regulatory measurement produces no decrease in the volume of government guarantees made to European banks. Schäfer, Schnabel and di Mauro (2016) analyze the reactions of CDS premia and stock returns of European banks in response to bail-in actions in Denmark, Spain, Holland, Cyprus and Portugal, as well as

to the implementation of the Single Resolution Mechanism (SRM). The authors also use an event study framework. One of their conclusions is that bail-in events cause a decrease of bailout expectations in the market. Schweikhard and Tsesmelidakis (2012) focus on predicted and observed historical CDS performance in the US banking sector. Investigating the impact of government guarantees, the authors compare the price of CDS default risk with stock markets (equity-implied CDS). More recent papers by Bongini, Nieri and Pelgatti (2015) and Moenninghoff, Ongena and Wieandt (2015) analyze the effects of the designation and special regulation of global systemically important banks (G-SIBs) proposed by the Financial Stability Board. They generally find negative stock price reactions, albeit some of the events, especially the official designation of banks as G-SIBs, lead to partly offsetting positive effects.

4.2.2 *European bail-in regulation: The institutional background*

In September 2009, the G20 decided to develop resolution tools and frameworks for the effective resolution of financial groups to help mitigate the disruption of financial institution failures and reduce moral hazard in the future. The Financial Stability Board (FSB) was tasked with proposing possible measures by the end of October 2010 including more intensive supervision and specific additional capital, liquidity, and other prudential requirements. Its final recommendations include strengthening national resolution regimes, cross-border cooperation, and resolution planning, and the enhanced resolvability of G-SIBs. In October 2011, the FSB adopted the Key Attributes of Effective Resolution Regimes for Financial Institutions, which were subsequently endorsed as global standards for resolution frameworks by the G20 during their Cannes summit in November 2011.

At the peak of the Eurozone debt crisis, the link between the default risk of governments and banks became one of the major challenges in stabilizing the financial system and led to an accelerated decision to establish the European bail-in regime, the Banking Union. During the June 2012 Euro area summit³⁶, the leaders laid the foundation for what would become the Euro area banking union, envisaging common supervision and resolution powers alongside harmonization of national deposit insurance laws.

The Banking Union contains three pillars: The Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM), and a planned common and harmonized European Deposit Insurance Scheme (EDIS) to protect the deposits of European citizens. The Single Resolution Board (SRB) is part of the second pillar, the SRM, and is governed by the provisions of the Bank Recovery and Resolution Directive (BRRD)³⁷ and the Single Resolution Mechanism Regulation (SRM-R)³⁸. While the BRRD applies to all EU member states, the SRM unifies the resolution of non-viable financial institutions within the Banking Union.³⁹ To limit state aid for failing banks, the BRRD provides for a bail-in mechanism (Articles 43 ff. BRRD). Since January 1, 2016, it is mandatory to bail in shareholders and creditors for a minimum amount of 8% of total liabilities

³⁶ Euro Area Summit, Brussels (29.06.2012)

³⁷ The Bank Recovery and Resolution Directive (2014/59/EU) (BRRD) was established by European Directive and therefore, due to national implementation for all SSM member states, acts as a recovery and resolution framework for EU credit institutions and investment firms. It contains requirements relating to recovery and resolution plans, early supervisory interventions and the resolution of firms, including the introduction of a bail-in tool. European directives such as the BRRD have to be implemented nationally by each member state of the European Union and are not implemented on a harmonized basis at the same time.

³⁸ Single Resolution Mechanism (SRM) applying to banks headquartered in EU member states participating in the single supervisory mechanism (SSM). The SRM, which was established by the SRM Regulation (806/2014) (SRM-R), forms part of the European Banking Union.

³⁹ The SRM consists of a central resolution authority (the Single Resolution Board) and a Single Resolution Fund (SRF). To be used in cases of bank failure, the SRF, financed by bank contributions, will be built up over eight years (2016-2023) to an amount of 55bn EUR. By 2024, it will reach at least 1% of covered deposits. Out of 143 SRB banks (142 in June 2016), the Single Resolution Board is drafting resolution plans for 68 ‘high priority banking groups’ and transitional resolution plans for 32 ‘medium priority banking groups’ in order to prepare the setting of MREL (minimum requirement of own funds and eligible liabilities) on a case-by-case basis. See presentation by M. Grande, 3rd SRB–Banking Industry Dialogue Meeting Resolution Planning in 2016, Brussels, May 23, 2016, p. 7.

and own funds (TLOF) before the Single Resolution Fund (SRF) can be tapped into (Article 44(5) BRRD).

On November 23, 2016, as part of a ‘banking reform package’, the European Commission presented proposed amendments to the Bank Recovery and Resolution Directive (BRRD) and the Single Resolution Mechanism Regulation (SRM-R). The aim of these proposals is to incorporate international standards on loss-absorption and recapitalization into European legislation.⁴⁰ While the EU’s current resolution framework has been in place since 2014,⁴¹ recent international policy developments⁴² – specifically those aimed at large and systemically important banks – made adjustments necessary. The ‘banking reform package’ includes, among others, the BRRD II, SRM-R II, CRR II and CRD V. We discuss key identifying events for our event study framework in greater detail in Section 4.3.1.

⁴⁰ Note that in order to make the EU resolution framework more operational, the new proposal contains a moratorium tool allowing for the suspension of certain contractual obligations for a short period of time in resolution, as well as in the early intervention phase.

⁴¹ See also Deutsche Bundesbank, Europe’s new recovery and resolution regime for credit institutions, in: Monthly Report, Frankfurt a. M., 2014, June, pp. 31-55 and for a more detailed account A. Kern, European Banking Union: A Legal and Institutional Analysis of the Single Supervisory Mechanism and the Single Resolution Mechanism, in: European Law Review, Issue 2, 2015, pp. 154-187

⁴² See also Carney, M., Ten years on: fixing the fault lines of the global financial crisis, Banque de France, Financial Stability Review, No 21, April 2017, pp. 13- 20.

4.2.3 *Empirical predictions*

Our overarching hypothesis is that the European bail-in regime lowered IGGs due to its detrimental effect on bail-out expectations in the market. Specifically, we expect a rise in CDS spreads and a decrease in equity returns. The European bail-in regime should have a direct impact on CDS spreads because a lower bailout probability raises the probability of default. Stock prices are affected indirectly since lower bailout expectations increase banks' costs of financing and thereby reduce profits.

Because banks have other margins of adjustment affecting stock returns, such as increasing the loan rate, we expect the European bail-in regime's effect on stock returns to be less pronounced relative to that on CDS spreads.⁴³ Similarly, among CDS contracts, we expect a stronger effect for the senior unsecured segment vis-à-vis the subordinated segment. This follows from the fact that senior unsecured bonds are relevant for a bail-in for the first time under the new European bail-in regime because they must be subordinated structurally, contractually or by law.^{44,45}

We also expect heterogenous effects of the European bail-in regime on different entity types. The effect should be most pronounced for systemically important institutions because they benefited the most from IGGs prior to the European Bail-in regime (Ueda and di Mauro, 2010, 2013). In particular, we expect stronger effects (plausibly in decreasing order) for G-SIBs versus

⁴³ Schäfer et al. (2015) also consider regulatory events that directly affect banks' profitability, which is then reflected in a decrease in stock returns.

⁴⁴ A massive share of the former senior unsecured layer is become to be subordinated under the new bail-in regime in order to ensure no-creditor-worse-off during a bail-in scenario. Certain characteristics (i.e., non-structured) of the former senior unsecured layer have to be met to be subordinated. The subordination has to be implemented on a national basis by enforcing the BRRD. Germany, for example, amended §46f KWG to ensure subordination by law. A grandfathering of former unsecured debt was granted by the competent regulator and ensured a transitional period for outstanding senior unsecured bonds, which were bail-in-able as well.

⁴⁵ More precisely, the BRRD lays out the legal foundation for the subordination of certain senior unsecured bonds. Historically, European governments have bailed out investors in banks' senior debt but not subordinated debt (see Moody's, 2009). Holders of unsecured bank debt other than subordinated bonds have typically been exempted from loss-sharing (Schich and Kim, 2012).

non-G-SIBs, EU versus non-EU banks, and SSM versus non-SSM banks. After the global financial crisis, especially G-SIB banks benefitted from IGGs by having tighter CDS spreads and higher equity returns than they would have under a non-IGG scenario which an effective new European bail-in regime would have counteracted. EU banks should be more affected because the BRRD directly establishes the legal framework for all EU countries. Nevertheless, non-EU banks may be affected due to regulatory spill-over effects and feed-back loops within the global network of financial institutions (Acharya et al., 2015). Similar arguments apply for why SSM banks should be more affected than non-SSM banks.

Additionally, we expect a stronger effect for low versus high z-score banks. This is because an Altman's (1986) z-score below 3 is considered as an indicator for a financial institution not being safe from bankruptcy (and a z-score below 1.81 indicates that a business is at considerable risk of going into bankruptcy). We expect a stronger effect on banks with a relatively low z-score due to the higher probability that the new bail-in rules will apply to them sooner than to banks with a relatively high z-score.

Table II⁴⁶ summarizes our empirical predictions.

Table II: Expected Effects on Bank CDS Spreads and Stock Returns

	<i>Expected effect on CDS spreads</i>					<i>Expected effect on stock returns</i>			
	<i>Senior CDS</i>	<i>G-SIB</i>	<i>EU</i>	<i>SSM</i>	<i>Low z-score</i>	<i>G-SIB</i>	<i>EU</i>	<i>SSM</i>	<i>Low z-score</i>
<i>All events</i>	[↑]	[↑]	[↑]	[↑]	[↑]	[↓]	[↓]	[↓]	[↓]
	<i>Expected stronger reactions against each counter group: CDS spreads</i>					<i>Expected stronger reactions against each counter group: stock returns</i>			
	<i>Senior CDS</i>	<i>G-SIB</i>	<i>EU</i>	<i>SSM</i>	<i>Low z-score</i>	<i>G-SIB</i>	<i>EU</i>	<i>SSM</i>	<i>Low z-score</i>
<i>BRRD</i>	X	X	X		X	X	X		X
<i>SRM</i>	X	X		X	X	X		X	X
<i>Other</i>		X			X	X			X

Description: This table presents the expected effects for various event types (all events, BRRD events, SRM events, other events) on CDS spreads and stock returns, assuming that regulators implemented the European Bail-in regime efficiently and in line with the regulations' stated objectives. Overall, we assume that the implementations events would have a diminishing effect on Implicit Government Guarantees (IGGs), which should be reflected in an increase in CDS spreads and a decrease in stock returns. BRRD-related event dates directly affect EU member states. SRM-R-related event dates directly affect SSM (EMU) member states.

4.3 DATA AND EMPIRICAL METHODOLOGY

This section outlines our empirical methodology to estimate the effects of regulatory events on CDS and stock market prices. We start by describing the procedure of identifying events, then we explain our data sample and present our empirical methodology, followed by testing and robustness check procedures.

⁴⁶ Expected effects on bank CDS spreads and stock returns with strict focus on regulator's objectives.

4.3.1 *Identification and classification of events*

We trace the implementation of the European bail-in regime starting with the first G20 meeting in Pittsburgh after the global financial crisis in 2009, continuing with the official statement by the European Commission on the full operationality of the SRM and implementation of the BRRD in 2015 (European Commission, 2015), and extending to the discussion of amendments to the BRRD in the risk reduction package in 2016 (European Commission, 2016). Table 3 shows all incorporated event dates for our analysis including short description and classification for each subgroup of events.

Overall, we identify 34 key events that are related to the bail-in regime's implementation process, including 8 events directly associated with the BRRD and 7 events associated with the SRM framework. The remaining 17 events are also related to the implementation of the European bail-in regime but are not directly linked to official BRRD or SRM announcements, e.g., G20 Meetings or EU Commission communications on the overall bail-in framework. The publications, announcements and websites of the European Commission (EU COM), European Parliament (EP), European Council (EC), European Central Bank (ECB), European Banking Authority (EBA), Financial Stability Board (FSB) and Deutsche Bundesbank, as well as the G20, serve as the major sources for explaining the implementation of regulatory bail-in measures within the EU and identifying significant event dates. We chose the first public date of disclosure for each event if it was during working hours on a workday, or the first workday after the disclosure date if it was a weekend or holiday. This aligns the event date with the date the markets opened the first time after the official announcement.

Table III: Sample Distribution by Events

No.	Event Description	Event Date	Source	<i>BRRD</i>	<i>SRM</i>	<i>Other</i>
1	EC issued a communication to EU Parliament setting out An EU Framework for Cross-Border Crisis Management in the Banking Sector	10/20/2009	EC (2010)			x
2	European Parliament adopted motion for a EU Framework for Crisis Management in the Financial Sector by vote	7/7/2010	EU Parliament (2010)			x
3	“Deauville Summit” - German-Franco Decision on creditors bail-in for the future within the European Union	10/18/2010	EU (2010)			x
4	EC consulted on technical details of a possible European crisis management framework.	3/3/2011	EC (2011)			x
5	Meeting of Insolvency Law Group of Experts (ILEG) on EU insolvency hierarchy harmonization	4/11/2011	EC (2011)			x
6	FSB publishes Key Attributes of Effective Resolution Regimes for Financial Institutions	10/3/2011	FSB (2011)			x
7	Endorsement of FSB ‘Key Attributes’ at the Cannes Summit in November 2011 as “a new international standards for resolution regimes”.	11/4/2011	G20 (2011)			x
8	EC publishes Bank recovery & resolution proposal	6/6/2012	EC (2012)	x		
9	EC published Liikanen Report: “In the future, bail-in should be the rule, and bail-out the rare exception”.	10/2/2012	EC (2012)			x
10	EU Economic and Monetary Affairs Commissioner Olli Rehn said direct ESM bank aid is key to breaking the bank-sovereign link.	5/7/2013	EU (2013)			x
11	EU finance ministers reach agreement on the Bank Recovery and Resolution Directive	6/27/2013	EU (2013)	x		
12	EC released proposal for a euro-area Single Resolution Mechanism, including 55 billion-euro common fund.	7/10/2013	EU (2013)		x	
13	EC application of State aid rules in the context of the financial crisis as from 1 August 2013 ('Banking Communication') - EU State Aid Regulation.	7/30/2013	EC (2013)			x
14	EU’s Barnier said there is no alternative to a single system for handling failing banks. “There is no plan B.”	8/29/2013	EU (2013)			x
15	EU made clear state-aid rules requiring creditor losses will apply to banks that get money from Single Resolution Mechanism.	10/16/2013	EU (2013)		x	
16	Trilogue agreement on the EU framework for bank recovery and resolution	12/12/2013	EC (2013)	x		
17	Council agreed general approach on Single Resolution Mechanism.	12/19/2013	EU Council (2013)		x	
18	The European Parliament and the Council reached a provisional agreement on the proposed Single Resolution Mechanism for the Banking Union	3/20/2014	EC (2014)			x

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19	The European Parliament adopted the Single Resolution Mechanism (SRM) proposed by the Commission in July 2013.	4/15/2014	EU Parliament (2014)	x	
20	26 Member States have signed the intergovernmental Agreement on the transfer and mutualization of contributions to the Single Resolution Fund (SRF).	5/21/2014	EU (2014)		x
21	European Parliament published consultation paper to define a framework for BRRD.	6/12/2014	EU Parliament (2014)	x	
22	EC fully signed off on Single Resolution Mechanism.	7/14/2014	EU (2014)		x
23	Regulation (EU) No 806/2014 establishing SRM enters into force	8/18/2014	EC (2014)		x
24	EBA consults on treatment of liabilities in bail-in	10/1/2014	EBA (2014)		x
25	FSB consults on proposal for a common international standard on Total Loss-Absorbing Capacity (TLAC) for global systemic banks	11/10/2014	FSB (2014)		x
26	EBA published a consultation paper on criteria for determining MREL.	11/28/2014	EBA (2015)		x
27	BRRD comes into force, except for bail-in rules on creditor write-downs that take effect one year later.	1/2/15	EC (2015)	x	
28	EBA publishes Draft Technical Standards on criteria for MREL	1/19/2015	EBA (2015)		x
29	EBA publishes final technical standards on MREL to ensure effective resolution under the BRRD and the contractual recognition of bail-in.	7/3/2015	EBA (2015)		x
30	FSB issues final Total Loss-Absorbing Capacity standard for global systemically important banks	11/9/2015	FSB (2015)		x
31	SRM becomes fully operational, implementing EU-wide Bank Recovery and Resolution Directive (BRRD) in the euro area.	12/31/2015	EC (2015)	x	
32	EU Commission presents risk reduction package. Amendments i.a. on BRRD Framework.	11/23/2016	EC (2016)		x
33	EBA provides Guidance on bail-in under the BRRD	4/5/2017	EBA (2017)	x	
34	On 25 April 2017, ECON committee held a Public Hearing on updating BRRD and SRM.	4/25/2017	EU Parliament (2017)	x	

Description: This table presents all relevant events associated with the implementation of the European Bail-in regime. These events were identified manually by checking press announcements by European institutions, national regulators, and major news outlets, as described in the main text. The event date is the announcement date when the announcement happened on a non-trading day or the first trading day after a non-trading day. We are unable to obtain enough data for our main variables for only two events dates (G20 Meeting in Pittsburgh, 25.09.09 and G20 Meeting in Korea, 07.06.10) and therefore omit those two events from our empirical analyses.

