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Capital requirements in Pillar 1 or Pillar 2: does it matter for market discipline?

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Abstract

The results of this paper provide empirical evidence that regulatory capital ratios drive bank Credit Default Swaps (CDS) and that markets react more to changes in capital requirements if implemented via direct adjustments to Pillar 1 risk weights than imposed as a percentage of Risk-Weighted Assets (RWAs) under Pillar 2. In other words, market discipline on bank capital adequacy is sensitive to the composition of the capital requirement stack. Therefore, this paper contributes novel insights to existing research on the market relevance of regulatory capital ratios, on the functioning of the Basel framework, and on market discipline along with its relationship with Pillar 1 and Pillar 2 capital requirements. The findings are relevant in light of the continuous discussions around the capital regulation for Interest Rate Risk in the Banking Book (IRRBB) and other Pillar 2 risks because they suggest that risks are more disciplined by markets if they are reflected in regulatory capital ratios via RWAs. Moreover, the results suggest that further regulatory alignment within the EU can impact the comparability of regulatory capital ratios and affect pricing decisions. In the first empirical step, the research investigates the drivers of CDS and identifies a significant relationship between CDS spreads and regulatory capital ratios. In the second step, the paper researches a quasi-natural experiment based on an event in the EU banking sector. In 2018, the Swedish supervisory authority changed the implementation approach of a risk weight floor on Swedish mortgages by shifting it from Pillar 2 to Pillar 1 while keeping total capital requirements stable. To assess if this merely technical regulatory adjustment triggered an unexpected reaction by markets, a two-step system Generalised Method of Moments (GMM) regression is applied to a sample of CDS spreads of 21 European banks between 2014 and 2020.

Keywords: European integration, banking regulation, capital requirements, bank default risk, funding costs, IRRBB, market discipline

JEL: F36, G12, G21, G28

Non-Technical Summary

Since the Basel II accord, international bank capital regulation rests on three Pillars. Pillar 1 and Pillar 2 govern the different components of total bank capital requirements, while Pillar 3 aims to promote market discipline through disclosure requirements for banks. Pillar 1 prescribes minimum capital requirements for credit, operational, and market risks, governs the calculation of RWAs, and allows to impose additional buffer requirements. Pillar 2 enables supervisors to require additional capital to cover bank-specific risks that are not or only partially covered by Pillar 1 requirements, such as IRRBB. The total capital requirements from both Pillars are binding, meaning that banks must satisfy them permanently, irrespective of their composition. However, risk-based regulatory capital ratios, such as the CET1 ratio, only depict the capitalisation of risks reflected in RWAs and thus do not contain information on the capital adequacy for Pillar 2 risks.

Regulatory authorities have two main tools to increase banks' capital requirements: they can either raise the required capital ratio or directly adjust the components used to calculate it. Direct adjustments include adding conservative add-ons to RWAs or excluding certain capital elements deemed less reliable for absorbing losses. These adjustments to the denominator or numerator directly affect a bank's regulatory capital ratio, making them more visible to the market. In contrast, raising required capital ratios, such as through higher Pillar 2 capital requirements, are less visible because they do not alter risk-based capital ratios.

Although banks must comply with the total capital requirement, irrespective of its composition, practitioners and academics commonly rely on regulatory capital ratios as bank capital adequacy indicators. For instance, previous literature found that banks with high capital ratios benefit from lower CDS than less capitalised banks because investors reward higher solvency with lower default risk premiums. However, there are limited insights into whether mere technical changes in the distribution of capital requirements across Pillar 1 and Pillar 2 can trigger market reactions. Against this background, I empirically examine the effects of the 2018 transformation of a Pillar 2 requirement for Swedish banks into an RWA add-on. Although the affected banks' risk profiles, capital holdings and total capital requirements remained stable, the increase in RWAs associated with the shift of the capital requirement to Pillar 1 led to a drop in capital ratios.

In my study, I run a dynamic linear panel model on 21 European banks between 2014 and 2019 and include an instrumental variable to identify the banks affected by the transformation.

Controlling for bank-specific and financial market factors, the results show that transforming the Pillar 2 capital requirement into Pillar 1 RWAs significantly increased CDS for the impacted Swedish banks. Thus, this paper contributes novel insights to the academic literature on market discipline, the relevance of regulatory capital ratios, and the functioning of the Basel framework. Specifically, it provides empirical evidence that market discipline is more sensitive to changes in capital requirements implemented through RWA adjustments in Pillar 1, compared to changes in capital requirements as a percentage of RWAs under Pillar 2. This finding highlights the significance of the distribution of capital requirements between Pillar 1 and Pillar 2 for market discipline, a topic that has not been addressed in prior academic studies.

Besides incentivising market participants to look beyond regulatory capital ratios when analysing bank capital adequacy, the findings are also relevant for regulators and academics. Policymakers and supervisors can consider that RWA uplifts are more disciplined by markets than increases in required capital ratios when designing bank capital requirements. In this context, the results suggest that markets would discipline the capitalisation of Pillar 2 risks, such as IRRBB, to a larger degree if they were reflected in Pillar 1 RWAs. This implies that a heterogeneous reflection of similar risks in regulatory capital ratios can distort the comparability of these ratios across countries and the level playing field of banks.

Future research could investigate the explanations for the results of this paper. A potential reason is that markets focus on capital ratios that reflect the capitalisation of Pillar 1 requirements when assessing capital adequacy because the costs of considering Pillar 2 requirements are comparably higher. The use of regulatory capital ratios as capital adequacy indicators in financial analysis and pricing has become standard practice and financial data providers offer more comprehensive and frequent data on capital ratios compared to Pillar 2 requirements. Moreover, Pillar 2 requirement methodologies differ between jurisdictions, their calibration is only partially transparent and investors might perceive them as more complex. Alternatively, markets might perceive Pillar 1 requirements to be more binding even though banks must always meet total capital requirements. Thus, they would reward higher headroom of regulatory capital ratios to Pillar 1 capital requirements, irrespective of the headroom to total requirements. Finally, this paper might encourage academics to further analyse the interplay of different types of capital requirements, and to investigate the role of the private sector in regulatory convergence based on examples comparable to the one presented in this paper.

1 Introduction

The Basel framework aims to strengthen the regulation, supervision, and risk management of banks. Its primary objectives are to enhance financial stability, reduce the likelihood of banking crises, and promote a more resilient global banking sector. The framework is structured around three pillars, collectively addressing both quantitative and qualitative aspects of banking regulation.

Pillar 1 governs the calculation of RWAs for credit, market, and operational risks, which form the basis for minimum capital requirements and regulatory capital ratios. Besides, Pillar 1 comprises the complementary buffer requirements and non-risk-based Leverage ratio requirements. If competent supervisors identify in the Supervisory Review and Evaluation Process (SREP) that bank risks are underestimated or not captured under Pillar 1, they can set additional, institution-specific capital requirements under Pillar 2. Pillar 2 manages risks such as IRRBB, which may not immediately impact bank capital when they materialise, and are challenging to uniformly address across diverse business models and financial systems. In fact, the Basel framework grants jurisdictions the flexibility to design national Pillar 2 regimes, facilitating the development of methodologies tailored to idiosyncratic risks and country-specific business environments, albeit at the expense of comparability of Pillar 2 requirements. For example, IRRBB is not captured by RWAs in most jurisdictions, so regulatory capital ratios do not include information on capital adequacy for this risk. While Pillar 1 and Pillar 2 requirements are designed differently and address different risks, they are equally binding and banks must meet them at all times.

Lastly, Pillar 3 requires increased transparency in regulatory disclosures to facilitate market discipline. Market discipline is a mechanism where financial markets influence institutions, particularly banks, to operate efficiently and manage risk effectively by responding to disclosed information. This process relies on the assumption that well-informed and rational market participants reward prudent behaviour and penalise excessive risk-taking.

The market relevance of regulatory capital ratios and the interaction of the three Basel pillars has been discussed by policymakers and in existing literature (see for instance VanHoose (2007)). According to Decamps et al. (2004), regulators, supervisors, and markets discipline bank risk and capital adequacy from different perspectives and their conclusions can differ due to information asymmetries. Vallascas and Hagendorff (2013), for example, find evidence that RWAs are misaligned to market measures of bank risk. In the same vein, policy debates continue regarding the disclosure and inclusion of certain Pillar 2 risks within Pillar 1 RWAs, particularly in relation to IRRBB, following the collapse of Silicon Valley Bank in 2023. One of the main arguments for reflecting IRRBB in Pillar 1 RWAs is that it might enhance transparency regarding the level of IRRBB, increase the degree of market discipline exercised, and improve risk management and capitalisation by banks.

Although risk-based capital ratios alone don't reflect Pillar 2 capital adequacy, they are widely used by markets and researchers as solvency indicators. Previous research has extensively demonstrated that changes in risk-based capital ratios significantly influence market behaviours, leading to varied reactions such as adjustments in funding costs or shifts in risk premiums. However, research on market reactions to changes in Pillar 2 capital requirements is still limited. BCBS (2013) suggests that harmonisation and transparency around Pillar 2 capital requirements facilitate their consideration by markets, improve the alignment between regulatory and market-based risk measures and promote market discipline. As long as the composition and calibration of Pillar 2 requirements are less transparent and comparable across jurisdictions than minimum capital requirements, market discipline on changes in Pillar 2 requirements might be comparatively lower.

When Nordea relocated its headquarters from Sweden to Finland in 2018, the Swedish supervisory authority transformed a Pillar 2 requirement into a direct adjustment to RWAs to facilitate its reciprocation by the Single Supervisory Mechanism (SSM). While RWAs increased due to the policy shift and resulted in reduced capital ratios, Pillar 2 requirements were lowered to avoid double-counting and to keep the total capital requirements equal. Thus, the affected banks' capital holdings, risk profiles and total capital requirements remained stable. This quasi-natural experiment enables novel empirical research on the relationship between the composition of the capital requirement stack and market discipline regarding bank default risk.

The results of this research contribute to academic literature by offering novel insights into the relationship between market discipline and different types of capital requirements. If the transformation of a Pillar 2 capital requirement into an RWA adjustment leads to significant CDS spread reactions of affected Swedish banks in the quasi-natural experiment, there is evidence that the market pays closer attention to changes in Pillar 1 RWAs than in Pillar 2 requirements. Hence, this would point to a misalignment between market and regulatory assessments of capital adequacy. Policymakers could consider the different degrees of market discipline when designing capital requirements and explore ways to strengthen market discipline around Pillar 2 capital adequacy. Market participants, in turn, could incorporate Pillar 2 requirements into capital adequacy indicators going forward to assess bank default risk more accurately.

2 Background

2.1 EU Transposition of Basel III

As opposed to Basel II rules, which were implemented at the national level, the Basel III framework was adopted at the EU level via the Single Rulebook in January 2014, comprising the Capital Requirements Regulation (CRR) and Capital Requirements Directive (CRD IV). The Single Rulebook aims to ensure an effective functioning of the Single Market, to increase regulatory harmonisation in the EU, and to close regulatory loopholes.

In addition to adopting the Single Rulebook, the Banking Union was created to govern banking supervision and resolution on EU level. The sovereign debt crisis revealed significant differences in capital requirements and supervisory frameworks across EU countries, illustrating the need for the Banking Union. Because of the high interconnectedness of EU banks, disruptions in national banking sectors related to public finances could spread and threaten the integrity and resilience of the Monetary Union. Therefore, it was decided that banking supervision should be governed at the EU level in the future.

The SSM was established in 2014 and comprises the European Central Bank (ECB) and the national competent authorities of euro area countries. One objective of the SSM's mandate is to ensure the consistent and effective application of the Single Rulebook to financial institutions under its supervision. Although the playing field for EU banks has become more level since its establishment, differences in national regulatory and supervisory frameworks persist, especially in EU Member States that have not adopted the Euro or have not signed a close cooperation agreement with the ECB.[1]

[1] EU Member States that are not part of the Monetary Union can voluntarily become part of the SSM under a close cooperation agreement and transfer the supervision of their domestic banks to the ECB. In 2020, Croatia and Bulgaria established such an agreement with the ECB.

2.2 IRB Models, RWAs and Supervisory Measures

As risk-based capital requirements and ratios are expressed as a percentage of RWAs, banks' Internal Ratings-Based (IRB) models must produce risk weights that prudently capture portfolio risks. Therefore, the regulatory preconditions for the use of internal models for calculating RWAs are sophisticated (Gai et al., 2019) and prescribe, for instance, that the historical default data used covers a full business cycle, that estimates are satisfactorily predictive and conservative, and that there is sound model governance. If IRB models exhibit deficiencies or lack compliance, the conservatism of risk estimates can be undermined. However, even fully compliant IRB models might still underestimate economic credit risk because the Pillar 1 framework does not account for all types of credit risk, such as concentration risk, which are therefore addressed under Pillar 2 (Prorokowski et al., 2019).

The approach to addressing concerns about risk underestimation by IRB models can differ between Basel Committee of Banking Supervision (BCBS) member states. Some competent authorities address risks due to internal model deficiencies via Pillar 2 requirements, while other jurisdictions address similar deficiencies with direct adjustments to Pillar 1 RWAs and impose multipliers or add-ons to IRB parameters, or risk weight floors. The SSM, for example, imposes limitations to model parameters or portfolio risk weights to mitigate some of the more severe model deficiencies, which directly affects risk-based capital ratios (ECB, 2021).

In addition to bank-specific capital requirements, certain CRR provisions allow authorities to increase portfolio risk weights for a set of domestic banks. Article 458(2)(d)(iv) CRR, for example, allows competent authorities to set risk weight floors to target asset bubbles in the residential and commercial property sectors. This provision serves as a residual measure to be applied when other macro-prudential measures and Pillar 2 capital requirements are deemed inadequate (Bassani, 2019).

