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How Do EU Banks' Funding Costs Respond to the CRD IV? – An Assessment Based on the Banking Union Directives Database

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How Do EU Banks' Funding Costs Respond to the CRD IV? – An Assessment Based on the Banking Union Directives Database*

Abstract

The establishment of the European Banking Union constitutes a major change in the regulatory framework of the banking system. Main parts are implemented via directives that show staggered transposition timing across EU member states. Based on the newly compiled Banking Union Directives Database, we assess how banks' funding costs responded to the Capital Requirements Directive IV (CRD IV). Our findings show an upward trend in funding costs which is driven by an increase in cost of equity and partially offset by a decline in cost of debt. The diverging trends are most present in countries with an ex-ante lower regulatory capital stringency, which is in line with banks' short-run adjustment needs but longer-run benefits from increased financial stability.

Keywords: banking union, CRD IV, funding costs, staggered difference-in-difference estimators

JEL classification: C52, G01, G18, G21

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1 Motivation

The global financial crisis starting in 2007/08 as well as the sovereign debt crises in Europe have ignited a concerted restructuring of the regulatory and supervisory framework of the European financial system. These reforms are part of a larger endeavor to harmonize the regulatory stance in the European Union (EU) and to create a European Banking Union (EBU) with shared micro- and macroprudential rules and procedures in place. Despite the EBU being a major regulatory achievement, empirical evidence of its effectiveness could be further developed. One reason for the limited amount of research on the new regulatory framework, and in particular the parts on capital regulation and deposit insurance, could be the increase in regulatory complexity (Herring, 2018). Another reason is likely to relate to the lack of data given that evidence-based policy evaluation requires information on the scope and timing of the legislative process. Especially in cross-country settings as applies to the EU such information is not easy to compile.

We hence assemble a new database, the "Banking Union Directives Database", covering the transposition dates of the three capstone directives of the EBU: the Capital Requirements Directive IV (CRD IV), the Bank Recovery and Resolution Directive (BRRD), and the Deposit Guarantee Scheme Directive (DGSD). These three directives, along with the Capital Requirements Regulation (CRR), constitute the Single Rulebook that serves as the foundation on which the three pillars of the EBU rest: the Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM) and the Harmonised Deposit Guarantee Scheme. One key feature of the directive transposition process is that although the EU sets a uniform transposition deadline, most member states of the European Union (EU) delay the national policy change. We show that there is heterogeneity in transposition delays across EU member states, whereas delays show no major correlations with economic fundamentals or ex-ante regulatory stringency. The staggered timing in directive transposition can thus be exploited for identification purposes (Christensen, Hail, and Leuz, 2016; Koetter, Krause, Sfrappini, and Tonzer, 2022).

Next to deposit insurance and newly introduced rules for bank resolution, capital requirements are a crucial tool to reduce the adverse effects of bank losses on systemic stability and the real economy. The contents of the CRD IV tighten the regulatory stance by requiring banks, amongst other things, to build up more capital of better quality and to strengthen corporate governance such that risks are better monitored. The tighter regulatory stance should hence strengthen bank (but also systemic) stability. The literature has, however, been silent so far

how the CRD IV shaped bank outcomes although it was the first directive to be transposed. By drawing on the newly collected transposition dates of the CRD IV, we analyze how banks' funding costs responded to the national implementation of the directive. CRD IV commonly refers to the EU Directive 2013/36/EU, which was issued by the European Parliament and the European Council on 26 June 2013, following a proposal by the European Commission to establish rules on bank capital adequacy in line with the Basel III framework. The directive had to be transposed by each member state by 31 December 2013 but the average implementation delay amounts to 182 days. The analysis is based on stock listed and large banks in the EU for which we obtain information on the weighted average cost of capital (WACC).

Regarding the direction of effects, it is ex-ante not clear how banks' WACC – composed of the cost of equity and the cost of debt – will react to tighter capital regulation. If higher capital requirements reduce leverage and failure risk, the Modigliani Miller theorem predicts a *decline* in the cost of equity (known as Modigliani-Miller offset) while the cost of debt stays *constant*. Consequently, the net effect is a decline in banks' WACC due to the Modigliani-Miller offset. Relaxing the assumptions of the Modigliani Miller theorem could, on the one hand, lead to an *increase* in the cost of equity due to the "low-risk anomaly" resulting in higher WACC.[1] On the other hand, it could lead to a *decrease* in the cost of debt because debt holders require lower risk compensation due to reduced bank failure risk. From a more general financial stability perspective, any decrease in either cost of equity or cost of debt could be indicative of equity or debt investors demanding lower risk compensation and thus reflect expectations about a strengthening effect of the CRD IV on individual banks' but also financial stability. Reversely, a decrease in bank leverage could stimulate risk-taking and result in riskier asset portfolios, which would thus increase investors' expected return and banks' cost of capital (Kovner and van Tassel, 2022).[2]

Results obtained by using a two-way fixed effects (TWFE) estimator reveal that the staggered CRD IV transposition only marginally increases banks' funding costs measured by WACC. This

[1]Baker and Wurgler (2015) put forward the "low-risk anomaly" and show that less risky equity (e.g., due to higher capital ratios) can go in tandem with higher values in terms of cost of equity. One reason could be that leverage-constraint investors prefer high beta stocks, which lowers demand for stocks of banks becoming safer. When the low-risk anomaly dominates for stocks compared to debt, the Modigliani Miller theorem does not hold and banks' WACC increases with higher capital requirements.

[2]Kashyap, Stein, and Hanson (2010) estimate a significant but smaller than 100% Modigliani-Miller offset meaning that higher costs of capital requirements are not fully counteracted by the decline in the cost of equity due to bank equity becoming less risky. Hail and Leuz (2006) find for firms that the cost of capital is lower in countries with more effective legal systems and disclosure requirements, emphasizing the role of the stability aspect. Begenau (2020) shows in a dynamic general equilibrium model that higher capital requirements can lower banks' cost of capital.

observation is driven by two opposing effects: a stronger increase in the cost of equity than a decline in the cost of debt. While the decline in the cost of debt would be in line with the financial stability argument, the increase in the cost of equity could go back to the low-risk anomaly but also demand side effects as banks have to build up capital buffers. The detected dynamic treatment effects following CRD IV transposition remain robust when applying recent estimators proposed by Sun and Abraham (2021) and Cengiz, Dube, Lindner, and Zipperer (2019). While the TWFE estimator can exhibit bias when the treatment is staggered over time (Baker, Larcker, and Wang, 2022), our results underscore that in scenarios, where treatment adoption is spread over a few periods, biases are of minor concern (Freedman, Hollingsworth, Simon, Wing, and Yozwiak, 2023). We expand the analyses and test whether the CRD IV had heterogeneous effects depending on bank size or ex-ante stringency of capital regulation. Importantly, banks' funding costs increase in particular for the smaller banks in the sample and in countries with a lower ex-ante capital stringency. While the decline in cost of debt supports the financial stability argument, the increase in cost of equity dominates. We acknowledge that our results constitute a lower bound of response intensity as market participants might have "front-loaded" their adjustments following early announcements of the directive. Nevertheless, the significant responses reveal that the legislative process is actively monitored by markets, which speaks in favor of new information contained in the document transposing the law in a member state.

The institutional setting in the EU is such that legislation takes place via regulations and directives. Regulations become enforceable as law in all member states simultaneously. Directives offer more discretion to the member states regarding the transposition timing and the choice of legal instrument used to transpose the directive into national law. When publishing a directive the European Commission sets a transposition deadline until when EU member states have to implement the directive into national law. Yet member states tend to delay national transposition, which is also observed in the case of EBU directives. Given these (often substantial) delays, it does not seem useful to use the EU-wide transposition deadline to empirically assess the economic effects of directive transposition. We suggest instead to use country-specific information on the staggered implementation of the directive into national law. In principle, EURLex provides information on member states legal documents referring to the directive. But in practice, it is difficult to identify what is the relevant document implementing the directive into national law. To overcome this constraint, we collected national implementation dates from

EURLex and official national websites for the three directives that are relevant to the EBU (CRD IV, BRRD, DGSD).[3]

The study contributes to two main strands of literature. First, we add to the literature evaluating the effects of the implementation of the EBU. While in-depth analyses on the DGSD are still lacking, there are a couple of studies focused on recent changes in the regulatory framework introduced by the CRD IV and the BRRD. The drivers of the transposition speed of these directives are assessed, for example, by Koetter, Krause, and Tonzer (2019), while Christopoulos and Quaglia (2009) study the main actors influencing the legislation of the Capital Requirements Directive (CRD). Colonnello, Koetter, and Wagner (2023) examine the consequences of the CRD IV concerning compensation practices based on the EU-wide transposition deadline. Amongst others, the CRD IV capped variable remuneration relative to fixed compensation for banks' executive directors to reduce risk-taking. The authors find higher turnover rates only at poorly performing banks. Dautović (2020) finds that bank-specific capital requirements based on the CRD IV and the CRR, which apply to systemically important EU banks, have a positive effect on capitalization but are accompanied by an increase in risky assets. We provide further evidence on the impact of the CRD IV on banks' funding costs.

While research on the CRD IV transposition is still scarce, the BRRD's effects on risk premia have been studied in several applications. Most of the related analyses are based on concrete bail-in events in selected countries (Giuliana, 2019; Schäfer, Schnabel, and Weder di Mauro, 2016), announcements of the new bail-in regime (Hahn, Momtaz, and Wieandt, 2022), or the EU-wide implementation date of the BRRD (Pancotto, Gwilym, and Williams, 2019). Around these dates different patterns between secured and unsecured yields, CDS spreads or equity prices of European financial institutions are assessed. Results show mixed evidence regarding the reduction of bailout expectations by market participants, which would be reflected by higher risk premia. While Giuliana (2019) finds that the wedge in yields increases following bail-in events or related legislative dates, Hahn et al. (2022) detect tighter CDS spreads following regulatory events related to the new resolution framework, which speaks against an increase in bail-in premia. Similarly, Pancotto et al. (2019) find no relevant evidence for a weakening of the bank-sovereign risk nexus when analyzing CDS spreads around the EU-wide BRRD deadline. In contrast, Cutura (2021) exploits the deadline for the activation of the BRRD's bail-in tool

[3]Our approach is in the spirit of Kalemli-Ozcan, Papaioannou, and Peydró (2010) who assembled a similar dataset for the EU-15 member states on the implementation of the Financial Services Action Plan and exploit the significant heterogeneity in the adaptation timing for their analysis of the euro's role for financial integration.

(01 January 2016) and finds that bonds maturing this date show a higher premium compared to similar bonds maturing just before.[4] Also Koetter et al. (2022) study the impact of the national BRRD transposition on banks' funding costs and find a significant as well as strong hike in European banks' WACC, especially for banks located in GIIPS and EU banks outside of the euro area. The mixed evidence about whether markets price in stricter rules for resolution and restructuring could go back to the different event dates used. National transposition dates, compared to EU-wide deadlines or announcement dates, give a more precise measure for the de-jure implementation of the policy change at the country level. For many applied purposes, our database is thus a relevant input next to using EU-wide deadlines or specific bail-in events.

Second, we contribute to studies evaluating changes in capital regulation and the effects on bank outcomes. For example, Kovner and van Tassel (2022) demonstrate that since the Dodd-Frank Act has been passed, the cost of capital decreased for banks in the United States (US). This decline in capital costs is most prevalent for large banks and suggests a reduction in systematic risk due to post-crisis regulatory measures in the US. Instead of studying capital costs, the literature on capital structure and lending outcomes following changes in capital regulation is abundant. For example, Raja (2022) analyzes how banks in the United Kingdom react to changes in capital requirements. While banks adjust their capital ratios through a combination of capital accumulation and risk adjustments in their asset portfolio, the quantity of loans remains stable. Anginer, Bertay, Cull, Demirgüç-Kunt, and Mare (2021) examine the evolution of regulatory capital after the global financial crisis. While the quantity of regulatory capital increased, the quality did not follow the same trajectory. They explain this divergence by a greater discretion in allowing a broader range of instruments to satisfy Tier 1 capital requirements. Further, they highlight bank solvency risk being much more sensitive to bank regulatory capital for small banks compared to large banks indicating the limitations of capital regulation for banks that are adept at managing their balance sheets.[5] We focus on the national transposition of the CRD IV to evaluate its effects on EU banks' funding costs by drawing on the newly compiled Banking Union Directives Database.

[4] From a more international perspective and for global systemically important banks (G-SIBs), Lewrick, Serena, and Turner (2019) analyze the bail-premia for senior unsecured bonds and find that investors demand higher bail-in premia for G-SIBs and price bail-in risk pro-cyclically.

[5] Evidence on counter-cyclical capital buffers (CCyB) shows no effects on mortgage lending but on higher pricing (Basten, 2020) and that the loan composition changes for Swiss banks after activating CCyBs (Auer, Matyunina, and Ongena, 2022). Further studies discussing and documenting the effects of capital requirements on banks' stability but also lending decisions include, amongst others, Admati and Hellwig (2014); Berger and Bouwman (2013); Berrospide and Edge (2024); Cohen and Scatigna (2016); Corbae and D'Erasmo (2021); Fraisse, Lé, and Thesmar (2020); Jiménez, Ongena, Peydró, and Saurina (2017).

2 The regulatory framework introduced by the Banking Union directives

2.1 Institutional set-up

The EBU has been implemented as a response to the flaws in the regulatory framework of the banking system revealed by the global financial crisis as well as the sovereign debt crises in Europe. The three pillars of the EBU are the Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM), and harmonized rules for deposit insurance. While all euro area members have to join the EBU, other EU countries outside of the currency union have the option to join the EBU. Nevertheless, the directives and regulations that form the legal basis of the EBU apply to all EU member states. We focus on the three directives including CRD IV, BRRD, and DGSD. The three directives address issues related to capital requirements, bank resolution, and deposit insurance schemes.

The CRD IV and the CRR contain relevant content for the SSM, in which the European Central Bank (ECB) acts as competent (supervisory) authority to conduct microprudential actions. The CRD IV, or EU Directive 2013/36/EU, was issued by the European Parliament and the European Council on 26 June 2013, following a proposal by the European Commission to establish rules on bank capital adequacy in line with the Basel III framework. The directive had to be transposed by each member state by 31 December 2013. The key elements regulated in this directive are capital buffers. To ensure the resilience of financial institutions in times of distress, the directive requires banks to hold, in addition to other own funds, a capital conservation buffer of Common Equity Tier 1 capital equal to 2.5% of total risk exposure, and a counter-cyclical capital buffer (CCyB) equivalent to total risk exposure multiplied by the weighted average of the counter-cyclical buffer rates. The introduction of capital buffers is in line with recommendations by the Financial Stability Board (FSB) to motivate banks to build up capital buffers to mitigate the pro-cyclical amplification of financial shocks throughout the banking system (Basel Committee on Banking Supervision, 2010). The CRD IV also increases the transparency and disclosure requirements of remuneration. It places a cap on the variable component of bank manager compensation. Further, the CRD IV introduces corporate governance provisions that mandate diversity among board members, improve transparency of cross-border bank activities and enhance the status of risk management to facilitate supervisory monitoring. Finally, the CRD IV emphasizes that banks should not solely rely on external ratings for their investment

decisions. Instead they are required to develop internal ratings as well.

The BRRD, or Directive 2014/59/EU, establishes rules for the orderly resolution and restructuring of distressed credit institutions and investment firms. The directive had to be transposed by 31 December 2014 and requires banks to set up resolution plans and allows the regulator to intervene if banks are distressed. The BRRD provides the basis for the SRM and stipulates that EU member states should adopt resolution instruments by 31 December 2014 and apply them from 1 January 2015 onwards.[6] The directive introduces four tools to be employed by the competent authorities, namely: the sale of business, bridge institutions, asset separation, and the bail-in tool. Bail-in rules were enforced as of January 1, 2016 and imply that shareholders bear losses first, followed by subordinated debt holders and other creditors in order to lower costs for the taxpayer. In extraordinary circumstances, and after a bail-in of losses amounting to 8% of total liabilities, resolution and restructuring costs can be covered by the Single Resolution Fund (SRF, for euro area banks) or national resolution funds (for non-euro area countries). The establishment of resolution funds is also part of the BRRD. The Single Resolution Board (SRB) and National Resolution Authorities (NRAs) are jointly responsible for applying the contents of the BRRD. The SRB is thus an important pillar of the EBU with the main role of safeguarding financial stability by establishing clear rules for bank resolution as well as managing bank failures (see Link). The SRB oversees banks supervised by the ECB and other cross-border groups, while NRAs are responsible for all other banks. However, the SRB can step in for all euro area banks in case the SRF is accessed or there is a need for a consistent application of resolution rules (see Link).