4.3.2 *Data sample*

Our main sample consists of two panels. The first includes daily market prices for European bank CDS spreads with senior and subordinated debt. The second includes European bank stock returns.

We focused on daily market prices for a time period from July 2009 until July 2017 to cover the

core implementation period of the European bail-in regime⁴⁷ and major post-crisis bail-in/bailout events when the global financial crisis peaked, and initial government reactions were observed.

The daily CDS spreads were retrieved from IHS Markit, which is the global leading supplier of CDS data. We collected all European banks' data points for each entity on a daily basis, including senior and sub-seniority bonds with maturities of 1y, 3y, 5y, 7y, 10y⁴⁸ and bid-, ask-, and mid-quotes.⁴⁹ In order to ensure comparability of all retrieved CDS spreads, we made sure contract specifics were aligned (e.g., currency, actively traded, restructuring clause and payment frequency). Our cross-sectional analysis only includes CDS spreads in the same tier with the same initial maturities and at mid-quotations. In our results section, we present the results for each bank aggregated and in subgroups.

We investigated data points for all European banks that were single listed, actively, continuously traded and denominated in an aligned currency traded on their home exchange. We divided the main sample into six subsamples in order to observe subsample-specific differences. We first distinguished between senior and subordinated CDS spreads for each bank where data was available. Insolvency layers in CDS contracts is highly relevant in the European bail-in regime, where plain-vanilla senior-unsecured bonds were subordinated and ranked *pari passu* with other subordinated liabilities.⁵⁰

⁴⁷ After our focal timeframe, discussions about the European bail-in regime, including BRRD, SRM-R and CRR/CRD, have continued at the European Commission level. Nevertheless, the core of the European bail-in regime in the European Union was implemented completely within our focused time period.

⁴⁸ Regulatory events may be priced long-term while market-induced events might be priced short-term. See also Lasfer, Melnik and Thomas (2003).

⁴⁹ Since CDS prices with a wide bid-ask spread would induce less liquidity in a CDS contract and could distort results, we also check for liquidity influences in our robustness check.

⁵⁰ See also the Hypothesis Section, where we assume that senior CDS should react at least the same as subordinated CDS in terms of the European bail-in regime. Under normal market conditions and assuming a perfect world without

For the whole sample, we created the following subsamples: (i) G-SIB Banks vs. non-G-SIB Banks, (ii) EU Banks vs. non-EU Banks, (iii) SSM Banks vs. non-SSM Banks and (iv) low z-score Banks vs. high z-score Banks (high/low cutoff).⁵¹ We tested for differences within each of those subsamples, as shown in Table IV.

Table IV: Summary Statistics by Bank Designations

<i>Bank sample</i>	<i>CDS spreads</i>			<i>Stock returns</i>		
	<i>Obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>
<i>G-SIB</i>	818	-0.073%	1.741%	325	-0.081%	1.064%
<i>EU</i>	3,928	-0.005%	2.841%	2,289	-0.082%	1.196%
<i>SSM</i>	2,890	0.016%	2.738%	1,793	-0.098%	1.256%
<i>Low z-score</i>	671	0.084%	1.496%	488	-0.161%	1.770%
<i>Whole sample</i>	<i>4,059</i>	<i>0.004%</i>	<i>2.834%</i>	<i>2,666</i>	<i>-0.071%</i>	<i>1.083%</i>

Description: This table shows summary statistics by each bank's subsample. Obs. refer to bank-/event observations for Senior and Subordinated CDS spreads as well as Stock returns. Classifications are set each year according to official designations by Financial Stability Board (FSB) and European Central Bank (ECB).

Following the lead of Galil, Shapir, Amiram, and Ben-Zion (2013), who conclude that market variables have explanatory power after controlling for firm-specific variables, we also

a bail-in regime that subordinated certain senior-unsecured liabilities, we would assume that sub CDS react more sensitively to market movements accompanying wider spreads than senior CDS.

⁵¹ For each subsample and bank, we looked at the single event date and identified whether a bank is at that point in time declared as (i) G-SIB according to FSB's annual published list of Global Systemically Important Banks, (ii) a bank whose belonging sovereign is an EU member state, (iii) an SSM declared bank according to the annual published SSM list and (iv) a bank with a low defined z-score according to our own calculations based on Thomson Reuters Data for the annual z-score.

retrieved data for control variables in order to check for external effects on our results, including potential endogeneity concerns resulting from omitted variables. Our level of control variable testing exceeds that of most prior work and includes for each event and each bank total assets size, long-term financial liabilities, EBIT, Altman z-score, governmental ownership, total capital ratio, volatility index (VIX), EuroStoxx50 index and the relevant sovereign CDS spreads for each event and each bank, as summarized in Table V. These are the most commonly used determinants in controlling for market events (see also Samaniego-Medina et al., 2016).

Table V: Summary Statistics for Control Variables

	<i>Sub Samples</i>					
	Senior CDS		Sub CDS		Stock returns	
	Mean [Median]	<i>Std. Dev.</i>	Mean [Median]	<i>Std. Dev.</i>	Mean [Median]	<i>Std. Dev.</i>
<i>Total Assets (000€)</i>	1,029,000 [543.000]	<i>1,583,000</i>	902,000 [592.000]	<i>944,000</i>	500,000 [104.000]	<i>913,000</i>
<i>LT Fin. Liabilities (000€)</i>	154,000 [54.000]	<i>250,000</i>	156,000 [55.000]	<i>254,000</i>	78,000 [11.000]	<i>19,000</i>
<i>EBIT (000€)</i>	11,000 [3.000]	<i>25,000</i>	9,000 [3.000]	<i>12,000</i>	5,000 [1.000]	<i>11,000</i>
<i>AZS</i>	0.141 [0,1352536]	<i>0.110</i>	0.135 [0,130513]	<i>0.105</i>	0.208 [0,1710318]	<i>0.159</i>
<i>State Ownership</i>	4.93% [1,24%]	<i>12.96%</i>	4.99% [1,27%]	<i>12.74%</i>	4.39% [0,9024%]	<i>12.90%</i>
<i>Total Capital Ratio</i>	13.18% [12,2%]	<i>3.39%</i>	13.11% [12,2%]	<i>3.37%</i>	13.87% [12,6%]	<i>4.66%</i>
<i>VIX Index</i>	16.59 [15,66]	<i>5.35</i>	16.63 [15,71]	<i>5.33</i>	16.37 [15,54]	<i>5.01</i>
<i>SX5E Index</i>	2,912.99 [2928,12]	<i>370.74</i>	2,909.99 [2928,12]	<i>371.34</i>	2,919.85 [2990,76]	<i>348.07</i>
<i>Sovereign CDS</i>	125.02 [69,68]	<i>147.84</i>	115.99 [66,833]	<i>130.88</i>	133.39 [77,139]	<i>146.27</i>
<i>Obs. total</i>	2180		2005		3210	
<i>Obs. per event date</i>	64		59		94	

Description: This table shows sample distribution by control variables for our event study framework classified by Senior CDS spreads, Subordinated CDS spreads and Stock returns within a 3-day event window.

4.3.3 *Seemingly Unrelated Regressions (SUR) to estimate abnormal returns*

The overall goal of our empirical analysis is to check for abnormal returns on CDS spreads as well as stocks associated with each regulatory announcement. Following Schäfer et al. (2016), we used a Seemingly Unrelated Regressions (SUR) framework. The rationale behind the SUR framework is that it econometrically accounts for the interconnectedness in security prices of European banks. As in Schäfer et al. (2016), our event study is designed to isolate the effect of the regulatory events on bank CDS spreads and equity returns from other general market movements. The abnormal return of bank i for event date τ is defined as the difference of the realized return and the expected return given the absence of the event:

$$AR_{i,\tau} = R_{i,\tau} - E[R_{i,\tau}] \quad (1)$$

The expected return (henceforth referred to as normal return) is unconditional on the event, but conditional on a separate information set. As the number of banks is large and their underlying benchmark indices vary hugely, we decided to model the normal return on the basis of the constant mean return model where M_i is the number of non-missing returns over the estimation window:

$$E[R_{i,\tau}] = \frac{1}{M_i} \sum_{i=T_0+1}^{T_1} R_{i,\tau} \quad (2)$$

We modeled an estimation window of 140 trading days for both CDS spreads as well as equity returns⁵². If there were data points missing for some trading days within an estimation window (e.g., due to country-specific holidays), we adjusted the estimation window in order to get exactly the same number of trading days before the event window for all events. Even though the constant mean return model is simple and more restrictive compared to other models, Brown and Warner

⁵² We also tested for a tighter event window of 80 trading days to check our results from the regression analysis.

(1985) show that results based on this model do not systematically deviate from results based on more sophisticated models.⁵³ In the empirical model equations, the CDS spreads and equity returns are a regression with bank equity returns as a constant and in which the return of the market index and the dummy variables are set to one at the event dates and set to zero otherwise. The left-hand side variable is the daily spread of CDS aligned with the daily return of the stock of bank j at time t , $j = 1; \dots; J$; $t = 1; \dots; T$. The return of the market portfolio is estimated by our modeled constant mean return model:

$$\begin{aligned} \Delta CDS_{1t} &= \mu_1 + \sum_{n=T-1}^{T+1} \tau_{1n} D_{1nt} + \varepsilon_{1t} \\ &\dots \\ \Delta CDS_{jt} &= \mu_j + \sum_{n=T-1}^{T+1} \tau_{jn} D_{jnt} + \varepsilon_{jt} \\ &\dots \\ \Delta CDS_{jt} &= \mu_j + \sum_{n=T-1}^{T+1} \tau_{jn} D_{jnt} + \varepsilon_{jt} \end{aligned} \tag{3}$$

We defined our event window very tightly in order to avoid the overlapping effects of market events other than our targeted events. Therefore, we modeled a 3-day event window which equals event date T , the day before $T-1$ and the day after $T+1$. This approach is used widely to focus directly on market effects with regulatory announcements (see also Schäfer, Schnabel, di Mauro,

⁵³ Nevertheless, as discussed above, we also used benchmark indices as control variables in our multivariate regression analyses in order to avoid contamination of effects and to check the robustness of our results.

2016).⁵⁴ To measure aggregated abnormal returns within those event windows for each event and each bank we used the cumulative abnormal return measure:

$$CAR_{i(\tau_1, \tau_2)} = \sum_{t=\tau_1}^{T_2} AR_{i,t} \quad (4)$$

4.4 EMPIRICAL RESULTS

4.4.1 *Initial evidence: Overall market pattern over sample period*

We begin by analyzing the long-term performance of each bank subgroup's CDS spreads and equity returns over the implementation process of the European bail-in regulation between September 25, 2009 (first G20 meeting dedicated to a global resolution framework forming the cornerstones of the European regime) and November 23, 2016 (presentation of EU Commission's risk reduction package with updates to the BRRD, SRM-R, and CRD/CRR. Trilogue⁵⁵ discussions at the European level, including the final outcome of the package, are not reflected in our event study because they have not yet been fully legally implemented and may still be further amended. Over this timeframe, the 5-year senior CDS spreads across the whole bank sample widened by a total of 79.98%, while the 5-year subordinated CDS spread widened by 113.36%. In the G-SIB subsample, the 5-year senior CDS spread widened by 47.34%, and the 5-year subordinated CDS spread widened by 62.51%, which shows that the CDS spread widened less among G-SIBs than across the whole bank sample. Within the same time period, the non-G-SIB subsample shows a

⁵⁴ In addition, we also tested for a 5-day event window, including event date T-2, T-1, T, T+1 and T+2, and find that the results are qualitatively the same.

⁵⁵ Trilogue discussions among the European Parliament, the European Council and the European Commission on a harmonized agreement of the proposed risk reduction package, also known as the banking package.

widening in CDS spreads within the 5-year senior layer of 92.54%, while the subordinated CDS contract widened by 135.92%.⁵⁶ The control variable EuroStoxx Banks 50 Index, which represents the banks' sample equity performance, exhibited a strong decrease in performance over the whole time period of -57.13%. As discussed in our hypothesis section, we generally associate a widening of CDS spreads and a decline in equity returns with a potential decrease of bailout-expectations. This could be evidence that IGGs have weakened.

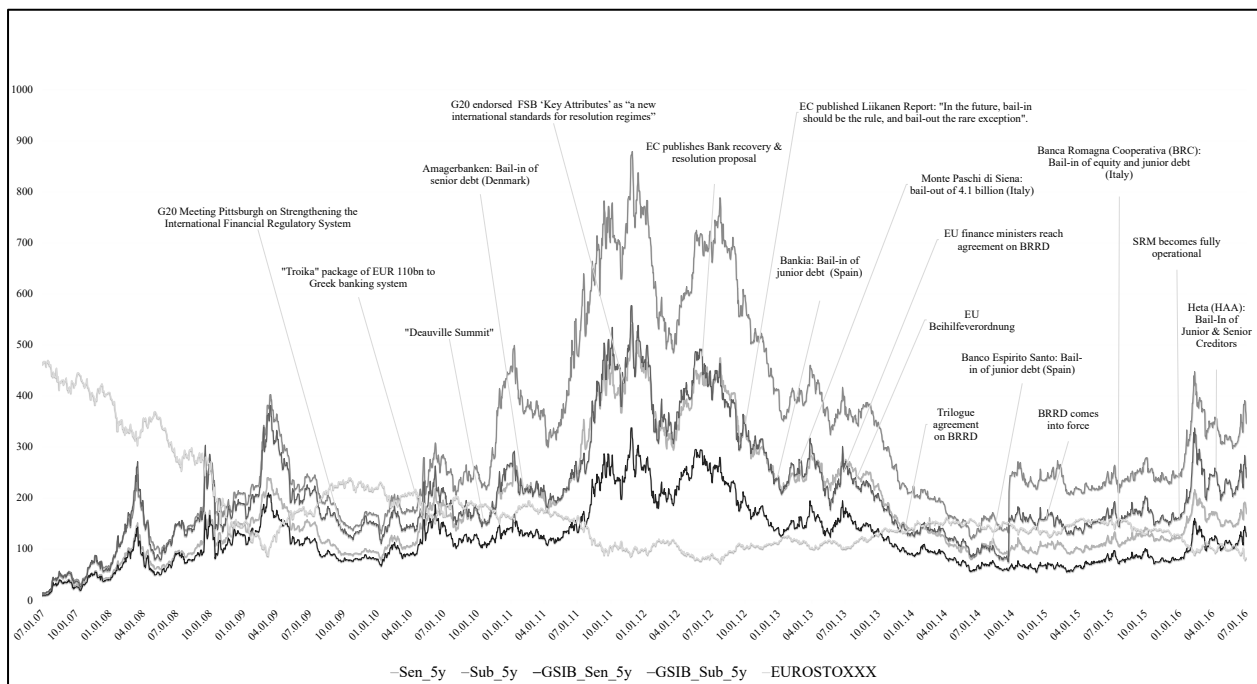


Figure 3: CDS spreads and stock returns performance over time series.

⁵⁶ See detailed performance of CDS spreads and equity returns over time in Figure 3.

However, during this time period, banking market patterns changed considerably. For example, total capital ratios increased from 7.5% in 2009 to 18.2% of RWA in 2016, while the interest rate environment turned negative and net interest margins (NIM) for banks decreased as well. These factors might also cause widened CDS spreads and decreased equity returns. To that end, to measure the efficiency of the European bail-in regime in terms of diminishing bailout expectations in the market within this shifting banking environment, our multivariate event study focuses on measurable changes following specific regulatory events.

4.4.2 *Baseline results*

4.4.2.1 Abnormal returns by regulatory events: aggregate evidence

Our baseline results from the SUR estimates show certain divergences from the overall market pattern. In connection with certain regulatory events stemming from the European Bail-in regime, we observe an overall tightening in CDS spreads and an increase in equity returns, which may be initial indicators of the inefficiency of the regime. Table VI summarizes the aggregated cumulative abnormal returns across all observed event dates for CDS spreads and stock returns of all banks, as well as aggregated results for BRRD-related, SRM-related and other events.

Table VI: Abnormal Returns by Event Types

		<i>Senior CDS spreads</i>	<i>Subordinated CDS spreads</i>	Stock returns	<i>Senior vs. Sub CDS</i>
All events (N=34)	Cumulated	-19.75%***	-17.49%***	2.36%*	-2.25%
	Mean	[-0.58%**]	[-0.51%***]	[0.07%]	[-0.07%]
<i>BRRD-related events (N=8)</i>	Cumulated	-11.90%***	-13.39%***	2.21%***	1.49%
	Mean	[-1.49%***]	[-1.67%***]	[0.28%**]	[1.86%]
<i>SRM-related events (N=7)</i>	Cumulated	-5.00%***	-6.20%***	4.83%***	1.21%
	Mean	[-0.72%***]	[-0.89%**]	[0.69%]	[0.17%]
<i>Other events (N=19)</i>	Cumulated	-2.85%	2.10%	-4.68%***	-4.95%
	Mean	[-0.15%]	[0.11%]	[-0.25%**]	[-0.26%]

Description: This table shows the cumulative and average abnormal returns for our dependent variables for various event types. These estimates are based on 260 bank entities, for which enough data are available. Annex I presents an overview of these entities. *** = significant at 1%, ** = significant at 5%, * = significant at 10%.