2.3 Shift of Swedish Mortgage Risk Weight Floor from Pillar 2 to Pillar 1

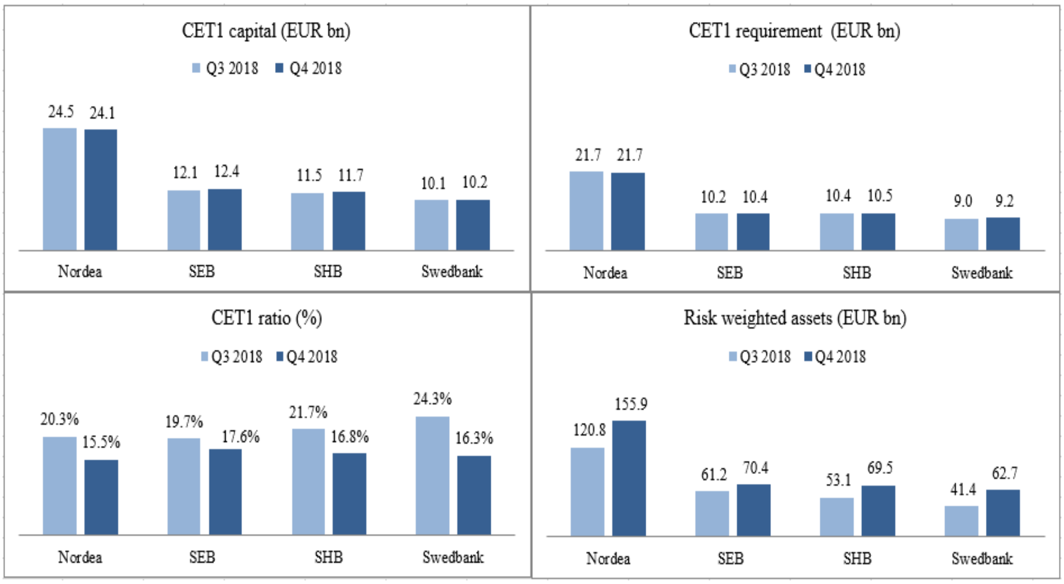
After Basel II was transposed into Swedish law in 2007, several domestic banks applied for the IRB approach to calculate the risk weights for Swedish mortgages. Due to few defaults and low credit losses in Swedish mortgage portfolios since the Nordic financial crisis in the 1990s, IRB-modelled risk weights dropped significantly to around 5% (Finansinpektionen, 2014), which is lower than the 35% risk weight prescribed by the Standardised Approach and the average mortgage risk weights in other EU countries. To ensure the prudent capitalisation of credit risk in Swedish mortgage IRB portfolios and to enhance the resilience of the Swedish financial sector, Finansinspektionen implemented a 15% IRB risk weight floor on Swedish mortgages as part of Pillar 2 capital requirements in May 2013. Specifically, Finansinspektionen calculated the additional capital a specific Swedish bank would need to hold if the 15% risk weight were applied to the IRB RWAs of its mortgage portfolio and transformed the derived amount of capital into a Pillar 2 requirement. Because the Pillar 2 requirement for Swedish mortgages was expressed as a percentage of unfloored RWAs, the RWAs—and thus the risk-based capital ratios—of affected banks remained unchanged, even though their total capital requirements increased. The risk weight floor, implemented under Pillar 2, was raised to 25% in 2014 (Finansinpektionen, 2014).

In October 2018, Nordea relocated its headquarters from Sweden to Finland. Following this re-domiciliation to a Banking Union member state, the SSM became the competent supervisor for Nordea. To maintain the applicability of the additional capital requirement for Swedish mortgages for Nordea, the SSM had to reciprocate the Swedish risk weight floor. However, the SSM's holistic SREP methodology did not permit the reciprocation of this measure as a Pillar 2 capital requirement. This is because the SSM's Pillar 2 requirements are determined based on a holistic risk assessment, whereas the Swedish Pillar 2 requirement can be broken down to individually quantified risk-by-risk components.

In order to facilitate the reciprocation of the risk weight floor by the SSM, Finansinspektionen decided on 1 October 2018 to make use of Article 458(2)(d)(iv) CRR. The risk weight floor was now more visible to the market as it was directly reflected in RWAs and capital ratios. Since the amount of capital in the numerator remained stable, the risk-based capital ratios of the affected Swedish banks dropped. To prevent double counting and keep total capital requirements stable, the Pillar 2 requirements for banks with IRB models for Swedish mortgages were adjusted downwards accordingly. Figure 1 shows that changes in CET1 capital and CET1 requirements were minor and thus did not warrant significant movements in CDS spreads. The lower bar charts illustrate that the increase in RWAs led to lower risk-based capital ratios.

Finansinspektionen published detailed communication before shifting the risk weight floor from Pillar 2 to Pillar 1, including the impact on capital requirements and ratios for banks with IRB models for Swedish mortgages (Finansinspektionen, 2018). This aimed to prevent undue market volatility due to changes in regulatory capital ratios. In this context, this paper analyses whether shifting the requirement to Pillar 1 triggered an unexpected market reaction.

Figure 1: CET1 ratios, requirements and RWAs of the four largest banks in Sweden before and after the regulatory change



3 Literature Review

This section provides an overview of literature related to the market relevance of regulatory capital ratios, the functioning of the Basel framework (Annaert et al., 2010; Hasan et al., 2014), and the interaction between market discipline, capital ratios, and Pillar 1 and Pillar 2 capital requirements (Hasan et al., 2014; Santos and Bonfim, 2005).

Extensive literature identified that changes in capital ratios and requirements can trigger market reactions and can influence bank risk taking and lending decisions. Drago et al. (2017) find that capital ratios, asset quality, leverage, the business environment, funding stability, balance sheet size and bank and sovereign credit ratings significantly influence banks' CDS levels. Similarly, Samaniego-Medina et al. (2016) analyse the drivers of CDS spreads for a sample of 45 European banks between 2004 and 2010 and show that bank leverage, non-performing loan ratios, and liquidity indicators are significant determinants of CDS spreads among other variables.

Using CDS spreads as a proxy to analyse the linkages between funding costs and capital ratios, Schmitz et al. (2017) estimate that increases of the capital ratio of 1 basis point can decrease funding costs by more than 1 basis point. Babihuga and Spaltro (2014) find that a 100 bps increase in the total capital ratio reduces CDS spreads by 26 bps in the long term. This is because a higher capital ratio indicates a lower probability of default, which the market rewards with a lower risk premium on funding. The default risk component of banks' funding costs for senior and subordinated debt instruments is reflected in the CDS spread. The identified relationship between funding cost and solvency aligns with the Modigliani-Miller theorem which posits that a company's capital structure is irrelevant to its overall funding costs, implying that increases in regulatory capital ratios decrease the marginal cost of funding through debt and equity instruments. Although the strong prerequisites of the Modigliani-Miller theorem, such as efficient markets and the absence of taxes, asymmetric information and agency costs (Modigliani and Miller, 1958), do not hold in reality, some conclusions of the model persist even when these assumptions are relaxed (Brusov et al., 2011).

Other authors conducted similar analyses using different funding cost proxies. For example, Arnould et al. (2022) employ a linear dynamic regression on a large unbalanced panel of bank data from two ECB proprietary datasets, covering the period between 2007 and 2017, and find a negative relationship between funding costs, measured by senior bond yields and deposit rates, and capital ratios. They also detect a non-linearity in this relationship, indicating that the negative correlation weakens as solvency increases. Similarly, Aymanns et al. (2016) approximate funding costs with interest expense ratios, and their linear panel estimation reveals a significant negative non-linear link between capital ratios and funding costs, which further intensifies during stressed periods. Thus, extensive literature supports the notion that markets discipline decreases in Pillar 1 capital ratios.

Another related research branch focuses on the effects of changes in capital requirements on financial stability and the real economy. Admati et al. (2013) argue that higher bank capital requirements reduce the probability of bank runs, which can support financial stability during crises. Beltratti and Stulz (2012) show that higher capital requirements can increase the survival probability of financial institutions in a financial crisis. Regarding the relationship of bank lending and capital requirements, Kapan and Minoiu (2013), for example, provide evidence that banks with lower leverage decrease lending less than banks with higher leverage in times of financial stress. Conversely, Fraisse et al. (2017) find that a 100 basis point increase in capital requirements reduces lending by 10%. Similarly, De Jonghe et al. (2020) document that higher Pillar 2 capital requirements reduce bank lending, although the impact is relatively small. Martinez-Miera and Suarez (2012) conduct a more comprehensive analysis and conclude that higher capital requirements can mitigate the decline in net consumption, bank lending, and GDP following a systemic shock.

Additional relevant literature examines the interaction of the Basel pillars more broadly. Delis and Staikouras (2011) empirically investigate how the interplay between capital regulation, supervision, and market discipline affects bank risk and find that Pillar 2 requirements and market discipline are more effective in reducing bank fragility than Pillar 1 minimum capital requirements. However, the findings show that stricter Pillar 1 requirements can reduce the risk of banks that operate close to the minimum requirements. VanHoose (2007) analyses the design of Pillar 2 and 3 from a conceptual perspective and argues that they might rather conflict with, rather than support, each other. He concludes that disclosure requirements under Pillar 3 are too limited to enhance market discipline in developed financial systems and that the supervisory discretion embedded in Pillar 2 may be counterproductive in enforcing regulatory and external reporting requirements. In the same vein, Fullenkamp and Rochon (2016) suggest increasing the importance and transparency of supervisory actions under Pillar 2 and promoting market discipline by simplifying the Pillar 1 framework to strengthen the mutual reinforcement of the Basel Pillars. Flannery and Bliss (2018) establish that market discipline can be exercised indirectly through Pillar 2 when supervisors enforce corrective actions based on market signals that indicate increased bank risk.

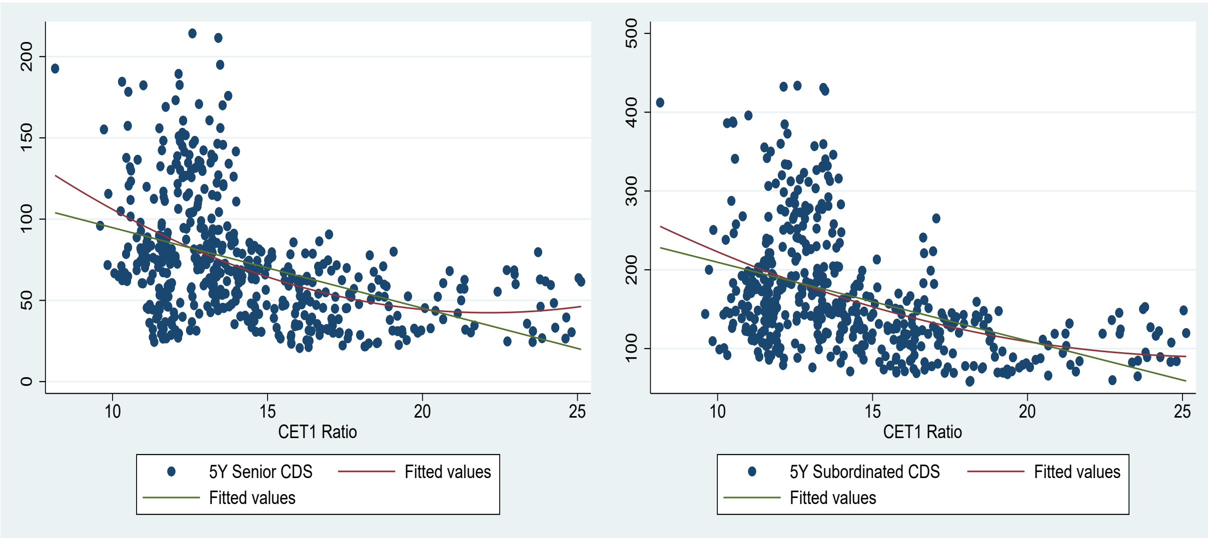
Flannery (2001) notes that a prerequisite for effective market discipline is that markets have access to sufficient and appropriate information regarding a bank's financial condition. Thus, an analysis of market reactions to shifts between Pillar 1 and Pillar 2 requirements needs to be considered in light of the complexity, heterogeneity, and opacity of national capital requirement frameworks as these factors can impede markets from processing the information and therefore distort the effective interaction of the Basel pillars. Herring (2018) argues that the capital regulation based on BCBS standards has become opaque, intricate and difficult to monitor following a series of revision rounds aimed at correcting perceived weaknesses in the framework, such as lack of risk sensitivity. Over time, capital ratios have become "too complex to verify, too error-prone to be reliably robust" (Haldane, 2011), thereby impairing the effectiveness of supervisory discretion and market discipline. In other words, placing too much weight on Pillar 1 has created an imbalance between the three Pillars and inhibited the robustness of the framework (Haldane, 2011). Hakenes and Schnabel (2014) examine regulatory capture in the context of setting Pillar 2 capital requirements as a result of complexity of the regulatory framework.

Despite the Single Rulebook, EU-level and national-level regulations and supervisory processes continue to coexist and national regulatory options and discretions remain in place, which can generate regulatory complexity, opacity, and heterogeneity (Enria, 2015). This is particularly applicable to Pillar 2 frameworks, especially if differences between national regimes are not fully transparent and, therefore, difficult for markets to identify. As previously noted, the SSM uses a more holistic approach to setting Pillar 2 capital requirements, while the Swedish supervisor follows a risk-by-risk method, which allowed for the implementation of the mortgage risk-weight floor under Pillar 2. A further difference lies in the disclosure practices: since 2014, Finansinspektionen has published quarterly Pillar 2 requirements for domestic banks, specifying the individual risks covered. In contrast, the ECB has only disclosed holistic Pillar 2 requirements annually since 2020, without detailing the specific risks. Therefore, the shift of the Swedish risk weight floor from Pillar 2 to Pillar 1 provides a useful example for examining the impact of complex differences between capital requirement frameworks on the comparability of capital ratios, the effective functioning of the Basel framework and its interplay with market discipline.

4 Data and Methodology

In a first step, this research paper empirically analyses the relationship between regulatory capital ratios and CDS spreads, reflecting the market consensus on the issuing bank's default risk. The scatterplots of CET1 ratios and senior and subordinated CDS spreads depicted in Figure 2 indicate that the negative correlation between capital ratios and CDS identified by previous literature exists in this paper's sample as well. Besides, the red quadratic regression line seems to fit the observations better which supports the finding of Arnould et al. (2022) and Aymanns et al. (2016) that the effect of increasing capital ratios on CDS is non-linear and decreases with higher levels.

Figure 2: Scatterplots of CET1 ratios (in %) and 5-year senior and subordinated CDS spreads (in basis points) with fitted linear and quadratic regression



The second part empirically tests whether the transformation of the Pillar 2 capital requirement into a floor to RWAs affected CDS of the Swedish IRB banks in the sample. Looking at the CDS spreads of the four largest affected banks displayed in Figure 3, the spike in Q4 2018 suggests that the shift of the capital requirement from Pillar 2 to Pillar 1 had a significant impact on the default risk pricing by markets. Since neither absolute capital amounts nor capital requirements changed significantly (see Figure 1) in Q4 2020, the jump in CDS spreads appears to be an unwarranted market reaction. The permanent nature of the move of the 25% risk weight floor allows dividing the sample into a treatment group comprising Swedish banks with IRB approval for mortgage exposures and a control group composed of 17 large European banks unaffected by the policy shift. With the methods outlined in Section 4.2, it is investigated if the treatment in the form of the policy change had a statistically significant effect on CDS spreads. Furthermore, the paper analyses the duration of the impact over several quarters.