The DGSD, or Directive 2014/49/EU, was issued on 16 April 2014 and establishes rules on harmonizing retail depositors' protection across EU member states. Its main body had to be transposed by 3 July 2015 and a second transposition deadline was set to 31 May 2016, which only relates to Articles 8(4) and 13. A fully integrated European Deposit Insurance Scheme (EDIS) as the intended third pillar of the EBU is still in the negotiation phase. Nevertheless, the DGSD introduces three key elements that provide the foundation for harmonized rules for national deposit insurance. First, member states are required to set up one or more national Deposit Guarantee Schemes (DGS) in their territory. Second, all banks are required to join them. Third, the harmonized level of protection is regulated to be EUR 100,000 per depositor per bank. Further, the DGSD specifies three dimensions of depositor protection. First, the

[6]The directive has been amended in May 2019 to harmonize requirements on loss-absorbing capital (2019/879/EU Directive).

amount of EUR 100,000 is guaranteed irrespective of the size of the DGS and irrespective of the size of the deposit (see Link; Link). Second, repayment deadlines decline gradually from currently 20 working days to 7 working days in 2024. Third, the DGS should be financed by banks through ex-ante contributions that reflect their risk profile. By 3 July 2024, the DGS should target a level of financial means of at least 0.8% of the amount of covered deposits.

Compared to regulations, member states have some discretion over when to implement directives into national law. Even though the European Commission sets deadlines for directive transposition, most countries delay their implementation. If countries delay or do not implement the content appropriately, the European Commission intervenes. For all three EBU directives, such interventions occurred. For example, the Commission requested six countries in October 2014 to implement the CRD IV directive into national law. The Commission's request was made in the form of a reasoned opinion, which is the second stage of the EU infringement procedures. In July 2018, the European Commission referred Spain to the Court of Justice for failing to implement CRD IV provisions into national law. Due to delays in the transposition of the BRRD, the Commission referred six member states to the Court of Justice. Moreover, the Commission formally notified three countries, Malta, Croatia and Hungary, in September 2021 of incorrectly transposing the DGSD into national law.[7]

2.2 The banking union directives database

We assembled the "Banking Union Directives Database" which reports the implementation dates of the three directives (CRD IV, BRRD, DGSD) for each EU member country.[8] The main data source is EURLex, which is a website that provides detailed information on the legislation processes in the EU, and it is run by the Publications Office of the European Union. The website lists for each EU country the dates when it communicates the transposition of a directive to the European Commission. EURLex is a convenient tool as it further provides the name of the legal document in the national language (as well as an English translation). Given that the national name of the law is known, in most cases, it is possible to trace back the document on national websites.

However, EURLex is also subject to several caveats such that we had to gather information

[7]For the CRD IV, see the press release as of October 2014 (Link), and the press release as of July 2018 (Link). For the BRRD, see the press release as of October 2015 (Link). For the DGSD, see the press release as of September 2021 (Link).

[8]When collecting the data, we focused on the first round of directive transposition, and not on possible amendments. For example, the BRRD has been amended by directive 2019/879 regarding loss-absorbing capacities. The "BRRD 2"'s transposition deadline was 28.12.2020; see Link.

form national websites as well. For example, for some countries, EURLex lists many different documents. Hence, without further information from national websites and documents, the main law that implements the directive in a country remains occasionally unclear. Additionally, EURLex tends to list the date at which countries deliver the information of transposition to the European Commission. However, it could be that the country has published the legal document a few days before already. Furthermore, in some circumstances, EURLex does not contain complete information for a law or document; for example, dates could be missing. Therefore, we cross-check all dates, and respectively complement them, with information collected from national sources.

For all three directives underlying the EBU, we proceed in the same way and collect three dates:

i. the date at which the country transposed any legal document on the directive for the first time after the directive had been published at the EU level,

ii. the date at which the country published the key law on the directive,

iii. and the date of the last document related to the directive before further amendments have been issued.

The second date is the main date as it indicates the publication date of the national law implementing the directive. We focus on the publication date compared to the signature date because publication implies that the information becomes available to market participants.[9] The publication date of the main law is summarized in Table 1. The first and third dates do not necessarily refer to national laws but can also be other types of legal documents. Tables OA1, OA2, and OA3 present the timing of the three selected dates for CRD IV, BRRD, and DGSD, respectively. Column 2 in Table OA2 also shows the NRA responsible for the resolution action, whereas Column 5 in Table OA3 shows the timing of implementation of the law related to Articles 8(4) and 13 of the DGSD, which were connected to a different implementation deadline.[10] Tables OA4, OA5 and OA6 show more details, such as the name of the document in the national language, and a link to the respective source for the main laws implementing each directive.[11]

[9]The signature date, that is the date when the law is signed, precedes the publication date of the law in an official law repository by not more than a couple of days.

[10]This date is not available for the Czech Republic and Denmark.

[11]We make the resulting dataset available to the public both in Excel and Stata formats: `https://bankinglibrary.com/data/financial-markets-directives-database/`. For more details on the construction of the dataset, please see the information provided in the online appendix.

To gain some insights into the average delay of a directive's implementation with respect to the EU-wide transposition deadline, we calculate the difference in days between the date of the law implementing the directive in a country and the transposition date. Alternatively, we define an indicator variable taking a value of one in case the delay is larger than zero days, and zero otherwise. Table 2 contains an overview of variable definitions and sources. The summary statistics in Table 3 show that the average delay across the 27 member states ranges between 100 and 200 days whereas maximum delays can reach close to 600 days. Moreover, there is substantial heterogeneity across countries. Despite that some countries implement the directive into national law before the EU deadline, the majority of countries (around 70 or 80%) publish the main law after the EU deadline.[12]

3 Empirical application: CRD IV and banks' funding costs

In this section, we describe the empirical estimation strategy and outline how stricter capital regulation could affect banks' funding costs. We then bring this question to the data and explore funding cost responses after the publication of the national law implementing the CRD IV. We check the robustness of results by applying recently developed difference-in-difference (DiD) estimators used in the context of staggered treatment. Finally, we study heterogeneity in treatment effects depending on banks' size and countries' regulatory stringency.

3.1 Estimation approach and data

To test whether the staggered CRD IV implementation impacts banks' capital costs, we follow the estimation strategy in Koetter et al. (2022) and start by conducting a two-way fixed effects (TWFE) event study regression, whereas corresponding results are reported in Section 3.3.1:

$$WACC_{bct} = \alpha_b + \gamma_t + \sum_{j=-6 \neq -1}^{j=6} \beta_j CRDIV(0/1)_{c,law+j} + \epsilon_{bct}. \quad (1)$$

The dependent variable ($WACC_{bct}$) is the weighted average cost of capital (or one of its cost components including cost of equity or cost of debt) of bank b in country c at time t. The explanatory variable of interest is $CRDIV(0/1)_{c,law}$, which equals one for the quarter when the law implementing the directive is published in country c and zero otherwise. In case the directive is transposed in the last month of a quarter, we shift the entry one quarter forward

[12] More detailed breakdowns are shown in Figures OA1 to OA3 in the online appendix.

as it is more likely to observe market reactions in the following quarter. We define a set of j indicator variables for each quarter relative to the quarter in which the implementation into national law takes place to trace out time trends around CRD IV transposition. The quarter before the CRD IV transposition is normalized to zero. The sample period is 2010 to 2018 but includes only the seven quarters before and the six quarters after implementation for each bank.

We include bank and quarter fixed effects indicated by α_b and γ_t. Due to the event study design, bank fixed effects should capture major differences across banks. For example, it seems implausible that banks substantially change their risk profile in the short time span of the event study such that market responses are likely to go back to the change in the policy. Quarter fixed effects absorb confounding factors affecting all banks in the same quarter. Standard errors are clustered at the bank level.

We obtain data on banks' funding costs (WACC, in %) from Bloomberg at a quarterly frequency and exploit further information on its cost components, cost of equity and cost of debt, respectively. Bloomberg computes WACC as:

$$WACC_{bt} = \frac{E_{bt}}{D_{bt} + E_{bt}} K_{bt}^{E} + \frac{D_{bt}}{D_{bt} + E_{bt}} K_{bt}^{D}(1 - Tax_{bt}),$$

where E_{bt} is the market value of equity and D_{bt} is the book value of total debt of bank b at quarter t. K_{bt}^{E} measures the cost of equity utilizing a Capital Asset Pricing Model (CAPM) and K_{bt}^{D} approximates the cost of debt as a book value weighted average of short- and long-term debt cost using fair market curves (FMC). Tax_{bt} is the bank-level annual effective tax rate defined as total tax expenses divided by pretax income. We keep only EU banks for which we obtain both information on their WACC and the size of their balance sheets, whereas the latter is obtained from Worldscope and used in Section 3.3.3. This data collection process results in a sample of 96 commercial banks in the EU. The list of institutions is presented in Table OA8 in the online appendix, while Table 3 reports summary statistics for the dependent variables. Banks' average WACC is around 4%, whereas the average cost of equity amounts to 11.4% and the average cost of debt is around 1%.

From a theoretical perspective, the Modigliani Miller theorem predicts a *decline* in the cost of equity (known as Modigliani-Miller offset) while the cost of debt stays *constant* in situations when bank failure risk decline due to tighter capital requirements. This would imply a *decline* in banks' overall funding costs. For example, Kovner and van Tassel (2022) show that large banks

targeted most by the Dodd-Frank Act experienced the strongest decline in their costs of capital. In contrast, Baker and Wurgler (2015) show that the "low-risk anomaly" implies that stricter capital requirements can reduce bank risk while at the same time *increase* cost of equity.[13] Under the assumption that debt is risk-less, their calibrations for US banks predict that capital costs *increase* in case of higher capital requirements. In reality, debt can be perceived as risky and investors might demand lower risk compensation in case of a tighter regulated financial system. A *decline* in cost of debt might thus counteract the effect arising from the "low-risk anomaly", while the net effect on WACC remains to be assessed empirically. More generally, observing a *decline* in cost of debt and/ or cost of equity and thus banks' capital costs can mirror that investors expect the new regulatory framework to reduce failure risk, such that they require lower risk premia. In contrast, if an *increase* in funding costs is observed, this could be indicative of higher risk premia requested by investors who fear that banks shift risk to the asset side given the need to deleverage.[14] In sum, different mechanisms can be at work and the effects on cost of equity and cost of debt, as well as the net effect on banks' WACC, are a priori not clear and remain an empirical question.

3.2 Identification and methodological robustness

A key topic in applied econometric research is evaluating the effects of policies or regulations on economic actors. The initial impetus for this research agenda came from difference-in-difference (DiD) estimators that compare differences in outcomes between two groups where one is affected and the other is unaffected by a single point-in-time treatment. However, in most circumstances, changes to the regulatory framework are not independent from events in the banking sector. The establishment of the EBU, for example, was a major response to the detected deficiencies in financial market regulations during the financial crisis period. Such inter-dependencies between banking sector developments and regulatory changes challenge an evaluation of causal effects.

Usefulness of the institutional setting in the EU

The setting in the EU in which regulatory changes applying to all member states are introduced via directives (next to regulations) can be exploited for identification. The key reason is that while the directives have to be transposed by each member state into national law until a defined

[13] The textbook case would predict lower expected returns for less risky firms. Yet, Baker and Wurgler (2015) argue that leverage-constraint investors seek high returns from high beta stocks. Tighter capital regulation depresses the availability of high beta stocks as banks become safer. This leads to an overpricing of high beta stocks and consequently lower cost of equity whereas the opposite happens for stocks of then safer banks.

[14] We provide an overview of the discussed effects in Table 5.

transposition deadline, member states tend to delay implementation delivering a "staggered" pattern of directive implementation (see Section 2.2). Extending the DiD setting towards a staggered treatment timing allows for the inclusion of time fixed effects in equation (1) which reduces the likelihood that confounding factors might bias the treatment effect. The underlying reason is that it is much more likely that a confounding event impacts the estimation of a single treatment effect compared to a setting where units get treated at different points in time.[15]

Robustness to alternative DiD estimators given staggered treatment

Recent advances in the DiD literature point out that estimating staggered treatment effects with a standard TWFE model can lead to "forbidden comparisons" (Goodman-Bacon, 2021). While using the standard DiD method only outcomes between treatment and control groups are compared, staggered treatment timing might (falsely) compare later-treated groups with earlier-treated groups. In combination with treatment effect heterogeneity over time or across groups, this can lead to biased estimates that are either too small, too large, or even have the wrong sign (Baker et al., 2022). Several new estimation techniques have been developed to remedy biased DiD treatment effects by preventing forbidden comparisons via carefully defining and using the right comparison groups (Borusyak, Jaravel, and Spiess, 2024; De Chaisemartin and d'Haultfoeuille, 2020; Callaway and Sant'Anna, 2021; Sun and Abraham, 2021; Cengiz et al., 2019). In Section 3.3.2, we probe the robustness of the TWFE estimates against two widely used advanced DiD estimators: Sun and Abraham (2021) and Cengiz et al. (2019).

The estimator by Sun and Abraham (2021)

Our setting does not offer a never-treated group, that is, one or more EU member states that opted out of CRD IV transposition, which is required to apply the estimator by Sun and Abraham (2021). As a remedy, we take the last treated units as control group and end the sample period before those banks' treatment date.[16] We estimate the following equation:

$$WACC_{bct} = \alpha_b + \gamma_t + \sum_{e} \sum_{l=-6 \neq -1}^{6} \delta_{el}(1\{E_b = e\} \cdot CRDIV(0/1)^l_{ct}) + \epsilon_{bct}. \tag{2}$$

As before, the dependent variable ($WACC_{bct}$) is the weighted average cost of capital (or one of its components) of bank b in country c at time t. $CRDIV(0/1)^l_{bt}$ are relative time indicators and

[15] As time fixed effects absorb the impact of individual events that impact all units, confounding events would have to be correlated with relative treatment time to impact the estimation of the treatment effect.

[16] Since Italy and Poland implement the CRD IV the latest, we take all banks in these countries as part of the (last treated) control group.

e are cohort indicators. E_b is the time period of initial treatment for each cohort. Equation (2) estimates the difference between the average change in WACC for cohort e, which is l periods relative to treatment, and the average change for cohorts that have not been treated by $t = e+l$. The estimation method further calculates the weighted average treatment effect in each period, where the weights are given by the share of cohorts that experience at least l periods relative to treatment. Again, we control for bank and quarter fixed effects, α_b and γ_t.

The approach by Cengiz et al. (2019)

The "stacked approach" by Cengiz et al. (2019) isolates a particular window of interest around each transposition event. Specifically, it creates a similar sample for each country-specific CRD IV transposition event under investigation and stacks all the samples with a unique identifier of the event each unit belongs to. We first create h-event specific datasets (each of the 27 EU countries transposes only once, but some do so at the same time so the number of events is lower than 27), stack them, align the events in event-time within a 13-quarter estimation window (t=-6 to t=6) and estimate an average effect across all events. The regression equation looks as follows:

$$WACC_{bcth} = \alpha_{bh} + \gamma_{th} + \sum_{\tau=-6\neq-1}^{6} \delta_{\tau h} CRDIV(0/1)^{\tau}_{cth} + \epsilon_{bcth}. \tag{3}$$

The treatment dummy $CRDIV(0/1)^{\tau}_{bth}$ equals one if country c transposed the directive τ quarters from date t. Unlike Cengiz et al. (2019), we cannot create clean controls by keeping control-group countries that did not transpose in the respective stack because the directive is transposed in a narrow time period. Instead, we take the latest-implementing countries as the control group (Italy and Poland) and exclude from the sample period observations following their implementation date. We control for bank and quarter fixed effects, α_{bh} and γ_{th}.