Overall, our results are highly significant. Across all observed events, CDS spreads tightened significantly. Specifically, cumulative senior CDS spreads tightened by 19.75% in aggregate, or on average by 0.58% per event date. Similarly, cumulative subordinated CDS spreads tightened by 17.49% over all events, corresponding to an average tightening of 0.51% per event date. These highly significant results are evidence of contrary development associated with the European bail-in regime, during which time equity returns increased by 2.36% across all events and all banks.

The fact that certain regulatory events are associated with abnormal returns in a direction that contradicts overall market development appears to imply that market participants do not trust the adoption and executability of the framework. Theoretically, efficient implementation of the regime should have widened CDS spreads and decreased equity returns as the result of decreased

IGGs and higher regulatory cost. However, our analysis indicates that the opposite is true, which underscores the findings in Schäfer, Schnabel and Di Mauro (2014), suggesting that market participants may view the regime as containing considerable loopholes.

Theoretically, European bail-in implementation should also have caused stronger market reactions for senior CDS spreads than for subordinated CDS spreads because the new bail-in tool makes senior unsecured bonds bail-in-able as well. Our analysis of differences between mean senior vs. mean subordinated CDS spreads across all events and for all banks indicates stronger tightening for senior CDS spreads than for subordinated CDS spreads. While the stronger reaction confirms our expectations, the direction of the tightening is opposite. A stronger tightening of senior CDS suggests that the regime may lack credibility among market participants. If IGGs had decreased due to an efficient bail-in regime, we would have seen a stronger widening in senior CDS spreads than in subordinated CDS spreads. Although a cumulative mean difference of -2.25% between senior CDS spreads and subordinated CDS spreads is relatively high, it does not reach the level of statistical significance.

A separate analysis of BRRD- and SRM-related event date subsamples shows the same result pattern as for all event dates, which confirms our initial expectations. We identified eight BRRD-related events with a cumulative abnormal return among senior CDS spreads of -11.90%, that is, on average -1.49% per event date. The cumulative subordinated CDS spread tightened highly significantly by 13.39%, corresponding on average to 1.67% per event date. The direction of both levels is the same as for all events, but the levels are lower, which may be attributable to the lower number of event dates. Cumulative stock returns within BRRD-related events increased by 2.21%, on average by 0.28% per event date. Across the seven identified SRM-related events, we observe a cumulative tightening of 5.00% of the senior CDS spreads across all banks, on

average 0.72% per event date. The cumulative subordinated CDS spread tightened by 6.20%, on average by 0.89% per event date. Stock returns show the highest increase of 4.83% (0.69% on average) compared to all event subsamples. All results are highly significant, far surpassing the 1% significance level.

For the “other events” associated with bail-in regime announcements but not directly linked to BRRD or SRM, we find heterogenous results with no significant effects on CDS spreads. This illustrates the appropriateness of grouping our data sample into BRRD and SRM for our analysis. To better understand what made the results across our BRRD and SRM event subsamples different from some of the “other events”, we calculated the cumulated abnormal returns for senior CDS spreads, subordinated CDS spreads and stock returns for all individual event dates (see Table VII).

Table VII: Abnormal Returns by Events

Event Description	Event Date	Senior CDS spreads	Sub CDS spreads	Stock returns
Panel A: BRRD related event dates				
EC publishes Bank recovery & resolution proposal	6/6/2012	-3.27%* [5.35%]	-5.05%** [0.00%]	4.98%*** [0.00%]
EU finance ministers reach agreement on the Bank Recovery and Resolution Directive	6/27/2013	-3.19%*** [0.00%]	- 3.64%*** [0.06%]	0.38% [73.01%]
Trilogue agreement on the EU framework for bank recovery and resolution	12/12/2013	0.31%* [8.86%]	0.21% [26.70%]	- 1.48%*** [0.05%]
European Parliament published consultation paper to define a framework for BRRD.	6/12/2014	0.32% [17.51%]	0.05% [50.53%]	- 2.48%*** [0.00%]
BRRD comes into force, except for bail-in rules on creditor write-downs that take effect one year later.	1/2/2015	1.62%* [7.01%]	1.60%** [0.81%]	-1.84%** [2.01%]
SRM becomes fully operational, implementing EU-wide Bank Recovery and Resolution Directive (BRRD) in the euro area.	12/31/2015	2.18%*** [0.01%]	2.20%** [2.78%]	-0.85% [13.83%]
EBA provides Guidance on bail-in under the BRRD	4/5/2017	-0.64%*** [0.00%]	0.71% [62.55%]	-0.31%* [7.85%]
On 25 April 2017, ECON committee held a Public Hearing on updating BRRD and SRM.	4/25/2017	-9.24%*** [0.00%]	-9.47%** [0.00%]	3.80%*** [0.00%]

Panel B: SRM related event dates

EC released proposal for a euro-area Single Resolution Mechanism, including 55 billion-euro common fund.	7/10/2013	-1.48%*** [0.24%]	-1.82%*** [0.01%]	0.42% [79.84%]
EU made clear state-aid rules requiring creditor losses will apply to banks that get money from Single Resolution Mechanism.	10/16/2013	-2.12%*** [0.03%]	-3.46%*** [0.00%]	1.76%** [3.94%]
Council agreed general approach on Single Resolution Mechanism.	12/19/2013	-1.89%*** [0.15%]	-2.42%*** [0.00%]	1.82%*** [0.06%]
The European Parliament adopted the Single Resolution Mechanism (SRM) proposed by the Commission in July 2013.	4/15/2014	-0.40% [82.40%]	-1.18% [52.60%]	-1.02%** [1.42%]
26 Member States have signed the intergovernmental Agreement on the transfer and mutualisation of contributions to the Single Resolution Fund (SRF).	5/21/2014	1.61%*** [0.06%]	1.35%*** [0.21%]	1.07% [16.03%]
EC fully signed off on Single Resolution Mechanism.	7/14/2014	0.54% [49.38%]	2.53%*** [0.42%]	0.01% [78.44%]
Regulation (EU) No 806/2014 establishing SRM enters into force	8/18/2014	-1.26% [10.09%]	-1.20% [14.64%]	0.78% [12.15%]

Panel C: Other event dates

EC issued a communication to EU Parliament setting out An EU Framework for Cross-Border Crisis Management in the Banking Sector	10/20/2009	-3.35% [40.36%]	-0.64% [77.31%]	-0.64%*** [0.71%]
European Parliament adopted motion for a EU Framework for Crisis Management in the Financial Sector by vote	7/7/2010	-5.69%*** [0.00%]	-5.79%*** [0.00%]	5.89%*** [0.00%]
“Deauville Summit” - German-Franco Decision on creditors bail-in for the future within the European Union	10/18/2010	0.80% [65.69%]	1.74%*** [0.49%]	0.61%* [6.09%]
EC consulted on technical details of a possible European crisis management framework.	3/3/2011	-0.08% [75.24%]	0.35% [67.95%]	-1.10%*** [0.06%]
Meeting of Insolvency Law Group of Experts (ILEG) on EU insolvency hierarchy harmonisation	4/11/2011	-0.35% [45.11%]	-0.41% [59.22%]	-0.45% [26.88%]
FSB publishes Key Attributes of Effective Resolution Regimes for Financial Institutions	10/3/2011	6.41%*** [0.00%]	7.06%*** [0.00%]	-5.63%*** [0.00%]
Endorsement of FSB ‘Key Attributes’ at the Cannes Summit in November 2011 as “a new international standards for resolution regimes”.	11/4/2011	-0.51%** [2.10%]	-0.09% [24.85%]	1.30% [10.20%]
EC published Liikanen Report: “In the future, bail-in should be the rule, and bail-out the rare exception”.	10/2/2012	-2.10%** [3.83%]	-2.58%*** [0.07%]	1.48%*** [0.14%]
EU Economic and Monetary Affairs Commissioner Olli Rehn said direct ESM bank aid is key to breaking the bank-sovereign link.	5/7/2013	0.61%*** [0.01%]	-0.58% [39.04%]	0.57% [54.58%]
EC application of State aid rules in the context of the financial crisis as from 1 August 2013 ('Banking Communication') - EU State Aid Regulation.	7/30/2013	-1.47%*** [0.25%]	-1.06%** [1.08%]	-0.63% [22.82%]
EU’s Barnier said there is no alternative to a single system for handling failing banks. “There is no plan B.”	8/29/2013	-0.84%** [4.75%]	-0.11% [88.99%]	0.21% [77.09%]
The European Parliament and the Council reached a provisional agreement on the proposed Single Resolution Mechanism for the Banking Union	3/20/2014	0.83% [58.13%]	1.54%*** [0.20%]	-0.65%* [7.18%]

EBA consults on treatment of liabilities in bail-in	10/1/2014	-1.26% [15.09%]	-0.66% [91.23%]	-1.27%*** [0.08%]
FSB consults on proposal for a common international standard on Total Loss-Absorbing Capacity (TLAC) for global systemic banks	11/10/2014	-2.03%*** [0.87%]	-1.22% [13.26%]	-1.39%*** [0.23%]
EBA published a consultation paper on criteria for determining MREL.	11/28/2014	-1.50%** [1.35%]	-2.20%*** [0.06%]	-0.89%** [1.46%]
EBA publishes Draft Technical Standards on criteria for MREL	1/19/2015	0.33% [64.31%]	-0.86% [27.74%]	1.82%*** [0.72%]
EBA publishes final technical standards on MREL to ensure effective resolution under the BRRD and the contractual recognition of bail-in.	7/3/2015	5.37%*** [0.05%]	5.19%*** [0.00%]	-4.12%*** [0.00%]
FSB issues final Total Loss-Absorbing Capacity standard for global systemically important banks	11/9/2015	2.20%*** [0.10%]	2.82%*** [0.63%]	0.17% [67.36%]
EU Commission presents risk reduction package. Amendments i.a. on BRRD Framework.	11/23/2016	-0.20% [31.32%]	-0.40% [85.78%]	0.06% [77.82%]

Description: This table presents abnormal returns for our dependent variables for all 34 events individually. The p-value is shown in brackets below each abnormal return estimate. These estimates are based on 260 bank entities, for which enough data are available. Annex I presents an overview of these entities. *** = significant at 1%, ** = significant at 5%, * = significant at 10%.

4.4.2.2 Abnormal returns by regulatory events: anecdotal evidence

By identifying highly significant single event dates, we seek insights into why the BRRD and the SRM specifically are not perceived as sufficiently credible to reduce IGGs. The first SRM and BRRD-related events mark the initial announcement of the European bail-in regime when the European Commission announced the Bank Recovery & Resolution proposal on June 6, 2012. On this date, we observe a significant tightening of senior (-3.27%) and subordinated CDS spreads (-5.10%) as well as a highly significant increase in stock returns (+4.98%). One year later, on June 27, 2013, the EU finance ministers agreed on the BRRD for the first time. On this date, we observe a highly significant cumulative abnormal return of -3.19% for senior CDS spreads and -3.64% for subordinated CDS spreads. Stock returns increased only slightly by 0.38%. Taken together, a tightening in CDS spreads and in increase in equity returns implies an overall ceteris paribus increase in potential IGGs. These findings indicate that, from the outset, market participants did consider the hitherto unknown bail-in regime in Europe credible.

However, when the BRRD went into effect January 1, 2015, the data indicates that market participants acknowledged the credibility of the new rules after all. CDS spreads around this event date widened significantly. Senior CDS spreads widened by 1.62%, Subordinated CDS spreads widened by 1.60% and stock returns declined by 1.84%. These significant shifts indicate a perceived decrease in IGGs and an (albeit weak) expectation that the European bail-in regime would be effective. In comparison, the most recent BRRD-related event date again shows one of the strongest and most significant tightening in CDS spreads (-9.24% for senior CDS spreads and -9.47% for subordinated CDS spreads) as well as the highest increase in equity returns (+3.8%) across all banks in the BRRD subsample. These results are aligned with the ECON committee's public hearing on updating the existing BRRD and SRM framework on April 25, 2017.⁵⁷ This indicates that market participants doubted the credibility and efficiency of the regime in terms of lowering perceived IGGs two years after it went into effect. In summary, our analysis of underlying market prices of CDS spreads and stock returns associated with single BRRD-related events shows that market participants perceived loopholes in the regime's new rules, including the BRRD's bail-in tool.

The most significant returns associated with specific SRM-related event dates show the same pattern. On July 10, 2013, the date of the first official discussions of the SRM-R, we observe a highly significant tightening in CDS spreads (-1.48% for senior CDS spreads and -1.83% for subordinated CDS spreads) and a slight increase in stock returns (+0.42%). Similar results can be observed around October 16, 2013, when the European Union disclosed that state-aid for banks would require creditor losses. On that event date, senior CDS spreads across our entire sample tightened by 2.12% and subordinated CDS spreads tightened by 3.46%. At the same time, stock

⁵⁷ Also known as the BRRD I and SRM-R I, which were updated to include the so-called Risk Reduction Package.

returns across all observed banks increased by 1.75%. Since this announcement directly refers to bail-in and the liability of creditors, a regime perceived as efficient would have caused wider CDS spreads and lower stock return levels due to a higher risk/return demand on the part of the investor. Here again, market participants perceived just the opposite. The highest significance levels in the SRM event subsample was on December 19, 2013, when the European Council agreed on the Single Resolution Mechanism (SRM). The market response included significantly tighter CDS spreads (-1.89% for senior CDS spreads and -2.42% for subordinated CDS spreads) and higher stock returns (+1.82%). These three event dates with the highest significance level across the two panels of CDS spreads and stock returns confirm our initial observations that the European bail-in regime was inefficient in terms of eliminating IGGs.

Our subsample of “other events” including official regulatory announcements around the European bail-in regime not directly linked to BRRD or SRM show more heterogenous results. For example, two announcements by the Financial Stability Board (FSB) regarding global standards for a bail-in framework reveal contradictory developments. On October 3, 2011 the FSB first published their “Key Attributes of Effective Resolution Regimes for Financial Institutions”. Our observed bank sample responded with significantly wider CDS spreads (+6.41% for senior CDS spreads and +7.06% for subordinated CDS spreads) as well as significantly lower stock returns (-5.63%). On July 3, 2015, the FSB published its final technical standards of minimum requirements of own funds and eligible liabilities (MREL). Since these standards directly affect creditors participation and were a game changer for ensuring bail-in, perceived IGGs were expected to decrease and CDS spreads indeed widened significantly (+5.37% for senior CDS spreads and +5.19% for subordinated CDS spreads) and stock returns declined by 4.12% on average across the sample. Although these results appear to suggest that global market participants

perceived announcements by global regulators regarding a bail-in regime as serious, European market participants ultimately perceived loopholes in the bail-in regime at the European level. This may be attributable to EU-circumstances, such as the lack of a harmonized European deposit insurance scheme. Moreover, market participants observing exemptions made in potential bail-in cases clearly lost faith in efficient implementation of the European Bail-in regime.

4.4.2.3 Abnormal returns by bank designations

The above analysis showing an overall tightening in CDS spreads and increase in stock returns is also observable for aggregated results within the BRRD and SRM event subsamples. These aggregated results imply that the market perceived the European bail-in regime as ineffective in terms of eliminating IGGs. In this section, we compare the effects across our pre-defined bank subsamples of G-SIB, EU banks, SSM banks and low z-score banks to the group of non-G-SIB, non-EU banks, non-SSM banks and high z-score banks. Table VIII provides the aggregated results of our SUR analysis across all events for senior CDS spreads, subordinated CDS spreads and stock returns classified by each bank designation of G-SIB vs. non-G-SIB, EU vs. non-EU, SSM vs. non-SSM and low z-score vs. high z-score banks.

Table VIII: Abnormal Returns by Bank Designation

	<i>CDS Senior</i>		<i>CDS Sub</i>		<i>Stock returns</i>	
	<i>Cumulative</i>	<i>Mean</i>	<i>Cumulative</i>	<i>Mean</i>	<i>Cumulative</i>	<i>Mean</i>
G-SIB	-28.64%***	[-0.84%***]	-26.81%***	[-0.79%***]	4.20%**	[0.12%]
Non-G-SIB	8.89%***	[0.26%]	9.32%***	[0.27%]	22.58%***	[0.66%***]
<i>Difference</i>	37.52%	[-1.10%]	-36.13%	[-1.06%]	-13.38%	[-0.54%]
EU	-20.22%***	[-0.60%**]	-20.04%***	[-0.59%**]	3.64%**	[0.11%]
Non-EU	0.47%	[0.01%]	2.55%	[0.07%]	-1.28%	[-0.04%]
<i>Difference</i>	-20.70%	[-0.61%]	-22.58%***	[-0.66%**]	4.92%	[0.15%*]
SSM	-17.18%***	[-0.51%**]	-15.83%***	[-0.47%]	3.66%*	[0.11%]
Non-SSM	-2.56%***	[-0.07%***]	-1.67%	[-0.05%]	-1.30%	[-0.04%]
<i>Difference</i>	-14.62%*	[-0.43%*]	-14.16%	[-0.42%]	4.97%	[0.15%]
Low-Z	-5.21%	[-0.15%]	-7.44%	[-0.22%]	4.32%	[0.13%]
High-Z	-14.54%***	[-0.43%]	-10.05%**	[-0.30%]	-1.96%	[-0.06%]
<i>Difference</i>	9.33%***	[0.27%]	2.61%**	[0.07%]	6.27%	[0.18%]

Description: This table shows abnormal returns for our dependent variables by bank designation (G-SIB vs. Non-G-SIB, EU vs. Non-EU, SSM vs. Non-SSM, and low vs. high z-score). These estimates are based on 260 bank entities, for which enough data are available. Annex I presents an overview of these entities. *** = significant at 1%, ** = significant at 5%, * = significant at 10%.