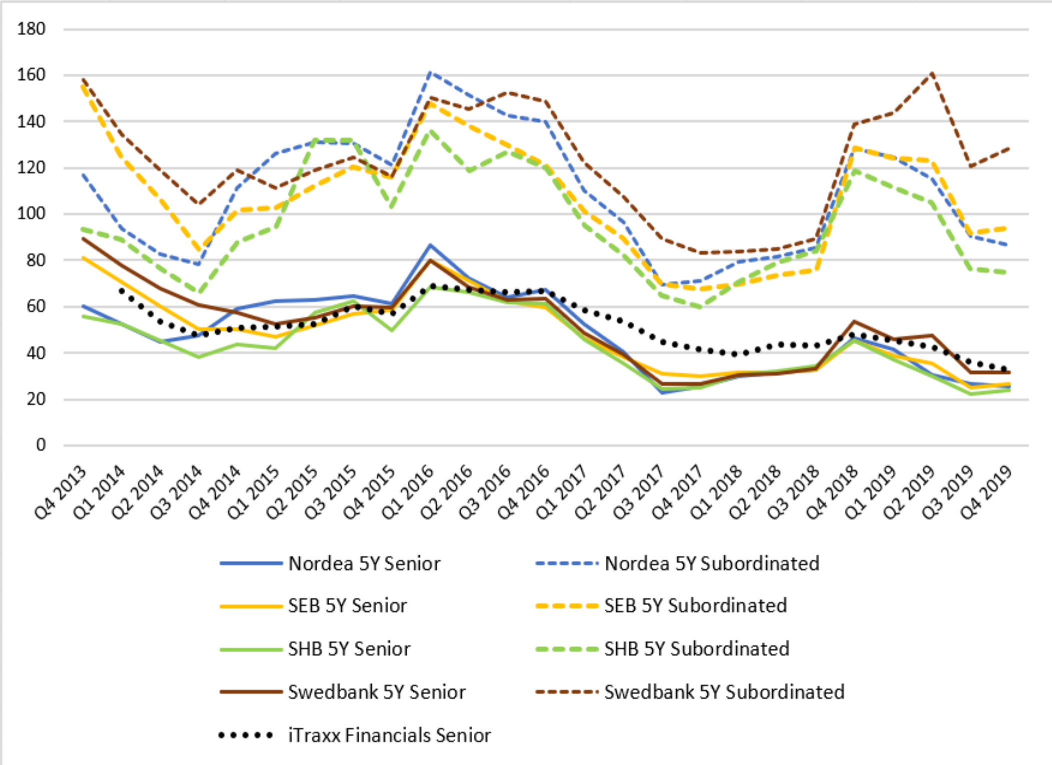
The decision to use CDS spreads to examine market reactions to changes in the composition of bank capital requirements is underpinned by several reasons. Investors trade CDS to insure debt instruments of banks against default risk and can discipline banks' risk-taking and solvency by driving incremental unsecured funding costs of a bank (Babihuga and Spaltro, 2014). As presented in Section 3, extensive previous academic literature underscores the sensitivity of CDS spreads to shifts in solvency indicators which supports that CDS are a suitable indicator of the market assessment of bank default risk for this research paper.

Furthermore, daily CDS data, with its consistent 5-year forward-looking dimension and international investor base, offers superior comparability across banks than alternative market indicators driven by bank solvency such as bond yields or other funding spreads, which can be clouded by differences in bank funding strategies, competition, tax considerations or maturity profiles of instruments (Annaert et al., 2010). Moreover, traded CDS spreads capture genuine market sentiments more effectively because they are less influenced by the intricacies of business relationships between a bank and its funding providers, which can affect borrowing terms. Blanco et al. (2005); Hull et al. (2004); Zhu (2006) found that CDS spreads react more swiftly to changes in credit quality indicators of the reference entity.

Importantly, this paper primarily investigates CDS spread movements due to changes in capital ratios following a technical transformation of existing capital requirements, rather than evaluating the actual bank default risk. Consequently, structural default risk models, which lack market data, are not viable as the emphasis lies on gauging market reactions irrespective of any tangible or hypothetical alterations in default risk. The implicit assumption driving this analysis is that the shift of the Swedish mortgage risk weight floor to Pillar 1 RWAs had no bearing on bank default risk but was met with an unjustified market response.

The usage of CDS spreads results in a sample comprising only 21 European banks due to the limited CDS data availability for smaller banks. Nevertheless, the sample is representative because it accounts for a large share of EU banking assets and their debt instruments are among the most common underlying names of CDS for European banks. Moreover, the sample includes the main European peers of the Swedish IRB banks subject to investigation in terms of size and systemic significance. Thus, the use of CDS spreads as the primary metric in this investigation is justified as it ensures that the results are emblematic of the wider European banking sector.

Figure 3: 5-year CDS spreads of the four largest banks in Sweden 2014-2020



4.1 Data

This research utilises an unbalanced panel dataset comprising quarterly data from Q1 2014 to Q4 2019. The dataset includes 5-year senior and subordinated CDS spreads of 21 EU banks, along with their key financial indicators and relevant financial market variables. An overview of the sample banks, sorted by total assets as of Q4 2019, is provided in Table 1. Collectively, the total assets of these banks, which are located in 10 different European countries, amount to approximately EUR 16 trillion.[2] The CET1 capital ratios as of Q4 2019 range from 11.65% (Banco Santander SA) to 18.56% (DNB ASA).

Daily CDS spreads for senior and subordinated debt instruments with a 5-year maturity are sourced from S&P Global Market Intelligence. The availability of CDS data for both senior and subordinated bonds allows for an analysis of whether the CDS drivers are consistent across different debt seniorities or sensitive to the seniority of the insured debt. To ensure consistency with the frequency of other variables, the quarterly average of daily observations is calculated.

[2]On 1 October 2018, Nordea relocated its headquarters from Sweden to Finland.

Table 1: Sample Overview

Bank	Country	Total Assets (EURm)	CET1 Ratio (%)
BNP Paribas SA	France	2,165	12.14
Crédit Agricole SA	France	1,768	12.11
Banco Santander SA	Spain	1,523	11.65
Société Générale SA	France	1,356	12.70
Deutsche Bank AG	Germany	1,298	13.63
ING Groep NV	Netherlands	892	14.57
UniCredit SpA	Italy	856	13.22
Intesa Sanpaolo SpA	Italy	816	13.92
BBVA SA	Spain	699	11.98
Coöperatieve Rabobank U.A.	Netherlands	591	16.32
Nordea Bank Abp (Nordea)	Finland	555	16.26
Danske Bank A/S	Denmark	503	17.29
Commerzbank AG	Germany	464	13.41
CaixaBank SA	Spain	391	12.03
ABN Amro Bank NV	Netherlands	375	18.13
Svenska Handelsbanken AB (SHB)	Sweden	292	18.53
DNB ASA	Norway	284	18.56
Skandinaviska Enskilda Banken AB (SEB)	Sweden	272	17.59
Erste Group Bank AG	Austria	246	13.76
Swedbank AB	Sweden	229	16.95
Bayerische Landesbank AoeR	Germany	226	15.89

Regulatory capital adequacy indicators, asset size, asset quality, profitability, and liquidity indicators for European banks are sourced from SNL and Orbis Bank Focus. The capital adequacy indicators include the CET1 ratio, Tier 1 ratio, Own Funds ratio, and the non-risk-sensitive Leverage ratio. Asset quality is represented by the share of loan loss reserves and problem loans relative to gross customer loans. Profitability indicators for this analysis include return on equity (ROE) and return on assets (ROA). The liquidity position of each bank is measured by the share of wholesale funding over total assets and the Loan-to-Deposit ratio.

The financial market indicators capture financing conditions, general risk aversion, and country risk. The domestic overnight interbank rate reflects the country's rate environment and monetary policy. The EONIA rate, sourced from the ECB Statistical Data Warehouse (now the ECB Data Portal), serves as a measure of financing conditions for Banking Union banks. For Danish, Swedish, and Norwegian banks, the CIBOR, STIBOR, and NIBOR overnight rates were obtained from the respective central banks' websites or Bloomberg. To approximate general risk aversion in the financial markets, volatility data for the EuroStoxx 50 (VSTOXX) and S&P 500 (VIX) equity indices was collected from Bloomberg. The quarterly averages of country-specific 5-year Sovereign CDS are included as explanatory variables to account for implicit sovereign guarantees for domestic systemically significant banks. The reasons for and effects of implicit sovereign guarantees have been widely discussed by academics and policymakers (Bank for International Settlements, 2011; Denk et al., 2015).

Table 2: Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
5Y Senior CDS (bps)	74.58	38.31	20.68	214.28	525
5Y Subordinated CDS (bps)	165.95	75.86	58.06	433.65	501
5Y Sovereign CDS (bps)	41.31	45.05	9	253	525
Overnight Rate (%)	-0.17	0.36	-0.63	1.51	525
VSTOXX (%)	18.6	4.28	12.87	28.61	525
VIX (%)	14.95	2.72	10.31	21.05	525
CET1 Ratio (%)	14.38	3.28	8.15	25.12	501
Tier1 Ratio (%)	15.86	3.77	9.04	28.66	515
Own Funds Ratio (%)	18.93	4.19	11.66	32.45	515
CET1/Total Assets (%)	4.42	1.1	1.83	6.75	501
Loan Loss Ratio (%)	2.34	2.03	0.17	8.85	518
Problem Loans Ratio (%)	3.98	3.61	0.3	16.94	513
RoE (%)	7.97	5.33	-33.32	20.62	503
RoA (%)	0.45	0.31	-1.41	1.4	503
Wholesale Funding/Total Assets (%)	34.34	9.39	16.03	57.32	479
Loan-to-Deposit Ratio (%)	128.38	36.72	61.19	248.23	496

Table 2 presents summary statistics of the variables feeding into equations (1) and (2) presented in Section 4.2. The wide range of 5-year senior and subordinated CDS spreads reflects the diverse and representative composition of the sample. While well-capitalised banks in fiscally and economically stable jurisdictions tend to have relatively low spreads, CDS spreads can be significantly higher for some Southern European banks with lower capital ratios. The negative average overnight rate reflects the low-interest rate environment prevalent for most observation periods. The statistics also reveal significant heterogeneity in the asset quality and liquidity indicators among the sample banks, and the average return on equity is below 8%.

4.2 Methodology

The empirical analysis in this paper follows a two-step approach. First, I examine the drivers of CDS spreads to determine whether there is a significant relationship between regulatory capital ratios and default risk premiums on bank debt. In the second step, I analyse the impact of shifting the 25% IRB risk weight floor on Swedish mortgages from Pillar 2 to Pillar 1. This section outlines the methodologies used for both steps.

The approach for the first step follows a dynamic linear model with the following equation:

$$y_{i,t} = \alpha_i + \theta y_{i,t-1} + \beta X_t + \delta Z_t + \epsilon_{i,t} \quad (1)$$

On the left-hand side, $y_{i,t}$ captures the 5-year senior or subordinated CDS spread of bank i at time t. On the right-hand side of the equation, $y_{i,t-1}$ denotes the lagged dependent variable, reflecting the CDS spreads from the previous quarter. Following the approach of Arnould et al. (2022), the lagged dependent variable is included to capture persistent CDS spread trends. X_t depicts a vector of the bank-specific metrics for capital adequacy, size, profitability, asset quality and liquidity at time t. Other bank fixed effects are captured by the individual intercept for each bank, α_i (Annaert et al., 2010). Z_t is a vector of the financial market variables accounting for financing conditions, general risk aversion, and country risk, as described in Section 4.1.

$$y_{i,t} = \alpha_i + \theta y_{i,t-1} + \beta X_t + \delta Z_t + \lambda Pillar1_{i,t} + \epsilon_{i,t} \quad (2)$$

In the second step, the dynamic linear model is modified by adding a treatment dummy, $Pillar1_{i,t}$, to investigate whether the shift of the 25% risk weight floor on Swedish mortgages from Pillar 2 to Pillar 1 is a statistically significant explanatory variable of CDS spreads. Only the non-risk-based Leverage ratio is used as capital adequacy indicator in equation (2) to avoid collinearity between the treatment dummies and RWAs, the denominator of risk-based capital ratios. The drop in the Swedish sample banks' regulatory capital ratios due to the policy change could have a more short-term impact or longer lasting effects on CDS spreads. To assess if the impact is persistent even over a longer period, the model is run several times with dummy variables assigned a value of one for Nordea, Svenska Handelsbanken, Skandinaviska Enskilda Banken, and Swedbank over varying periods. For example, in the first regression, the dummy variable equals one only in Q4 2018, whereas in regression (5), it equals one from Q4 2018 until Q4 2019.

The modelling approach for solving equations (1) and (2) follows the methods used in prior research by Arnould et al. (2022) and Aymanns et al. (2016). The two-step GMM estimator employed combines differences and level regressions and is known as the

Arellano-Bover/Blundell-Bond system estimator (Arellano and Bover, 1995; Blundell and Bond, 1998).

In this research, the choice of the GMM methodology over alternative techniques like Ordinary Least Squares (OLS), differences-in-differences, or an event study is motivated by methodological considerations and the nature of the dataset at hand. One primary concern related to the model used in this paper is the endogeneity arising from the simultaneity between bank-specific variables and the CDS spread. As pointed out by Schmitz et al. (2017), banks' regulatory capital ratios tend to decrease when funding costs rise, and it is economically logical to infer that a bank's profitability declines as its funding costs increase. In the presence of such endogeneity, OLS estimates for equations (1) and (2) would be biased (Delis and Staikouras, 2011). The system GMM estimator mitigates this issue by using instrumental variables that are correlated with the endogenous explanatory variables but uncorrelated with the error terms.

Besides, the system GMM allows for the inclusion of lagged dependent variables in dynamic panel data models, which is crucial for capturing persistent trends. In contrast, static models do not account for the impact of previous values on current observations and are thus less suitable for estimating the variables in this study (Klinac et al., 2019). The system GMM addresses this limitation by combining two sets of equations—one in levels and one in differences. This approach deals with estimator bias arising from the correlation between the lagged dependent variable and the error terms, a problem particularly significant with datasets that have small to moderately large numbers of entities and time periods (Kiviet, 1995). Thus, the GMM methodology is well-suited for capturing persistent time trends in a dataset covering a limited 24 quarters, with only five quarters observed post-treatment. The limited number of time periods, combined with the quarterly frequency of bank-specific control variables, reduces the applicability of conventional event study methods, which are more effective with longer time series or higher data granularity. Therefore, previous studies exploring the relationship between CDS and risk-based solvency indicators, or other relevant variables, have relied on GMM (Apergis et al., 2022; Balduzzi et al., 2018; Benbouzid et al., 2017). This supports the appropriateness of GMM for the research objectives and data structure.