Further concerns about the exogeneity of staggered transposition timing

The usefulness of the directive dates for empirical analyses hinges on two further elements. First, the heterogeneity in the transposition timing across countries should not be driven by banking sector outcomes. A natural hypothesis could be that countries delay more in case they want to shield their ailing banks. A useful feature that lowers respective concerns is that the country-specific process of transposition is determined by institutional features rather than banking system-related variables or strategic motives of governments. This way, the setting introduces an element of exogeneity that can be exploited in empirical analyses. To corroborate

this argument, we show correlations between the country-specific delays and country controls related to economic developments, banking system health, and regulatory indices.[17] For the latter, we draw on the database "World Bank surveys on bank regulation" by Barth, Caprio Jr, and Levine (2013) spanning until the year 2011 such that we obtain an ex-ante measure for a country's regulatory stringency before the first directive was transposed.[18] Table 4 shows that correlations amongst the implementation delays (in days) across the three directives and variables related to banking system health are not significantly different from zero. This feature is also visualized in Figure OA4 showing scatter plots between implementation delays and country-specific controls capturing the stance of the banking sector of the year preceding the transposition deadline of the directive. It can be seen that no clear pattern emerges, which lowers concerns that countries in which, for example, the share of non-performing loans is high try to delay the introduction of a directive that implements a resolution scheme.[19] Regulatory indices do not show relevant correlations with CRD IV implementation delays (Table 4).[20]

Second, as the directives' documents (e.g., Directive 2013/36/EU for the CRD IV) have been published in advance at the *EU level*, one might be concerned that the national transposition does not contain new information and market participants' adjustment takes place upon release of the directive document. Yet, in the case of EU directives, countries have substantial discretion in how to implement the new regulatory and supervisory rules at the national level. This fact is, for example, revealed by differences in the types and number of legal documents used to transpose the directive as demonstrated by the assembled dataset. Hence, there are reasons to hypothesize that the *national* implementation via the publication of the main law contains new information. Whether market participants indeed respond to the CRD IV's national transposition, which would provide evidence for a surprise element and active monitoring of the legal process by markets, is assessed in the next section.

[17] The variables and their definitions are described in Table 2 and summary statistics are provided in Table OA7.

[18] Descriptive statistics for the regulatory indices in Table OA7 reveal that there is cross-country heterogeneity. Such differences in regulation and supervision were indeed one reason for the introduction of the Single Rulebook in the EU (and the EBU in the euro area) to ensure a level-playing field by harmonizing the regulatory framework.

[19] Similarly, Koetter et al. (2019) have shown for the case of *notification dates* of EU directives – that is, the first date at which member states notify the EU Commission about directive transposition but which still has to be verified by the EU Commission – that banking sector health is not a main predictor of notification.

[20] The correlations between delays and regulatory indices are additionally visualized in Figure OA5. There is weak evidence that tighter capital regulation correlates positively with BRRD or DGSD delays, as well as that deposit insurance systems that prevent moral hazard relate to shorter DGSD delays. The latter could suggest that countries had less issues implementing new rules on deposit insurance given related schemes were more developed.

3.3 Banks' funding costs around CRD IV implementation

3.3.1 Baseline result

Figure 1 shows results obtained from estimating equation (1) and reveals how banks' WACC, as well as cost of equity and cost of debt, behave around CRD IV implementation. The left panel presents results for the composite measure, WACC, and shows no relevant signs of pre-trends. There is some indication that funding costs increase slightly following CRD IV transposition. In quarter t, that is when the directive is implemented, funding costs increase significantly by around 0.25 percentage points compared to the previous quarter. Yet in the following quarters, coefficients turn out to be not significantly different from zero. Even though we do not observe pre-trends, it could well be that earlier announcements and news on changes in capital requirements via the CRD IV resulted in market reactions. Hence, our baseline effect following the de-jure transposition at the country level rather represents a lower bound of the total response intensity.

When looking at the components (cost of equity or cost of debt), again no relevant pattern can be detected *before* directive implementation. Yet it becomes obvious that the total WACC effect is hiding a significant surge in equity costs (panel in the centre) as well as a downward trend of cost of debt (right panel). Cost of equity thereby increases directly in the quarter of CRD IV implementation relative to the pre-implementation quarter. Cost of equity stays at a more elevated level until quarter $t + 4$. The increase in banks' cost of equity could be in line with the "low-risk anomaly" put forward by Baker and Wurgler (2015) who argue that tighter regulation can decline banks' riskiness which, however, increases banks' cost of capital. Their calibrations for US banks (under certain assumptions including risk-less debt) predict an 85-basis-point increase in cost of capital if capital requirements would go up by ten percentage points.[21] In reality, debt might not be risk-less and changes in the cost of debt determine the composite effect on capital costs as well. The observed decline in cost of debt has thus some offsetting effects and could be indicative of debt investors requiring a lower risk premium. The latter could be due to the financial stability enhancing effect of the CRD IV by requiring banks to build up equity buffers and to more carefully monitor risks.

[21] Alternatively, the increase in cost of equity could go back to expectations of reduced government guarantees or demand side effects as EU banks need to raise capital buffers at the same time.

3.3.2 Staggered policy events and recent advances in DiD estimators

Figure 2 compares coefficient estimates of the TWFE approach to those obtained from estimating equations (2) and (3). Results turn out to be consistent as regards the response direction. Banks' funding costs increase slightly following the transposition of the CRD IV, whereas cost of equity shows an upward trend compared to cost of debt revealing a downward pattern. While confidence bands can deviate from each other when considering results for specific quarters, the point estimates of all three estimators seem to be quantitatively within the same range. This "eyeballing" result is assessed in more detail in Table 6. We check whether the coefficient estimates obtained from the three different methods are statistically different from each other by showing the corresponding p-values of two-tailed t-tests (Clogg, Petkova, and Haritou, 1995). Overall the results corroborate the graphical findings by highlighting that the majority of treatment effect estimates are similar in magnitude across the different methods. Statistically different point estimates occur most often when comparing estimates obtained by the Sun and Abraham (2021) versus Cengiz et al. (2019) estimator. For cost of equity as the outcome variable, and around the transposition date, there are few significant differences in the estimates obtained by the TWFE and the Cengiz et al. (2019) estimator. There is also some evidence that statistically different estimates arise before transposition (i.e., before quarter t), which would lead to different conclusions regarding pre-trends.

The preceding robustness exercise provides an interesting insight. Coefficient magnitudes as well as their patterns are mostly consistent across the three different methods. One potential reason why the advanced DiD estimators deliver similar results compared to a standard TWFE estimator is that transposition dates across countries are not spread out over many years. The closer the transposition dates are to each other, the less likely forbidden comparisons are between later-treated units and earlier-treated units (Freedman et al., 2023). There are, however, differences between the two advanced estimators, which are most pronounced when looking at pre-implementation quarters. The reason for these differences can be twofold. First, in contrast to the Cengiz et al. (2019) estimator, Sun and Abraham (2021) produces a weighted average treatment effect with weights being the share of units that experience their first treatment in the respective period. Weighting by sample shares can reduce issues related to outliers driving average effects. Second, the choice of control group could also impact the different estimates across methods. If control-group banks in the latest-implementing countries are not representative or might anticipate the policy shock, then the Cengiz et al. (2019) estimator amplifies any potential

endogeneities as every stack or cohort has multiple copies of problematic "anticipators". In this case, it might be more recommendable to use the Sun and Abraham (2021) estimator.

3.3.3 Estimating heterogeneous treatment effects

As a final test to evaluate the outcomes of CRD IV transposition, we assess heterogeneous treatment effects, and again compare results across the three different estimators. We start by investigating the role of *bank size*. Banks being "too-big-to-fail" was a key reason for the introduction of specific capital surcharges for very large banks and there is plenty of evidence that large banks benefited from public guarantees going hand in hand with reduced risk premia and increased risk-taking (Andersen and Jensen, 2022; Laeven, Ratnovski, and Tong, 2016; Strahan, 2013). Internalizing large banks' contribution to systemic risk was thus a key objective of recent regulatory changes including those related to capital regulation. Making the banking industry more resilient via the implementation of CRD IV could reduce banks' systematic risk exposure, especially if they are targeted more by the new regulation as found by Kovner and van Tassel (2022). Methodologically, we expand the regression equations (1)-(3) by including an interaction with an indicator for banks being above median size.[22] We then report the dynamic marginal effects of treatment conditional on bank size.

Results in Figure 3 reveal that for larger banks (left panel), most coefficient estimates are insignificant; if at all, there is some evidence for anticipation effects. In contrast, we observe an upward adjustment in banks' funding costs for banks being smaller than the median bank, while the estimators do not yield a robust result as regards pre-trends. In the fourth quarter after CRD IV transposition, the WACC of smaller banks has risen by almost 1.5 percentage points compared to the quarter before transposition. Comparing the estimates across estimation techniques, Figure 3 echoes the findings from the previous subsection. The coefficients' sign and statistical significance of the pre-trend treatment effects can change depending on the estimator's choice. However, point estimates in the post-transposition period are very similar.[23] One reason for these observed patterns in funding costs for larger versus smaller banks could be that larger banks benefit most from a reduction in systematic risk due to the regulatory change as found by Kovner and van Tassel (2022) for US banks. Another reason could be that the larger banks are subject to other types of capital regulation, e.g., the systemic capital buffer for G-SIB

[22] Large banks are defined as those that are above median size based on the average amount of total assets over the sample period.

[23] The difference in coefficient size as well as coefficient sign is most pronounced comparing the estimators by Sun and Abraham (2021) and Cengiz et al. (2019).

banks (Degryse, Mariathasan, and Tang, 2023), thus underlie greater regulatory scrutiny, and consequently have already adjusted their capital structure. For example, Cohen and Scatigna (2016) show based on data from the Bank for International Settlements (BIS) that large and international banks have adjusted regulatory capital ratios by 3.5 percentage points on average from 2009 to 2012 compared to 1.6 percentage points by smaller banks. When repeating the analysis for cost of debt and cost of equity, again by differentiating for bank size, it turns out that both groups show a decline in cost of debt speaking in favor of the financial stability aspect. Yet, for banks below the median size, cost of equity shows a stronger and significant upward trend, which thus offsets the cost of debt effect.[24]

Second, we focus on heterogeneity due to differences in the *stringency of capital regulation* across countries. We draw on the World Bank's measure for capital regulatory stringency, which is an index ranging between zero and ten where higher values indicate more stringent capital regulation (see also Section 3.2). For example, for banks in countries having a lower degree of capital regulation before CRD IV transposition, one might expect sharper increases of funding costs because banks need to adjust their capital structure by more. Banks' increased demand might drive up cost of capital.[25] Reversely, banks in countries with higher capital stringency might already have built up higher capital ratios in the past. For example, Brewer III, Kaufman, and Wall (2008) found for a sample of large private banks and the pre-financial crisis period that capital ratios are, amongst others, determined by the stringency of country-specific capital regulation. Reduced spillover risks due to tighter regulation across all EU countries, could eventually decline systematic risk also for the banks in countries with ex-ante tighter capital regulation, and result in lower cost of capital. Consequently, harmonizing capital regulation across EU countries via the CRD IV could have differential short-run effects on banks depending on the ex-ante regulatory stance. In the longer run, it could provide an equalized regulatory framework, thereby lowering incentives for regulatory arbitrage (Gao and Jang, 2021), and increase financial stability due to tighter capital requirements. For the global financial crisis, Beltratti and Stulz (2009) show that banks performed better in terms of stock returns in countries with stricter capital regulation.

Figure 4 compares funding cost responses for banks in countries with a lower (left panel) versus a higher (right panel) ex-ante capital regulatory index. A striking result is that the

[24]Results for these additional tests can be found in Figures OA6 and OA7 in the online appendix .

[25]The beneficial effect of tighter capital regulation on financial stability might be most pronounced in these countries – but probably only depress risk premia in the longer run.

funding costs of banks located in countries with a lower stance of capital regulation in 2011 significantly adjusted upwards in the third and fourth quarters following the national CRD IV transposition. This pattern emerges across the three different types of estimators and could go back to, for example, a demand side effect as banks need to simultaneously increase capital ratios, or it could be due to investors fearing increased risk-taking when banks need to adjust leverage downwards. Additional tests show that cost of debt particularly goes down in countries with ex-ante low regulatory stringency, which would support the financial stability argument and speak against fears of risks being shifted to the asset side. In contrast, cost of equity goes up resulting in an offsetting effect on banks' WACC. The joint observation of an increase in cost of equity and a decline in cost of debt reveals that in the short run, higher costs due to adjusting the capital structure might dominate lower risk premium in a more stable financial system.[26] When considering banks in countries with a higher capital stringency before CRD IV transposition, the right panel shows clearly that across all three estimators, there is no evidence for significant reactions in banks' WACC. [27] Hence, the key results are not only consistent across estimators but they again support that the national CRD IV transposition contains novel details that lead to market reactions. These market reactions can be observed especially in those countries in which banks might be most under pressure to adjust their capital structure.

4 Conclusions

Policymakers have substantially adjusted the regulatory framework of the banking system in recent years. In Europe, the Banking Union constitutes a major institutional change with the objective to harmonize the regulatory framework within the euro area. To evaluate the effectiveness of these regulatory changes and to draw conclusions for the design of future regulatory policies, empirical investigations are a relevant input. The legislative process in the EU is such that directives have to be transposed into national law by each member state and empirical tests hinge critically on the availability of these country-specific implementation dates. We hence compile detailed data on country-specific transposition dates of the three directives (CRD IV, BRRD, DGSD) that do not only apply to all EU member states but also underlie the Banking Union.

[26] The corresponding graphs for the cost components are available in Figures OA8 and OA9 in the online appendix.

[27] When looking at the funding cost components, there is some but mostly insignificant evidence for a downward (upward) trend in cost of debt (equity).

The CRD IV constitutes the first directive to be transposed by member states and contains new rules on capital buffers, remuneration policies and the monitoring of risks. The directive thus tightens the regulatory and supervisory environment to reduce risk-taking by banks. We exploit the staggered implementation of the CRD IV to control for confounding factors and we assess its impact on banks' funding costs. The results show some evidence for an upward pattern in banks' funding costs following the national implementation of the CRD IV. The finding reflects that the national transposition of directives results in market reactions and thus contains new information. Zooming in, we find opposing trends in funding cost components: cost of equity increases significantly while cost of debt has a downward trend. These results are robust to alternative estimators used in the context of staggered treatment.

Accounting for bank and country-level heterogeneity, our results highlight the presence of heterogeneous treatment effects. We find that funding costs increase in particular for banks below median-size as well as for banks in countries with less stringent capital regulation before the CRD IV. The net effect is driven by a decline in cost of debt, suggesting lower risk premia by debt investors who consider the financial system to be more stable after the reform, and an increase in cost of equity. Given adjustment needs regarding the capital structure are more pronounced in countries with an ex-ante lower regulatory stringency, banks in these countries see a short-run increase in capital costs.

5 References

Admati, A. and M. Hellwig (2014). *The bankers' new clothes: What's wrong with banking and what to do about it*. Princeton University Press.

Andersen, T. B. and P. S. Jensen (2022). Too big to fail and moral hazard: Evidence from an epoch of unregulated commercial banking. *IMF Economic Review 70*(4), 808–830.

Anginer, D., A. C. Bertay, R. Cull, A. Demirgüç-Kunt, and D. S. Mare (2021). Bank capital regulation and risk after the global financial crisis. *Journal of Financial Stability*, 100891.

Auer, R., A. Matyunina, and S. Ongena (2022). The countercyclical capital buffer and the composition of bank lending. *Journal of Financial Intermediation 52*, 1–17.

Baker, A. C., D. F. Larcker, and C. C. Wang (2022). How much should we trust staggered difference-in-differences estimates? *Journal of Financial Economics 144*(2), 370–395.

Baker, M. and J. Wurgler (2015). Do Strict Capital Requirements Raise the Cost of Capital? Bank Regulation, Capital Structure, and the Low-Risk Anomaly. *The American Economic Review 105*(5), 315–320.

Barth, J. R., G. Caprio Jr, and R. Levine (2013). Bank regulation and supervision in 180 countries from 1999 to 2011. *Journal of Financial Economic Policy 5*(2), 111–219.