Across all event dates, we observe a highly significant tightening in both senior and subordinated CDS spreads as well as a significant increase in stock returns for G-SIBs. Cumulative senior CDS spreads tightened by 28.64%, corresponding on average to 0.84% per event date. Cumulative subordinated CDS spreads tightened slightly less but also highly significantly by 26.81% across all events and on average by 0.79% per event date. Stock returns increased by

4.20% across all events and by 0.12% per event date. These abnormal returns mark the strongest reaction across all banks' subsamples.

Interestingly, our results for non-G-SIBs show the contrary. Senior CDS spreads for non-G-SIBs widened highly significantly by 8.89% across all events and by 0.26% on average. Subordinated CDS spreads for non-G-SIBs also widened significantly by 9.32% and by 0.27% per each event date. This observation suggests that G-SIBs still benefit the most from IGGs and the ineffectiveness of the European bail-in regime will further strengthen the nexus of IGGs within G-SIBs. This result is in line with Moenninghoff, Ongena and Wieandt's (2015) recent observations.

The EU bank and SSM bank subsamples show the same direction of highly significant results but with an overall lower magnitude, which is in line with our hypotheses and strengthens our conclusion that G-SIBs again benefit more from IGGs in the market compared to non-G-SIBs. Among low z-score banks, we observe the same result pattern but at a non-significant level. Only banks with a high z-score reacted with significantly tightened CDS spreads, both on senior and subordinated CDS contracts. Since most high z-score banks are well capitalized and credible banks, this result is not surprising. Nevertheless, the result for low z-score banks could imply that even if risky banks are found to be failing or likely to fail, no widening of CDS spreads under the European bail-in regime is observed, which attests to the lack of perceived credibility of the regime.

4.4.2.4 Abnormal returns by bank designations and regulatory events

In a next step, we investigate the reactions among our banks' subsamples to BRRD, SRM and other events subsamples. Table IX shows aggregated abnormal returns for G-SIBs vs. non-GSIBs, EU-banks vs. non-EU-banks, SSM-banks vs. non-SSM-banks and low z-score banks vs. high z-score banks across each event subsample of BRRD-related, SRM-related and other event dates.

Table IX: Abnormal Returns by Bank Designation and Event Type

Panel A: BRRD-related events (N=8)						
	<i>CDS Senior</i>		<i>CDS Sub</i>		<i>Stock returns</i>	
	<i>Cumulative</i>	<i>Mean</i>	<i>Cumulative</i>	<i>Mean</i>	<i>Cumulative</i>	<i>Mean</i>
G-SIB	-23.53%***	[-2.99%***]	-25.83%***	[-3.34%***]	0.55%	[0.09%]
Non-G-SIB	-6.01%***	[-0.58%]	-6.43%***	[-1.38%***]	1.79%**	[0.31%]
<i>Difference</i>	-17.52%***	[-2.40%***]	-19.40%***	[-1.97%***]	-1.24%	[-0.22%]
EU	-8.33%***	[-0.93%**]	-11.21%***	[-1.91%***]	2.14%**	[0.39%**]
Non-EU	-10.10%	[0.41%]	-17.37%*	[-2.17%]	-0.77%	[-0.21%]
<i>Difference</i>	1.76%	[-0.53%]	6.16%	[0.26%]	2.91%*	[0.60%*]
SSM	-6.45%***	[-0.54%]	-8.77%***	[-1.64%***]	2.46%**	[0.31%]
Non-SSM	-14.36%***	[-2.05%***]	-13.20%***	[-2.01%***]	0.20%	[-0.21%]
<i>Difference</i>	7.92%***	[-1.51%**]	4.44%	[-0.37%]	2.26%	[0.10%]
Low-Z	6.16%*	[2.55%]	-1.20%	[-0.54%]	4.34%*	[0.52%]
High-Z	-11.97%***	[-1.76%***]	-11.71%***	[-1.97%***]	1.05%	[0.23%]
<i>Difference</i>	18.31%***	[4.31%**]	10.51%***	[1.43%**]	3.30%	[0.30%]

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Panel B: SRM-related events (N=7)						
	<i>CDS Senior</i>		<i>CDS Sub</i>		<i>Stock returns</i>	
	<i>Cumulative</i>	<i>Mean</i>	<i>Cumulative</i>	<i>Mean</i>	<i>Cumulative</i>	<i>Mean</i>
G-SIB	-11.48%***	[-1.66%***]	-11.68%***	[-1.67%***]	8.89%***	[1.47%***]
Non-G-SIB	-3.36%***	[-0.54%**]	-4.31%*	[-0.79%*]	2.95%***	[0.63%***]
Difference	-8.12%	[-1.12%]	-7.37%	[-0.88%]	5.94%	[0.84%]
EU	-4.50%***	[-0.70%***]	-5.76%***	[-0.97%**]	3.81%***	[0.66%***]
Non-EU	-6.07%***	0.87%***]	-5.83%	[-0.83%]	2.53%***	[0.97%***]
Difference	1.56%	[0.17%]	0.06%***	[-0.14%**]	1.28%	[-0.31%*]
SSM	-3.58%***	[-0.54%***]	-3.20%*	[-0.44%]	3.35%**	[0.62%**]
Non-SSM	-7.24%***	[-1.15%**]	-11.67%***	[-2.19%**]	3.92%***	[0.88%***]
Difference	3.66%*	[0.61%]	8.47%*	[1.75%*]	-0.58%	[-0.26%]
Low-Z	-0.70%	[-0.15%]	-1.19%	[-0.24%]	7.92%*	[1.25%*]
High-Z	-5.39%***	[-0.82%***]	-6.62%***	[-1.10%**]	-2.72%***	[-0.61%***]
Difference	4.69%**	[0.67%**]	5.43%*	[0.86%]	5.20%	[0.64%]
Panel C: Other events (N=19)						
	<i>CDS Senior</i>		<i>CDS Sub</i>		<i>Stock returns</i>	
	<i>Cumulative</i>	<i>Mean</i>	<i>Cumulative</i>	<i>Mean</i>	<i>Cumulative</i>	<i>Mean</i>
G-SIB	7.74%**	[0.55%**]	12.33%**	[0.70%**]	-2.26%	[-0.14%]
Non-G-SIB	-1.96%***	[-0.65%]	-0.42%***	[0.38%]	-3.36%***	[-0.34%***]
Difference	9.70%**	[1.20%*]	-12.76%**	[0.32%]	1.10%	[0.20%]
EU	-1.16%	[-0.57%]	1.37%	[0.39%]	-2.96%**	[-0.27%*]
Non-EU	10.46%	[1.33%]	12.99%*	[1.44%]	-4.40%***	[-0.54%***]
Difference	-11.62%	[-1.90%]	-11.62%*	[-1.06%]	1.43%	[0.27%]
SSM	-1.03%	[-0.07%]	0.20%	[0.40%]	-4.07%***	[-0.53%***]
Non-SSM	0.37%	[-1.75%]	6.33%	[0.53%]	-1.98%*	[-0.00%]
Difference	-1.40%	[1.68%]	-6.13%	[0.12%]	-2.09%	[-0.53%]
Low-Z	-0.56%	[-0.40%]	6.36%	[1.12%]	-4.68%	[-0.28%]
High-Z	-0.71%	[-0.51%]	1.09%	[-0.31%]	-2.98%***	[-0.33%**]
Difference	0.15%	[0.11%]	5.27%	[0.81%]	-1.70%	[0.06%]

Description: This table shows abnormal returns for our dependent variables by bank designation (G-SIB vs. Non-G-SIB, EU vs. Non-EU, SSM vs. Non-SSM, and low vs. high z-score) and event types (various Panels). These estimates are based on 260 bank entities, for which enough data are available. Annex I presents an overview of these entities. *** = significant at 1%, ** = significant at 5%, * = significant at 10%.

For the BRRD and SRM event subsamples, we again find the highest market reactions among G-SIBs, which further confirms our observation that market participants regard the European bail-in regime as especially inefficient in terms of eliminating IGGs for banks which benefitted most in the past and during the global financial crisis. Within the event subsample of BRRD, G-SIBs' cumulative senior CDS spreads tightened highly significantly by 23.53%, while non-G-SIBs' senior CDS spreads only tightened by 6.01%. The over 17.5 percentage point difference is highly significant. Subordinated CDS spread shows the same result pattern, but with a slightly higher magnitude (-28.53% for G-SIBs and -6.43% for non-G-SIBs). Stock returns for both bank subsamples increased across all BRRD-related events. While the increase for non-G-SIBs was also slightly higher, the increase for G-SIBs is not statistically significant. Similar results for G-SIBs vs. non-G-SIBs market reactions are observable for SRM-related events. The results associated with both BRRD-related and SRM-related events confirm the observations we made for G-SIBs vs. non-G-SIBs across all event dates.

Our analysis of effects among EU-banks towards the announcement of BRRD-related events and SSM-banks towards SRM-related events are again highly significant. CDS spreads of EU-banks tightened significantly within the event subsample of BRRD-related event dates. Specifically, senior CDS spreads for EU-banks tightened by 8.33% and by 11.21% for subordinated CDS spreads. Cumulative stock returns increased significantly by 2.14% across all BRRD-related event dates. This pattern again implies that the regime is not perceived as being implemented effectively. Especially for EU-banks, for which the BRRD is directly legally binding, we would have expected a significant widening in CDS spreads and a decline in stock returns reflecting a decrease in IGGs. For non-EU banks (for which the sample is much smaller), we almost observe the same direction of results on the CDS spreads but at insignificant levels. This is

in line with our expectations of greater reactions among EU-banks within the BRRD event subsample. However, the greater reactions among EU-banks are in the opposite direction as would be expected assuming efficient implementation of the European Bail-in regime.

For the SRM-related events, we also observe a highly significant tightening in both senior and subordinated CDS spreads as well as a significant increase in stock returns. We expected SSM-banks to react most strongly towards SRM-related announcements because they are most directly affected by the regulation. If the regime efficiently eliminates bail-out expectations, we may expect a widening in CDS spreads and a decrease in stock returns. Furthermore, the senior CDS spreads should be more strongly affected than subordinated CDS spreads because senior debt is subject to creditor liability for the first time. However, our SUR analysis shows a more significant tightening in senior CDS spreads (by 3.58%) than in subordinated CDS spreads (by 3.20%). Furthermore, we observe a highly significant increase in stock returns (by 3.35%). The overall results within the event subsample of SSM events and especially for SRM-related banks again confirms that the European bail-in regime lacks efficiency and credibility in terms of eliminating IGGs.

Our analysis of the other events (i.e., events not related to BRRD or SRM) shows more heterogenous and less statistically significant results. In order to test for various external effects and limit endogeneity, we next conduct a multivariate analysis and include control variables that might impact our dependent variables of senior CDS spreads, subordinated CDS spreads and stock returns.

4.4.3 *Multivariate results*

On average, across all events and all subsamples, our univariate results show a tightening in CDS spreads and an increase in stock returns. Furthermore, our overall results show that G-SIBs benefit more from IGGs and the inefficiency of the European bail-in regime than non-G-SIBs. The implementation of the regime shows tremendous inefficiency of the regime, as it completely counteracts the regulations' objectives regarding the diminishing of bailout expectations. So far, the results from our univariate analyses answer the initial stated question of whether the European bail-in regime is efficient in eliminating IGG with a clear "No."

Although previous work largely restricts the evidence to univariate analyses (e.g., Schäfer et al., 2016), we now test the robustness of this conclusion in a multivariate regression to rule out any potential omitted variables bias. Table X summarizes the overall results from our regression analyses for the whole sample of regulatory events.

Table X: Multivariate Regression Results for Whole Sample

	<i>Dependent variable:</i>		
	Senior CDS Spread	Subordinate CDS Spread	Stock Return
I(Event)	-1.50%*** [0.2465]	-1.82%*** [0.6338]	0.45%*** [0.1493]
<i>Control Variables in %:</i>			
Total Assets	-0.0815* [0.1117]	-0.5727 [0.7144]	0.0920* [0.1258]
LT Fin. Liabilities	-0.3063 [0.6763]	-1.6868 [2.3043]	-0.4573* [0.6400]
EBIT	2.7498 [6.3174]	25.7191 [60.1555]	-2.9775 [9.8910]
AZS	-0.3337 [0.0070]	-9.8416*** [0.0735]	1.2185** [0.0046]
State Ownership	0.0084* [0.0092]	-0.0169 [0.0251]	0.0106* [0.0057]
Total Capital Ratio	0.0378 [0.0433]	0.2013* [0.1153]	0.0129 [0.0173]
VIX Index	0.2921*** [0.0271]	0.3318*** [0.0711]	-0.0736*** [0.0180]
SX5E Index	0.0004 [0.0004]	0.0012*** [0.0010]	-0.0001* [0.0003]
Sovereign CDS	0.0009 [0.0008]	-0.0006 [0.0026]	-0.0008* [0.0005]
No. Observations	2180	2005	3210
R ²	0.0814	0.0208	0.0165
Adjusted R ²	0.0772	0.0159	0.0134
p-value	0.000	0.000	0.000

Description: These are regression estimates. The dependent variables are the change in the senior CDS spread, the change in the subordinate CDS spread, and the stock return in the first, second, and third column, respectively. These variables are obtained from our seemingly-unrelated-regression models, as described in the text. The main independent variable is an indicator, I(Event), which takes the value of 1 for days on which an event, as shown in Table III, occurred, and 0 otherwise. The estimate for I(Event) measures the average effect (in %) the regulatory events that are associated with the implementation of the European bail-in regime had on the three dependent variables. *** = significant at 1%, ** = significant at 5%, * = significant at 10%.

The regression results confirm the conclusion from our univariate analyses that the “Banking Package” has not effectively reduced IGGs in the European banking sector. The event dummy variable, which proxies for each event associated with the legal implementation of the European bail-in framework, shows a strongly significant abnormal tightening in senior (-1.49%) and subordinated CDS spreads (-1.82%). A significant increase in stock returns (0.45%) can also be observed.

For the controls, both magnitude and statistical significance of the estimated coefficients are fairly stable across all columns. The parameter estimates are mostly consistent with related studies (Schäfer, Schnabel and di Mauro, 2016; Moenninghoff, Ongena and Wieandt, 2015; Zhao, 2014). In particular, we document that (i) the bank’s total asset size is positively correlated to the height of IGGs, (ii) the amount of a bank’s long-term financial liabilities has a positive effect on IGGs, (iii) EBIT is positively correlated with IGGs, (iv) the coefficient of a low Altman z-score is positively related, (v) the degree of a bank’s state ownership is positively correlated, (vi) the amount of total capital in relation to a bank’ risk-weighted assets has a positive effect, (vii) the overall market uncertainty expressed through the volatility index shows a positive correlation, (viii) the market performance expressed through the EuroStoxx 50 banks index has a positive correlation, and (ix) the bank’s underlying sovereign CDS spread shows a positive correlation to IGGs.

Table XI shows our regression results based on all regulatory events for the subsamples. For almost all subsamples, we report highly significant results. G-SIBs show the strongest significant tightening in CDS spreads and the highest significant increase in equity returns. The results for the SSM banks subsample also show a significantly stronger tightening of senior CDS spreads, as compared to subordinated CDS spreads. The EU and SSM bank subsamples each show

the same results as the results for G-SIBs. Both subsamples reveal a significant tightening in their CDS spreads in conjunction with a significant increase in the performance of their equity returns. The results for banks with a low z-score also demonstrate a highly significant tightening of their CDS spreads, but no increase in equity returns. Nevertheless, the result of this decrease is not significant.

Table XI: Multivariate Regression Results for Subsamples

	<i>Dependent variable:</i>		
	Senior CDS Spread	Subordinate CDS Spread	Stock Return
<i>G-SIB Subsample:</i>			
I(Event)	-2.73%*** [0.0035]	-3.20%*** [0.0034]	1.42%*** [0.0039]
No. Observations	699	703	577
R^2	0.1748	0.1755	0.0524
Adjusted R^2	0.1628	0.1636	0.0357
p-value	0.000	0.000	0.001
<i>EU Subsample:</i>			
I(Event)	-1.53%*** [0.0027]	-1.85%*** [0.0057]	0.44%** [0.0017]
No. Observations	2140	1963	3039
R^2	0.0825	0.0208	0.0168
Adjusted R^2	0.0782	0.0158	0.0135
p-value	0.000	0.000	0.000
<i>SSM Subsample:</i>			
I(Event)	-1.66%*** [0.0035]	-1.47%* [0.0088]	0.45%*** [0.0021]
No. Observations	1354	1257	2233
R^2	0.0806	0.0230	0.0192
Adjusted R^2	0.0737	0.0152	0.0148
p-value	0.000	0.001	0.000
<i>Low z-score Subsample:</i>			
I(Event)	-0.99%*** [0.0029]	-2.01%** [0.0082]	-0.51% [0.0058]
No. Observations	337	317	634
R^2	0.0583	0.1004	0.0194
Adjusted R^2	0.0294	0.0710	0.0037
p-value	0.031	0.000	0.265

Description: These are regression estimates for various subsamples by bank classification. The dependent variables are the change in the senior CDS spread, the change in the subordinate CDS spread, and the stock return in the first, second, and third column, respectively. These variables are obtained from our seemingly-unrelated-regression models, as described in the text. The main independent variable is an indicator, I(Event), which takes the value of 1 for days on which an event, as shown in Table III, occurred, and 0 otherwise. The estimate for I(Event) measures the average effect (in %) the regulatory events that are associated with the implementation of the European bail-in regime had on the three dependent variables. We also include all control variables, but they are suppressed in Table XI for brevity, because they are very similar to those reported in Table X. *** = significant at 1%, ** = significant at 5%, * = significant at 10%.