In sum, the reasons outlined above underscore the alignment of GMM with my research goals, the dataset, and the distinct analytical challenges presented by this study. Given its robustness, GMM is a comprehensive and pragmatic framework well-suited for analysing the relationships between CDS spreads and changes in the composition of the total capital requirement stack, particularly in the example of the shift of the Swedish mortgage risk weight floor from Pillar 2 to Pillar 1 in 2018.

Because Arellano-Bover/Blundell-Bond GMM models allow for substantial degrees of freedom when solving system equations, it is crucial to specify which variables and moment conditions are used in the difference and level regressions (Roodman, 2009). This transparency in model specifications enhances the credibility of the results. In the difference equation of this paper, first differences of the exogenous financial market variables are used as standard instruments. The endogenous bank-specific indicators and CDS spreads are included as GMM instruments with lags of one and two quarters, respectively. Similarly, the level equation includes financial market indicators at period t as standard instruments, while the lagged difference of CDS spreads and the first difference of bank-specific metrics are included as GMM-type instruments. To address increased variation in small samples, the asymptotic standard errors of the regressor coefficients are corrected using the method proposed by Windmeijer (2005).

As robustness checks for the results, standard tests for Arellano-Bover/Blundell-Bond GMM models are conducted. The differences-in-Hansen test assesses the joint validity of the instruments included in the model, while the Arellano-Bond test checks for autocorrelation in the idiosyncratic error terms (Roodman, 2007). Additionally, equation (1) is estimated using OLS regression with entity-fixed effects to validate the results of the main model. To mitigate endogeneity in the OLS approach, the lagged dependent variable is excluded as an explanatory variable, and bank-specific variables are lagged by one quarter.

5 Empirical Results and Discussion

5.1 Drivers of Bank CDS spreads

This section presents the results of model (1) and discusses potential interpretations. Tables 3 and 4 exhibit the outcomes of the dynamic linear regressions of European bank CDS spreads for 5-year senior and subordinated debt instruments, regressed on bank-specific and financial market variables. In these regression variants, the banks' CET1 ratio is used to analyse the relationship between capital ratios and CDS spreads. The results for the Tier 1, Own Funds and Leverage ratios are available in Tables 9 to 14 in the Appendix.

Six of the eight regression variations presented in Table 3 show a significant negative relationship between banks' CET1 ratios and 5-year senior CDS spreads at the 99% confidence level. The regression coefficients suggest that a 100 basis point increase in the CET1 ratio results in a decrease in 5-year senior CDS spreads ranging from -3.31 basis points (7) to -4.85 basis points (2). The estimated CDS spread reduction of 4 basis points in regression (8) is notably lower than the reduction of 26 basis points identified by Babihuga and Spaltro (2014). This discrepancy could be attributed to the earlier observation period of 2001-2012 and the non-linear relationship between capital ratios and CDS spreads. As described in previous sections, the marginal impact of higher capital ratios on CDS levels decreases as capital ratios rise. European banks have significantly increased their capitalisation since the CRR came into force in 2014.

When considering CDS as a proxy for funding costs, this paper's results align more closely with the findings of Aymanns et al. (2016) and Gambacorta and Shin (2018). Aymanns et al. (2016) estimate that a 100 basis point increase in capital ratios reduces funding costs, as approximated by average interest expenses over liabilities, by around 2 basis points. Similarly, Gambacorta and Shin (2018), using a dynamic panel regression, find that a 1 percentage point increase in the equity-to-total-assets ratio leads to a reduction of average debt funding costs of 4 basis points.

Besides regulatory capital ratios, the bank-specific control variables for profitability and asset quality show a statistically significant relationship with CDS spreads, whereas bank liquidity is not a significant driver of senior CDS spreads. Asset size is a significant explanatory variable only in the first two regression variants. The lagged dependent variable influences CDS spreads at time t with at least a 95% confidence level in all regressions, supporting the presumption that CDS trends persist over time.

Among the financial market control variables, the volatility of the EuroStoxx 50 index, as an indicator of market uncertainty and risk aversion, is the most significant and shows the expected positive correlation. As risk aversion increases, the price of European bank CDS also increases. As described in Section 4.1, European sovereigns and large domestic banks are interconnected through sovereign debt exposure, implicit government guarantees, and shared economic risks (Dell'Ariccia et al., 2018). The regression results in Table 3 confirm this positive correlation between sovereign CDS and domestic bank CDS. However, the coefficients are not statistically significant in all variants. Besides, the relationship between the overnight rate and credit spreads is negative but insignificant in most regressions. The narrowing of credit spreads due to short-term rate increases is consistent with economic theory and previous research, which suggests that higher short-term rates are associated with economic growth, and default risk is lower during periods of economic expansion (Kajurova, 2015). The regressions for the Tier 1 and Own Funds ratios, shown in Tables 9 and 10 in the Appendix, support these findings. Interestingly, the negative relationship between capital ratios and CDS spreads weakens when lower-quality capital is included in the numerator. Additionally, the results do not support the explanatory power of the non-risk-sensitive Leverage ratio, as illustrated in Table 11.

Table 4 reports the results of the system GMM regression with subordinated CDS as the dependent variable. The relationship between the CET1 ratio and subordinated CDS spreads is negative and significant in all regressions except for variants (4) and (7). Tables 12 to 14 in the Appendix demonstrate that the Tier 1 and Own Funds ratios have explanatory power for subordinated CDS spreads in most regressions.

The coefficients show that the sensitivity of subordinated CDS to capital ratio changes is higher than that of senior CDS spreads. As expected, subordinated debt holders are more sensitive to fluctuations in risk-based capital ratios because they rank lower in the repayment hierarchy in the event of default. For instance, regression (6) in Table 4 estimates that a 100 basis point increase in the CET1 ratio reduces subordinated CDS by 11.42 basis points, which is more than three times higher than the reduction observed for senior CDS spreads in the same regression shown in Table 3. Among the financial market control variables, the overnight rate and the risk aversion indicator show explanatory power for subordinated CDS spreads. In contrast to the results for senior CDS spreads, bank-specific variables other than capital ratios generally exhibit limited predictive power for subordinated CDS. The lagged dependent variable is highly significant in seven of the regressions.

The p-values from the Hansen J-test and the Arellano-Bond autocorrelation test show that most models are free from bias due to overidentification of restrictions and second-order autocorrelation in the idiosyncratic error terms, particularly for senior CDS. The OLS regressions presented in Tables 15 to 22 in the Appendix support the results described in this section but indicate an overall higher statistical significance of bank and financial market control variables.

Table 3: System GMM Regression - Drivers of 5Y Senior Debt CDS - CET1 Ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	est1	est2	est3	est4	est5	est6	est7	est8
L.5Y Senior CDS	0.69***	0.73***	0.58***	0.60***	0.81**	0.56***	0.68***	0.74***
	(0.13)	(0.17)	(0.15)	(0.19)	(0.35)	(0.10)	(0.16)	(0.10)
CET1 Ratio	-4.65***	-4.85***	-2.20	-1.93	-3.50***	-3.53***	-3.31***	-4.00***
	(1.18)	(1.35)	(1.60)	(1.79)	(1.30)	(1.22)	(1.16)	(1.25)
ln_Total Assets	1.85*	2.26**	-0.71	-1.24	1.92	0.15	1.45	1.69
	(0.95)	(1.06)	(1.54)	(1.76)	(1.21)	(1.21)	(1.06)	(1.06)
VSTOXX	2.54***	2.28***	3.43***	3.63***	2.47***	3.05***	2.39***	2.40***
	(0.66)	(0.68)	(0.61)	(0.71)	(0.85)	(0.73)	(0.64)	(0.66)
5Y Sovereign CDS	0.21**	0.20	0.21**	0.21**	-0.03	0.19**	0.24***	0.23**
	(0.10)	(0.12)	(0.09)	(0.10)	(0.23)	(0.08)	(0.07)	(0.10)
Overnight Rate	-11.98	-11.65	-15.39	-18.70	-11.19	-11.75	-7.19	-13.33*
	(9.96)	(12.31)	(10.13)	(14.35)	(14.95)	(11.20)	(5.13)	(7.19)
Loan Loss Reserves/Customer Loans	-4.14**						-4.65**	
	(2.09)						(2.24)	
Problem Loans/Customer Loans		-2.96**						-3.09***
		(1.23)						(0.75)
RoE			-0.46**				-0.56**	
			(0.18)				(0.23)	
RoA				-6.61				-8.28**
				(4.75)				(3.33)
Wholesale Funding/Total Assets					-0.66		0.00	
					(0.72)		(0.37)	
Loan-to-Deposit Ratio						0.06		-0.01
						(0.06)		(0.06)
Instruments	11	11	11	11	11	11	15	15
Hansen J-test	0.227	0.208	0.339	0.120	0.095	0.256	0.193	0.404
Autocorrelation order 2	0.961	0.907	0.846	0.839	0.744	0.756	0.795	0.742
Banks	21.000	21.000	21.000	21.000	21.000	21.000	21.000	21.000
Observations	498	495	500	500	479	495	479	491

Standard errors in parentheses

Specifications are subject to Windmeijer corrected standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: System GMM Regression - Drivers of 5Y Subordinated Debt CDS - CET1 Ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	est1	est2	est3	est4	est5	est6	est7	est8
L.5Y Subordinated CDS	0.68***	0.74***	1.04***	0.74	0.79***	1.15***	0.62***	0.75***
	(0.16)	(0.15)	(0.37)	(0.78)	(0.12)	(0.32)	(0.16)	(0.15)
CET1 Ratio	-8.16*	-8.34**	-10.16***	-7.81	-7.27**	-11.42***	-6.41	-8.87***
	(4.43)	(4.07)	(3.42)	(8.68)	(3.03)	(4.20)	(4.71)	(2.61)
ln_Total Assets	1.18	2.06	4.13	0.42	6.66**	2.85	2.88	1.49
	(5.12)	(4.56)	(3.26)	(9.45)	(3.10)	(3.21)	(4.21)	(3.32)
VSTOXX	7.16***	6.09***	3.68	6.72	6.30***	2.43	6.70***	5.71***
	(2.12)	(1.74)	(2.89)	(7.36)	(0.91)	(2.79)	(1.07)	(1.46)
5Y Sovereign CDS	0.40	0.27	-0.36	0.14	-0.09	-0.39	0.44	0.30
	(0.44)	(0.47)	(0.47)	(1.12)	(0.15)	(0.41)	(0.28)	(0.44)
Overnight Rate	-47.67**	-41.06**	-45.47**	-59.35**	-21.45*	-38.19**	-33.79**	-45.78***
	(23.48)	(18.64)	(19.73)	(26.72)	(12.18)	(16.72)	(16.75)	(15.64)
Loan Loss Reserves/Customer Loans	-6.75						-6.24	
	(13.65)						(7.57)	
Problem Loans/Customer Loans		-3.22						-3.12
		(8.37)						(6.30)
RoE			-1.15*				-0.77	
			(0.60)				(0.78)	
RoA				-6.80				-6.82
				(25.37)				(9.58)
Wholesale Funding/Total Assets					-3.28**		-1.06	
					(1.33)		(0.96)	
Loan-to-Deposit Ratio						0.33		0.20
						(0.27)		(0.18)
Instruments	11	11	11	11	11	11	15	15
Hansen J-test	0.024	0.047	0.075	0.038	0.246	0.194	0.059	0.197
Autocorrelation order 2	0.536	0.643	0.831	0.867	0.773	0.880	0.699	0.823
Banks	21.000	21.000	21.000	21.000	21.000	21.000	21.000	21.000
Observations	476	474	478	478	461	473	461	470

Standard errors in parentheses

Specifications are subject to Windmeijer corrected standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.2 Capital Requirements in Pillar 1 or Pillar 2: Does It Matter for Market Discipline?

The negative relationship between CDS spreads and capital ratios, as evidenced in the previous section, implies that the CDS spreads of Swedish IRB banks increased after their capital ratios dropped due to the shift of the risk weight floor from Pillar 2 to Pillar 1. However, the observed reduction in capital ratios was not caused by changes in bank solvency or an increase in capital requirements but was instead triggered by a mere technical change in the implementation of a capital requirement. The risk perception of the competent authority did not change either, which was transparently communicated by Swedish supervisors and banks in advance. Assuming no market imperfections or information asymmetries, one would expect that bank CDS spreads would remain stable because the underlying default risk and regulatory capital of banks were unchanged. By solving equation (2) introduced in Section 4.2, I test whether the transformation of a Pillar 2 requirement into a direct RWA adjustment in Pillar 1 triggered a significant market reaction, and thereby assess whether market discipline is sensitive to the distribution of capital requirements between Pillar 1 and Pillar 2.

Table 5 presents the outcome of the analysis for senior CDS. The coefficients of the treatment dummies indicate that the shift of the Pillar 2 requirement to Pillar 1 RWAs significantly increased senior CDS spreads in three out of five quarters. In the first quarter after the capital requirement was shifted to Pillar 1, the senior CDS spreads of the affected Swedish IRB banks increased by 9.13 basis points. After three quarters, the effect weakened to 6.72 basis points but remained significant at the 90% confidence level. By the end of the observation period in Q4 2019, the average increase of the treatment group's CDS spreads amounts to 7.78 basis points and is still significant at the 90% level. This constitutes approximately 22% of the 35.54 basis point average 5-year senior CDS spread of the four treatment banks between Q4 2018 and Q4 2019. The results suggest that risk weight floor shift to Pillar 1 capital requirements has a relatively large and lasting positive effect on CDS spreads. This finding is consistent with the visual persistence of the increase in CDS spreads shown in Figure 3. After the capital requirement was implemented via Pillar 1 and capital ratios dropped, the gap between senior CDS spreads of the Swedish treatment banks and the iTraxx Europe Financial index narrowed. Among the financial market variables, VSTOXX and the Sovereign CDS spreads have significant explanatory power, while the coefficient of the overnight rate is statistically insignificant. Consistent with the results described in Section 5.1, leverage and liquidity ratios do not appear to drive senior CDS spreads.