Basel Committee on Banking Supervision (2010). Basel III: A global regulatory framework for more resilient banks and banking systems. Technical report, BIS.

Basten, C. (2020). Higher Bank Capital Requirements and Mortgage Pricing: Evidence from the Counter-Cyclical Capital Buffer. *Review of Finance 24(2)*, 453–495.

Begenau, J. (2020). Capital requirements, risk choice, and liquidity provision in a business-cycle model. *Journal of Financial Economics 136*(2), 355–378.

Beltratti, A. and R. M. Stulz (2009). Why did some banks perform better during the credit crisis? A cross-country study of the impact of governance and regulation. NBER Working Paper, National Bureau of Economic Research.

Berger, A. N. and C. H. Bouwman (2013). How does capital affect bank performance during financial crises? *Journal of Financial Economics 109*(1), 146–176.

Berrospide, J. M. and R. M. Edge (2024). Bank capital buffers and lending, firm financing and spending: What can we learn from five years of stress test results? *Journal of Financial Intermediation 57*, 101061.

Borusyak, K., X. Jaravel, and J. Spiess (2024). Revisiting Event-Study Designs: Robust and Efficient Estimation. *The Review of Economic Studies*, rdae007.

Brewer III, E., G. G. Kaufman, and L. D. Wall (2008). Bank capital ratios across countries: Why do they vary? *Journal of Financial Services Research 34*, 177–201.

Callaway, B. and P. H. Sant'Anna (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics 225*, 200–230.

Cengiz, D., A. Dube, A. Lindner, and B. Zipperer (2019). The Effect of Minimum Wages on Low-Wage Jobs. *The Quarterly Journal of Economics 134*(3), 1405–1454.

Christensen, H. B., L. Hail, and C. Leuz (2016). Capital-Market Effects of Securities Regulation: Prior Conditions, Implementation, and Enforcement. *The Review of Financial Studies 29*(11), 2885–2924.

Christopoulos, D. C. and L. Quaglia (2009). Network Constraints in EU Banking Regulation: The Capital Requirements Directive. *Journal of Public Policy 29*(2), 179–200.

Clogg, C. C., E. Petkova, and A. Haritou (1995). Statistical methods for comparing regression coefficients between models. *American Journal of Sociology 100*(5), 1261–1293.

Cohen, B. H. and M. Scatigna (2016). Banks and capital requirements: channels of adjustment. *Journal of Banking & Finance 69*, S56–S69.

Colonnello, S., M. Koetter, and K. Wagner (2023). Compensation regulation in banking: Executive director behavior and bank performance after the EU bonus cap. *Journal of Accounting and Economics 76*(1), 101576.

Corbae, D. and P. D'Erasmo (2021). Capital Buffers in a Quantitative Model of Banking Industry Dynamics. *Econometrica 89*(6), 2975–3023.

Cutura, J. (2021). Debt holder monitoring and implicit guarantees: Did the BRRD improve market discipline? *Journal of Financial Stability 54*, 100879.

Dautović, E. (2020). Has regulatory capital made banks safer? Skin in the game vs moral hazard. ECB Working Paper 2449, European Central Bank.

De Chaisemartin, C. and X. d'Haultfoeuille (2020). Two-way fixed effects estimators with heterogeneous treatment effects. *American Economic Review 110*(9), 2964–96.

Degryse, H., M. Mariathasan, and H. T. Tang (2023). GSIB status and corporate lending. *Journal of Corporate Finance 80*, 102362.

Fraisse, H., M. Lé, and D. Thesmar (2020). The real effects of bank capital requirements. *Management Science 66*(1), 5–23.

Freedman, S. M., A. Hollingsworth, K. I. Simon, C. Wing, and M. Yozwiak (2023). Designing Difference in Difference Studies With Staggered Treatment Adoption: Key Concepts and Practical Guidelines. *NBER Working Paper No. 31842*.

Gao, J. and Y. Jang (2021). What drives global lending syndication? Effects of cross-country capital regulation gaps. *Review of Finance 25*(2), 519–559.

Giuliana, R. (2019). Fluctuating Bail-in Expectations and Effects on Market Discipline, Risk-taking and Cost of Capital. Available at SSRN: https://ssrn.com/abstract=2935259.

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics 225*(2), 254–277.

Hahn, S., P. P. Momtaz, and A. Wieandt (2022). The economics of banking regulation in Europe: does the post-GFC bail-in regime effectively eliminate implicit government guarantees? *The European Journal of Finance 29*(7), 700–725.

Hail, L. and C. Leuz (2006). International differences in the cost of equity capital: Do legal institutions and securities regulation matter? *Journal of Accounting Research 44*(3), 485–531.

Herring, R. J. (2018). The evolving complexity of capital regulation. *Journal of Financial Services Research 53*, 183–205.

Jiménez, G., S. Ongena, J.-L. Peydró, and J. Saurina (2017). Macroprudential Policy, Countercyclical Bank Capital Buffers, and Credit Supply: Evidence from the Spanish Dynamic Provisioning Experiments. *Journal of Political Economy 125*(6), 2126–2177.

Kalemli-Ozcan, S., E. Papaioannou, and J.-L. Peydró (2010). What lies beneath the euro's effect on financial integration? Currency risk, legal harmonization, or trade? *Journal of International Economics 81*(1), 75–88.

Kashyap, A. K., J. C. Stein, and S. G. Hanson (2010). An analysis of the impact of 'substantially heightened' capital requirements on large financial institutions. mimeo.

Koetter, M., T. Krause, E. Sfrappini, and L. Tonzer (2022). Completing the European Banking Union: Capital cost consequences for credit providers and corporate borrowers. *European Economic Review 148*, 104229.

Koetter, M., T. Krause, and L. Tonzer (2019). Delay determinants of European Banking Union implementation. *European Journal of Political Economy 58*, 1 – 20.

Kovner, A. and P. van Tassel (2022). Evaluating Regulatory Reform: Banks' Cost of Capital and Lending. *Journal of Money, Credit and Banking 54(4)*, 1313–1367.

Laeven, L., L. Ratnovski, and H. Tong (2016). Bank size, capital, and systemic risk: Some international evidence. *Journal of Banking & Finance 69*, S25–S34.

Lewrick, U., J. Serena, and G. Turner (2019, December). Believing in bail-in? Market discipline and the pricing of bail-in bonds. BIS Working Papers 831, Bank for International Settlements.

Pancotto, L., O. Gwilym, and J. Williams (2019). The European Bank Recovery and Resolution Directive: A market assessment. *Journal of Financial Stability 44*, 100689.

Raja, A. (2022). The impact of changes in bank capital requirements. Bank of England Working Paper Series 1004, Bank of England.

Schäfer, A., I. Schnabel, and B. Weder di Mauro (2016). Bail-in Expectations for European Banks: Actions Speak Louder than Words. CEPR Discussion Papers 11061, CEPR.

Strahan, P. E. (2013). Too big to fail: Causes, consequences, and policy responses. *Annual Review of Financial Economics 5*(1), 43–61.

Sun, L. and S. Abraham (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics 225*, 175–199.

6 Tables and figures

Table 1: Implementation dates of EU directives

Country	**CRDIV**	**BRRD**	**DGSD**
Austria	Aug 07, 2013	Dec 29, 2014	Aug 14, 2015
Belgium	May 07, 2014	Jul 06, 2016	May 12, 2016
Bulgaria	Mar 25, 2014	Aug 14, 2015	Aug 14, 2015
Croatia	Dec 30, 2013	Feb 20, 2015	Jul 24, 2015
Cyprus	Jan 30, 2015	Mar 18, 2016	Feb 11, 2016
Czech Republic	Aug 07, 2014	Dec 28, 2015	Dec 28, 2015
Denmark	Mar 25, 2014	Apr 02, 2015	Apr 02, 2015
Estonia	May 09, 2014	Mar 19, 2015	Dec 31, 2015
Finland	Aug 14, 2014	Dec 23, 2014	Dec 23, 2014
France	Nov 05, 2014	Aug 21, 2015	Oct 30, 2015
Germany	Sep 03, 2013	Dec 18, 2014	Jun 05, 2015
Greece	May 05, 2014	Jul 23, 2015	Mar 07, 2016
Hungary	Sep 27, 2013	Jul 18, 2014	Dec 30, 2014
Ireland	Apr 04, 2014	Jul 14, 2015	Nov 20, 2015
Italy	Jun 12, 2015	Nov 16, 2015	Mar 08, 2016
Latvia	May 14, 2014	Jul 02, 2015	Jun 18, 2015
Lithuania	Jul 31, 2014	Dec 02, 2015	Dec 02, 2015
Luxembourg	Jul 31, 2015	Dec 24, 2015	Dec 24, 2015
Malta	Jan 24, 2014	Sep 22, 2015	Dec 04, 2015
Netherlands	Jul 07, 2014	Nov 25, 2015	Nov 25, 2015
Poland	Aug 05, 2015	Jul 08, 2016	Jul 08, 2016
Portugal	Jul 28, 2014	Mar 26, 2015	Mar 26, 2015
Romania	Dec 30, 2013	Dec 11, 2015	Dec 11, 2015
Slovakia	Jul 30, 2014	Dec 20, 2014	Oct 14, 2015
Slovenia	Apr 13, 2015	Apr 13, 2015	Apr 11, 2016
Spain	Jun 27, 2014	Jun 19, 2015	Jun 19, 2015
Sweden	Jun 26, 2014	Dec 29, 2015	Jun 02, 2016

Notes: This table presents the national implementation dates of the EU directives CRD IV, BRRD, and DGSD. The dates refer the publications of the key laws implementing the directives. For more details on the sources, see also the information provided in the online appendix.

Table 2: Variable description

Variable	Definition	Source
Directive delays		
Directive (delay in days)	Difference in days between law date and transposition date	EURLex, own caluclations
Directive (delay 0/1)	Indicator taking a value of 1 in case the difference in days between law date and transposition date is larger than zero	EURLex, own caluclations
Country controls		
GDP growth	GDP growth (in %)	Worldbank
Government debt	Government gross public debt (in % of GDP)	ECB Macro-prudential Database
Banking system health		
Tier 1 ratio	Tier 1 ratio (in %)	ECB Macro-prudential Database
NPL ratio	Non-performing loans ratio (in %) - domestic banks only	ECB Macro-prudential Database
Bank concentration	Share of 5 largest CIS in total assets (in %)	ECB Macro-prudential Database
Return on assets	Average return on assets in % - domestic banks only	ECB Macro-prudential Database
Regulatory indices		
Capital regulatory stringency	Index (0-10), higher values indicate greater stringency in 2011	World Bank Banking Supervision Survey 2011
Restructuring power index	Index (0-6), higher values indicate greater restructuring power in 2011	World Bank Banking Supervision Survey 2011
Deposit insurance stringency	Index (0-3), higher values indicate lower moral hazard from deposit insurance in 2011	World Bank Banking Supervision Survey 2011

Continued on next page

Variable description – continued

Variable	Definition	Source
Banks' capital costs		
WACC	Weighted average cost of capital in %: $\frac{E}{D+E}K_E + \frac{D}{D+E}K_D(1 - t_c)$, where E=market value of equity; D=book value of total debt; K_E=cost of equity (CAPM); K_D=cost of debt; t_c=annual effective rate calculated as total tax expenses divided by pretax income	Bloomberg
Cost of Equity	Derived from CAPM model: $CAPM = r_f + \beta(r_m - r_f)$ (in %), where r_f=10-year treasury yield; r_m=expected market return based on a three-stage dividend discount model consisting of a growth, transition, and mature or steady-state stage. The length of the growth and transition periods depends on whether the equity is classified as explosive growth, high growth, average growth, or slow/mature growth. This classification is based on the normalized distribution of the forecasted growth rate for all equities. The market return is calculated by taking a capital weighted average of the internal rate of return over all the members of the country's major index.	Bloomberg
Cost of Debt	$[\frac{SD}{TD} * (CSD)] + [\frac{LD}{TD} * (CLD)]$, where SD=book value of short term debt (1 year maturity); LD=book value of long term debt (>1 year maturity); TD=book value of total debt; CSD=pre-tax return on the company's short term (one year) debt, derived from fair market curves (FMC). If FMC is not available, Bloomberg takes government short or long term bond rate of the country where the bank is domiciled multiplied by an adjustment factor (AF); CLD=pre-tax return on the company's long term (10 year) debt, derived from FMC. If FMC is not available, Bloomberg takes government long term bond rate of the country where the bank is domiciled multiplied by an adjustment factor (AF); AF=Debt adjustment factor (only used when fair market curve (FMC) for bank is not available) defined as average yield above government bonds for a given rating class. The lower the rating, the higher the adjustment factor.	Bloomberg
Bank level variables		
Total assets	Total assets in billion US $	Worldscope
Above median size	Indicator equal to one for banks with average total assets above the sample median, and zero otherwise.	Own computation
Low capital regulatory stringency	Indicator equal to one for banks in countries with low capital regulatory stringency, i.e. a score below six (whereas the index ranges between zero and ten).	Own computation

Table 3: Summary statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Implementation delays by directive					
CRD IV (delay in days)	27	182.1	195.1	-146	582
CRD IV (delay 0/1)	27	0.8	0.4	0	1
BRRD (delay in days)	27	209.2	180.0	-166	555
BRRD (delay 0/1)	27	0.8	0.4	0	1
DGSD (delay in days)	27	111.5	151.1	-192	371
DGSD (delay 0/1)	27	0.7	0.4	0	1
Banks' characteristics					
WACC	1307	3.992	2.713	0.618	14.596
Cost of Equity	1307	11.376	5.588	2.807	26.414
Cost of Debt	1307	0.984	0.837	0.000	4.433
Total assets	1208	227.348	466.512	0.134	2079.620
Above median size	1307	0.484	0.500	0	1
Low capital regulatory stringency	1307	0.225	0.418	0	1

Notes: This table shows descriptive statistics for implementation delays by directive across the 27 EU countries as well as capital costs for the sample of banks. Delays are defined as the difference (in days) between a country's c national implementation of the law and the EU's transposition deadline. Alternatively, we create a dummy variable and assign a value of one in case the delay is larger than zero days. More information on the variable definitions can be found in Table 2.

Table 4: Correlations between implementation delays and country-level variables (by directive)

Variable	CRD IV	BRRD	DGSD
Country controls			
GDP growth	-0.2022	0.0033	0.1475
Government debt	-0.0653	-0.0176	0.0522
Banking system health			
Tier 1 ratio	-0.1621	-0.053	0.2186
NPL ratio	0.2503	0.1539	0.1753
Bank concentration	-0.1336	-0.0531	-0.0449
Return on assets	0.256	0.0375	-0.0794
Regulatory indices			
Capital regulatory stringency	0.1767	**0.537**	**0.4498**
Restructuring power index	0.0795	0.0127	0.112
Deposit insurance stringency	-0.0689	-0.1978	-0.3527

Notes: This table shows correlations among the implementation delays and country-level variables. The delay is defined as the difference (in days) between a country's c national implementation of the law and the EU's transposition deadline. The column headers depict the name of the directive for which we compute the correlations with the different controls. The country-level controls are defined as in Table 2 whereas we use values as of the year preceding the respective directive's transposition deadline. E.g., for the CRD IV, the transposition deadline is end of 2013 such that we use data as of 2012 (respectively 2011 for the regulatory indices). Summary statistics for the country-level variables across the three cross-sections are shown in Table OA7. Correlations significant at the 10% level are depicted in bold. None of the values is significant at the 5% or 1% level.