4.5 DISCUSSION AND CONCLUDING REMARKS

Our overall results suggest that the implementation of the European bail-in regime, with the cornerstones BRRD and SRM-R, has not weakened Implicit Government Guarantees (IGGs). The results from our event study are consistent with other, recent studies of the European bail-in regime, such as Schäfer, Schnabel and di Mauro (2016).

Our univariate analysis indicates a significant abnormal tightening in CDS spreads, and a positive performance of equity returns across all events and all banks. Both observations are indicators for increased IGGs. Moreover, we observed the strongest effects within the subsample of G-SIBs. Those banks which benefitted most from the too-big-to-fail dilemma in the form of implicit government guarantees now again benefit from an inefficient bail-in regime. In fact, almost all banks in our sample are benefitting from the new regime in terms of significantly lower funding costs (tighter CDS spreads) and higher profitability expectations (increasing equity returns). This may reflect generally higher safety levels within the banking sector, because of, among others, higher capital adequacies, lower risk in the banking books and a stable growth from the last decade within the European Union. Nevertheless, G-SIBs benefitted most from the regulatory changes, which creates an even less level playing field within the European banking sector and indicates that the potential bailout expectations for large, complex and systemically relevant banks continue to increase over time.

Our multivariate regression analysis suggests that in addition to an increase in IGGs, the fatal doom-loop still exists. Banks with higher government ownership levels enjoy significantly greater benefits from potential IGGs. Additionally, size still matters. Our results show a significant positive effect from higher asset volumes to potential magnitude of IGG, i.e. tightening effect on CDS spreads and an increasing effect on equity returns.

Taken together, in response to the global financial crisis and on the basis of the initiating discussions of the G20 on new regulation, supervision as well as resolution to counter the topic of IGG, the Eurozone reached a decisive milestone when it completed the comprehensive assessment and established the Single Supervisory Mechanism (SSM) and the Single Resolution Mechanism (SRM) as the second pillar of the Banking Union, as well as the implementation of the Bank Recovery and Resolution Directive (BRRD). Taxpayer-funded bailouts were replaced by bail-in by shareholders and bondholders, bank supervision was strengthened, and the fatal doom-loop between governments and banks was weakened. While those developments represented enormous progress compared to the situation in 2008 (with no bank resolution framework in place and almost no cross-border-cooperation across competent authorities), there are still significant shortcomings related to the complicated resolution mechanism, the non-harmonized implementation of the framework, the instrument of precautionary recapitalization as a major exception tool for bail-in, and the lack of a Eurozone-wide deposit insurance scheme (see Schoenmaker and Wolff, 2015), which may all help explain the results of this event study.

The European banking sector must finally completely break the nexus between banks, national sovereigns and European authorities. If the loopholes of the European bail-in regime are not closed soon, the Banking Union will fail, and the regulators will not be able to completely eliminate IGGs within the European banking sector. Given the anticipated impact of the Covid-19 Crisis on the European banking system it is highly questionable whether EU governments are willing to make the necessary changes to the European bail-in regime.

Chapter 5. CONCLUSION

This dissertation discusses the existence, negative effects and methods of measuring the size of implicit government guarantees (IGGs) in the European banking sector. Specifically, it empirically analyzes the development of IGGs in conjunction with the European bail-in regime defined by the Bank Recovery and Resolution Directive (BRRD) and the Single Resolution Mechanism Regulation (SRM-R), which went into effect in 2015. This dissertation answers three overarching research questions: First, what are IGGs and how do they influence national and international financial stability? Second, how can IGGs be measured accurately? Third, does the new European bail-in regulation, including the cornerstone legislation BRRD and SRM-R, eliminate IGGs effectively in the European banking sector? The structure of this thesis follows these three questions.

Chapter 2, *Implicit Government Guarantees. A Literature Review*, reviews extant literature relevant to IGGs, including how IGGs differ from explicit government guarantees and the economic implications of IGGs. We find that the existence and value of IGGs are related to a bank's size, their ratings and the overall financial environment, and that IGGs negatively impact the performance, competitiveness and financial well-being of financial institutions. We conclude that in order to ascertain the effectiveness of policy measures adopted to limit bail-out expectations in the market and to ensure accurate pricing of bank equity and debt, IGGs must be measured consistently and disclosed transparently.

Chapter 3, *Measuring Implicit Government Guarantees. A Comparative Analysis*, categorizes and analyses the method used by scholars to quantify the value of IGGs, including a critical assessment of the outcomes and limitations of each model as a basis for identify the most

suitable models to ensure consistent measurement and transparent disclosure of IGGs. Overall, we find that CDS spreads and cash equity-based approaches have statistical advantages over other models. We combine these approaches in the empirical analysis presented in Chapter 4.

In Chapter 4, *Evidence from The European Bail-In Regime. An Empirical Analysis*, we assess the market effects of regulatory events associated with the implementation of a bail-in regime for failing European banks. The bail-in regime was designed to make banks efficiently resolvable in order to abolish (IGGs). We use a seemingly-unrelated-regressions framework to estimate the effects on CDS spreads and equity returns of key events associated with the two cornerstones of the European bail-in regime, the BRRD and the SRM-R, and other relevant events. Contrary to the regulations' objectives, By tracking market reactions to the implementation of the bank resolution regime and quantifying the impact of key regulatory events between mid-2009 and mid-2017 on credit default swap (CDS) spreads and stock returns of 260 European banks, we conclude that the European bail-in regime alone has not eliminated IGGs. We find that regulatory events associated with the implementation of BRRD and SRM-R led to tighter CDS spreads and higher equity returns. The pattern varies with bank heterogeneity and is particularly pronounced for G-SIBs, suggesting that the regime does not effectively solve the systemic problem of bailout expectations in the European banking sector. Worse still, CDS spreads, especially among global systemically important banks, have tightened and equity returns have increased significantly, despite the implementation of the resolution regime.

In other words, the European bail-in regime has not yet solved the systemic problem of bailout expectations in the market. We identify the “precautionary recapitalization” tool as a legal loophole. Recent Italian bank failures are proof that big banks still have the muscle to negotiate with national governments and regulatory agencies to avoid complete bail-in – that is, of course,

if avoiding complete bail-in is of individual, political and/or national interest. As long as exceptions to the European bail-in regime are made, banks and investors know that government guarantees are just as implicit as they were during the global financial crisis of 2007/08. Europe must break the nexus between banks and national sovereigns. If the loopholes of the European bail-in regime are not closed soon, the Banking union is in risk of failing.

BIBLIOGRAPHY

- [1] Acharya, Viral V., Anginer, D., Warburton, A. J. (2015). The End of Market Discipline? Investor Expectations of Implicit State Guarantees, New York University - Leonard N. Stern School of Business; Centre for Economic Policy Research (CEPR); National Bureau of Economic Research (NBER); New York University (NYU) - Department of Finance.
- [2] Acharya, V., Drechsler, I. and Schnabl, P. (2014). A pyrrhic victory? Bank bailouts and sovereign credit risk. *The Journal of Finance*, 69(6), pp. 2689-2739.
- [3] Admati, A. R., & Hellwig, M. F. (2019). Bank leverage, welfare, and regulation. Rock Center for Corporate Governance at Stanford University Working Paper, (235).
- [4] Allen, F., Carletti, E., Goldstein, I., & Leonello, A. (2015). Moral hazard and government guarantees in the banking industry. *Journal of Financial Regulation*, 1(1), 30-50.
- [5] Alogoskoufis, S., & Langfield, S. (2019). Regulating the doom loop (No. 2313). ECB Working Paper.
- [6] Angelini, P., Clerc, L., Curdia, V., Gambacorta, L., Gerali, A., Locamo, A., Motto, R., Roeger, W., Van den Heuvel, S., Vıcek, J. (2011). BASEL III: long-term impact on economic performance and fluctuations, BIS Working Paper No. 338.
- [7] Angelini, P., Grande, G. and Panetta, F. (2014). The negative feedback loop between banks and sovereigns. Bank of Italy Occasional Paper, (213).
- [8] Angeloni, C. and Wolff, G.B. (2012). Are banks affected by their holdings of government debt? (No. 2012/07). Bruegel working paper.

- [9] Araten, M., & Turner, C. M. (2012). Understanding the Funding Cost Differences between Global Systemically Important Banks (G-SIBs) and Non-G-SIBs in the United States. Available at SSRN 2226939.
- [10] Araten, M. (2013). Credit Ratings as Indicators of Implicit Government Support for Global Systemically Important Banks, *Journal of Risk Management in Financial Institutions*, July 2013.
- [11] Araten, M., Turner, C. (2013). Understanding the Funding Cost Differences between Global Systemically Important Banks (G-SIBs) and non-G-SIBs in the United States, *Journal of Risk Management in Financial Institutions*.
- [12] Armendáriz, B., D'Espallier, B., Hudon, M., & Szafarz, A. (2013). Subsidy uncertainty and microfinance mission drift. Available at SSRN 1731265.
- [13] Avgouleas, E. and Goodhart, C. (2015). Critical reflections on bank bail-ins. *Journal of Financial Regulation*, 1(1), pp.3-29.
- [14] Avgouleas, E. and Goodhart, C. (2019). Bank resolution 10 years from the global financial crisis: a systematic reappraisal. School of European Political Economy, LUISS, 7. *Journal of Banking & Finance*, 52(38), pp.1010-1051.
- [15] Ayadi, R. (2019). Changing Role of Banks in the Financial System. In *Banking Business Models* (pp. 5-20). Palgrave Macmillan, Cham.
- [16] Bai, J., Collin-Dufresne, P. (2011). The Determinants of the CDS-Bond Basis During the Financial Crisis of 2007-2009, Discussion Paper Network for Studies on Pensions, Aging and Retirement.

- [17] Bao, J., & Jun P. (2013). Bond Illiquidity and Excess Volatility. *Review of Financial Studies*, Vol. 26, No. 12, pp. 3068–103.
- [18] Barth, A., Schnabel, I. (2013). Why banks are not too big to fail—evidence from the CDS market. *Economic Policy*, 28(74), 335-369.
- [19] Barth, A., Seckinger, C. (2018). Capital regulation with heterogeneous banks—Unintended consequences of a too strict leverage ratio. *Journal of Banking & Finance*, 88, 455-465.
- [20] Beck, R., Ferrucci, G., Hantzsche, A., & Rau-Goehring, M. (2017). Determinants of sub-sovereign bond yield spreads—The role of fiscal fundamentals and federal bailout expectations. *Journal of International Money and Finance*, 79, 72-98.
- [21] Belliaeva, N., Khaksari, S. and Tsafack, G. (2015). Implicit government guarantee and the CDS spreads. *The Journal of Fixed Income*, 25(2), pp. 25-37.
- [22] Berger, A.N., Himmelberg, C.P., Roman, R.A. and Tsyplov, S. (2019). Bank Bailouts, Bail-ins, or No Regulatory Intervention? A Dynamic Model and Empirical Tests of Optimal Regulation. A Dynamic Model and Empirical Tests of Optimal Regulation (May 19, 2019).
- [23] Bijlsma, M and Mocking, R. (2013). The private value of too-big-to-fail guarantees. Tilburg University, TILEC discussion paper, May
- [24] Binder, J.H. (2015). Resolution planning and structural bank reform within the Banking Union. SAFE Working paper series (pp. 147-173).
- [25] Bliss, Robert R. (2001). Market Discipline and Subordinated Debt: A Review of Some Salient Issues. *Federal Reserve Bank of Chicago Economic Perspectives* 25, p.34-45.

- [26] Bliss, Robert R. (2004). Market Discipline: Players, Processes, and Purposes. *Market Discipline Across Countries and Industries*. W. Hunter, G. Kaufman, C. Borio, and K. Tsatsaronis (eds.). MIT Press, Boston, p.37-53.
- [27] Blundell-Wignall, A. and Slovik, P. (2011). A market perspective on the European sovereign debt and banking crisis. *OECD Journal: Financial market trends*, 2010(2), pp.9-36.
- [28] Bongini, P., Nieri, L., Pelagatti, M. (2015). The importance of being systemically important financial institutions. *Journal of Banking & Finance*, 50, issue C, 562-574.
- [29] Bordo, M. and James, H. (2014). The European crisis in the context of the history of previous financial crises. *Journal of Macroeconomics*, 39, pp.275-284.
- [30] Borisova, G., Fotak, V., Holland, K., & Megginson, W. L. (2015). Government ownership and the cost of debt: Evidence from government investments in publicly traded firms. *Journal of Financial Economics*, 118(1), 168-191.
- [31] Breuss, F. (2013). *European Banking Union* (No. 454). WIFO Working Papers.
- [32] Brou, D., & Ruta, M. (2013). A commitment theory of subsidy agreements. *The BE Journal of Economic Analysis & Policy*, 13(1), 239-270.
- [33] Brown, Stephen J., Warner, Jerold B. (1985). Using daily stock returns: The case of event studies, *Journal of Financial Economics*, Volume 14, Issue 1, 3-31.
- [34] Brunnermeier, M. K., Garicano, L., Lane, P. R., Pagano, M., Reis, R., Santos, T., Thesmar, D, Nieuwerburgh, S. V.. & Vayanos, D. (2016). The sovereign-bank diabolic loop and ESBies. *American Economic Review*, 106(5), 508-12.

- [35] Carney, M. (2017). Ten years on: fixing the fault lines of the global financial crisis, Banque de France, Financial Stability Review, No 21, 13- 20.
- [36] Chabot, B., & Moul, C. C. (2014). Bank Panics, Government Guarantees, and the Long-Run Size of the Financial Sector: Evidence from Free-Banking America. *Journal of Money, Credit and Banking*, 46(5), 961-997.
- [37] Chan, T. (1999). Pricing contingent claims on stocks driven by Lévy processes. *Annals of Applied Probability*, pp.504-528.
- [38] Cœuré, B. (2013). The implications of bail-in rules for bank activity and stability, Opening speech by Mr Benoît Cœuré, Member of the Executive Board of the European Central Bank, at the conference on “Financing the recovery after the crisis – the roles of bank profitability, stability and regulation”, Bocconi University, Milan.
- [39] Cutura, J. (2018). Debt holder monitoring and implicit guarantees: Did the BRRD improve market discipline? *Economic Policy*, 20(2), pp.35-69.
- [40] Davies, R., & Tracey, B. (2014). Too big to be efficient? The impact of implicit subsidies on estimates of scale economies for banks. *Journal of Money, Credit and Banking*, 46(s1), 219-253.
- [41] De Grauwe, P. (2011). The European Central Bank as a lender of last resort. *VoxEU.org*, 18, pp.08-11.
- [42] Denk, O., Schich, S. and Cournède, B. (2015). Why implicit bank debt guarantees matter: Some empirical evidence. *Financial Market Trends*, 2015(2).

- [43] EFA, Europäische Freie Allianz (2013). Implicit subsidies in the EU banking sector, retrieved from <https://sven-giegold.de/wp-content/uploads/2014/01/Implicit-subsidies-in-the-EU-banking-sector.pdf>.
- [44] Eisert, T., & Eufinger, C. (2019). Interbank networks and backdoor bailouts: Benefiting from other banks' government guarantees. *Management Science*, 65(8), 3673-3693.
- [45] Elliott, D. J. (2014). Implicit subsidies for very large banks: a primer. *Economic Studies at Brookings*.
- [46] Epstein, R. and Rhodes, M. (2018). From governance to government: Banking union, capital markets union and the new EU. *Competition & Change*, 22(2), pp.205-224.
- [47] Epstein, R.A. and Rhodes, M. (2016). The political dynamics behind Europe's new banking union. *West European Politics*, 39(3), pp.415-437.
- [48] Fischer, M., Hainz, C., Rocholl, J., & Steffen, S. (2014). Government guarantees and bank risk taking incentives.
- [49] Freixas, X. (2010). Post-crisis challenges to bank regulation. *Economic Policy*, 25(62), 375-399.
- [50] Freixas, X., Rochet, J.-C. (2008). *Microeconomics of Banking*. The MIT Press Cambridge, Massachusetts London, England.
- [51] Galil, K., Shapir, O., Amiram, D., & Benzion, U. (2013). The Determinants of CDS Spreads. *SSRN Electronic Journal*. 10.2139/ssrn.2361872.
- [52] Groenewegen, J., & Wierds, P. (2017). Two big distortions: bank incentives for debt financing (No. 53). *ESRB Working Paper Series*.