Table 5: System GMM - RW floor shift from Pillar 2 to Pillar 1 - 5Y Senior CDS

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5
L.5Y Senior CDS	0.79***	0.80***	0.80***	0.80***	0.90***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CET1/Total Assets	1.20	2.08	2.26	2.35	1.94
	(0.713)	(0.477)	(0.447)	(0.425)	(0.445)
ln_Total Assets	-0.55	-0.74	-0.82	-0.97	-0.47
	(0.770)	(0.654)	(0.626)	(0.564)	(0.661)
VSTOXX	2.21***	2.14***	2.14***	2.20***	1.99***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
5Y Sovereign CDS	0.21**	0.19**	0.20**	0.20**	0.16*
	(0.015)	(0.021)	(0.021)	(0.016)	(0.053)
Overnight Rate	-1.46	-1.93	-1.89	-2.22	-1.44
	(0.835)	(0.761)	(0.770)	(0.732)	(0.781)
Loan Loss Reserves/Customer Loans	-3.87	-3.80	-3.79	-3.74	-4.49*
	(0.163)	(0.171)	(0.178)	(0.179)	(0.076)
RoE	-0.62*	-0.61*	-0.61*	-0.59*	-0.63**
	(0.057)	(0.054)	(0.059)	(0.060)	(0.022)
Wholesale Funding/Total Assets	-0.49	-0.47	-0.45	-0.41	-0.65
	(0.392)	(0.387)	(0.421)	(0.460)	(0.208)
Treatment 1 Quarter	9.13**				
	(0.020)				
Treatment 2 Quarters		5.00			
		(0.111)			
Treatment 3 Quarters			6.72*		
			(0.068)		
Treatment 4 Quarters				1.10	
				(0.726)	
Treatment 5 Quarters					7.78*
					(0.084)
Instruments	16	16	16	16	16
Hansen J-test	0.074	0.099	0.091	0.078	0.218
Autocorrelation order 2	0.444	0.372	0.396	0.382	0.344
Banks	21.000	21.000	21.000	21.000	21.000
Observations	479	479	479	479	479

p-values in parentheses

Specifications are subject to robust standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: System GMM - RW floor shift from Pillar 2 to Pillar 1 - 5Y Subordinated CDS

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5
L.5Y Subordinated CDS	0.76***	0.75***	0.75***	0.77***	0.83***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CET1/Total Assets	8.49*	10.43**	10.48**	10.71**	4.97
	(0.091)	(0.016)	(0.027)	(0.025)	(0.506)
ln_Total Assets	-2.29	-2.55	-2.46	-2.76	-2.63
	(0.278)	(0.237)	(0.256)	(0.227)	(0.372)
VSTOXX	6.42***	6.38***	6.24***	6.32***	5.76***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
5Y Sovereign CDS	0.22	0.20	0.20	0.17	0.18
	(0.477)	(0.491)	(0.508)	(0.576)	(0.534)
Overnight Rate	-18.00*	-16.93*	-16.16	-17.13	-9.27
	(0.094)	(0.099)	(0.128)	(0.123)	(0.514)
Loan Loss Reserves/Customer Loans	-0.66	-0.57	-0.31	0.12	-0.03
	(0.899)	(0.908)	(0.949)	(0.981)	(0.995)
RoE	-1.43***	-1.36***	-1.35***	-1.29***	-1.42**
	(0.002)	(0.003)	(0.004)	(0.007)	(0.012)
Wholesale Funding/Total Assets	-2.14*	-2.14*	-2.15	-2.13	-1.42
	(0.094)	(0.094)	(0.104)	(0.130)	(0.283)
Treatment 1 Quarter	25.13***				
	(0.000)				
Treatment 2 Quarters		27.61***			
		(0.000)			
Treatment 3 Quarters			43.32***		
			(0.000)		
Treatment 4 Quarters				25.68***	
				(0.001)	
Treatment 5 Quarters					36.23***
					(0.000)
Instruments	16	16	16	16	16
Hansen J-test	0.547	0.581	0.593	0.567	0.215
Autocorrelation order 2	0.698	0.576	0.643	0.582	0.654
Banks	21.000	21.000	21.000	21.000	21.000
Observations	461	461	461	461	461

p-values in parentheses

Specifications are subject to robust standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The regressions using subordinated CDS spreads yield similar but more robust outcomes. Table 6 indicates that the shift of the supervisory measure to Pillar 1 significantly increased subordinated CDS levels for the treatment group throughout the observation period. The smallest effect, 25.13 basis points, is observed in the first quarter, while the highest coefficient, 43.32 basis points, is estimated over three quarters. Similar to the case of senior CDS, this represents a substantial share of the average 5-year subordinated CDS spread. After Q4 2018, subordinated CDS spreads of Nordea, Svenska Handelsbanken, Skandinaviska Enskilda Banken, and Swedbank averaged 114.19 basis points. The coefficients for the other control variables largely mirror those found for senior CDS. However, the statistical significance of the asset size and profitability indicators decreases compared to the analysis of senior CDS. Additionally, Sovereign CDS do not exhibit a significant relationship with subordinated CDS.

While the Hansen J-test indicates potential overidentification of instruments in some regressions for senior CDS reported in Table 5, the results for subordinated CDS presented in Table 6 appear robust. The Arellano-Bond tests for second-order autocorrelation are satisfactory and provide reassurance regarding the model specifications and results.

Although the estimated impact of shifting the supervisory measure from Pillar 2 to Pillar 1 appears high at first glance, it is lower than expected when considering the results presented in Section 5.1. The unweighted average decrease in CET1 ratios for the four affected banks in Q4 2018 was 496 basis points. Multiplying this average drop by the CET1 ratio coefficient of -3.09 basis points, as shown in regression (8) in Table 3, results in an expected increase in senior CDS spreads of approximately 15 basis points. Similarly, based on the results from variant (8) of the GMM regression for 5-year subordinated CDS in Table 4, we would expect the spreads of the treatment group to increase by 44 basis points in response to a 496 basis point decrease in average CET1 ratios.

Arnould et al. (2022) detect non-linearity in the relationship between capital ratios and funding costs. This non-linearity helps explain why CDS spreads were less responsive to the drop in capital ratios than expected after step one, as the affected Swedish IRB banks had high capital ratios prior to the policy change. While the coefficients of the CET1 ratio in Tables 3 and 4 reflect the impact of a 100 basis point increase on CDS spreads for all sample banks, the treatment dummies in equation (2) specifically pertain to the four IRB banks with the most material Swedish mortgage portfolios. In the quarter before the shift of the risk weight floor to Pillar 1, these banks had an average CET1 ratio of 21.49%, which was substantially higher than the sample average of 14.29%. Due to the non-linear relationship between capital ratios and CDS spreads, the marginal increase in CDS spreads from a 100 basis point decrease in CET1 ratios is lower for banks with high initial capital ratios. Another potential explanation is that some market participants anticipated the drop in risk-based capital adequacy indicators due to Finansinspektionen's public communication prior to the adjustment of capital requirements. Potentially, some market participants correctly concluded that the banks' capital adequacy did not change significantly despite the drop in their risk-based capital ratios and maintained the previous risk premiums. In this case, however, one would not expect a persistent increase in CDS spreads because market participants had enough time to process and assess the new situation.

The results of equation (2) demonstrate that markets discipline Pillar 1 requirements more than Pillar 2 requirements, creating an imbalance across the Basel pillars and giving Pillar 1 a privileged status. Specifically, markets respond more strongly to changes in bank capital ratios resulting from Pillar 1 RWA adjustments than to changes in Pillar 2 requirements, which are not reflected in capital ratios. This suggests that markets primarily rely on capital ratios, which only capture Pillar 1 risks, when pricing bank default risk, rather than considering broader indicators such as the headroom to total capital requirements or non-RWA-based metrics. As a result, markets may be misled when focusing solely on regulatory capital ratios, especially when such changes are due to technical adjustments to existing requirements, as shown in the example analysed in this paper.

5.3 Robustness Checks

Tables 7 and 8 are included as additional robustness checks to ensure that the increases in CDS spreads of Swedish IRB banks were not primarily driven by rumors related to one of the largest bank money laundering scandals in history. Beginning in March 2017, Danske Bank gained significant public attention due to allegations that its internal governance and controls failed to prevent substantial money laundering activities through its Estonian branch (Yeoh, 2020). Bjerregaard and Kirchmaier (2019) find that accusations of suspicious transactions exceeding EUR 200 billion having been processed through the bank led to a significant decline in the share price of Danske Bank and other European banks associated with the case.

To test whether the results presented above remain valid when considering the potential impact of money laundering allegations on CDS spreads, additional control variables are created based on the Reuters article "European banks hit by Russian money laundering scandal" from March 2019 and included in the GMM regressions. The sample banks associated with the money laundering scandal, as mentioned in the article, include ABN AMRO, Crédit Agricole, Danske Bank, Deutsche Bank, ING Groep, Nordea, Rabobank, and Swedbank (Reuters, 2019). These banks are captured by the variable "ML dummy". The dummy variable "No ML Treatment banks 3 Quarters," included in regressions (1) in Tables 7 and 8, equals one for the Swedish IRB banks not mentioned in the money laundering scandal (Skandinaviska Enskilda Banken and Svenska Handelsbanken) for three quarters following the shift of the risk weight floor. The statistical significance of this dummy indicates that the money laundering allegations were not the primary driver of CDS volatility for the Swedish treatment banks.

The dummy variables in regressions (2) and (3) capture, respectively, all banks associated with the money laundering scandal and only the banks mentioned in the Reuters article not affected by the shift of the risk weight floor. For senior CDS, the coefficients for both groups do not show statistical significance. For subordinated CDS, the money laundering allegation dummy is significant only when it includes Nordea and Swedbank, which were both subject to the risk weight floor shift to Pillar 1 RWAs, as shown in regression (2). Regression (4) demonstrates that the interaction term between the money laundering dummy and the Swedish bank dummy lacks explanatory power. Moreover, the treatment dummy in Table 8 is statistically significant at the 99% level, indicating that the primary driver of the changes in subordinated CDS spreads of the four treatment banks between Q4 2018 and Q2 2019 was the shift of the mortgage risk weight floor from Pillar 2 to Pillar 1. The results of the Hansen J-test again suggest that the model is more robust for subordinated CDS than for senior CDS in terms of potential overidentification of instruments.

Table 7: System GMM Regression 5Y Senior CDS - ML Robustness Check

	(1) est1	(2) est2	(3) est3	(4) est4
L.5Y Senior CDS	0.80***	0.79***	0.77***	0.80***
	(0.000)	(0.000)	(0.000)	(0.000)
CET1/Total Assets	2.07	2.41	2.96	2.40
	(0.497)	(0.444)	(0.302)	(0.440)
ln_Total Assets	-0.81	-0.93	-1.17	-0.84
	(0.637)	(0.612)	(0.486)	(0.650)
VSTOXX	2.18***	2.17***	2.67***	2.11***
	(0.001)	(0.000)	(0.000)	(0.001)
5Y Sovereign CDS	0.20**	0.19**	0.17*	0.19**
	(0.020)	(0.029)	(0.096)	(0.033)
Overnight Rate	-2.10	-1.66	-2.93	-1.45
	(0.750)	(0.772)	(0.554)	(0.803)
Loan Loss Reserves/Customer Loans	-3.83	-3.50	-2.74	-3.55
	(0.170)	(0.250)	(0.384)	(0.244)
RoE	-0.62*	-0.57*	-0.42	-0.58*
	(0.056)	(0.090)	(0.184)	(0.090)
Wholesale Funding/Total Assets	-0.44	-0.42	-0.61	-0.44
	(0.425)	(0.465)	(0.301)	(0.456)
No ML Treatment banks 3 Quarters	5.95*			
	(0.093)			
ML dummy		5.71		4.63
		(0.126)		(0.332)
ML dummy Non-Swedish			3.06	
			(0.639)	
Treatment 3 Quarters				5.92
				(0.113)
ML dummy x Treatment				-2.74
				(0.588)
Instruments	16	16	16	18
Hansen J-test	0.086	0.082	0.224	0.088
Autocorrelation order 2	0.392	0.371	0.443	0.376
Banks	21	21	21	21
Observations	479	479	479	479

p-values in parentheses

Specifications are subject to robust standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: System GMM Regression 5Y Subordinated CDS - ML Robustness Check

	(1) est1	(2) est2	(3) est3	(4) est4
L.5Y Subordinated CDS	0.76***	0.74***	0.75***	0.73***
	(0.000)	(0.000)	(0.000)	(0.000)
CET1/Total Assets	10.13**	11.13**	10.74**	10.97**
	(0.034)	(0.031)	(0.046)	(0.049)
ln_Total Assets	-2.54	-2.80	-2.86	-2.32
	(0.246)	(0.156)	(0.148)	(0.240)
VSTOXX	6.43***	6.17***	6.38***	5.97***
	(0.000)	(0.000)	(0.000)	(0.000)
5Y Sovereign CDS	0.20	0.22	0.22	0.22
	(0.505)	(0.448)	(0.469)	(0.455)
Overnight Rate	-17.28	-15.12*	-16.79**	-12.77
	(0.116)	(0.051)	(0.038)	(0.100)
Loan Loss Reserves/Customer Loans	-0.56	-0.46	-0.77	-0.41
	(0.910)	(0.927)	(0.881)	(0.936)
RoE	-1.42***	-1.29**	-1.40***	-1.31**
	(0.002)	(0.013)	(0.007)	(0.014)
Wholesale Funding/Total Assets	-2.15	-1.96*	-1.99*	-2.09*
	(0.108)	(0.074)	(0.079)	(0.059)
No ML Treatment banks 3 Quarters	41.34***			
	(0.000)			
ML dummy		21.54**		16.02
		(0.020)		(0.100)
ML dummy Non-Swedish			13.34	
			(0.236)	
Treatment 3 Quarters				41.39***
				(0.000)
ML dummy x Treatment				-9.05
				(0.322)
Instruments	16	16	16	18
Hansen J-test	0.563	0.515	0.511	0.521
Autocorrelation order 2	0.607	0.536	0.557	0.607
Banks	21	21	21	21
Observations	461	461	461	461

p-values in parentheses

Specifications are subject to robust standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6 Implications

This paper represents the first academic contribution that provides empirical evidence that market discipline is more pronounced for capital requirements embedded in Pillar 1 RWAs than for Pillar 2 capital requirements, which are not directly visible in regulatory capital ratios. In other words, the composition of the capital requirement stack significantly influences market discipline.

Future research could explore the various potential explanations for these findings. One plausible reason for markets predominantly focusing on regulatory capital ratios when assessing capital adequacy might be their perception that the costs associated with considering Pillar 2 are higher. Pillar 2 requirements are less transparent in their composition and calibration, making them potentially more complex for investors to incorporate into pricing decisions. Additionally, heterogeneity between Pillar 2 regimes across different jurisdictions, as observed in the studied example, can further complicate the effective and consistent incorporation of Pillar 2 requirements in markets' assessments of bank default risk.

In this context, the findings support calls for fostering harmonisation in the implementation of the Basel framework in the EU to ensure the comparability of banks. This is timely, considering that Finansinspektionen imposed risk weight floors of 35% on corporate exposures secured by commercial real estate and 25% on corporate exposures secured by residential real estate, applicable as of Q4 2019 for Swedish IRB banks (Finansinspektionen, 2020). Similar to the initial implementation of the 25% risk weight floor on Swedish mortgages, this floor is not directly applied to Pillar 1 RWA. Instead, Finansinspektionen calculates how much capital each IRB bank would need to hold if the floor were applied to Pillar 1 RWAs and adds the resulting amount to the bank-specific Pillar 2 requirements. Conversely, the Norwegian Ministry of Finance applies a 35% risk weight floor directly to Pillar 1 risk weights for Norwegian commercial real estate exposures, according to Article 458(2)(d)(iv) CRR since Q4 2020 (Finansdepartementet, 2019). These two decisions further illustrate the prevailing inconsistencies in the application of the CRR across Europe and even between portfolios within a single country. Some of the recent amendments to the EU Banking package can reduce overlaps between different tools and foster regulatory harmonisation and simplification by enhancing the macro-prudential toolkit, clarifying the scope of Pillar 2, and limiting its use to idiosyncratic risks (Evrard et al., 2018).