Table 5: Illustration of possible funding cost responses

	(1) Modigliani Miller theorem	(2) Low-risk anomaly	(3) Financial stability	(4) Asset side risk
Cost of equity	+	+	–	+
Cost of debt	constant	constant	–	+
WACC	+	+	–	+

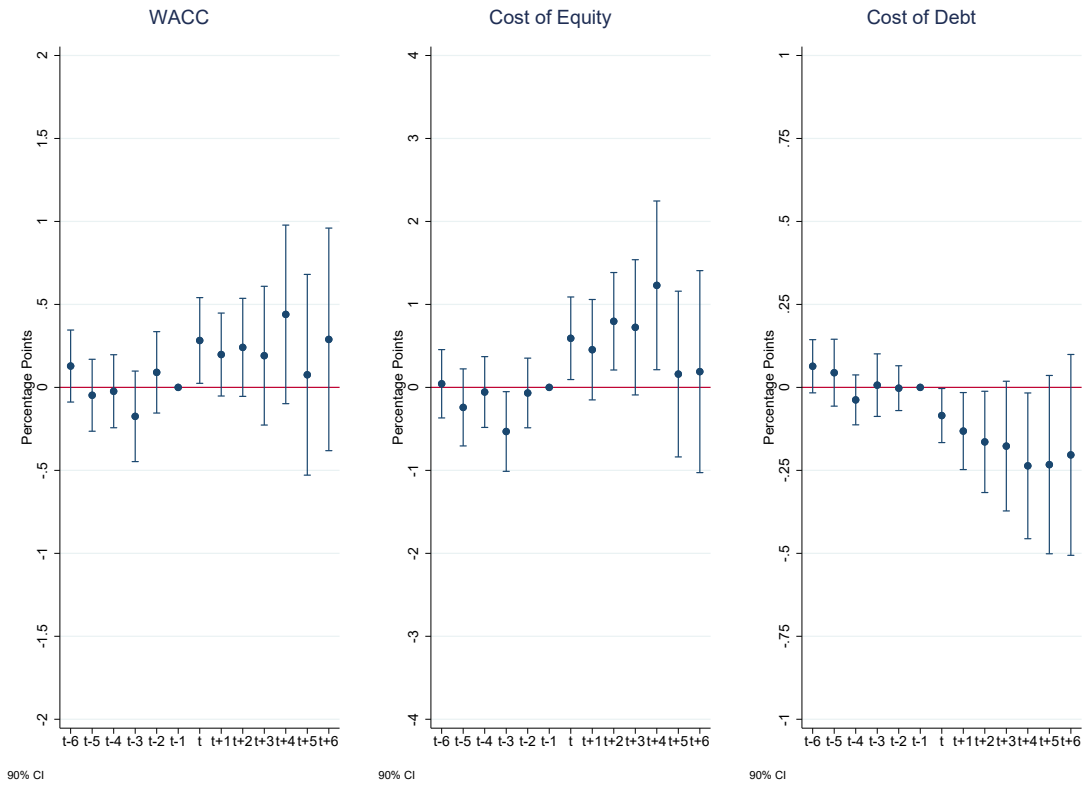
Notes: This table shows expected response patterns in the funding cost components, cost of equity and cost of debt, and the net effect on WACC based on commonly discussed mechanisms. "+" indicates an increase, "–" a decline. Predictions in columns (1) and (2) rely on the assumptions of friction-less capital markets and risk-less debt. If these assumptions are relaxed, then cost of debt might go down with lower leverage and the net effect on WACC remains a priori unclear.

Table 6: Tests of equality between coefficients of event analysis with different methods

Relative Time	TWFE - S&A	TWFE - Stacking	S&A - Stacking
	Dependent variable: WACC		
t-6	0.95	0.33	0.40
t-5	0.45	0.76	0.62
t-4	0.99	0.72	0.75
t-3	0.32	0.22	**0.04**
t-2	0.63	0.38	0.22
t	0.53	0.59	0.96
t+1	0.76	0.76	0.98
t+2	0.98	0.94	0.96
t+3	0.77	0.80	0.97
t+4	0.49	0.51	0.99
t+5	0.35	0.78	0.32
t+6	0.26	0.41	**0.09**
	Dependent variable: Cost of Equity		
t-6	0.92	0.35	0.53
t-5	0.24	0.32	0.10
t-4	0.37	0.88	0.34
t-3	0.83	0.28	0.29
t-2	0.20	**0.03**	**0.00**
t	0.61	**0.09**	0.33
t+1	0.76	**0.09**	0.22
t+2	0.74	0.24	0.18
t+3	0.45	0.61	0.20
t+4	0.34	0.92	0.41
t+5	0.79	0.89	0.75
t+6	0.28	0.12	0.92
	Dependent variable: Cost of Debt		
t-6	0.89	0.29	0.51
t-5	0.76	0.40	0.36
t-4	0.41	0.16	0.17
t-3	**0.08**	0.70	**0.04**
t-2	0.25	0.31	**0.07**
t	1.00	0.25	0.30
t+1	0.53	0.22	0.54
t+2	0.89	0.43	0.53
t+3	0.79	0.51	0.72
t+4	0.22	0.19	0.95
t+5	0.85	0.87	0.73
t+6	0.51	0.52	0.89

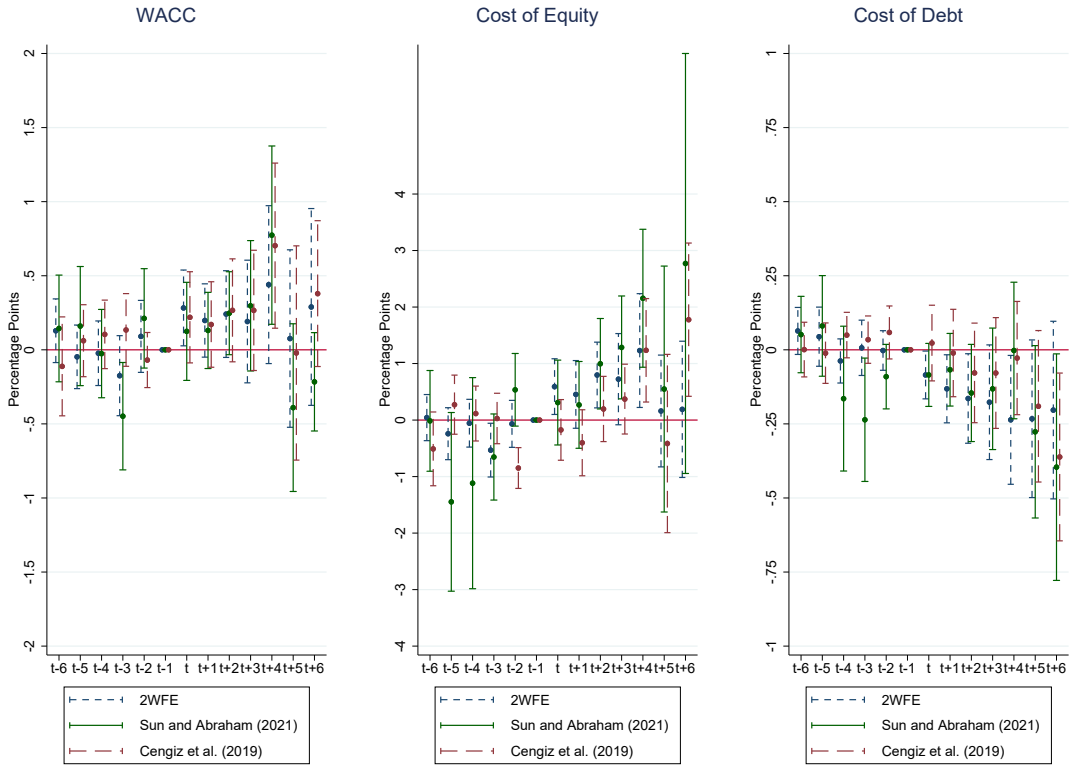
Notes: This table investigates whether there are significant differences in the estimated event analysis coefficients across models in Figure 2. Columns TWFE - S&A, TWFE - Stacking, S&A - Stacking report the p-values of two-tailed t-tests, where the t-value was calculated following Clogg et al. (1995). The three models relate to the two-way fixed effect model (TWFE), the estimator by Sun and Abraham (2021) (S&A) and the stacking approach (Cengiz et al., 2019). The dependent variable is weighted average cost of capital, WACC (in %), Cost of Equity (in %), or Cost of Debt (in %). For each dependent variable, relative time coefficients for the implementation of CRDIV are reported.

Figure 1: Banks' funding costs around CRD IV transposition



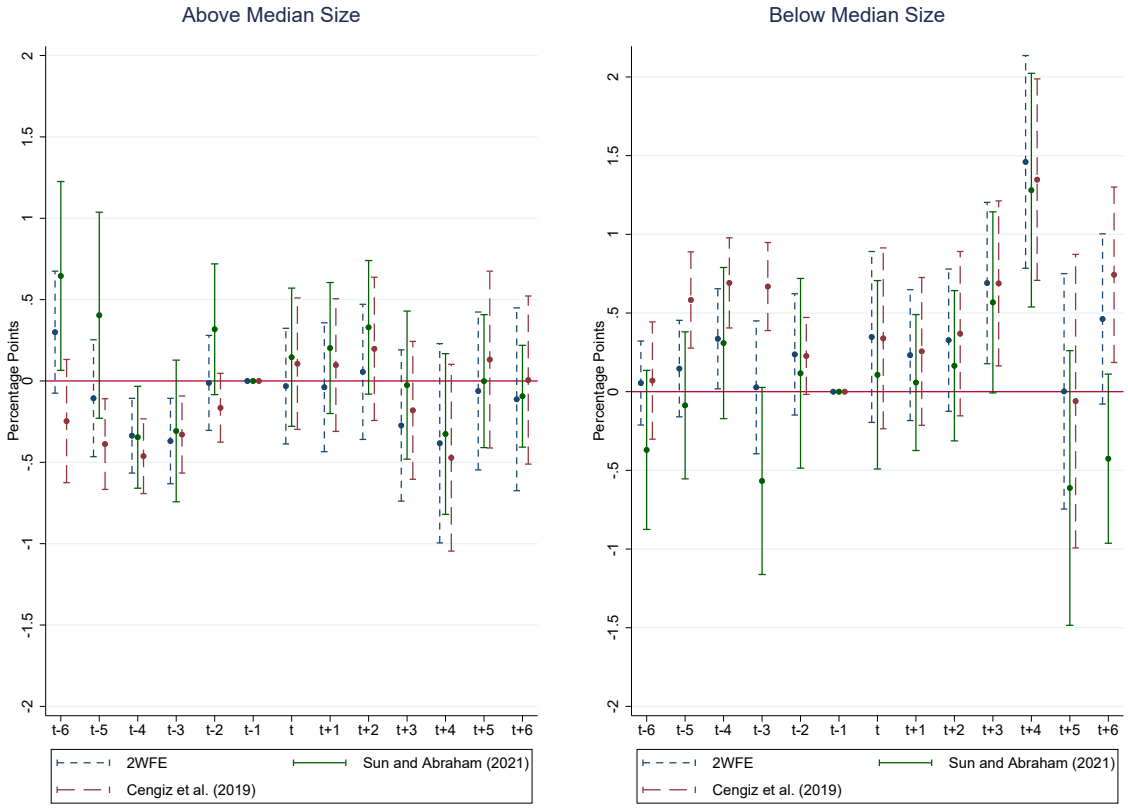
Notes: This figure represents the dynamic impact of the CRD IV on the capital costs of banks. It reports the results of the baseline two-way fixed effects approach in equation (1). The dependent variable is Weighted Average Cost of Capital (WACC, in %) and its pricing components Cost of Equity and Cost of Debt. Each point in the figure represents the coefficient estimate for the treatment indicator variables for the six quarters before and after the country-specific law implementing the CRD IV was published. We exclude the quarter before the directive is transposed into national law, thus estimating the dynamic effects relative to that quarter. The sample includes all banks listed in Table OA8. The observation period includes the seven quarters before and six after publication of the national law for each of those banks. The regression specification uses time and bank fixed effects. Standard errors are clustered at the bank level. Coefficient estimates are surrounded by 90% confidence bands.

Figure 2: Banks' funding costs around CRD IV transposition: Alternative estimators



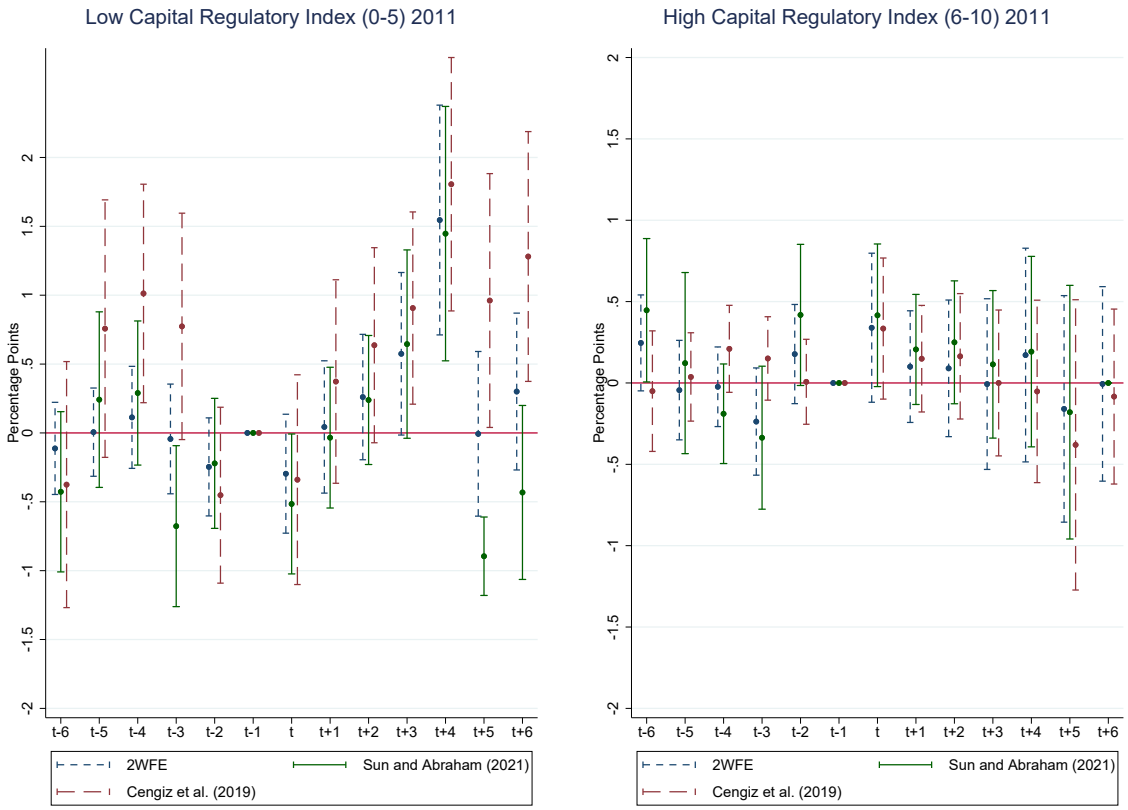
Notes: This figure represents the dynamic impact of the CRD IV on the capital costs of banks. It reports the results of three different estimators: TWFE, Sun and Abraham (2021), and Cengiz et al. (2019). The dependent variable is Weighted Average Cost of Capital (WACC, in %) and its pricing components Cost of Equity and Cost of Debt. Each point in the figure represents the coefficient estimate for the treatment indicator variables for the six quarters before and after the country-specific law implementing the CRD IV was published. We exclude the quarter before the directive is transposed into national law, thus estimating the dynamic effects relative to that quarter. The sample includes all banks listed in Table OA8. The observation period includes the seven quarters before and six after publication of the national law for each of those banks. The regression specification uses time and bank fixed effects and can be seen in equations (1), (2), and (3) respectively. Standard errors are clustered at the bank level. Coefficient estimates are surrounded by 90% confidence bands.

Figure 3: Heterogeneous treatment effects conditional on bank size



Notes: This figure represents the dynamic impact of the CRD IV on the WACC of banks conditional on whether the bank is above the median of the size distribution (Total Assets) over the sample period. It reports the results of three different estimators: TWFE, Sun and Abraham (2021), and Cengiz et al. (2019). The regression specifications in equation (1), (2), and (3) are extended to include an interaction with an indicator for banks above median size. The two graphs for each directive report the dynamic marginal effects of treatment conditional on whether the bank is above the median (left) or not (right). The dependent variable is Weighted Average Cost of Capital (WACC, in %). The sample includes all banks listed in Table OA8. The observation period includes the seven quarters before and six quarters after publication of the national law for each of those banks. Standard errors are clustered at the bank level. Coefficient estimates are surrounded by 90% confidence bands.