- [53] Gropp, R., Gruendl, C., & Guettler, A. (2014). The impact of public guarantees on bank risk-taking: Evidence from a natural experiment. *Review of Finance*, 18(2),
- [54] Gudmundsson, T. (2014). Whose Credit Line is it Anyway: An Update on Banks' Implicit Subsidies, IMF Working Paper, WP/16/224.
- [55] Gudmundsson, T. (2016). Whose Credit Line Is It Anyway. International Monetary Fund.
- [56] Hahn, S. (2020). Implicit Government Guarantees – What are they and how do they impact individual bank behavior, bank competition and financial stability? A Literature Review. Unpublished Working Paper.
- [57] Hahn, S. (2020). Measuring Implicit Government Guarantees. A Comparative Analysis. Unpublished Working Paper.
- [58] Hahn, S., Momtaz, P. P., Wieandt, A. (2020). Implementing a European Bail-in Regime: Do BRRD and SRM-R effectively eliminate Implicit Government Guarantees in the European Banking Sector??. Unpublished working paper, actually under review by the *Journal of Banking and Finance (JBF)*. Accessed via <https://ssrn.com/abstract=3645298>.
- [59] Haldane, A. G. (2010). The \$100 billion question. Comments given at the Institute of Regulation & Risk, Hong Kong, March 2010.
- [60] Haldane, A. G. (2011). The \$100 billion question, Comments by Mr Andrew G Haldane, Executive Director, Financial Stability, Bank of England, at the Institute of Regulation & Risk, Hong Kong.
- [61] Hett, F., & Schmidt, A. (2017). Bank rescues and bailout expectations: The erosion of market discipline during the financial crisis. *Journal of Financial Economics*, 126(3), 635-651.

- [62] Howarth, D. and Quaglia, L. (2014). The steep road to European banking union: Constructing the single resolution mechanism. *J. Common Mkt. Stud.*, 52, p.125.
- [63] IMF (2014). Global Financial Stability Report. Moving from Liquidity to Growth Driven Markets, Retrieved from <http://gesd.free.fr/glostab143.pdf>.
- [64] Jin, S., Wang, W., & Zhang, Z. (2018). The Value and Real Effects of Implicit Government Guarantees. Available at SSRN 2916456.
- [65] Kacperczyk, M. T., Schnabl, P. (2011). Implicit Guarantees and Risk Taking: Evidence from Money Market Funds. NYU Working Paper No. 2451/31335.
- [66] Kalaitzake, M. (2019). Central banking and financial political power: An investigation into the European Central Bank. *Competition & Change*, 23(3), pp.221-244.
- [67] Kalemli-Ozcan, S., Sorensen, B. and Yesiltas, S. (2012). Leverage across firms, banks, and countries. *Journal of international Economics*, 88(2), pp.284-298.
- [68] Kelly, B., Lustig, H., & Van Nieuwerburgh, S. (2016). Too-systemic-to-fail: What option markets imply about sector-wide government guarantees. *American Economic Review*.
- [69] Kelly, Bryan T., Lustig, H., Van Nieuwerburgh, S. (2011). Too-Systemic-To-Fail: What Option Markets imply about sector-wide Government Guarantees. Working Paper 17149 National Bureau of Economic Research.
- [70] Kim, B.-H.; Schich, S. (2012). Developments in the Value of Implicit Guarantees for Bank Debt: The Role of Resolution Regimes and Practices. *OECD Journal*.
- [71] Klaus, B., & Schäfer, D. (2013). Implicit state guarantees exacerbate problem: Separated banking system alone not a solution. *DIW Economic Bulletin*, 3(6), 3-14.

- [72] Kloeck, A. (2014), “Implicit Subsidies in the EU Banking Sector”, An Intermediary Report which is Part of the Forthcoming Study: “Banking Structural Reforms: A Green Perspective”, Study commissioned by the Greens/EFA group in the European parliament, January 2014, https://www.philippelamberts.eu/wp-content/uploads/2014/01/ImplicitSubsidy-of-Banking-sector_Greens-in-the-EP-study_January-2014.pdf
- [73] Lapteacru, I. (2019). Do bank activities and funding strategies of foreign and state-owned banks have a differential effect on risk-taking in Central and Eastern Europe?. *Economics of Transition and Institutional Change*, 27(2), pp.541-576.
- [74] Lasfer, M. A., Melnik, A., Thomas, D. C. (2003). Short-term reaction of stock markets in stressful circumstances. *Journal of Banking & Finance*. Elsevier, vol. 27(10), 1959-1977.
- [75] Li, Z., Qu, S., & Zhang, J. (2011). Quantifying the value of implicit government guarantees for large financial institutions. Moody’s Analytics Quantitative Research Group, January.
- [76] Liu, C. (2018). Bank lending, bank regulation and European sovereign debt crisis (Doctoral dissertation, University of Reading).
- [77] Lucas, D., & McDonald, R. (2010). Valuing government guarantees: Fannie and Freddie revisited. In *Measuring and managing federal financial risk* (pp. 131-154).
- [78] Lucchini, S., Moscianese, J., de Angelis, I., & Di Benedetto, F. (2017). State Aid and the Banking System in the Financial Crisis: From Bail-out to Bail-in. *Journal of European Competition Law & Practice*, 8(2), 88-98.
- [79] Maes, S. (2013). Structural Reform in the EU Banking Sector. *Economic Policy*, 92(17), pp.278-312.

- [80] Mariathasan, M., Merrouche, O., Werger, C. R. (2014). Bailouts and Moral Hazard: How Implicit Government Guarantees Affect Financial Stability. No 10311, CEPR Discussion Papers, C.E.P.R. Discussion Papers.
- [81] Mauro, B., Ueda, K. (2013). Quantifying Structural Subsidy Values for Systemically Important Financial Institutions. *Journal of Banking & Finance*. 37. 10.1016/j.jbankfin.2013.05.019.
- [82] Mengus, E. (2019). Asset Purchase Bailouts and Endogenous Implicit Guarantees. HEC Paris Research Paper No. ECO/SCD-2018-1248.
- [83] Merler, S. and Pisani-Ferry, J. (2012). Hazardous tango: sovereign-bank interdependence and financial stability in the euro area. *Financial Stability Review*, 16, pp.201-210.
- [84] Merton, R. C., Tsesmelidakis, Z. (2013). The Value of Implicit Guarantees. WFA 2013, AFA 2014, FIRS 2015, NBER Meetings Paper.
- [85] Moenninghoff, S. C., Ongena, S., Wieandt, A. (2015). The Perennial Challenge to Counter Too-Big-to-Fail in Banking: Empirical Evidence from the New International Regulation Dealing with Global Systemically Important Banks. *Journal of Banking & Finance*. 61, issue C, 221-236.
- [86] Moloney, N. (2014). European Banking Union: assessing its risks and resilience. *Common Market Law Review*, 51(6), pp.1609-1670.
- [87] Morrison, A. (2011). Systemic risks and the 'Too-big-to-fail' Problem. *Oxford Review of Economic Policy* 27(3), pp. 498-516

- [88] Noss, J. and Sowerbutts, R. (2012). The implicit subsidy of banks. Bank of England Financial Stability Paper, (15).
- [89] Nystrom, K., Skoglund, J. (2002). Quantitative Operational Risk Management. Swedbank, Group Financial Risk Control Report, 105.
- [90] Oxera (2011). Assessing State Support to the UK Banking Sector. Prepared at the request of The Royal Bank of Scotland, March 2011, www.oxera.com/Oxera/media/Oxera/downloads/reports/Assessing-statesupport-to-the-UK-banking-sector.pdf?ext=.pdf.
- [91] Pancotto, L., Gwilym, O. and Williams, J. (2019). The European Bank Recovery and Resolution Directive: A market assessment. *Journal of Financial Stability*, 44, p.100689.
- [92] Panetta, F., Correa, R., Davies, M., Di Cesare, A., Marques, J.M., Nadal de Simone, F., Signoretti, F., Vespro, C., Vildo, S., Wieland, M. and Zaghini, A. (2011). The impact of sovereign credit risk on bank funding conditions. *Journal of Banking & Finance*, 27(10), pp.77-102.
- [93] Prabha, A. P., & Wihlborg, C. (2014). Implicit guarantees, business models and banks' risk-taking through the crisis: Global and European perspectives. *Journal of Economics and Business*, 76, 10-38.
- [94] Samaniego-Medina, R., Trujillo-Ponce, A., Parrado-Martínez, P., di Pietro, F. (2016). Determinants of bank CDS spreads in Europe. *Journal of Economics and Business*. Elsevier, vol. 86(C), 1-15.
- [95] Schäfer, A. (2016). A SIFI Badge for Banks in Europe: Reduction in Bail-Out Expectations or Monumental Heritage Protection?. *Journal of Banking & Finance*, 25(19), pp.222-254.

- [96] Schäfer, A., Schnabel, I. & di Mauro, B. W. (2016). “Bail-in expectations for European banks: Actions speak louder than words,” ESRB Working Paper Series 07, European Systemic Risk Board.
- [97] Schäfer, A., Schnabel, I., Weder Di Mauro, B. (2014). Getting to Bail-in: Effects of Creditor Participation in European Bank Restructuring. Background Paper for the German Council of Economic Experts.
- [98] Schäfer, A., Schnabel, I., Weder di Mauro, B. (2016). Financial sector reform after the subprime crisis: has anything happened? *Review of Finance*, 20(1), 77-125.
- [99] Schich, S. (2009), “Expanded Guarantees for Banks: Benefits, Costs and Exit Issues”, *OECD Financial Market Trends Vol. 2009/2*, November
- [100] Schich, S. and Lindh, S. (2012). Implicit guarantees for bank debt. *OECD Journal: Financial Market Trends*, 2012(1), pp.45-63.
- [101] Schich, S., & Aydin, Y. (2014). Measurement and analysis of implicit guarantees for bank debt. *OECD Journal: Financial Market Trends*, 2014(1), 39-67.
- [102] Schich, S., & Aydin, Y. (2014). Policy responses to the issue of implicit bank debt guarantees: OECD survey results. *OECD Journal: Financial Market Trends*, Retrieved from <https://www.oecd.org/finance/Implicit-bank-debt-guarantees-policy-responses.pdf> [03.12.2020]
- [103] Schich, S., & Kim, B. H. (2013). Developments in the value of implicit guarantees for bank debt. *OECD Journal: Financial Market Trends*, 2012(2), 35-65.

- [104] Schich, S. (2011). Bank Competition and Financial Stability. OECD Publication with additional authors, Chapter III.
- [105] Schich, S., Aydin, Y. (2014). Measurement and analysis of implicit guarantees for bank debt: OECD survey results, OECD Journal.
- [106] Schillig, M. (2019). BRRD/SRM, corporate insolvency law and EU State aid-the trifurcated EU framework for dealing with banks in distress. In: The European Banking Union and the Role of Law. Edward Elgar Publishing.
- [107] Schneider, M. and Tornell, A. (2004). Balance Sheet Effects, Bailout Guarantees and Financial Crises. *The Review of Economic Studies*. 71(3), pp. 883-913.
- [108] Schweikhard, F. A., & Tsesmelidakis, Z. (2011). The impact of government interventions on CDS and equity markets. In Finance Meeting EUROFIDAI-AFFI, Paris, December.
- [109] Schweikhard, F. A., Tsesmelidakis, Z. (2012). The Impact of Government Interventions on CDS and Equity Markets. AFA 2012 Chicago Meetings Paper.
- [110] Siegart, C. & Willison M. (2015). Helping Regulate Implicit Government Guarantees. Available at: <https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-paper/2015/estimating-the-extent-of-the-too-big-to-fail-problem>. Accessed on: 7th February, 2020.
- [111] Toader, O. (2014). Quantifying and Explaining Implicit Public Guarantees for European Banks, Laboratoire d'Economie d'Orléans, LEO.
- [112] Ueda, K. and di Mauro, B. (2012), 'Quantifying structural subsidy values for systemically important financial institutions', IMF Working Paper No. 128.

- [113] Vallascas, F. and Hagendorff, J. (2011). The impact of European bank mergers on bidder default risk. *Journal of Banking & Finance*, 35(4), pp.902-915.
- [114] Véron, N. (2017a). The governance and ownership of significant euro-area banks. Bruegel Policy Contribution, 30 May 2017.
- [115] Zhao L. (2019). Helping Regulate Implicit Government Guarantees. Available at: <https://www.escpeurope.eu/news/helping-regulate-implicit-government-guarantees>. Accessed on: 7th February, 2020.
- [116] Zhao, L. (2018). Market-based estimates of implicit government guarantees in European financial institutions. *European Financial Management*, 24(1), 79-112.
- [117] Zhao, L. (2014). Implicit Government Guarantees in European Financial Institutions, Paris December 2014 Finance Meeting - AFFI Paper.

APPENDIX

ANNEX I.
Summary Statistics by Banks | CDS spreads & Stock returns

ID	Name of Bank	Country ID	CDS spreads		Stock returns		G-SIB	Designations		z-score
			Mean	Std. Dev.	Mean	Std. Dev.		EU	SSM	
1	Alliance & Leicester	GB	-0.019%	1.215%	-	-		X		X
2	Allied Irish Banks	IE	0.000%	0.899%	0.043%	2.341%		X	X	X
3	BNP Paribas	FR	-0.088%	1.984%	-0.133%	1.079%	X	X	X	
4	Banca Popolare di Milano	IT	0.017%	1.340%	-	-		X	X	X
5	Banco Comercial Portugues	PT	-0.001%	1.389%	-0.350%	1.806%		X	X	X
6	Bankinter	ES	0.017%	1.498%	-0.118%	1.085%		X	X	X
7	Barclays Bank	GB	-0.183%	2.358%	0.005%	1.109%	X	X		
8	Alpha Bank	GR	0.000%	1.741%	-0.119%	2.262%		X	X	X
9	Anglo Irish Bank	IE	-	-	-	-		X	X	X
10	Bank Austria Deutsche	AT	-	-	-	-		X	X	
11	Pfandbriefbank	DE	-	-	-0.108%	0.871%		X	X	
12	Eksportfinans	NO	-0.053%	3.601%	-	-		X	X	
13	Erste Bank	AT	-	-	-0.163%	1.035%		X	X	
14	Commerzbank	DE	-0.104%	1.684%	-0.258%	1.214%		X	X	
15	Crédit Lyonnais	FR	-0.065%	1.431%	-	-		X	X	
16	Danske Bank	DK	-0.084%	1.425%	-0.044%	0.750%		X	X	
17	Deutsche Bank	DE	-0.086%	1.511%	-0.144%	1.085%	X	X	X	
18	Dresdner Bank*	DE	-	-	-	-		X	X	
19	Fortis Bank Nederland Holding	NL	-	-	-	-		X	X	
20	Fortis Bank Hypothekenbank	BE	0.030%	1.313%	-	-		X	X	
21	Essen IKB Deutsche	DE	-	-	-	-		X	X	X
22	Industriebank	DE	0.006%	11.474%	-	-		X	X	
23	ING Group	NL	-0.063%	1.746%	-0.017%	1.163%	X	X	X	
24	HSBC Holdings	GB	-0.230%	1.912%	0.001%	0.649%	X	X		
25	HBOS	GB	-0.069%	1.577%	-	-		X		
26	HSBC Bank	GB	-0.079%	1.836%	-	-		X		
27	LBBW Norddeutsche	DE	0.000%	4.510%	-	-		X	X	
28	Landesbank Royal Bank of	DE	0.002%	4.170%	-	-		X	X	
29	Scotland Group	GB	-0.095%	1.912%	-0.180%	1.248%	X	X		
30	Sampo Bank	FI	-0.002%	0.568%	-	-		X	X	X
31	SEB Group	SE	-0.123%	1.560%	-0.061%	0.822%		X		
32	Société Générale Standard Chartered	FR	-0.122%	1.992%	-0.156%	1.287%	X	X	X	
33	Bank Svenska	GB	-0.164%	1.821%	-	-	X	X		
34	Handelsbanken	SE	-0.022%	1.255%	0.026%	0.739%		X		
35	BAWAG	AT	0.000%	1.777%	-	-		X	X	
36	Erste Group	AT	0.000%	1.496%	0.024%	1.262%		X	X	
37	Hypo Alpe Adria Bank	AT	-0.008%	0.645%	-	-		X	X	X
38	Investkredit Bank Österreichische	AT	-	-	-	-		X	X	
39	Volksbanken Raiffeisen Bank	AT	0.005%	1.366%	-	-		X	X	
40	International Raiffeisen Zentralbank	AT	-0.043%	1.709%	-0.106%	1.383%		X	X	
41	Österreich	AT	-0.004%	1.496%	-	-		X	X	
42	UniCredit Bank	AT	-0.017%	2.802%	-	-		X	X	
43	BNP Paribas Fortis	BE	-0.121%	1.634%	-	-		X	X	