On the contrary, the decision by EU policymakers to deviate from the Basel III agreements in the final EU implementation, for example in relation to the risk weights for residential mortgages and unrated corporate obligors, constitutes another source of ongoing regulatory fragmentation and discontinuity. In this regard, Budnik et al. (2021) argue that these deviations from Basel agreements can confuse markets and increase regulatory complexity, which may restrain the positive effects of lower risk weights on funding costs and bank profitability. In fact, the effects of the risk weight floor shift from Pillar 2 to Pillar 1 analysed in this paper resemble the anticipated risk weight increase due to the implementation of input and output floors as part of the finalisation of the revised Basel III reforms in the EU. Although capital holdings and economic risks of banks will not change with the implementation of the floors, capital ratios will decrease and potentially trigger market reactions. The phase-in of the output floor mitigates the immediate impact upon its enforcement in 2025 but will continue to affect EU bank capital ratios until the final output floor of 72.5% of the Standardised Approach capital requirements is reached in 2030. At the same time, the input parameter floors will become applicable in 2025, and changes to the Standardised Approach will be phased in over several years. Due to the resulting continuous changes of the regulatory framework, investors, banks, and supervisors will have to isolate the actual changes in risks and capital holdings from the effects of Basel III's finalisation when assessing the solvency of international banks. This can hamper the effectiveness and consistency of market discipline across Pillar 1 and Pillar 2. Further research could analyse more deeply the extent to which complexity, heterogeneity, and discontinuity in capital requirement frameworks affect the effectiveness of the interaction between the Basel pillars and market discipline.

Another potential explanation is that markets prioritise risk-based capital ratios as indicators of bank default risk because they consider minimum capital requirements under Pillar 1 to be the most binding type of capital requirement, even though banks must meet their total capital requirements at all times. This misconception could lead markets to favour a higher headroom of capital ratios relative to minimum Pillar 1 requirements, irrespective of the headroom to Pillar 2 capital requirements. A simpler explanation is that the widespread use, broad availability, and frequent disclosure of regulatory capital ratios as standard solvency indicators in financial analysis and research have entrenched their role in market assessments. Financial data providers and regulatory disclosure reports offer more extensive information on capital ratios than on Pillar 2 requirements, further reinforcing their prominence in market evaluations. Furthermore, regulatory capital ratios of large banks are typically published on a quarterly basis, whereas Pillar 2 requirements are rather disclosed annually in major jurisdictions, such as the euro area. In line with Flannery (2001), the comparatively less detailed and less frequent public disclosure of Pillar 2 requirements' components in conjunction with the relatively limited information about their calibration in major jurisdictions may partially explain the findings. This lack of transparency could encourage policymakers to enhance the clarity around methodologies to determine Pillar 2 requirements and to disclose the specific risks these capital requirements address in more detail, thereby enabling markets to assess them more effectively.

For policymakers, the findings provide new insights to consider when determining the technical implementation of capital requirements. Since the regression results indicate that Pillar 1 requirements are subject to a higher degree of market discipline than Pillar 2 requirements, policymakers might prefer to reflect risks such as IRRBB and credit concentration risk in Pillar 1 RWAs. In this context, academia could contribute by developing transparent and harmonised approaches to capital requirement calculations for risks currently addressed under Pillar 2 that can be consistently applied across all banks.

For market participants, the results might encourage a shift in focus from regulatory capital ratios as capital adequacy indicators to alternative metrics. For example, the RWA-insensitive Leverage ratio or metrics related to the headroom to total capital requirements may be less distorted by differences between national capital requirement frameworks.

Finally, the role of private actors in European integration could be further examined. An interesting aspect of the quasi-natural experiment analysed in this paper is that a private bank operating across borders decided to move its headquarters, thereby triggering regulatory alignment between Sweden and the euro area. This suggests that some banks seek a harmonised regulatory framework and that the private sector can be a powerful driver of international regulatory harmonisation. In the context of global banking and regulatory harmonisation, it would also be valuable to research the role, governance, and benefits of Supervisory Colleges.

7 Conclusions

This paper advances existing literature on the functioning of the Basel framework, the market relevance of regulatory capital ratios, and the sensitivity of market discipline to the distribution of capital requirements between Pillar 1 and Pillar 2. The results provide empirical support for a negative relationship between capital ratios and CDS spreads and contribute to the literature as the first to demonstrate that capital requirements implemented through Pillar 1 RWAs are subject to a higher degree of market discipline than those implemented through Pillar 2 requirements.

The first analytical step investigates the influence of capital ratios and other indicators on the senior and subordinated CDS spreads of 21 European banks from 2014 to 2019. Consistent with previous research, the results confirm that higher capital ratios are associated with lower CDS spreads. Additionally, the Arellano-Bover/Blundell-Bond GMM regression finds that the drivers of senior CDS differ from those of subordinated CDS, that the connection between capital ratios and CDS is more pronounced for subordinated debt, and that the risk-insensitive Leverage ratio is not a significant explanatory variable.

In the second step, this paper builds on the intuition of the findings from the first step and analyses a quasi-natural experiment to test the hypothesis that market discipline is higher for changes of Pillar 1 requirements than of Pillar 2 requirements. The shift of the 25% risk weight floor for Swedish mortgages from Pillar 2 to Pillar 1 allows for dividing the sample into a treatment group, consisting of the Swedish IRB banks affected by the shift, and a control group comprising other European banks not subject to the risk weight floor. Although absolute capital holdings and requirements remained constant after the treatment, the purely technical change in the implementation of a capital requirement and the resulting drop in capital ratios had a lasting impact on the affected banks' CDS spreads. Therefore, the regression results confirm that the composition of the capital requirement stack influences market discipline.

One potential explanation for the findings is that the complexity and heterogeneity among Pillar 2 frameworks, their lower disclosure frequency, and the lack of transparency regarding the composition and calibration of Pillar 2 requirements hinder their equal consideration by markets compared to Pillar 1 requirements reflected in regulatory capital ratios via RWAs. The remaining heterogeneities between national regulatory frameworks can obstruct the comparability of capital adequacy indicators for banks, impact the effectiveness of market discipline, and thereby compromise the level playing field and integration of the European banking sector. Moreover, the results suggest that policymakers could increase market discipline around the capitalisation of specific risks, such as IRRBB, if these are addressed via Pillar 1 RWAs instead of Pillar 2 requirements. The results may encourage policymakers to increase regulatory harmonisation and the transparency around Pillar 2 requirements to optimise the effectiveness of the interplay between the Basel pillars and market discipline, and to foster the integration of banking markets.

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Appendix

Table 9: System GMM Regression - Drivers of 5Y Senior Debt CDS - Tier1 Ratio

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5	(6) est6	(7) est7	(8) est8
L.5Y Senior CDS	0.68***	0.72***	0.56***	0.55***	0.75*	0.54***	0.66***	0.74***
	(0.12)	(0.18)	(0.16)	(0.19)	(0.39)	(0.10)	(0.15)	(0.11)
Tier1 Ratio	-3.93***	-4.04***	-2.41**	-2.51*	-3.26***	-3.16***	-3.01***	-3.55***
	(0.88)	(1.01)	(1.16)	(1.37)	(1.13)	(1.03)	(0.84)	(0.93)
ln_Total Assets	1.63**	1.93**	-0.36	-0.59	1.54	0.11	0.91	1.35
	(0.78)	(0.91)	(1.28)	(1.50)	(1.29)	(1.13)	(1.14)	(0.97)
VSTOXX	2.51***	2.27***	3.47***	3.75***	2.58***	3.08***	2.55***	2.61***
	(0.64)	(0.64)	(0.62)	(0.73)	(0.88)	(0.76)	(0.52)	(0.61)
5Y Sovereign CDS	0.23**	0.22*	0.20**	0.21*	0.00	0.20**	0.27***	0.24***
	(0.10)	(0.13)	(0.10)	(0.12)	(0.25)	(0.09)	(0.09)	(0.09)
Overnight Rate	-14.15	-14.11	-17.72	-20.32	-14.28	-14.17	-11.45*	-17.35**
	(10.14)	(12.93)	(11.07)	(15.62)	(17.51)	(12.71)	(6.61)	(7.66)
Loan Loss Reserves/Customer Loans	-4.30**						-4.89***	
	(1.68)						(1.77)	
Problem Loans/Customer Loans		-2.91***						-3.01***
		(0.97)						(0.75)
RoE			-0.50***				-0.51**	
			(0.19)				(0.21)	
RoA				-6.79				-7.86**
				(4.87)				(3.45)
Wholesale Funding/Total Assets					-0.41		0.20	
					(0.66)		(0.39)	
Loan-to-Deposit Ratio						0.06		-0.00
						(0.06)		(0.07)
Instruments	11	11	11	11	11	11	15	15
Hansen J-test	0.220	0.222	0.302	0.078	0.101	0.206	0.185	0.323
Autocorrelation order 2	0.969	0.892	0.758	0.639	0.879	0.704	0.897	0.833
Banks	21.000	21.000	21.000	21.000	21.000	21.000	21.000	21.000
Observations	495	492	497	497	477	492	477	488

Standard errors in parentheses

Specifications are subject to Windmeijer corrected standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: System GMM Regression - Drivers of 5Y Senior Debt CDS - Own Funds Ratio

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5	(6) est6	(7) est7	(8) est8
L.5Y Senior CDS	0.78***	0.78***	0.63***	0.66***	0.80***	0.58***	0.74***	0.72***
	(0.17)	(0.22)	(0.17)	(0.19)	(0.28)	(0.09)	(0.14)	(0.11)
Own Funds Ratio	-2.58***	-2.80***	-1.50***	-1.50***	-2.03***	-1.86***	-2.33***	-2.48***
	(0.81)	(0.88)	(0.54)	(0.56)	(0.64)	(0.61)	(0.69)	(0.69)
ln_Total Assets	0.72	1.20	-0.71	-0.93	1.25	-0.36	0.97	0.87
	(1.27)	(1.48)	(0.91)	(0.99)	(1.70)	(1.07)	(0.99)	(1.06)
VSTOXX	2.45***	2.24***	3.15***	3.22***	2.55***	2.85***	2.40***	2.76***
	(0.64)	(0.65)	(0.64)	(0.62)	(0.93)	(0.77)	(0.57)	(0.59)
5Y Sovereign CDS	0.18	0.19	0.17*	0.16	-0.01	0.20***	0.21***	0.23**
	(0.12)	(0.13)	(0.10)	(0.11)	(0.19)	(0.06)	(0.07)	(0.10)
Overnight Rate	-14.55	-14.05	-16.10	-19.64	-10.51	-10.26	-10.48*	-14.01**
	(12.47)	(14.51)	(9.92)	(13.29)	(11.57)	(9.35)	(5.53)	(6.98)
Loan Loss Reserves/Customer Loans	-3.81*						-4.62**	
	(1.95)						(2.23)	
Problem Loans/Customer Loans		-2.49**						-2.41***
		(1.13)						(0.93)
RoE			-0.49***				-0.52**	
			(0.18)				(0.23)	
RoA				-7.61**				-7.30**
				(3.65)				(3.31)
Wholesale Funding/Total Assets					-0.65		0.06	
					(0.76)		(0.35)	
Loan-to-Deposit Ratio						0.04		-0.02
						(0.05)		(0.07)
Instruments	11	11	11	11	11	11	15	15
Hansen J-test	0.147	0.162	0.331	0.307	0.104	0.165	0.274	0.202
Autocorrelation order 2	0.750	0.691	0.936	0.906	0.655	0.980	0.701	0.800
Banks	21.000	21.000	21.000	21.000	21.000	21.000	21.000	21.000
Observations	495	492	497	497	477	492	477	488

Standard errors in parentheses

Specifications are subject to Windmeijer corrected standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: System GMM Regression - Drivers of 5Y Senior Debt CDS - Leverage Ratio

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5	(6) est6	(7) est7	(8) est8
L.5Y Senior CDS	0.73***	0.73***	0.56***	0.57***	0.75***	0.57***	0.80***	0.73***
	(0.16)	(0.16)	(0.14)	(0.14)	(0.21)	(0.12)	(0.10)	(0.11)
CET1/Total Assets	3.24	4.41	2.11	2.45	0.16	0.30	1.99	5.38*
	(3.70)	(4.10)	(2.67)	(3.12)	(4.55)	(5.92)	(3.08)	(2.88)
ln_Total Assets	-2.45**	-2.75*	-2.41**	-2.53**	-0.27	-1.41	-0.85	-1.91***
	(1.22)	(1.51)	(0.94)	(1.12)	(2.22)	(2.06)	(1.70)	(0.69)
VSTOXX	2.58***	2.66***	3.29***	3.25***	2.12**	2.56**	2.21***	2.78***
	(0.71)	(0.76)	(0.77)	(0.89)	(0.84)	(1.25)	(0.62)	(0.67)
5Y Sovereign CDS	0.24***	0.21***	0.25***	0.25***	0.11	0.26*	0.20**	0.25***
	(0.07)	(0.07)	(0.08)	(0.08)	(0.16)	(0.14)	(0.08)	(0.10)
Overnight Rate	-8.20	-8.49	-5.54	-6.77	-0.62	-0.61	-2.32	-6.65
	(10.55)	(10.82)	(10.32)	(10.84)	(10.65)	(9.90)	(6.62)	(6.42)
Loan Loss Reserves/Customer Loans	-2.86						-3.84	
	(3.35)						(2.78)	
Problem Loans/Customer Loans		-1.54						-2.93**
		(1.61)						(1.35)
RoE			-0.50**				-0.61*	
			(0.21)				(0.32)	
RoA				-8.15*				-11.59***
				(4.79)				(4.38)
Wholesale Funding/Total Assets					-0.67		-0.43	
					(0.70)		(0.54)	
Loan-to-Deposit Ratio						-0.02		-0.11
						(0.06)		(0.08)
Instruments	11	11	11	11	11	11	15	15
Hansen J-test	0.064	0.059	0.053	0.044	0.041	0.057	0.085	0.247
Autocorrelation order 2	0.475	0.431	0.813	0.747	0.390	0.629	0.390	0.421
Banks	21.000	21.000	21.000	21.000	21.000	21.000	21.000	21.000
Observations	498	495	500	500	479	495	479	491