Figure 4: Heterogeneous treatment effects conditional on ex-ante regulatory stringency



Notes: This figure represents the dynamic impact of the CRD IV on the WACC of banks conditional on whether the bank resides in a country with high or low capital regulatory stringency. It reports the results of three different estimators: TWFE, Sun and Abraham (2021), and Cengiz et al. (2019). The regression specifications in equation (1), (2), and (3) are extended to include an interaction with an indicator for low regulatory stringency. As the index is between 0 and 10, countries with a score below 6 are defined as those with low stringency. The two graphs for each directive report the dynamic marginal effects of treatment conditional on whether the bank is in a low stringency country (left) or not (right). The dependent variable is Weighted Average Cost of Capital (WACC, in %). The sample includes all banks listed in Table OA8. The observation period includes the seven quarters before and six quarters after publication of the national law for each of those banks. Standard errors are clustered at the bank level. Coefficient estimates are surrounded by 90% confidence bands.

Online Appendix

This appendix is for Online Publication and provides further tables and figures.

More details on the Banking Union Directives Database

Publication date, signature date and entry into force date

We always focus on the publication date of the respective document, for example, in some national law journal. Sometimes, the date of signature precedes the publication by a few days. We assume that the moment when the public gets access to the document is more important for empirical studies. Note that even if a country has published a national law on a directive, this does not imply that all content is immediately in force. For example, with the national implementation of the BRRD, the bail-in tool is not automatically activated. However, the European Commission requires countries to not only implement the directive but also to put its contents into force from 01 January 2015 onwards. The bail-in tool should be implemented by EU member states at the latest until 01 January 2016.

Choosing a legal document

As regards the content of the documents related to the three dates, we do not make specific restrictions. For the first and last date, the important issue is that a document has been passed irrespective of the relevance of its content. For the second date, we focus on the national law and, in most cases, countries have passed one specific law to implement the main content of the directive. There are a few cases, in which no law has been passed but other legal means have been used. For example, Italy commonly uses *decreti legislativi* for technical issues, in which case the parliament delegates to the government the power to legislate on a specific topic. Sometimes two documents closely follow each other. For instance, in the case of Portugal for the BRRD. We comment on such details in the accompanying Excel file. Some countries list more than one law on EURLex and we identify the crucial one to implement changes in capital, resolution and restructuring, as well as deposit insurance legislation for banks. We also indicate these cases in the Excel tables such that researchers can retrace each decision. We make the resulting dataset available both in Excel and Stata format: `https://bankinglibrary.com/data/financial-markets-directives-database/`.

Time span to choose legal documents

As regards the time span, we make two restrictions: First, we omit any dates listed in EURLex before the European Commission made the document on the directive officially available (June 2013 for the CRD IV, May 2014 for the BRRD and April 2014 for the DGSD). Second, we ignore all documents with a date after 2018 for the CRD IV and after 2016 for the BRRD. The reason to ignore documents issued after these dates is that the laws were amended and a few countries had already adjusted their national law accordingly. For example, for directives and regulations amending the CRD IV, see this link. We focus in the data collection process on the first round of transposition of the CRD IV and the BRRD.

Data formats and reporting of dates

The final dataset contains the three different dates per directive and is available both in Stata and Excel formats. The Excel files contain some more information on, for example, whether national sources have been used next to EURLex or whether there is some document available after 2018 for the CRD IV or after 2016 for the BRRD. We provide the exact publication date. Whenever we transform it to the quarterly level, we shift the date one quarter forward in case the publication date is in the last month of a quarter. The reason is that for any analysis at the quarterly level, it seems unreasonable that one sees significant market reactions during a quarter in case the directive is transposed in the last month of that quarter. We realize that this approach might not be appropriate in other research contexts. This is exactly the reason, why we provide exact dates as well. Thereby, researchers can define transposition dates differently according to their specific needs.

Links to documents underlying the directive dates

We furthermore save the names of the legal documents and the original documents, in which the publication date is explicitly stated. We provide references to these documents such that it is possible to verify the listed dates. However, we acknowledge that there might be further country-specific regulation that relates to these directives but is not reported to the European Commission and thus not listed on EURLex. This in turn could imply that we miss some relevant dates despite careful searching the web and not only relying on EURLex. Please report missing information to the authors.

Breakdown of the time span between the first, main and last date of a directive

Figure OA1 illustrates implementation delays based on the publishing date of the main law in the respective EU member state. We plot the delay (in full months) comparing the transposition deadline and the main national law to transpose the directive. With some exceptions, countries do not consistently implement with similar timing across directives. A consistent finding is that countries tend to delay. For all three pieces of legislation, the vast majority of countries implemented after the transposition deadline, 81% of all 27 EU member states delayed the CRD IV and BRRD implementations, while 70% delayed the DGSD implementation. The 27 EU member states implemented the CRD IV with an average delay of around 6 full months, the BRRD with an average of 6.5 full months and the DGSD with an average of 3.4 full months.[28] These delays are all below the EU average transposition delay of 8.6 months in 2021.[29]

A detailed breakdown of the implementation time spans for each directive are depicted in Figures OA2 and OA3. Figure OA2 illustrates a country's directive implementation duration in full months based on the country-specific difference between the publication date of the first legal document related to each directive and the date of the main law, with an average duration of 3, 4.1, 2.4 full months for the CRD IV, BRRD and DGSD, respectively. Figure OA3 shows the time span (in full months) between the publication date of the main law and the last legal document available, with an average duration of 23, 1.7, 8.9 full months respectively. Some countries implemented each directive with one piece of legislation, which is accordingly considered simultaneously as the first, the last, and the document representing the main law. This is the case for 67% of EU member states in the case of the CRD IV, 59% for the BRRD and 85% for the DGSD.

[28] Only in case the month has fully passed with respect to the transposition deadline, it counts in this delay calculation.

[29] See for more details the Single Market Scoreboard of the European Commission. Source: Link.

Tables and figures

Table OA1: CRD IV implementation dates into national law (first, law, last)

(1) Country	(2) First legal document on CRD IV	(3) Law on CRD IV published	(4) Last legal document on CRD IV
Austria	2013Q3	2013Q3	2017Q4
Belgium	2014Q2	2014Q2	2016Q4
Bulgaria	2014Q2	2014Q2	2015Q3
Croatia	2014Q1	2014Q1	2018Q4
Cyprus	2014Q3	2015Q1	2017Q3
Czech Republic	2013Q3	2014Q3	2017Q4
Denmark	2013Q3	2014Q2	2017Q4
Estonia	2014Q2	2014Q2	2014Q2
Finland	2014Q3	2014Q3	2014Q3
France	2014Q1	2014Q4	2014Q4
Germany	2013Q4	2013Q4	2014Q1
Greece	2014Q2	2014Q2	2014Q2
Hungary	2013Q4	2013Q4	2014Q3
Ireland	2014Q2	2014Q2	2018Q2
Italy	2015Q3	2015Q3	2015Q3
Latvia	2014Q2	2014Q2	2017Q1
Lithuania	2013Q4	2014Q3	2016Q3
Luxembourg	2014Q1	2015Q3	2015Q3
Malta	2014Q1	2014Q1	2015Q2
Netherlands	2014Q1	2014Q3	2018Q3
Poland	2015Q3	2015Q3	2018Q3
Portugal	2014Q3	2014Q3	2014Q4
Romania	2013Q4	2014Q1	2015Q2
Slovakia	2014Q3	2014Q3	2017Q4
Slovenia	2015Q2	2015Q2	2017Q1
Spain	2013Q4	2014Q3	2019Q1
Sweden	2014Q3	2014Q3	2015Q2

Notes: This table shows information on quarterly CRD IV dates by country. Columns (2)-(4) show different dates related to the CRD IV implementation process. The transposition deadline of the CRD IV directive set by the European Commission has been in December 2013. Column (2) shows the quarter in which the first legal document on the CRD IV has been published according to EURLex, and in column (4) information on the last date before the amendment is provided. Column (3) shows the quarter in which the main law on the CRD IV implementation has been published by a country. In case a document is published in the last month of a quarter, the quarterly date is moved to the following quarter. The main source is EURLex as well as national official websites.

Table OA2: BRRD implementation dates into national law (first, law, last)

(1) Country	(2) Resolution Authority	(3) First legal document on BRRD	(4) Law on BRRD published	(5) Last legal document on BRRD
Austria	Financial Market Authority	2015Q1	2015Q1	2015Q1
Belgium	National Bank of Belgium	2015Q2	2016Q3	2016Q3
Bulgaria	Bulgarian National Bank	2015Q1	2015Q3	2015Q3
Croatia	Croatian National Bank, Croatian Financial Services Supervisory Agency, State Agency for Deposit Insurance and Bank Resolution	2014Q3	2015Q1	2015Q4
Cyprus	Central Bank of Cyprus	2014Q3	2016Q2	2016Q2
Czech Republic	Czech National Bank	2014Q3	2016Q1	2016Q1
Denmark	Danish Financial Supervisory Authority	2015Q2	2015Q2	2015Q3
Estonia	Financial Supervision Authority	2015Q2	2015Q2	2015Q2
Finland	Finnish Financial Stability Authority (Rahoitusvakausvirasto)	2015Q1	2015Q1	2015Q3
France	Prudential Supervisory and Resolution Authority	2015Q1	2015Q3	2015Q4
Germany	Federal Financial Supervisory Authority	2015Q1	2015Q1	2015Q1
Greece	Bank of Greece, Hellenic Capital Market Commission	2015Q1	2015Q3	2015Q3
Hungary	Central Bank of Hungary	2014Q3	2014Q3	2014Q3
Ireland	Central Bank of Ireland	2015Q3	2015Q3	2016Q2
Italy	Bank of Italy	2015Q4	2015Q4	2015Q4
Latvia	Financial and Capital Market Commission (Finanšu un kapitāla tirgus komisija)	2015Q3	2015Q3	2015Q3
Lithuania	Bank of Lithuania	2014Q3	2016Q1	2016Q1
Luxembourg	Commission for the Supervision of Financial Sector (Commission de Surveillance du Secteur Financier)	2016Q1	2016Q1	2016Q1
Malta	Malta Financial Services Authority	2015Q3	2015Q4	2015Q4
Netherlands	Dutch Central Bank	2015Q1	2015Q4	2015Q4
Poland	Bank Guarantee Fund	2016Q3	2016Q3	2016Q3
Portugal	Bank of Portugal	2015Q2	2015Q2	2015Q3
Romania	National Bank of Romania, Financial Supervisory Authority	2016Q1	2016Q1	2016Q1
Slovakia	Resolution Council (Rada pre riešenie krízových situácií)	2015Q1	2015Q1	2015Q1
Slovenia	Bank of Slovenia	2015Q1	2015Q2	2016Q3
Spain	Bank of Spain, Spanish Executive Resolution Authority, National Securities Market Commission	2015Q3	2015Q3	2015Q4
Sweden	Swedish National Debt Office	2016Q1	2016Q1	2016Q1

Notes: This table shows information on resolution authority and quarterly BRRD dates by country. Information on resolution authorities in column (2) is obtained from the European Banking Authority (Link). Columns (3)-(5) show different dates related to the BRRD implementation process. The transposition deadline of the BRRD directive set by the European Commission has been in December 2014. The bail-in tool should be implemented by EU member states at the latest until 01.01.2016. Column (3) shows the quarter in which the first legal document on the BRRD has been published according to EURLex, and in column (5) information on the last date before the amendment is provided. Column (4) shows the quarter in which the main law on the BRRD implementation has been published by a country. In case a document is published in the last month of a quarter, the quarterly date is moved to the following quarter. The main source is EURLex as well as national official websites.

Table OA3: DGSD implementation dates into national law (first, law, last)

(1) Country	(2) First legal document on DGSD	(3) Law on DGSDV published	(4) Last legal document on DGSD	(5) Law wrt second deadline on DGSD published
Austria	2015Q3	2015Q3	2015Q3	2015Q3
Belgium	2014Q2	2016Q2	2017Q1	2016Q4
Bulgaria	2015Q3	2015Q3	2015Q3	2015Q3
Croatia	2015Q1	2015Q3	2021Q1	2021Q1
Cyprus	2016Q2	2016Q2	2020Q3	2016Q2
Czech Republic	2014Q3	2016Q1	2020Q3	.
Denmark	2015Q2	2015Q2	2015Q2	.
Estonia	2016Q1	2016Q1	2016Q2	2016Q1
Finland	2015Q1	2015Q1	2015Q3	2015Q2
France	2015Q4	2015Q4	2015Q4	2015Q3
Germany	2015Q3	2015Q3	2015Q3	2015Q3
Greece	2016Q2	2016Q2	2016Q2	2016Q2
Hungary	2015Q1	2015Q1	2016Q3	2016Q1
Ireland	2015Q4	2015Q4	2015Q4	2015Q4
Italy	2016Q2	2016Q2	2016Q2	2016Q2
Latvia	2015Q3	2015Q3	2015Q3	2015Q3
Lithuania	2016Q1	2016Q1	2016Q1	2016Q1
Luxembourg	2016Q1	2016Q1	2016Q1	2016Q1
Malta	2016Q1	2016Q1	2016Q1	2016Q1
Netherlands	2015Q4	2015Q4	2015Q4	2015Q4
Poland	2015Q1	2016Q3	2017Q2	2016Q3
Portugal	2015Q2	2015Q2	2015Q4	2015Q2
Romania	2016Q1	2016Q1	2016Q1	2016Q1
Slovakia	2015Q4	2015Q4	2015Q4	2015Q4
Slovenia	2016Q2	2016Q2	2016Q2	2016Q2
Spain	2015Q3	2015Q3	2015Q4	2015Q4
Sweden	2016Q3	2016Q3	2016Q3	2016Q3

Notes: This table shows the transposition dates of the deposit guarantee scheme by country. The Deposit Guarantee Scheme Directive (DGSD) has two different transposition deadlines. The first transposition deadline of the DGSD set by the European Commission has been the 3rd of July 2015. A second deadline on 31th of May 2016 is set for the implementation of article 8(4) and 13 regulating the repayment of deposits in the transitional period ending in December 2023 and the contributions to the DGS. Column (2) shows the date at which the first legal document on the DGSD has been published according to EURLex, and in column (4) information on the last date is provided. Column (3) shows the date at which the main law on the DGSD implementation has been published by a country. In case the law is published in the last month of a quarter, the date is moved to the following quarter and indicated in the table accordingly. The main source is EURLex as well as national official websites. Column (5) shows the date at which the law has been published according to EURLex law that relate to Article 8(4) and 13 of the DGSD.