44	Belfius	BE	-	-	0.007%	3.716%		X	X	X
45	Bayerische Landesbank	DE	-0.003%	1.161%	-	-		X	X	
46	Corealcreditbank	DE	-	-	-	-		X	X	
47	DEKA Bank	DE	-	-	-	-		X	X	
48	Deutsche Apotheker- und Ärzte Bank	DE	0.000%	0.404%	-	-		X	X	
49	DG HYP	DE	-	-	-	-		X	X	
50	Deutsche Pfandbriefbank	GB	0.000%	39.383%	-	-		X		
51	Hypothekenbank	DE	0.000%	1.369%	-	-		X	X	
52	Deutsche Postbank	DE	-0.054%	1.617%	-	-		X	X	
53	DZ Bank	DE	-0.001%	0.896%	-	-		X	X	
54	Hypo Real Estate Hypothekenbank	DE	-	-	-	-		X	X	X
55	Frankfurt	DE	0.013%	1.067%	-	-		X	X	X
56	Bremer Landesbank	DE	0.003%	0.923%	-	-		X	X	X
57	HELABA	DE	0.000%	2.549%	-	-		X	X	
58	Landesbank Saar Girozentrale	DE	0.111%	7.542%	-	-		X	X	
59	Landesbank Sachsen LKB Baden-	DE	-	-	-	-		X	X	
60	Württembergische Landwirtschaftliche Rentenbank	DE	0.000%	1.585%	-	-		X	X	
61	Landesbank Rheinland-Pfalz	DE	-	-	-	-		X	X	
62	Münchener Hypothekenbank	DE	-	-	-	-		X	X	
63	Landesbank Berlin	DE	0.000%	1.694%	-	-		X	X	
64	HSH Nordbank	DE	0.000%	0.283%	-	-		X	X	
65	UniCredit Bank	DE	-0.035%	1.961%	-	-		X	X	X
66	Volkswagen Bank	DE	-	-	-	-		X	X	
67	BBVA	ES	-0.098%	1.672%	-0.121%	1.034%		X	X	
68	Banco de Sabadell	ES	0.054%	1.560%	-0.350%	1.083%		X	X	X
69	Banco Popular	ES	0.065%	2.038%	-0.358%	1.508%		X	X	X
70	Banco Santander	ES	-0.003%	1.611%	0.037%	1.029%	X	X	X	
71	Banco Espanol de Credito	ES	0.007%	1.235%	-	-		X	X	
72	Bankia	ES	-0.004%	1.668%	-0.279%	7.553%		X	X	X
73	Caja de Ahorros del Mediterráneo	ES	0.000%	1.604%	-	0.893%		X	X	
74	La Caixa D'estalvis De Barcelona	ES	0.057%	1.828%	-	-		X	X	X
75	Caixa de Aforros de Galicia	ES	-0.152%	85.759%	-	-		X	X	
76	Caixa Bank	ES	0.000%	1.354%	-0.066%	0.990%		X	X	
77	Catalunya Bank	ES	-0.138%	0.810%	-	-		X	X	
78	Banque Fédérative du Crédit Mutuel	FR	-0.014%	1.904%	-	-		X	X	
79	Banque PSA Finance	FR	-0.071%	1.642%	-	-		X	X	
80	BPCE	FR	-0.200%	1.294%	-	-	X	X	X	
81	Crédit Agricole (CIB Entity)	FR	0.142%	2.245%	-	-		X	X	
82	Crédit Agricole	FR	-0.077%	1.651%	-0.103%	1.247%	X	X	X	
83	Crédit Industriel et Commercial	FR	-0.113%	1.003%	-	-		X	X	
84	Dexia	FR	-0.001%	1.448%	-	-		X	X	
85	Natixis	FR	0.007%	1.509%	-0.038%	1.212%		X	X	
86	RCI Banque	FR	-0.313%	1.285%	-	-		X	X	
87	Anglo Irish Bank (UK Entity)	GB	-	-	-	-		X	X	X
88	Gov & Co Bank Irlnd	IE	0.009%	1.536%	-	-		X	X	X
89	Gov & Co Bank	GB	-	-	-	-		X		X
90	Scotland	GB	-	-	-	-		X		X
91	BCP Finance Bank	KY	0.014%	1.180%	-	-		X	X	
92	Co-Operative Bank	GB	0.002%	0.856%	-	-		X		

93	Depfa ACS Bank	IE	-	-	-	-		X	X	X
94	Depfa Bank	IE	-0.001%	1.055%	-	-		X	X	X
95	FCE Bank	GB	-0.015%	1.406%	-	-		X		
96	Lloyds Trustee Savings Bank	GB	0.201%	1.714%	-	-		X		
97	ICICI Bank (UK Entity)	GB	-	-	-	-		X		
98	Irish Bank Resolution Corporation	IE	-0.305%	1.639%	-	-		X	X	X
99	Irish Bank Resolution Corporation*	IE	1.029%	2.665%	-	-		X	X	X
100	Lloyds Banking Group	GB	0.443%	8.540%	0.008%	0.991%		X		
101	Lloyds Bank	GB	-0.178%	1.651%	-	-		X		
102	National Westminster Bank	GB	-0.205%	1.258%	-	-		X		
103	Nationwide Building Society	GB	0.033%	1.437%	-	-		X		
104	Northern Rock Asset Management*	GB	0.000%	1.522%	-	-		X		
105	Standard Life Bank	GB	-	-	-	-		X		
106	Royal Bank of Scotland N.V.	GB	-0.104%	1.608%	-	-		X		
107	Santander	GB	-0.070%	1.502%	-	-		X		
108	Standard Chartered Group	GB	0.000%	2.268%	0.054%	0.990%	X	X		
109	Standard Life Bank Group*	GB	0.000%	1.425%	-	-		X		
110	Bank of Scotland	GB	-0.031%	1.535%	-	-		X		
111	Credit Suisse	CH	0.100%	1.615%	-0.149%	0.910%	X			
112	UBS	CH	-0.005%	1.571%	-0.100%	0.895%	X			
113	Jyske Bank	DK	-0.001%	0.930%	-0.044%	0.657%		X		
114	Nordea*	DK	-	-	-	-		X		
115	Espirito Santo Bank of Cyprus Public Company	LU	-0.111%	1.559%	0.000%	1.357%		X	X	
116	BBK*	CY	-	-	-	-		X	X	
117	Investcorp*	BH	-	-	-	-		X	X	
118	Marfin Popular Bank	BH	-	-	-	-		X	X	
119	ABN Amro	CY	-	-	-	-		X	X	
120	Achmea Bank	NL	-0.001%	2.040%	-0.080%	0.804%		X	X	
121	Rabobank	NL	0.010%	0.417%	-	-		X	X	
122	Forts Bank HoldCo	NL	-0.133%	1.557%	-	-		X	X	
123	Foris Bank OpC	NL	-	-	-	-		X	X	
124	KBC Group	NL	-	-	-	-		X	X	
125	Nederlandsche Waterschapsbank	BE	-0.043%	1.427%	-0.037%	1.201%		X	X	
126	NIBC Bank	NL	-0.018%	2.232%	-	-		X	X	
127	Royal Bank of Scotland N.V.*	NL	0.003%	1.098%	-	-		X	X	
128	SNS Bank	NL	-0.038%	2.244%	-	-		X	X	
129	F. van Lanschot Bankiers	NL	0.000%	1.095%	-	-		X	X	
130	DNB Ex Holding*	NL	0.006%	1.366%	-0.011%	0.917%		X	X	
131	DNB OpCo*	NO	-	-	0.001%	1.007%			X	
132	DNB HoldCo*	NO	0.000%	2.522%	-	-			X	
133	Nordea*	NO	0.964%	2.988%	-	-			X	
134	UniCredit Group	NO	-	-	-	-			X	
135	UBI	IT	0.075%	1.757%	-0.125%	1.342%	X	X	X	
136	Banca delle Marche	IT	0.002%	2.194%	-0.193%	1.620%		X	X	
137	Banca Italease	IT	-0.001%	0.955%	-	-		X	X	X
138	Banca Monte dei Paschi di Siena	IT	0.218%	1.784%	-	-		X	X	X
139	Banca Naz del Lavoro	IT	0.129%	3.101%	-0.462%	1.943%		X	X	X
140	Intesa Sanpaolo	IT	0.058%	1.693%	-	-		X	X	
141	Mediobanca	IT	-0.010%	1.783%	0.011%	1.282%		X	X	
142	Nordea*	IT	-0.026%	1.431%	-0.221%	1.276%		X	X	
143	Nordea*	SE	-0.089%	1.379%	-0.125%	0.862%	X	X		
144	Swedbank	SE	-0.024%	1.815%	-0.059%	0.874%		X		
145	Landsbanki	IS	-	-	-	-		X	X	

146	National Bank of Greece	GR	0.000%	2.925%	-0.576%	2.485%	X	X	X
147	Pohjola Bank	FI	0.000%	1.150%	-	-	X	X	X
148	UkrSibbank	UA	0.000%	0.893%	-	-	X	X	
149	Zagrebacka Banka	HR	-	-	-	-	X	X	
150	Kaupthing	IS	-	-	-	-	X	X	
151	LBI	IS	-	-	-	-	X	X	
152	OTP Bank	HU	-0.002%	3.654%	0.203%	1.507%	X		
153	Banco BPI	PT	0.000%	2.470%	-0.132%	1.180%	X	X	
154	Banco Espirito Santo	PT	0.379%	2.223%	-0.469%	1.668%	X	X	
155	Piraeus Bank	GR	-0.003%	1.856%	-0.133%	3.048%	X	X	X
156	Bre Bank* Caixa Geral de Depositos	PL PT	- 0.001%	- 1.610%	- -	- -	X X	X X	
158	Danske Bank* EFG Eurobank	FI	-0.124%	1.560%	-	-	X	X	
159	Ergasias	GR	0.923%	1.564%	-	-	X	X	X
160	Eurobank Ergasias	GR	0.038%	1.097%	-0.365%	2.722%	X	X	
161	Julius Bär	CH	-	-	-0.066%	0.710%			
162	Bank of Ireland	IR	-	-	-0.094%	1.611%	X	X	
163	PKO Bank Bank Polska Kasa Opieki	PL PL	- -	- -	- -0.116%	- 0.977%	X X		X X
165	Bank Zachodni	PL	-	-	-0.016%	0.857%	X		X
166	Komerční Banka	CZ	-	-	0.068%	0.777%	X		X
167	Banco BPM Banque Cantonale Vaudoise	IT CH	- -	- -	-0.291% -0.019%	1.844% 0.544%	X X	X X	X X
168	BGEO Group	UK	-	-	0.219%	1.028%	X	X	
170	Oberbank	AT	-	-	0.031%	0.223%	X	X	
171	Spar Nord Bank	DK	-	-	-0.008%	0.581%	X		
172	Vontobel	CH	-	-	-0.072%	0.711%			
173	BPER Banca	IT	-	-	-0.273%	1.633%	X	X	
174	CYBG	UK	-	-	-0.014%	0.873%	X	X	
175	Fincombank	IT	-	-	0.068%	0.921%	X	X	
176	KBC Ancora Luzerner Kantonalbank	BE CH	- -	- -	-0.025% 0.048%	1.310% 0.320%	X X	X X	
177	mBank	PL	-	-	-0.035%	0.976%	X		
179	Sydbank UNI SEC SOL GS PAR*	DK FR	- -	- -	-0.166% -	0.723% 0.130%	X X		X X
180	Aktia	FI	-	-	0.020%	0.766%	X	X	
182	Aldermore Group	GB	-	-	-0.120%	1.338%	X		
183	Alior Bank	PL	-	-	-0.071%	1.044%	X		
184	Banca Carige Banca Popolare di Sondrio*	IT IT	- -	- -	-0.459% -0.132%	1.703% 1.143%	X X	X X	X X
185	Bank Millenium	PL	-	-	-0.163%	1.188%	X		
187	Berner Kantonalbank BRD Groupe Société Générale	CH RU	- -	- -	0.040% -0.141%	0.440% 0.567%			
188	Cembra Money Bank	CH	-	-	0.054%	0.525%	X		
190	Credito Emiliano	IT	-	-	0.045%	1.123%	X	X	
191	EFG International	CH	-	-	-0.259%	1.407%			
192	Handlowy	PL	-	-	-0.021%	1.083%	X		
193	Lollands Bank	DK	-	-	-0.174%	0.865%	X		
194	Moneta Money Bank	CZ	-	-	-0.032%	0.622%	X		
195	Nordjyske Bank	DK	-	-	0.000%	0.553%	X		
196	Permanent TSB Schweizerische Nationalbank	IR CH	- -	- -	0.115% 0.067%	3.198% 0.708%	X X	X X	
197	Secure Trust Bank St. Galler Kantonalbank	GB CH	- -	- -	-0.040% 0.074%	0.939% 0.523%	X X		
199	Walliser Kantonalbank	CH	-	-	0.003%	0.391%			
200	Zuger Kantonalbank	CH	-	-	0.081%	0.447%			
201	Attica Bank	GR	-	-	-0.266%	2.751%	X	X	
202									

203	Banca Finnat Euramerica	IT	-	-	0.008%	0.921%	X	X	
204	Banca Popolare di Spoleto	IT	-	-	-0.199%	0.698%	X	X	X
205	Banca Profilo	IT	-	-	-0.222%	1.415%	X	X	
206	Banca di Sardegna	IT	-	-	-0.040%	0.948%	X	X	
207	Bank BGZ	PL	-	-	-0.022%	0.637%	X		
208	Bank Coop	CH	-	-	-0.091%	0.588%			
209	Bank Linth	CH	-	-	0.037%	0.332%			
210	Bank of Greece	GR	-	-	-0.104%	1.046%	X	X	
211	Bank of Valletta	MT	-	-	-	0.501%	X	X	
212	Banknordik Banque Canton de Geneve	DK CH	- -	- -	0.216% 0.033%	0.928% 0.388%	X		
213	Banque National de Belgique	BE	-	-	-0.027%	0.520%	X	X	
214	Basler Kantonalbank	CH	-	-	0.015%	0.668%			
215	Credito Valtellinese	IT	-	-	-0.334%	1.601%	X	X	X
216	Banco Desio	IT	-	-	-0.118%	1.111%	X	X	X
217	Crédit Agricole du Morbihan	FR	-	-	0.033%	0.728%	X	X	
218	Crédit Agricole Atlantique Vendée	FR	-	-	0.043%	0.679%	X	X	
219	Crédit Agricole d'Ille- et-Vilaine	FR	-	-	0.001%	0.695%	X	X	
220	Crcam Du Languedoc	FR	-	-	0.002%	0.421%	X	X	
221	Ca Nord De France	FR	-	-	-0.033%	0.869%	X	X	
222	Crédit Agricole d'Ile de France	FR	-	-	0.010%	0.467%	X	X	
223	Crédit Agricole Toulouse	FR	-	-	0.004%	0.434%	X	X	
224	Crédit Agricole Tourane	FR	-	-	-0.013%	0.648%	X	X	
225	Crédit Agricole Brie Picardie	FR	-	-	0.048%	0.659%	X	X	
226	Graub Kantonalbank	CH	-	-	0.106%	0.413%			
227	Gronlansbankn Hypothekarbank	GL	-	-	0.080%	0.731%	X	X	
228	Lenzburg	CH	-	-	0.121%	0.357%			
229	Jutlander Bank	DK	-	-	-0.079%	0.944%	X		
230	Melhus Sparebank	NO	-	-	0.026%	0.462%		X	
231	Merkur Bank	DE	-	-	0.006%	1.020%	X	X	
232	Mons Bank	DK	-	-	-	-	X		
233	Nordfyns Bank	DK	-	-	-0.153%	0.582%	X		
234	Ostjydsk Bank	DK	-	-	-	1.838%	X		X
235	Patria Bank	RO	-	-	0.002%	0.551%	X	X	X
236	Quirin Privatbank Ringkjøbing	DE	-	-	0.000%	1.026%	X	X	
237	Landbobank	DK	-	-	0.100%	0.475%	X		X
238	Salling Bank	DK	-	-	-0.266%	0.892%	X		
239	Sandnes Sparebank	NO	-	-	-0.059%	0.739%		X	
240	Siauliu Bankas	LT	-	-	-	1.178%	X	X	
241	Skjern Bank	DK	-	-	0.013%	0.864%	X		X
242	Skue Sparebank	NO	-	-	-0.124%	0.584%		X	
243	Sparebank 1	NO	-	-	-0.263%	1.007%		X	
244	Totalbanken	DK	-	-	-0.233%	1.078%	X		
245	Totens Sparebank	NO	-	-	-0.135%	0.832%		X	
246	Umweltbank	DE	-	-	0.132%	0.951%	X	X	
247	Vestjysk Bank	DK	-	-	-0.244%	2.576%	X		
248	VPB Vaduz Holand og Setskog	LI	-	-	-0.026%	0.769%		X	
249	Sparebank	NO	-	-	0.001%	0.994%		X	
250	Hvidbjerg Bank	DK	-	-	-	-	X		
251	Indre Sogn Sparebank	NO	-	-	-0.032%	0.658%		X	
252	Jcren Sparebank	NO	-	-	-0.073%	0.638%		X	
253	BBVA Bancomer	ES	-	-	-0.003%	0.754%	X	X	
254	Banca Popolare di Sondrio*	IT	-	-	-0.073%	1.152%	X	X	

256	BKS Bank	AT	-	-	-	0.320%	X	X	
257	Bank CDA	CH	-	-	-0.149%	0.117%			
258	Metrobank	GB	-	-	0.366%	0.901%	X		
259	Banco Desio*	IT	-	-	-0.145%	2.077%	X	X	
260	Oldenburgische Landesbank	DE	-	-	-	-	X	X	X
Total Observations			0.521%	2.834%	-10.128%	1.083%			

Description: This table shows sample distribution by banks shows all included banks for our event study framework. The table shows summary statistics for two data panels. Panel A for observed banks and summary statistics within the CDS spreads sub-sample and Panel B for observed banks and summary statistics within the Stock Returns sub-sample. *marked banks are not included in our analysis due to inactivity or double counting of parent company. Classifications are set each year according to official designations by FSB and ECB. Shaded entities were active during our observation period and/or faced a change in legal structure as well as their underlying CDS contract.

ANNEX II.