Standard errors in parentheses

Specifications are subject to Windmeijer corrected standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: System GMM Regression - Drivers of 5Y Subordinated Debt CDS - Tier1 Ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	est1	est2	est3	est4	est5	est6	est7	est8
L.5Y Subordinated CDS	0.72***	0.79***	0.89**	0.81*	0.77***	1.03***	0.61***	0.75***
	(0.14)	(0.18)	(0.40)	(0.47)	(0.13)	(0.23)	(0.17)	(0.21)
Tier1 Ratio	-8.18**	-7.07*	-6.23**	-5.98**	-7.01***	-7.35***	-5.23*	-6.20***
	(3.18)	(3.67)	(2.50)	(2.98)	(2.39)	(2.18)	(2.97)	(2.21)
ln_Total Assets	2.94	1.95	1.44	0.26	6.66*	1.33	1.87	0.23
	(4.12)	(4.51)	(2.28)	(4.29)	(3.53)	(2.38)	(3.33)	(2.76)
VSTOXX	5.74***	5.14***	4.63*	5.57	6.39***	3.42***	6.82***	5.29***
	(2.10)	(1.64)	(2.54)	(4.77)	(0.96)	(1.28)	(1.06)	(2.00)
5Y Sovereign CDS	0.40	0.17	-0.05	0.10	-0.09	-0.17	0.42	0.30
	(0.34)	(0.54)	(0.51)	(0.62)	(0.19)	(0.28)	(0.31)	(0.53)
Overnight Rate	-41.53**	-35.15*	-44.81**	-56.32**	-30.26**	-35.97*	-38.19**	-43.97**
	(20.16)	(18.37)	(19.45)	(23.26)	(13.48)	(21.45)	(16.34)	(17.71)
Loan Loss Reserves/Customer Loans	-8.74						-4.23	
	(10.23)						(6.94)	
Problem Loans/Customer Loans		-1.41						-1.58
		(8.89)						(6.59)
RoE			-1.22**				-0.95	
			(0.59)				(0.73)	
RoA				-14.39				-12.25
				(16.69)				(11.99)
Wholesale Funding/Total Assets					-2.97**		-0.83	
					(1.50)		(1.06)	
Loan-to-Deposit Ratio						0.13		0.17
						(0.29)		(0.18)
Instruments	11	11	11	11	11	11	15	15
Hansen J-test	0.040	0.033	0.068	0.105	0.202	0.109	0.073	0.181
Autocorrelation order 2	0.652	0.767	0.838	0.945	0.670	0.895	0.683	0.991
Banks	21.000	21.000	21.000	21.000	21.000	21.000	21.000	21.000
Observations	473	471	475	475	459	470	459	467

Standard errors in parentheses

Specifications are subject to Windmeijer corrected standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: System GMM Regression - Drivers of 5Y Subordinated Debt CDS - Own Funds Ratio

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5	(6) est6	(7) est7	(8) est8
L.5Y Subordinated CDS	0.83***	0.80***	0.76**	0.66**	0.68***	0.93***	0.58***	0.73***
	(0.17)	(0.14)	(0.39)	(0.30)	(0.15)	(0.24)	(0.14)	(0.18)
Own Funds Ratio	-7.24**	-6.33*	-4.32***	-3.63***	-3.58*	-5.09**	-4.77**	-4.97**
	(3.34)	(3.46)	(1.54)	(0.96)	(2.05)	(2.02)	(2.11)	(2.09)
ln_Total Assets	4.62	2.99	0.77	-0.59	4.24	0.62	3.17	1.32
	(4.78)	(4.71)	(1.62)	(1.80)	(3.23)	(2.50)	(2.70)	(2.90)
VSTOXX	4.24**	4.84***	5.20**	5.98**	6.48***	3.78**	6.75***	5.18**
	(1.94)	(1.62)	(2.19)	(3.04)	(1.07)	(1.78)	(1.09)	(2.07)
5Y Sovereign CDS	0.41	0.29	0.11	0.31	0.12	-0.02	0.51**	0.37
	(0.36)	(0.48)	(0.44)	(0.40)	(0.18)	(0.27)	(0.23)	(0.48)
Overnight Rate	-29.66**	-29.96**	-34.78**	-45.99**	-24.19*	-28.55	-32.00***	-35.54**
	(13.24)	(13.76)	(14.33)	(19.76)	(14.63)	(17.91)	(12.00)	(13.85)
Loan Loss Reserves/Customer Loans	-14.10						-6.87	
	(16.56)						(5.13)	
Problem Loans/Customer Loans		-4.37						-2.63
		(9.39)						(6.00)
RoE			-0.89				-0.70	
			(0.72)				(0.73)	
RoA				-8.68				-9.77
				(13.10)				(10.82)
Wholesale Funding/Total Assets					-2.64		-1.04	
					(1.62)		(1.09)	
Loan-to-Deposit Ratio						0.11		0.04
						(0.28)		(0.17)
Instruments	11	11	11	11	11	11	15	15
Hansen J-test	0.024	0.017	0.021	0.065	0.021	0.045	0.062	0.095
Autocorrelation order 2	0.995	0.887	0.889	0.996	0.879	0.859	0.707	0.960
Banks	21.000	21.000	21.000	21.000	21.000	21.000	21.000	21.000
Observations	473	471	475	475	459	470	459	467

Standard errors in parentheses

Specifications are subject to Windmeijer corrected standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: System GMM Regression - Drivers of 5Y Subordinated Debt CDS - Leverage Ratio

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5	(6) est6	(7) est7	(8) est8
L.5Y Subordinated CDS	0.59	0.57	0.75**	0.47	0.85***	0.11	0.76***	0.73***
	(0.41)	(0.43)	(0.37)	(0.52)	(0.13)	(0.98)	(0.12)	(0.28)
CET1/Total Assets	18.58	18.98	15.07	13.81	2.58	16.74	9.94**	15.33
	(15.39)	(16.40)	(13.37)	(14.73)	(8.00)	(26.59)	(4.42)	(13.64)
ln_Total Assets	-10.70**	-10.69**	-8.19**	-8.66**	0.51	-11.72	-2.85	-7.25***
	(4.70)	(5.04)	(3.47)	(4.31)	(3.98)	(9.72)	(2.11)	(2.62)
VSTOXX	9.26**	9.43*	7.17***	9.18**	6.34***	14.28	6.55***	7.55***
	(4.57)	(4.90)	(2.68)	(4.56)	(1.31)	(11.54)	(0.95)	(2.60)
5Y Sovereign CDS	0.37	0.43	0.19	0.58	0.06	1.00	0.20	0.44
	(0.52)	(0.50)	(0.45)	(0.59)	(0.16)	(1.04)	(0.30)	(0.49)
Overnight Rate	-59.21***	-59.75***	-44.98**	-57.55***	-11.38	-87.52*	-19.22*	-40.99**
	(20.41)	(22.43)	(18.50)	(18.89)	(14.19)	(45.57)	(10.42)	(15.97)
Loan Loss Reserves/Customer Loans	1.55						-0.65	
	(7.04)						(4.93)	
Problem Loans/Customer Loans		-0.10						-3.98
		(2.65)						(5.66)
RoE			-1.31**				-1.41***	
			(0.66)				(0.45)	
RoA				-17.91				-22.11***
				(13.28)				(7.63)
Wholesale Funding/Total Assets					-3.44**		-2.04	
					(1.42)		(1.27)	
Loan-to-Deposit Ratio						-0.12		-0.16
						(0.38)		(0.30)
Instruments	11	11	11	11	11	11	15	15
Hansen J-test	0.271	0.213	0.070	0.124	0.228	0.286	0.561	0.217
Autocorrelation order 2	0.970	0.937	0.673	0.971	0.698	0.664	0.572	0.669
Banks	21.000	21.000	21.000	21.000	21.000	21.000	21.000	21.000
Observations	476	474	478	478	461	473	461	470

Standard errors in parentheses

Specifications are subject to Windmeijer corrected standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15: OLS Regressions for 5Y Senior Debt CDS -CET1 Ratio

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5	(6) est6	(7) est7	(8) est8	(9) est9
L.CET1 Ratio	-3.46***	-3.08***	-3.34***	-3.39***	-3.21***	-3.00***	-2.92***	-2.43***	-2.73***
	(0.74)	(0.72)	(0.72)	(0.74)	(0.74)	(0.73)	(0.74)	(0.71)	(0.72)
L.ln_Total Assets	-57.27***	-37.40***	-38.26***	-56.97***	-56.02***	-55.18***	-49.53***	-33.60***	-36.46***
	(12.48)	(12.74)	(12.83)	(12.57)	(12.47)	(12.84)	(12.89)	(12.81)	(12.97)
Overnight Rate	-15.25***	-22.75***	-21.65***	-16.42***	-16.68***	-17.49***	-11.44**	-19.48***	-17.74***
	(4.68)	(4.73)	(4.76)	(4.69)	(4.66)	(5.40)	(4.79)	(5.21)	(4.81)
VSTOXX	2.87***	2.40***	2.50***	2.86***	2.82***	2.92***	2.83***	2.32***	2.49***
	(0.19)	(0.20)	(0.20)	(0.19)	(0.19)	(0.19)	(0.19)	(0.20)	(0.20)
5Y Sovereign CDS	0.79***	0.85***	0.90***	0.77***	0.77***	0.81***	0.80***	0.88***	0.88***
	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
L.Loan Loss Reserves/Customer Loans		8.06***						9.34***	
		(1.41)						(1.58)	
Problem Loans/Customer Loans			3.42***						3.22***
			(0.69)						(0.70)
L.RoE				-0.47**				-0.07	
				(0.21)				(0.21)	
L.RoA					-11.39***				-6.32*
					(3.56)				(3.60)
L.Wholesale Funding/Total Assets						0.83**		0.05	
						(0.41)		(0.41)	
L.Loan-to-Deposit Ratio							0.07		-0.01
							(0.11)		(0.11)
Constant	1220.51***	789.40***	812.84***	1217.60***	1197.86***	1140.96***	1045.20***	699.19***	774.35***
	(261.01)	(267.21)	(268.83)	(262.78)	(260.78)	(269.81)	(273.33)	(268.73)	(274.93)
R^2	0.58	0.61	0.60	0.59	0.59	0.60	0.59	0.64	0.62
$\hat{\sigma}$	17.5	16.9	17.1	17.3	17.2	17.0	17.2	16.3	16.6
Entity FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Joint F-Test	25	28	27	21	23	26	25	24	24
# Entities	21	21	21	21	21	21	21	21	21
Observations	480	477	477	479	479	458	474	458	472

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 16: OLS Regressions for 5Y Senior Debt CDS - Tier1 Ratio

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5	(6) est6	(7) est7	(8) est8	(9) est9
L.Tier1 Ratio	-3.20***	-2.60***	-2.82***	-3.16***	-2.97***	-2.99***	-2.92***	-2.20***	-2.50***
	(0.70)	(0.68)	(0.69)	(0.70)	(0.70)	(0.68)	(0.69)	(0.68)	(0.68)
L.ln_Total Assets	-54.17***	-35.20***	-35.95***	-54.30***	-53.38***	-53.54***	-48.02***	-32.16**	-35.37***
	(12.39)	(12.78)	(12.87)	(12.48)	(12.39)	(12.71)	(12.76)	(12.77)	(12.96)
Overnight Rate	-18.92***	-24.07***	-23.22***	-20.13***	-20.09***	-20.53***	-15.19***	-20.71***	-19.73***
	(5.13)	(5.09)	(5.14)	(5.16)	(5.12)	(5.67)	(5.16)	(5.48)	(5.14)
VSTOXX	2.84***	2.40***	2.51***	2.83***	2.79***	2.87***	2.80***	2.30***	2.49***
	(0.19)	(0.20)	(0.20)	(0.19)	(0.19)	(0.19)	(0.19)	(0.21)	(0.20)
5Y Sovereign CDS	0.78***	0.84***	0.88***	0.77***	0.76***	0.80***	0.79***	0.88***	0.86***
	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
L.Loan Loss Reserves/Customer Loans		7.65***						9.05***	
		(1.45)						(1.61)	
Problem Loans/Customer Loans			3.15***						2.98***
			(0.70)						(0.71)
L.RoE				-0.44**				-0.07	
				(0.21)				(0.21)	
L.RoA					-10.93***				-6.28*
					(3.58)				(3.62)
L.Wholesale Funding/Total Assets						0.77*		0.05	
						(0.41)		(0.41)	
L.Loan-to-Deposit Ratio							0.05		-0.02
							(0.11)		(0.11)
Constant	1157.35***	741.97***	762.95***	1163.52***	1143.79***	1113.80***	1020.37***	670.04**	754.17***
	(258.77)	(268.08)	(269.78)	(260.59)	(258.69)	(266.79)	(270.35)	(267.91)	(274.72)
R^2	0.58	0.60	0.59	0.59	0.59	0.61	0.59	0.64	0.61
$\hat{\sigma}$	17.5	17.0	17.2	17.4	17.3	17.0	17.2	16.4	16.6
Entity FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Joint F-Test	24	27	26	21	22	26	25	24	24
# Entities	21	21	21	21	21	21	21	21	21
Observations	477	474	474	476	476	456	471	456	469

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: OLS Regressions for 5Y Senior Debt CDS - Own Funds Ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	est1	est2	est3	est4	est5	est6	est7	est8	est9
L.Own Funds Ratio	-1.83***	-1.65***	-1.83***	-1.81***	-1.67***	-1.86***	-1.59***	-1.54***	-1.59***
	(0.60)	(0.58)	(0.59)	(0.60)	(0.60)	(0.59)	(0.59)	(0.57)	(0.58)
L.ln_Total Assets	-53.27***	-33.50***	-34.42***	-52.98***	-51.92***	-53.18***	-46.24***	-31.47**	-33.61**
	(12.73)	(12.95)	(13.04)	(12.84)	(12.72)	(13.00)	(13.10)	(12.91)	(13.13)
Overnight Rate	-13.49***	-21.21***	-20.15***	-14.73***	-14.96***	-16.48***	-9.87*	-18.88***	-16.72***
	(5.08)	(5.10)	(5.14)	(5.10)	(5.06)	(5.68)	(5.09)	(5.49)	(5.12)
VSTOXX	2.90***	2.40***	2.52***	2.89***	2.85***	2.92***	2.85***	2.29***	2.50***
	(0.19)	(0.20)	(0.20)	(0.19)	(0.19)	(0.19)	(0.19)	(0.21)	(0.20)
5Y Sovereign CDS	0.78***	0.85***	0.89***	0.76***	0.76***	0.80***	0.79***	0.88***	0.87***
	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
L.Loan Loss Reserves/Customer Loans		8.36***						9.70***	
		(1.44)						(1.59)	
Problem Loans/Customer Loans			3.50***						3.27***
			(0.70)						(0.71)
L.RoE				-0.49**				-0.07	
				(0.21)				(0.21)	
L.RoA					-12.14***				-6.69*
					(3.61)				(3.64)
L.Wholesale Funding/Total Assets						0.88**		0.08	
						(0.41)		(0.42)	
L.Loan-to-Deposit Ratio							0.06		-0.02
							(0.11)		(0.11)
Constant	1122.85***	695.46**	720.01***	1121.00***	1098.90***	1090.50***	966.44***	647.68**	707.71**
	(266.44)	(271.65)	(273.50)	(268.66)	(266.26)	(273.29)	(278.26)	(270.85)	(278.76)
R^2	0.57	0.60	0.59	0.58	0.58	0.60	0.58	0.63	0.61
$\hat{\sigma}$	17.8	17.1	17.3	17.6	17.5	17.2	17.4	16.5	16.8
Entity FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Joint F-Test	22	26	24	19	21	24	23	23	23
# Entities	21	21	21	21	21	21	21	21	21
Observations	477	474	474	476	476	456	471	456	469