Table OA4: CRD IV law transposition date – Sources

(1) Country	(2) Law on CRD IV published	(3) Exact date	(4) Name of law (in the national language)	(5) Source
Austria	2013Q3	07.08.2013	Bundesgesetz, mit dem das Bankwesengesetz, das Bausparkassengesetz, das Börsegesetz 1989, das E-Geldgesetz 2010, das Finanzkonglomerategesetz, das Finanzmarktaufsichtsbehördengesetz, das Finanzmarktstabilitätsgesetz, das Finanz-sicherheiten-Gesetz, das Immobilien-Investment-fondsgesetz, das Investmentfondsgesetz 2011, das Kapitalmarktgesetz, das Nationalbankgesetz 1984, das Sparkassengesetz, das Stabilitätsabgabe-gesetz, das Wertpapieraufsichtsgesetz 2007, das Zahlungsdienstegesetz, das Pensionskassengesetz, das Betriebliche Mitarbeiter- und Selbständigen-vorsorgegesetz und das Versicherungsaufsichts-gesetz geändert werden	Link
Belgium	2014Q2	07.05.2014	Loi relative au statut et au contrôle des établissements de crédit [et des sociétés de bourse]	Link
Bulgaria	2014Q2	25.03.2014	Закон за кредитните институции	Link
Croatia	2014Q1	30.12.2013	Zakon o kreditnim institucijama	Link
Cyprus	2015Q1	30.01.2015	Μακροπρολεπτικής Εποπτείας των Ιδρυμάτων Νόμος του 2015	Link
Czech Republic	2014Q3	07.08.2014	Vyhláška č. 163/2014 Sb., o výkonu činnosti bank, spořitelních a úvěrních družstev a obchodníků s cennými papíry	Link
Denmark	2014Q2	25.03.2014	Lov om ændring af lov om finansiel virksomhed og forskellige andre love	Link
Estonia	2014Q2	09.05.2014	Krediidiasutuste seadus; Finantsinspektsiooni seadus; Väärtpaberituru seadus	Link
Finland	2014Q3	14.08.2014	Laki luottolaitostoiminnasta/Kreditinstitutslag (610/2014)	Link
France	2014Q4	05.11.2014	Arrêté du 3 novembre 2014 relatif aux coussins de fonds propres des prestataires de services bancaires et des entreprises d'investissement autres que les sociétés de gestion de portefeuille	Link
Germany	2013Q4	03.09.2013	Gesetz zur Umsetzung der Richtlinie 2013/36/EU über den Zugang zur Tätigkeit von Kreditinstituten und die Beaufsichtigung von Kreditinstituten und Wertpapierfirmen und zur Anpassung des Aufsichtsrechts an die Verordnung (EU) Nr. 575/2013 über Aufsichtsanforderungen an Kreditinstitute und Wertpapierfirmen (CRD IV-Umsetzungsgesetz)	Link
Greece	2014Q2	05.05.2014	ΝΟΜΟΣ ΥΠ' ΑΡΙΘ. 4261 Πρόσβαση στη δραστηριότητα των πιστωτικών ιδρυμάτων και προληπτική εποπτεία πιστωτικών ιδρυμάτων και επιχειρήσεων (ενσωμάτωση της Οδηγίας 2013/36/ ΕΕ), κατάργηση του ν. 3601/2007 και άλλες διατάξεις	Link
Hungary	2013Q4	27.09.2013	2013. évi CXXXIX. törvény a Magyar Nemzeti Bankról	Link
Ireland	2014Q2	04.04.2014	EUROPEAN UNION (CAPITAL REQUIREMENTS) REGULATIONS 2014; European Union (Capital Requirements) (No. 2) Regulations 2014.	Link 1; Link 2
Italy	2015Q3	12.06.2015	DECRETO LEGISLATIVO 12 maggio 2015, n. 72, Attuazione della direttiva 2013/36/UE, che modifica la direttiva 2002/87/CE e abroga le direttive 2006/48/CE e 2006/49/CE, per quanto concerne l'accesso all'attivita' degli enti creditizi e la vigilanza prudenziale sugli enti creditizi e sulle imprese di investimento. Modifiche al decreto legislativo 1° settembre 1993, n. 385 e al decreto legislativo 24 febbraio 1998, n. 58. (15G00087)	Link
Latvia	2014Q2	14.05.2014	Likums "Grozījumi Finanšu instrumentu tirgus likumā"	Link 1; Link 2
Lithuania	2014Q3	31.07.2014	Lietuvos banko valdybos 2014 m. liepos 31 d. nutarimas Nr. 03-136 „Dėl Visuomenei skelbiamos informacijos reikalavimų“	Link

(1) Country	(2) Law on CRD IV published	(3) Exact date	(4) Name of law (in the national language)	(5) Source
Luxembourg	2015Q3	31.07.2015	Loi du 23 juillet 2015 portant: - transposition de la directive 2013/36/UE du Parlement européen et du Conseil du 26 juin 2013; - transposition des articles 2 et 3 de la directive 2011/89/UE du Parlement européen et du Conseil du 16 novembre 2011; - transposition de l'article 6, paragraphe 6 de la directive 2011/61/UE du Parlement européen et du Conseil du 8 juin 2011; - modification de: 1. la loi modifiée du 5 avril 1993 relative au secteur financier; 2. la loi modifiée du 23 décembre 1998 portant création d'une commission de surveillance du secteur financier; 3. la loi du 12 juillet 2013 relative aux gestionnaires de fonds d'investissement alternatifs.	Link
Malta	2014Q1	24.01.2014	CRD (Administrative Penalties, Measures andInvestigatory Powers) Regulations, 2014	Link
Netherlands	2014Q3	07.07.2014	Wet van 25 juni 2014 tot wijziging van de Wet op het financieel toezicht en enige andere wetten ter implementatie van richtlijn 2013/36/EU van het Europees Parlement en de Raad van 26 juni 2013 betreffende toegang tot het bedrijf van kredietinstellingen en het prudentieel toezicht op kredietinstellingen en beleggingsondernemingen, tot wijziging van Richtlijn 2002/87/EG en tot intrekking van de Richtlijnen 2006/48/EG en 2006/49/EG (PbEU 2013, L 176) en ter implementatie van verordening (EU) nr. 575/2013 van het Europees Parlement en de Raad van 26 juni 2013 betreffende prudentiële vereisten voor kredietinstellingen en beleggingsondernemingen en tot wijziging van Verordening (EU) nr. 648/2012 (PbEU 2013, L 176) (Implementatiewet richtlijn en verordening kapitaalvereisten)	Link
Poland	2015Q3	05.08.2015	Ustawa z dnia 5 sierpnia 2015 r. o nadzorze makroostrożnościowym nad systemem finansowym i zarządzaniu kryzysowym w systemie finansowym	Link
Portugal	2014Q3	28.07.2014	LEI N.º 46/2014 - DIÁRIO DA REPÚBLICA N.º 143/2014, SÉRIE I DE 2014-07-28 Ato da Série I Assembleia da República Autoriza o Governo, no âmbito da transposição da Diretiva n.º 2013/36/UE, do Parlamento Europeu e do Conselho, de 26 de junho, a proceder à alteração ao Regime Geral das Instituições de Crédito e Sociedades Financeiras, aprovado pelo Decreto-Lei n.º 298/92, de 31 de dezembro, ao Código dos Valores Mobiliários, aprovado pelo Decreto-Lei n.º 486/99, de 13 de novembro, às Leis n.os 25/2008, de 5 de junho, e 28/2009, de 19 de junho, e aos Decretos-Leis n.os 260/94, de 22 de outubro, 72/95, de 15 de abril, 171/95, de 18 de julho, 211/98, de 16 de julho, 357-B/2007 e 357-C/2007, de 31 de outubro, 317/2009, de 30 de outubro, e 40/2014, de 18 de março	Link
Romania	2014Q1	30.12.2013	Regulament privind cerinţe prudenţiale pentru instituţiile de credit	Link
Slovakia	2014Q3	30.07.2014	Zákon č. 213/2014 Z. z., ktorým sa mení a dopĺňa zákon č. 483/2001 Z. z. o bankách a o zmene a doplnení niektorých zákonov v znení neskorších predpisov a ktorým sa menia a dopĺňajú niektoré zákony	Link
Slovenia	2015Q2	13.04.2015	Zakon o bančništvu	Link
Spain	2014Q3	27.06.2014	Ley 10/2014, de 26 de junio, de ordenación, supervisión y solvencia de entidades de crédito.	Link
Sweden	2014Q3	26.06.2014	Lag om kapitalbuffertar	Link

Notes: This table shows information on the date at which the main law on the CRD IV has been published by a country. In case the law is published in the last month of a quarter, the date is moved to the following quarter and indicated in the table accordingly (Column (2)). The exact publication date is shown in Column (3). The name of the law in the national language is shown in Column (4). The main source on the national law is EURLex (Link) as well as national official websites (see also Column (5)).

Table OA5: BRRD law transposition date – Sources

(1) Country	(2) Law on BRRD published	(3) Exact date	(4) Name of law (in the national language)	(5) Source
Austria	2015Q1	29.12.2014	Bundesgesetz über die Sanierung und Abwicklung von Banken	Link 1; Link 2
Belgium	2016Q3	06.07.2016	FEDERALE OVERHEIDSDIENST FINANCIEN - Wet van 27 juni 2016 tot omzetting van diverse bepalingen van Richtlijn 2014/59/EU [...]	Link 1; Link 2
Bulgaria	2015Q3	14.08.2015	Закон за възстановяване и преструктуриране на кредитни институции и инвестиционни посредници	Link 1; Link 2
Croatia	2015Q1	20.02.2015	Zakon o sanaciji kreditnih institucija i investicijskih društava	Link
Cyprus	2016Q2	18.03.2016	Ο περί Εξυγίανσης Πιστωτικών Ιδρυμάτων και Επενδυτικών Εταιρειών Νόμος του 2016.	Link 1; Link 2
Czech Republic	2016Q1	28.12.2015	Zákon č. 374/2015 Sb., o ozdravných postupech a řešení krize na finančním trhu	Link
Denmark	2015Q2	02.04.2015	Lov nr. 333 af 31. marts 2015 om restrukturering og afvikling af visse finansielle virksomheder	Link 1; Link 2
Estonia	2015Q2	19.03.2015	Finantskriisi ennetamise ja lahendamise seadus	Link
Finland	2015Q1	23.12.2014	Laki luottolaitosten ja sijoituspalveluyritysten kriisinratkaisusta / Lag om resolution av kreditinstitut och värdepappersföretag (1194/2014) 19/12/2014	Link 1; Link 2; Link 3
France	2015Q3	21.08.2015	Ordonnance n° 2015-1024 du 20 août 2015 [. . .]	Link
Germany	2015Q1	18.12.2014	Gesetz zur Sanierung und Abwicklung von Kreditinstituten	Link 1; Link 2
Greece	2015Q3	23.07.2015	Επείγοντα μέτρα εφαρμογής του ν. 4334/2015 (Α΄ 80)	Link
Hungary	2014Q3	18.07.2014	2014. évi XXXVII. törvény a pénzügyi közvetítőrendszer egyes szereplőinek biztonságát erősítő intézményrendszer továbbfejlesztéséről	Link 1; Link 2
Ireland	2015Q3	14.07.2015	S.I. No. 289/2015 - European Union (Bank Recovery and Resolution) Regulations 2015	Link
Italy	2015Q4	16.11.2015	DECRETO LEGISLATIVO 16 novembre 2015, n. 180 & n. 181	Link
Latvia	2015Q3	02.07.2015	Kredītiestāžu un ieguldījumu brokeru sabiedrību darbības atjaunošanas un noregulējuma likums	Link
Lithuania	2016Q1	02.12.2015	Lietuvos Respublikos finansinio tvarumo įstatymo Nr. XI-393 pakeitimo įstatymas Nr. XII-2053	Link 1; Link 2
Luxembourg	2016Q1	24.12.2015	Loi du 18 décembre 2015 relative aux mesures de résolution, d'assainissement et de liquidation des établissements de crédit [...]	Link
Malta	2015Q4	22.09.2015	Recovery and Resolution Regulations, 2015 MALTA FINANCIAL SERVICES AUTHORITY ACT (CAP. 330)	Link 1; Link 2; Link 3
Netherlands	2015Q4	25.11.2015	Implementatiewet Europees kader voor herstel en afwikkeling van banken en beleggingsondernemingen 431/2015	Link
Poland	2016Q3	08.07.2016	Ustawa z dnia 10 czerwca 2016 r. o Bankowym Funduszu Gwarancyjnym, systemie gwarantowania depozytów oraz przymusowej restrukturyzacji	Link 1; Link 2
Portugal	2015Q2	26.03.2015	Lei n.º 23-A/2015 de 26 de março	Link
Romania	2016Q1	11.12.2015	Legii nr. 312/2015 privind redresarea și rezoluția instituțiilor de credit și a firmelor de investiții, precum și pentru modificarea și completarea unor acte normative în domeniul financiar	Link 1; Link 2
Slovakia	2015Q1	20.12.2014	LZákon č. 371/2014 Z. z. o riešení krízových situácií na finančnom trhu a o zmene a doplnení niektorých zákonov	Link
Slovenia	2015Q2	13.04.2015	Zakon o bančništvu	Link
Spain	2015Q3	19.06.2015	Ley 11/2015 de recuperación y resolución de entidades de crédito y empresas de servicios de inversión	Link
Sweden	2016Q1	29.12.2015	Lag (2015:1016) om resolution	Link 1; Link 2

(1)	(2)	(3)	(4)	(5)
Country	Law on BRRD published	Exact date	Name of law (in the national language)	Source

Notes: This table shows information on the date at which the main law on the BRRD has been published by a country. In case the law is published in the last month of a quarter, the date is moved to the following quarter and indicated in the table accordingly (Column (2)). The exact publication date is shown in Column (3). The name of the law in the national language is shown in Column (4). The main source on the national law is EURLex (Link) as well as national official websites (see also Column (5)).

Table OA6: DGSD law transposition date – Sources

(1) Country	(2) Law on DGSD published	(3) Exact date	(4) Name of law (in the national language)	(5) Source
Austria	2015Q3	14.08.2015	Bundesgesetz, mit dem ein Bundesgesetz über die Einlagensicherung und Anlegerentschädigung bei Kreditinstituten erlassen wird und das Bankwesengesetz, das Finanzmarktaufsichtsbehördengesetz, das Wertpapieraufsichtsgesetz 2007, das Investmentfondsgesetz 2011, das Alternative Investmentfonds Manager-Gesetz, das Sparkassengesetz und das Sanierungs- und Abwicklungsgesetz geändert werden	Link
Belgium	2016Q2	12.05.2016	Wet tot omzetting van richtlijn 2014/49/EU inzake depositogarantiestelsels en houdende diverse bepalingen.	Link
Bulgaria	2015Q3	14.08.2015	Закон за гарантиране на влоговете в банките	Link
Croatia	2015Q3	24.07.2015	Zakon o osiguranju depozita	Link
Cyprus	2016Q2	11.02.2016	Ο Περί Συστήματος Εγγύησης των Καταθέσεων και Εξυγίανσης Πιστωτικών και Άλλων Ιδρυμάτων Νόμος του 2016.	Link
Czech Republic	2016Q1	28.12.2015	Zákon č. 375/2015 Sb., kterým se mění některé zákony v souvislosti s přijetím zákona o ozdravných postupech a řešení krize na finančním trhu a v souvislosti s úpravou systému pojištění vkladů	Link
Denmark	2015Q2	02.04.2015	Lov om ændring af lov om finansiel virksomhed, lov om finansiel stabilitet, lov om en garantifond for indskydere og investorer, lov om værdipapirhandel m.v. og ligningsloven	Link
Estonia	2016Q1	31.12.2015	Tagatisfondi seadus	Link
Finland	2015Q1	23.12.2014	Laki rahoitusvakausviranomaisesta / Lag om myndigheten för finansiell stabilitet (1195/2014) 19/12/2014	Link
France	2015Q4	30.10.2015	Arrêté du 27 octobre 2015 relatif à la mise en œuvre de la garantie des dépôts, au plafond d'indemnisation et aux modalités d'application de l'article L. 312-4-1 du code monétaire et financier	Link
Germany	2015Q3	05.06.2015	Gesetz zur Umsetzung der Richtlinie 2014/49/EU des Europäischen Parlaments und des Rates vom 16. April 2014 über Einlagensicherungssysteme (DGSD-Umsetzungsgesetz)	Link
Greece	2016Q2	07.03.2016	Συστήματα Εγγύησης Καταθέσεων (ενσωμάτωση Οδηγίας 2014/49/Ε-Ε), Ταμείο Εγγύησης Καταθέσεων και Επενδύσεων και άλλες διατάξεις.	Link
Hungary	2015Q1	30.12.2014	2014. évi CIV. törvény egyes pénzügyi tárgyú törvényeknek a betétbiztosítást, valamint a pénzügyi közvetítőrendszert érintő módosításáról	Link
Ireland	2015Q4	20.11.2015	European Union (Deposit Guarantees Schemes) Regulations 2015	Link
Italy	2016Q2	08.03.2016	Attuazione della direttiva 2014/49/UE del Parlamento europeo e del Consiglio, del 16 aprile 2014, relativa ai sistemi di garanzia dei depositi	Link
Latvia	2015Q3	18.06.2015	Noguldījumu garantiju likums	Link
Lithuania	2016Q1	02.12.2015	Lietuvos Respublikos indėlių ir įsipareigojimų investuotojams draudimo įstatymo Nr. IX-975 pakeitimo įstatymas Nr. XII-2054	Link
Luxembourg	2016Q1	24.12.2015	Loi du 18 décembre 2015 relative aux mesures de résolution, d'assainissement et de liquidation des établissements de crédit et de certaines entreprises d'investissement ainsi qu'aux systèmes de garantie des dépôts et d'indemnisation des investisseurs, portant: 1. transposition de la directive 2014/59/UE du Parlement européen et du Conseil du 15 mai 2014 établissant un cadre pour le redressement et la résolution des établissements de crédit et des entreprises d'investissement et modifiant la directive 82/891/CEE du Conseil ainsi que les directives du Parlement européen et du Conseil 2001/24/CE, 2002/47/CE, 2004/25/CE, 2005/56/CE, 2007/36/CE, 2011/35/UE, 2012/30/UE et 2013/36/UE et les règlements du Parlement européen et du Conseil (UE) n° 1093/2010 et (UE) n° 648/2012; 2. transposition de la directive 2014/49/UE du Parlement européen et du Conseil du 16 avril 2014 relative aux systèmes de garantie des dépôts; 3. modification: a) de la loi modifiée du 5 avril 1993 relative au secteur financier; etc.	Link