Sample distributed by Cumulated Abnormal Return (CAR) across each event date | CDS spreads

Senior & Subordinated CDS spreads

Event No.	Whole Sample		G-SIB		EU		SSM		Low z-score	
	Senior CDS	Sub CDS	Senior CDS	Sub CDS	Senior CDS	Sub CDS	Senior CDS	Sub CDS	Senior CDS	Sub CDS
1	-3.35%	-0.64%	-1.82%	-1.41%	-3.41%	-0.65%	-2.38%	-0.06%	-0.21%***	-0.67%
	[40.36%]	[77.31%]	[92.16%]	[28.48%]	[39.96%]	[78.96%]	[75.89%]	[15.77%]	[0.25%]	[92.58%]
2	-5.69%***	-5.79%***	-8.76%***	-7.44%***	-5.57%***	-5.71%***	-5.88%***	-6.44%***	-6.11%***	-5.85%***
	[0.00%]	[0.00%]	[0.00%]	[0.00%]	[0.00%]	[0.00%]	[0.00%]	[0.00%]	[0.00%]	[0.02%]
3	0.80%	1.74%***	2.88%***	4.11%***	0.69%	1.59%**	0.20%	1.07%	-0.12%	1.19%
	[65.69%]	[0.49%]	[0.73%]	[0.17%]	[84.70%]	[1.33%]	[46.21%]	[30.91%]	[52.74%]	[38.06%]
4	-0.08%	0.35%		2.12%***	-0.08%	0.31%	0.43%	0.47%	-0.47%***	-0.11%
	[75.24%]	[67.95%]	[0.00%]	[0.06%]	[75.24%]	[78.14%]	[99.18%]	[59.94%]	[0.00%]	[68.77%]
5	-0.35%	-0.41%	1.27%***	-0.06%	-0.43%	-0.57%	-0.69%	-0.10%	-0.33%	-0.90%
	[45.11%]	[59.22%]	[0.33%]	[97.59%]	[33.24%]	[43.43%]	[12.86%]	[98.12%]	[72.72%]	[13.65%]
6	6.41%***	7.06%***	15.66%***	13.05%***	6.18%***	6.97%***	4.28%*	5.19%**	3.75%	7.63%***
	[0.00%]	[0.00%]	[0.00%]	[0.01%]	[0.01%]	[0.01%]	[7.41%]	[2.56%]	[59.02%]	[0.03%]
7	-0.51%**	-0.09%	0.50%	0.07%	-0.66%***	-0.23%	-0.94%***	0.42%	-1.60%	0.02%
	[2.10%]	[24.85%]	[95.36%]	[60.54%]	[0.85%]	[14.95%]	[0.77%]	[95.44%]	[12.98%]	[67.71%]
8	-3.27%*	-5.05%***	-7.61%***	-8.38%***	-3.13%*	-5.00%***	-2.62%	-5.11%***	-1.32%	-4.83%***
	[5.35%]	[0.00%]	[0.00%]	[0.00%]	[8.85%]	[0.00%]	[36.69%]	[0.00%]	[93.99%]	[0.09%]
9	-2.10%**	-2.58%***	-5.69%***	-4.35%***	-2.04%*	-2.46%***	-1.72%	-2.67%***	-3.02%**	-2.32%
	[3.83%]	[0.07%]	[0.00%]	[0.01%]	[5.80%]	[0.20%]	[26.41%]	[0.36%]	[3.63%]	[10.73%]
10	0.61%***	-0.58%	1.33%**	0.05%	0.57%***	-0.66%	0.72%***	-0.15%	0.97%***	-1.55%
	[0.01%]	[39.04%]	[1.76%]	[53.36%]	[0.02%]	[31.73%]	[0.05%]	[89.44%]	[0.07%]	[28.11%]
11	-3.19%***	-3.64%***	-7.03%***	-7.87%***	-3.19%***	-3.57%***	-2.53%***	-2.79%*	-2.32%	-4.38%***
	[0.00%]	[0.06%]	[0.00%]	[0.00%]	[0.00%]	[0.11%]	[0.72%]	[6.14%]	[15.57%]	[0.04%]
12	-1.48%***	-1.82%***	-3.21%***	-3.68%***	-1.44%***	-1.85%***	-0.84%	-1.02%*	-0.97%	-1.48%
	[0.24%]	[0.01%]	[0.01%]	[0.01%]	[0.44%]	[0.01%]	[35.75%]	[8.48%]	[46.66%]	[13.92%]
13	-1.47%***	-1.06%**	-4.01%***	-3.07%***	-1.47%***	-0.98%**	-1.15%*	-0.76%	-0.95%	-0.46%
	[0.25%]	[1.08%]	[0.00%]	[0.00%]	[0.36%]	[2.60%]	[9.02%]	[21.66%]	[44.16%]	[82.16%]
14	-0.84%**	-0.11%	-1.12%	-0.74%**	-0.86%***	-0.13%	-0.79%	0.13%	-0.36%	0.01%
	[4.75%]	[88.99%]	[14.57%]	[3.10%]	[4.80%]	[81.42%]	[14.70%]	[52.62%]	[38.86%]	[76.88%]
15	-2.12%***	-3.46%***	-3.07%***	-3.88%***	-2.15%***	-3.44%***	-2.62%***	-3.88%***	-1.95%*	-3.07%***
	[0.03%]	[0.00%]	[0.01%]	[0.00%]	[0.04%]	[0.01%]	[0.00%]	[0.06%]	[5.26%]	[0.02%]
16	0.31%*	0.21%	1.20%***	-0.08%	0.30%	0.20%	0.24%	0.34%	1.06%***	0.19%
	[8.86%]	[26.70%]	[0.31%]	[67.56%]	[11.53%]	[30.54%]	[29.11%]	[14.41%]	[0.15%]	[59.67%]
17	-1.89%***	-2.42%***	-3.18%***	-3.24%***	-1.85%***	-2.43%***	-1.68%***	-2.39%***	-2.30%***	-2.72%***
	[0.15%]	[0.00%]	[0.28%]	[0.03%]	[0.31%]	[0.00%]	[3.97%]	[0.04%]	[2.55%]	[0.24%]
18	0.83%	1.54%***	4.18%***	3.22%***	0.77%	1.47%***	1.99%***	1.28%*	2.32%***	0.68%
	[58.13%]	[0.20%]	[0.00%]	[0.01%]	[62.82%]	[0.49%]	[0.11%]	[7.03%]	[0.22%]	[73.83%]
19	-0.40%	-1.18%	-0.64%	0.24%*	-0.42%	-1.27%	-0.32%	-0.19%	0.52%*	-3.82%
	[82.40%]	[52.60%]	[68.48%]	[8.62%]	[79.00%]	[50.19%]	[96.52%]	[86.72%]	[5.02%]	[42.57%]
20	1.61%***	1.35%***	1.19%	0.63%	1.61%***	1.30%***	2.28%***	2.18%***	2.03%***	1.67%*
	[0.06%]	[0.21%]	[28.59%]	[39.94%]	[0.09%]	[0.44%]	[0.00%]	[0.01%]	[3.21%]	[9.22%]
21	0.32%	0.05%	0.03%	1.15%***	0.25%	-0.02%	0.63%**	-0.05%	1.63%**	1.56%*
	[17.51%]	[50.53%]	[78.87%]	[0.11%]	[26.15%]	[59.96%]	[3.93%]	[72.31%]	[1.26%]	[5.16%]
22	0.54%	2.53%***	-0.70%	0.42%	0.60%	2.67%***	0.69%	3.08%**	2.24%***	3.87%**
	[49.38%]	[0.42%]	[18.02%]	[87.26%]	[45.19%]	[0.35%]	[45.68%]	[1.19%]	[0.61%]	[4.71%]
23	-1.26%	-1.20%	-2.23%***	-2.44%**	-1.31%*	-1.20%	-1.46%***	-1.20%	-1.23%	-1.00%
	[10.09%]	[14.64%]	[0.76%]	[1.24%]	[8.90%]	[15.57%]	[0.95%]	[24.52%]	[26.58%]	[72.42%]
24	-1.26%	-0.66%	-3.69%***	-0.19%	-1.31%	-0.78%	-0.84%	-0.95%	-0.38%	-0.06%
	[15.09%]	[91.23%]	[0.36%]	[22.72%]	[13.75%]	[91.78%]	[64.45%]	[74.60%]	[79.60%]	[34.57%]
25	-2.03%***	-1.22%	-2.51%**	-1.56%*	-2.12%***	-1.24%	-2.13%**	-1.58%**	-1.72%**	-0.76%
	[0.87%]	[13.26%]	[3.24%]	[5.18%]	[0.73%]	[13.72%]	[2.36%]	[6.39%]	[7.86%]	[86.78%]
26	-1.50%**	-2.20%***	-1.11%	-1.58%	-1.53%**	-2.37%***	-1.70%***	-2.09%***	-1.40%	-2.42%**
	[1.35%]	[0.06%]	[63.92%]	[16.66%]	[1.05%]	[0.01%]	[0.62%]	[0.95%]	[22.64%]	[4.35%]
27	1.62%*	1.60%***	2.06%	2.29%**	1.61%*	1.67%***	1.76%*	1.32%	2.29%**	1.78%*
	[7.01%]	[0.81%]	[20.10%]	[1.48%]	[9.00%]	[0.65%]	[7.33%]	[11.70%]	[5.20%]	[6.39%]
28	0.33%	-0.86%	-0.60%	-1.88%**	0.38%	-0.76%	0.74%	-0.73%	-0.60%	0.38%
	[64.31%]	[27.74%]	[23.82%]	[2.79%]	[61.11%]	[35.48%]	[39.32%]	[49.83%]	[27.12%]	[59.89%]
29	5.37%***	5.19%***	7.40%***	7.67%***	5.51%***	5.17%***	5.02%**	4.58%***	9.77%**	6.03%***
	[0.05%]	[0.00%]	[0.01%]	[0.00%]	[0.05%]	[0.00%]	[1.48%]	[0.00%]	[3.25%]	[0.06%]
30	2.20%***	2.82%***	5.12%***	5.42%*	2.13%***	2.78%**	1.68%**	2.31%***	3.87%**	2.42%***
	[0.10%]	[0.63%]	[0.02%]	[7.88%]	[0.23%]	[1.02%]	[5.99%]	[0.36%]	[1.42%]	[3.88%]
31	2.18%***	2.20%**	4.34%***	2.26%	2.21%***	2.00%*	1.88%**	2.41%**	2.41%	2.20%
	[0.01%]	[2.78%]	[0.00%]	[42.09%]	[0.00%]	[6.37%]	[0.68%]	[2.75%]	[12.37%]	[36.48%]
32	-0.20%	-0.40%	-0.95%*	-1.56%*	-0.16%	-0.34%	-0.13%	-0.26%	0.25%	4.20%
	[31.32%]	[85.78%]	[9.32%]	[6.49%]	[45.21%]	[88.99%]	[59.53%]	[94.61%]	[56.05%]	[32.57%]

33	-0.64%*** [0.00%]	0.71% [62.55%]	-1.00%*** [0.47%]	-0.91% [12.57%]	-0.76%*** [0.00%]	-1.04% [10.73%]	-0.69%*** [0.05%]	1.14% [58.47%]	-0.49% [17.32%]	4.11% [50.27%]
34	-9.24%*** [0.00%]	-9.47%*** [0.00%]	-16.85%*** [0.00%]	-15.22%*** [0.00%]	-9.14%*** [0.00%]	-9.47%*** [0.00%]	-8.63%*** [0.27%]	-9.33%*** [0.01%]	-10.50%*** [0.20%]	-8.99%*** [2.19%]

Description: This table presents the results from SUR regressions corresponding to the subevents for CDS spreads and Stock returns using an estimation window of 140 trading days and an event window of 3 trading days.

*** = significant at 1%, ** = significant at 5%, * = significant at 10%

ANNEX III.

Sample distributed by Cumulated Abnormal Return (CAR) across
each event date | Stock returns

Event No.	<i>Stock returns</i>				
	<i>Whole Sample Stock returns</i>	<i>G-SIB Stock returns</i>	<i>EU Stock returns</i>	<i>SSM Stock returns</i>	<i>Low z-score Stock returns</i>
1	-0.64%*** [0.71%]	-0.49% [36.41%]	-0.75%** [1.14%]	-1.15%*** [0.07%]	-1.11%** [1.50%]
2	5.89%*** [0.00%]	10.54%*** [0.00%]	6.75%*** [0.00%]	6.73%*** [0.00%]	7.50%*** [0.00%]
3	0.61%* [6.09%]	1.64%** [3.42%]	0.66%* [7.39%]	1.06%*** [0.10%]	1.93%*** [0.00%]
4	-1.10%*** [0.06%]	-2.95%*** [0.08%]	-1.06%*** [0.49%]	-1.26%*** [0.03%]	-1.74%*** [0.01%]
5	-0.45% [26.88%]	-1.27%*** [0.02%]	-0.69%* [8.30%]	-0.56% [25.39%]	-1.46%** [3.37%]
6	-5.63%*** [0.00%]	-10.07%*** [0.02%]	-6.25%*** [0.00%]	-6.46%*** [0.00%]	-7.84%*** [0.02%]
7	1.30% [10.20%]	1.40% [11.55%]	1.90%** [3.54%]	2.10%** [3.06%]	5.94%*** [0.21%]
8	4.98%*** [0.00%]	6.65%*** [0.00%]	5.62%*** [0.00%]	5.57%*** [0.00%]	7.68%*** [0.02%]
9	1.48%*** [0.14%]	2.62%** [3.10%]	1.63%*** [0.24%]	1.84%*** [0.10%]	2.73%*** [0.16%]
10	0.57% [54.58%]	0.40% [95.64%]	0.55% [58.42%]	0.61% [51.26%]	1.55% [30.28%]
11	0.38% [73.01%]	-0.17% [54.76%]	0.38% [73.01%]	0.22% [98.46%]	-0.06% [75.95%]
12	0.42% [79.84%]	0.54% [68.85%]	0.42% [79.84%]	0.01% [81.79%]	-0.12% [70.96%]
13	-0.63% [22.82%]	-1.79% [18.91%]	-0.78% [17.84%]	-0.99% [12.34%]	-2.84%*** [0.16%]
14	0.21% [77.09%]	0.11% [96.34%]	0.26% [72.85%]	0.51% [47.92%]	1.66%** [2.86%]
15	1.76%** [3.94%]	1.87%** [2.95%]	2.08%** [2.03%]	2.54%** [1.53%]	2.07% [12.57%]
16	-1.48%*** [0.05%]	-2.68%*** [0.16%]	-1.69%*** [0.06%]	-1.35%** [1.61%]	-2.30%*** [0.59%]
17	1.82%*** [0.06%]	3.58%*** [0.00%]	1.72%*** [0.58%]	1.85%*** [0.44%]	2.39%* [5.71%]
18	-0.65%* [7.18%]	-0.65% [23.18%]	-0.59% [12.56%]	-0.76% [12.27%]	-0.97% [11.98%]
19	-1.02%** [1.42%]	0.19% [48.33%]	-1.08%** [1.54%]	-1.10%* [5.16%]	-2.37%* [7.24%]
20	1.07% [16.03%]	1.45%* [8.56%]	1.09% [16.50%]	0.90% [46.02%]	1.56% [43.71%]
21	-2.48%*** [0.00%]	-1.51%* [6.01%]	-2.57%*** [0.00%]	-2.70%*** [0.00%]	-3.86%*** [0.01%]
22	0.01% [78.44%]	1.11%* [5.98%]	0.01% [80.31%]	-0.39% [33.21%]	-1.27% [27.96%]
23	0.78% [12.15%]	0.93%** [3.27%]	0.80% [20.33%]	0.62% [47.38%]	0.89% [47.65%]
24	-1.27%*** [0.08%]	-2.62%*** [0.00%]	-1.48%*** [0.14%]	-1.13%** [4.49%]	-0.18% [78.39%]
25	-1.39%*** [0.23%]	-1.62%* [5.09%]	-1.74%*** [0.05%]	-1.92%*** [0.02%]	-3.83%*** [0.05%]
26	-0.89%** [1.46%]	-0.88%* [8.29%]	-0.84%** [4.29%]	-1.31%*** [0.49%]	-1.92%*** [0.25%]
27	-1.84%** [2.01%]	-4.39%*** [0.14%]	-1.88%** [2.59%]	-1.75% [12.12%]	-2.49% [25.10%]
28	1.82%*** [0.72%]	2.96%** [1.11%]	2.07%*** [0.27%]	2.35%*** [0.16%]	3.85%** [2.16%]
29	-4.12%*** [0.00%]	-4.12%** [2.33%]	-4.37%*** [0.00%]	-4.44%*** [0.00%]	-6.91%*** [0.00%]
30	0.17% [67.36%]	0.87%* [7.42%]	0.12% [82.94%]	0.27% [54.21%]	0.95%** [4.46%]
31	-0.85% [13.83%]	-2.59%*** [0.27%]	-1.06%* [5.88%]	-0.61% [48.25%]	-0.72% [61.80%]
32	0.06% [77.82%]	-0.15% [42.78%]	0.17% [90.90%]	-0.02% [63.28%]	-0.01% [76.04%]
	-0.31%*	-1.05%***	-0.21%	-0.29%	-0.81%*

33	[7.85%]	[0.04%]	[25.08%]	[23.97%]	[6.83%]
34	3.80%***	6.32%***	4.47%***	4.69%***	6.41%***
	[0.00%]	[0.02%]	[0.00%]	[0.00%]	[0.01%]

Description: This table presents the results from SUR regressions corresponding to the subevents for CDS spreads and Stock returns using an estimation window of 140 trading days and an event window of 3 trading days.

*** = significant at 1%, ** = significant at 5%, * = significant at 10%