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 18: OLS Regressions for 5Y Senior Debt CDS - Leverage Ratio

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5	(6) est6	(7) est7	(8) est8	(9) est9
L.CET1/Total Assets	-12.26***	-10.83***	-12.29***	-13.41***	-12.44***	-11.91***	-11.10***	-9.89***	-11.56***
	(2.66)	(2.59)	(2.61)	(2.69)	(2.72)	(2.72)	(2.67)	(2.64)	(2.71)
L.ln_Total Assets	-79.85***	-56.81***	-60.61***	-84.06***	-81.18***	-79.10***	-67.95***	-53.76***	-57.56***
	(14.45)	(14.61)	(14.60)	(14.71)	(14.74)	(14.91)	(14.53)	(14.90)	(14.74)
Overnight Rate	-9.06**	-17.27***	-16.01***	-11.35***	-11.68***	-12.36**	-7.33*	-15.41***	-14.76***
	(4.14)	(4.27)	(4.27)	(4.15)	(4.13)	(4.86)	(4.31)	(4.71)	(4.37)
VSTOXX	2.80***	2.33***	2.42***	2.78***	2.76***	2.84***	2.72***	2.26***	2.38***
	(0.19)	(0.20)	(0.20)	(0.19)	(0.19)	(0.19)	(0.19)	(0.20)	(0.20)
5Y Sovereign CDS	0.77***	0.84***	0.89***	0.75***	0.75***	0.79***	0.79***	0.87***	0.87***
	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
L.Loan Loss Reserves/Customer Loans		8.10***						9.29***	
		(1.41)						(1.58)	
Problem Loans/Customer Loans			3.52***						3.26***
			(0.69)						(0.70)
L.RoE				-0.48**				-0.08	
				(0.21)				(0.20)	
L.RoA					-10.66***				-4.94
					(3.57)				(3.63)
L.Wholesale Funding/Total Assets						0.79*		0.01	
						(0.41)		(0.41)	
L.Loan-to-Deposit Ratio							0.16		0.09
							(0.11)		(0.11)
Constant	1696.35***	1198.15***	1285.37***	1793.17***	1730.91***	1650.91***	1425.03***	1129.74***	1212.51***
	(306.11)	(309.81)	(309.39)	(311.44)	(312.08)	(317.27)	(309.33)	(316.22)	(313.55)
R^2	0.58	0.61	0.60	0.59	0.59	0.61	0.59	0.64	0.62
$\hat{\sigma}$	17.5	16.9	17.1	17.2	17.2	17.0	17.2	16.3	16.5
Entity FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Joint F-Test	27	30	29	21	22	27	25	24	23
# Entities	21	21	21	21	21	21	21	21	21
Observations	480	477	477	479	479	458	474	458	472

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 19: OLS Regressions for 5Y Subordinated Debt CDS - CET1 Ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	est1	est2	est3	est4	est5	est6	est7	est8	est9
L.CET1 Ratio	-10.01***	-9.10***	-9.69***	-9.65***	-9.37***	-8.81***	-8.64***	-7.39***	-7.99***
	(1.64)	(1.63)	(1.63)	(1.64)	(1.65)	(1.62)	(1.63)	(1.60)	(1.62)
L.ln_Total Assets	-76.97***	-55.88*	-54.43*	-72.21**	-72.01**	-87.52***	-62.74**	-46.31	-41.51
	(29.29)	(30.23)	(30.34)	(29.54)	(29.42)	(30.16)	(30.18)	(30.31)	(30.73)
Overnight Rate	-86.08***	-93.97***	-92.11***	-86.73***	-87.53***	-63.79***	-73.58***	-64.41***	-79.89***
	(10.56)	(10.75)	(10.78)	(10.62)	(10.57)	(12.13)	(10.73)	(11.83)	(10.88)
VSTOXX	4.61***	3.81***	4.02***	4.55***	4.48***	4.42***	4.48***	3.34***	3.92***
	(0.42)	(0.47)	(0.45)	(0.42)	(0.42)	(0.42)	(0.42)	(0.46)	(0.45)
5Y Sovereign CDS	1.63***	1.71***	1.78***	1.60***	1.59***	1.63***	1.62***	1.77***	1.73***
	(0.11)	(0.12)	(0.13)	(0.11)	(0.11)	(0.12)	(0.11)	(0.12)	(0.13)
L.Loan Loss Reserves/Customer Loans		12.98***						16.71***	
		(3.40)						(3.61)	
Problem Loans/Customer Loans			5.13***						4.61***
			(1.59)						(1.61)
L.RoE				-1.22***				-0.56	
				(0.46)				(0.45)	
L.RoA					-24.04***				-17.02**
					(7.85)				(7.98)
L.Wholesale Funding/Total Assets						-0.81		-2.33**	
						(0.90)		(0.93)	
L.Loan-to-Deposit Ratio							0.09		-0.03
							(0.25)		(0.24)
Constant	1738.16***	1268.20**	1250.97**	1646.38***	1640.73***	1979.70***	1417.64**	1137.68*	978.92
	(612.89)	(634.59)	(636.43)	(618.03)	(615.51)	(632.04)	(640.09)	(634.25)	(651.84)
R^2	0.50	0.50	0.50	0.51	0.51	0.49	0.49	0.52	0.51
$\hat{\sigma}$	38.2	37.7	37.9	37.9	37.8	37.2	37.3	36.1	36.6
Entity FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Joint F-Test	24	25	24	20	22	24	24	21	22
# Entities	21	21	21	21	21	21	21	21	21
Observations	462	459	459	461	461	444	456	444	454

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 20: OLS Regressions for 5Y Subordinated Debt CDS - Tier1 Ratio

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5	(6) est6	(7) est7	(8) est8	(9) est9
L.Tier1 Ratio	-8.13***	-6.90***	-7.51***	-7.75***	-7.44***	-7.80***	-7.45***	-6.03***	-6.48***
	(1.55)	(1.56)	(1.55)	(1.55)	(1.56)	(1.51)	(1.52)	(1.51)	(1.53)
L.ln_Total Assets	-61.09**	-41.19	-40.66	-56.42*	-56.47*	-75.04**	-50.54*	-34.56	-29.99
	(29.26)	(30.34)	(30.52)	(29.48)	(29.36)	(29.86)	(29.94)	(30.10)	(30.65)
Overnight Rate	-87.88***	-92.39***	-90.97***	-87.91***	-88.30***	-66.85***	-75.90***	-64.32***	-79.16***
	(11.59)	(11.58)	(11.66)	(11.68)	(11.63)	(12.68)	(11.53)	(12.38)	(11.60)
VSTOXX	4.49***	3.70***	3.96***	4.43***	4.36***	4.27***	4.35***	3.23***	3.83***
	(0.43)	(0.47)	(0.46)	(0.43)	(0.43)	(0.42)	(0.43)	(0.46)	(0.45)
5Y Sovereign CDS	1.63***	1.71***	1.76***	1.59***	1.58***	1.62***	1.62***	1.76***	1.71***
	(0.12)	(0.12)	(0.13)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)
L.Loan Loss Reserves/Customer Loans		13.00***						16.53***	
		(3.54)						(3.68)	
Problem Loans/Customer Loans			4.69***						4.23**
			(1.63)						(1.64)
L.RoE				-1.26***				-0.57	
				(0.46)				(0.46)	
L.RoA					-24.60***				-17.83**
					(7.98)				(8.05)
L.Wholesale Funding/Total Assets						-0.91		-2.32**	
						(0.91)		(0.93)	
L.Loan-to-Deposit Ratio							0.08		-0.03
							(0.25)		(0.25)
Constant	1396.31**	945.01	949.45	1306.07**	1304.49**	1723.63***	1163.04*	885.73	732.25
	(610.97)	(636.45)	(639.68)	(615.57)	(613.13)	(624.78)	(634.03)	(629.51)	(649.85)
R^2	0.49	0.49	0.49	0.50	0.50	0.49	0.49	0.52	0.51
$\hat{\sigma}$	38.7	38.2	38.4	38.4	38.3	37.3	37.5	36.3	36.9
Entity FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Joint F-Test	22	23	22	19	20	23	24	20	21
# Entities	21	21	21	21	21	21	21	21	21
Observations	459	456	456	458	458	442	453	442	451

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 21: OLS Regressions for 5Y Subordinated Debt CDS - Own Funds Ratio

	(1) est1	(2) est2	(3) est3	(4) est4	(5) est5	(6) est6	(7) est7	(8) est8	(9) est9
L.Own Funds Ratio	-5.50***	-4.96***	-5.50***	-5.19***	-4.98***	-5.44***	-4.97***	-4.56***	-4.73***
	(1.33)	(1.31)	(1.32)	(1.34)	(1.34)	(1.31)	(1.31)	(1.28)	(1.30)
L.ln_Total Assets	-62.53**	-39.30	-38.95	-56.88*	-56.72*	-76.89**	-50.46	-34.42	-28.28
	(29.92)	(30.64)	(30.83)	(30.17)	(30.00)	(30.50)	(30.61)	(30.39)	(30.96)
Overnight Rate	-78.08***	-87.57***	-85.60***	-78.27***	-79.20***	-59.19***	-66.48***	-61.00***	-74.16***
	(11.44)	(11.55)	(11.60)	(11.53)	(11.46)	(12.71)	(11.35)	(12.35)	(11.50)
VSTOXX	4.63***	3.67***	3.95***	4.56***	4.48***	4.39***	4.47***	3.19***	3.83***
	(0.43)	(0.48)	(0.47)	(0.43)	(0.43)	(0.42)	(0.43)	(0.47)	(0.46)
5Y Sovereign CDS	1.62***	1.72***	1.78***	1.58***	1.57***	1.62***	1.61***	1.78***	1.73***
	(0.12)	(0.12)	(0.13)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)
L.Loan Loss Reserves/Customer Loans		15.20***						18.44***	
		(3.49)						(3.64)	
Problem Loans/Customer Loans			5.71***						5.11***
			(1.62)						(1.64)
L.RoE				-1.34***				-0.54	
				(0.47)				(0.46)	
L.RoA					-26.92***				-18.27**
					(8.02)				(8.10)
L.Wholesale Funding/Total Assets						-0.63		-2.24**	
						(0.92)		(0.94)	
L.Loan-to-Deposit Ratio							0.09		-0.05
							(0.25)		(0.25)
Constant	1401.23**	886.24	895.18	1291.88**	1287.45**	1731.22***	1136.22*	867.15	683.21
	(626.03)	(642.86)	(646.45)	(631.16)	(627.76)	(638.98)	(649.64)	(635.42)	(657.01)
R^2	0.48	0.49	0.48	0.49	0.49	0.48	0.48	0.52	0.50
$\hat{\sigma}$	39.2	38.4	38.7	38.8	38.7	37.7	38.0	36.4	37.1
Entity FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Joint F-Test	20	21	21	18	19	21	22	19	20
# Entities	21	21	21	21	21	21	21	21	21
Observations	459	456	456	458	458	442	453	442	451

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 22: OLS Regressions for 5Y Subordinated Debt CDS - Leverage Ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	est1	est2	est3	est4	est5	est6	est7	est8	est9
L.CET1/Total Assets	-22.90***	-17.94***	-22.03***	-23.35***	-21.17***	-22.14***	-19.32***	-16.15***	-17.18***
	(6.20)	(6.23)	(6.18)	(6.30)	(6.39)	(6.28)	(6.18)	(6.18)	(6.40)
L.ln_Total Assets	-93.74***	-61.74*	-68.40**	-91.83***	-87.48**	-107.42***	-68.20**	-54.62	-44.91
	(33.25)	(34.33)	(34.12)	(33.90)	(34.00)	(34.21)	(33.24)	(34.51)	(34.29)
Overnight Rate	-61.00***	-70.71***	-68.30***	-63.58***	-64.46***	-40.52***	-53.05***	-44.00***	-60.83***
	(9.49)	(9.84)	(9.82)	(9.56)	(9.53)	(11.04)	(9.79)	(10.75)	(10.03)
VSTOXX	4.59***	3.77***	3.97***	4.52***	4.46***	4.37***	4.37***	3.27***	3.82***
	(0.43)	(0.48)	(0.47)	(0.43)	(0.43)	(0.43)	(0.44)	(0.47)	(0.46)
5Y Sovereign CDS	1.58***	1.68***	1.74***	1.54***	1.54***	1.59***	1.60***	1.74***	1.71***
	(0.12)	(0.12)	(0.13)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)
L.Loan Loss Reserves/Customer Loans		13.78***						17.45***	
		(3.51)						(3.68)	
Problem Loans/Customer Loans			5.44***						4.67***
			(1.62)						(1.64)
L.RoE				-1.37***				-0.66	
				(0.46)				(0.46)	
L.RoA					-25.94***				-17.77**
					(8.09)				(8.25)
L.Wholesale Funding/Total Assets						-1.05		-2.58***	
						(0.92)		(0.94)	
L.Loan-to-Deposit Ratio							0.31		0.17
							(0.25)		(0.25)
Constant	2050.41***	1342.57*	1504.24**	2026.30***	1928.25***	2378.31***	1470.48**	1289.02*	991.32
	(703.21)	(727.85)	(722.41)	(717.08)	(719.40)	(725.47)	(707.07)	(730.44)	(729.02)
R^2	0.47	0.48	0.48	0.49	0.49	0.47	0.47	0.51	0.50
$\hat{\sigma}$	39.2	38.7	38.8	38.8	38.7	37.9	38.1	36.7	37.4
Entity FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Joint F-Test	24	25	24	19	20	23	23	20	19
# Entities	21	21	21	21	21	21	21	21	21
Observations	462	459	459	461	461	444	456	444	454

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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