(1)	(2)	(3)	(4)	(5)
Country	Law on DGSD published	Exact date	Name of law (in the national language)	Source
Malta	2016Q1	04.12.2015	Depositor Compensation Scheme Regulations, 2015 BANKING ACT (CAP. 371)	Link
Netherlands	2015Q4	25.11.2015	Besluit implementatie richtlijn depositogarantiestelsels	Link
Poland	2016Q3	08.07.2016	Ustawa z dnia 10 czerwca 2016 r. o Bankowym Funduszu Gwarancyjnym, systemie gwarantowania depozytów oraz przymusowej restrukturyzacji	Link
Portugal	2015Q2	26.03.2015	LEI N.º 23-A/2015 - DIÁRIO DA REPÚBLICA N.º 60/2015, 1º SUPLEMENTO, SÉRIE I DE 2015-03-26 Assembleia da República Transpõe as Diretivas 2014/49/UE, do Parlamento Europeu e do Conselho, de 16 de abril, relativa aos sistemas de garantia de depósitos, e 2014/59/UE, do Parlamento Europeu e do Conselho, de 15 de maio, alterando o Regime Geral das Instituições de Crédito e Sociedades Financeiras, a Lei Orgânica do Banco de Portugal, o Decreto-Lei n.º 345/98, de 9 de novembro, o Código dos Valores Mobiliários, o Decreto-Lei n.º 199/2006, de 25 de outubro, e a Lei n.º 63-A/2008, de 24 de novembro	Link
Romania	2016Q1	11.12.2015	Lege nr. 311/2015 privind schemele de garantare a depozitelor si Fondul de garantare a depozitelor bancare	Link
Slovakia	2015Q4	14.10.2015	Zákon č. 239/2015 Z. z., ktorým sa mení a dopĺňa zákon Národnej rady Slovenskej republiky č. 118/1996 Z. z. o ochrane vkladov a o zmene a doplnení niektorých zákonov v znení neskorších predpisov a ktorým sa menia a dopĺňajú niektoré zákony	Link
Slovenia	2016Q2	11.04.2016	Zakon o sistemu jamstva za vloge	Link
Spain	2015Q3	19.06.2015	Ley 11/2015, de 18 de junio, de recuperación y resolución de entidades de crédito y empresas de servicios de inversión	Link
Sweden	2016Q3	02.06.2016	Lag (2016:625) om ändring i lagen (1995:1571) om insättningsgaranti	Link

Notes: This table shows information on the date at which the main law on the deposit guarantee scheme implementation has been published by a country. In case the law is published in the last month of a quarter, the date is moved to the following quarter and indicated in the table accordingly (Column (2)). The exact publication date is shown in Column (3). The name of the law in the national language is shown in Column (4). The main source on the national law is EURLex (Link) as well as national official websites (see also Column (5)).

Table OA7: Summary statistics – Country-level data

Variable	Observations	Mean	Std. Dev.	Min	Max
Directive (delay in days)	81	167.6	179.0	-192.0	582.0
Directive (delay 0/1)	81	0.8	0.4	0.0	1.0
Country controls					
GDP growth	81	0.8	2.6	-7.1	8.7
Government debt	81	70.6	37.6	8.3	180.3
Banking system health					
Tier 1 ratio	80	14.2	3.7	4.5	28.3
NPL ratio	74	10.6	9.3	0.5	46.1
Bank concentration	81	61.4	17.1	30.6	94.1
Return on assets	78	0.9	1.6	0.1	10.9
Regulatory indices					
Capital regulatory stringency	75	7.1	1.5	4.0	9.0
Restructuring power index	72	2.3	0.9	0.0	3.0
Deposit insurance stringency	72	1.3	0.7	0.0	3.0

Notes: This table shows summary statistics for the three cross-sections of EU countries per date at which one of the three directives has been implemented. The country-level controls are defined as in Table 2 whereas for the country-level controls we use values as of the year preceding the respective directive's transposition deadline. E.g., for the CRD IV, the transposition deadline is end of 2013 such that we use data as of 2012, respectively 2011 for the regulatory indices.

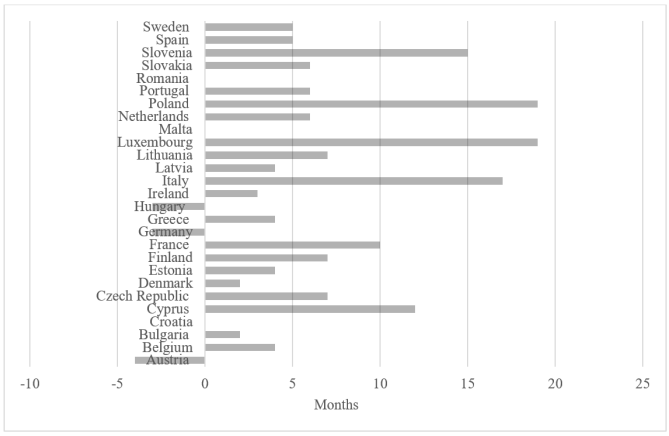
Table OA8: List of banks in event analysis

Name of the bank	Country
BKS BANK AG	Austria
OBERBANK AG	Austria
RAIFFEISEN BANK	Austria
ERSTE GROUP BANK AG	Austria
BANK FUER TIROL UND	Austria
KBC GROUP NV	Belgium
BULGARIAN AMERICAN	Bulgaria
CENTRAL COOPERATIVE	Bulgaria
FIRST INVESTMENT	Bulgaria
KARLOVACKA BA	Croatia
ISTARSKA KREDITNA	Croatia
JT BANKA DD	Croatia
ZAGREBACKA BANKA	Croatia
HPB DD	Croatia
BANK OF CYPRUS	Cyprus
HELLENIC BANK PUBLIC	Cyprus
KOMERCNI BANKA, A.S.	Czech Republic
MONETA MONEY	Czech Republic
LOLLANDS BANK A/S	Denmark
DANSKE A	Denmark
RINGKJ. LANDBOBANK	Denmark
SYDBANK A/S	Denmark
DANSKE BANK A/S	Denmark
KREDITBANKEN AS	Denmark
LAN & SPAR BANK A/S	Denmark
A/S MONS BANK	Denmark
FYNSKE BANK	Denmark
DJURSLANDS BANK A/S	Denmark
HVIDBJERG BANK A/S	Denmark
JUTLANDER BANK	Denmark
JYSKE BANK A/S	Denmark
SPAR NORD BANK	Denmark
LHV GROUP AS	Estonia
AKTIA BANK PLC	Finland
ALANDSBANKEN ABP	Finland
STE. GENL. DE FRANCE	France
NATIXIS	France
BNP PARIBAS SA	France
CREDIT AGRICOLE SA	France
COMMERZBANK AG	Germany
COMDIRECT BANK AG	Germany
DEUTSCHE POSTBANK AG	Germany
DEUTSCHE PFA	Germany
DEUTSCHE BANK AG	Germany
NATL BANK OF GREECE	Greece
ATTICA BANK SA	Greece
ALPHA BANK SA	Greece
EUROBANK ERGASIAS SA	Greece

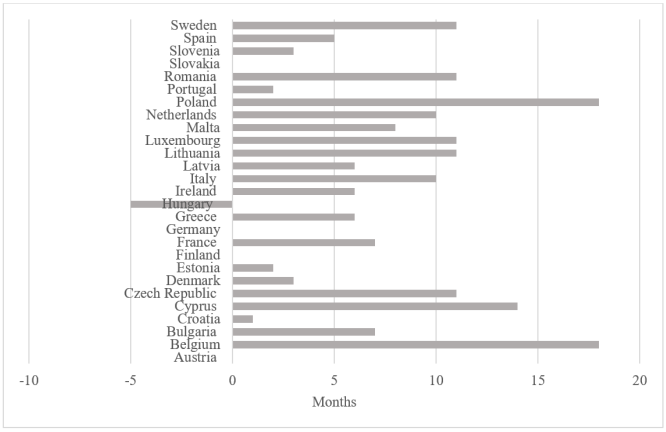
Continued on next page

Table OA8 – *Continued from previous page*

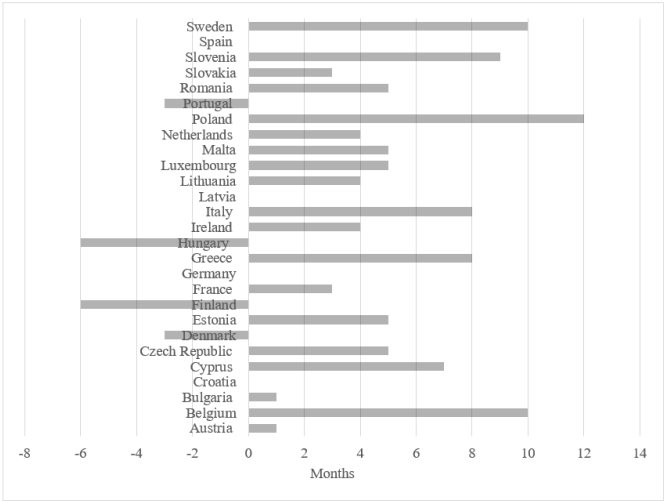
Name of the bank	Country
PIRAEUS BANK	Greece
FINECOBANK	Italy
BANCO BPM SPA	Italy
CREDITO EMILIANO SPA	Italy
BANCO DESIO BRIANZA	Italy
BANCA IFIS SPA	Italy
BANCA PICCOLO	Italy
BANCA POPOLARE	Italy
BANCA MONTE PASCHI	Italy
BANCA CARIGE	Italy
MEDIOBANCA SPA	Italy
UNICREDIT SPA	Italy
INTESA SANPAOLO SPA	Italy
BPER BANCA SPA	Italy
UNIONE DI BAN	Italy
BANCO DI SARDEGNA	Italy
SIAULIU BANKAS AB	Lithuania
ABN AMRO BANK	Netherlands
ING GROEP N.V.	Netherlands
VAN LANS	Netherlands
BANK OCHRONY	Poland
BANK HANDLOWY	Poland
ING BANK SLASKI SA	Poland
IDEA BANK SA	Poland
GETIN HOLDING SA	Poland
MBANK	Poland
POWSZECHNA KASA	Poland
GETIN NOBLE BANK SA	Poland
BANK MILLENNIUM SA	Poland
ALIOR BANK SA	Poland
BNP PARIBAS BA	Poland
BANK PEKAO S.A.	Poland
SANTANDER BANK	Poland
BANCO COMERCIAL PORT	Portugal
BANCO BPI, S.A.	Portugal
BRD GROUPE SOCIETE	Romania
BANCA TRANSILVANIA	Romania
ABANKA VIPA	Slovenia
BANKINTER S.A.	Spain
BANKIA SAU	Spain
BANCO SABADELL	Spain
CAIXABANK	Spain
BANCO SANTANDER SA	Spain
BANCO BILBAO VIZCAYA	Spain
LIBERBANK SA	Spain
SV. HANDELSBANKEN AB	Sweden
SKANDINAVISKA ENSK	Sweden
SWEDBANK AB	Sweden



(a) CRD IV delay (December 2013 – date of main law)



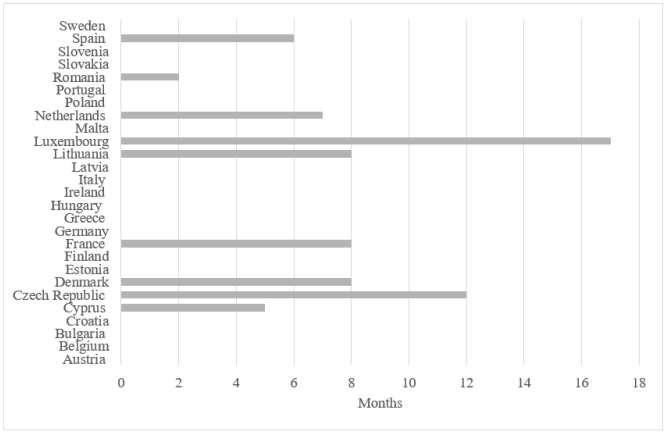
(b) BRRD delay (December 2014 – date of main law)



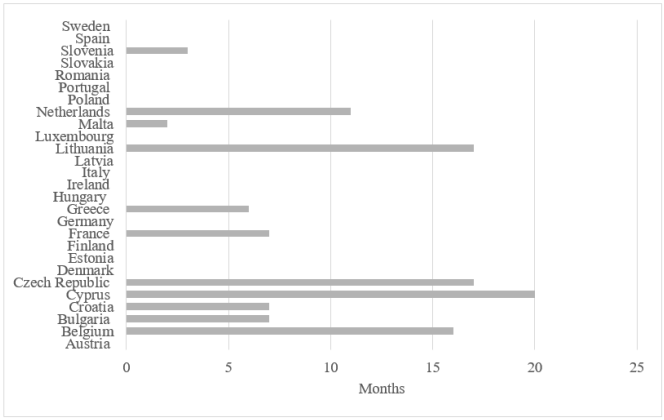
(c) DGSD delay (July 2015 – date of main law)

Figure OA1: Implementation delays: Time span between transposition deadline and country-specific law date

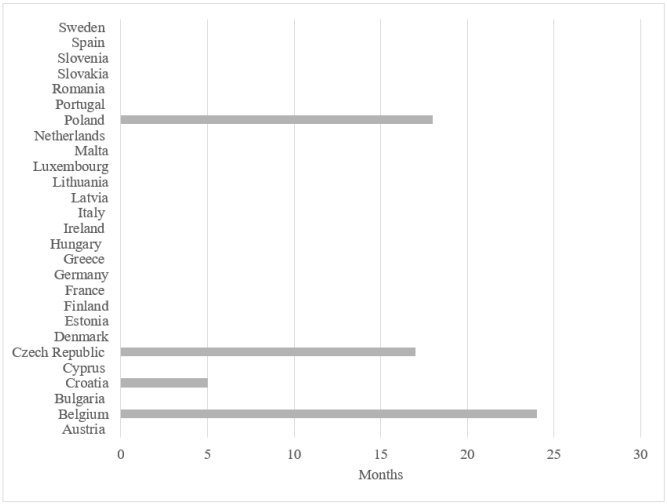
Notes: This figure shows the implementation delay for each member state for the three directives calculated as the number of fully passed months between the transposition deadline in December 2013 and the date at which the member state published the main law on the directive Source: EURLex and own calculations.



(a) CRD IV



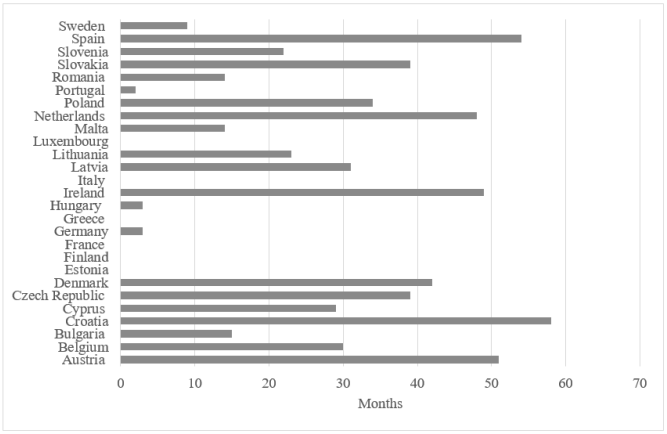
(b) BRRD



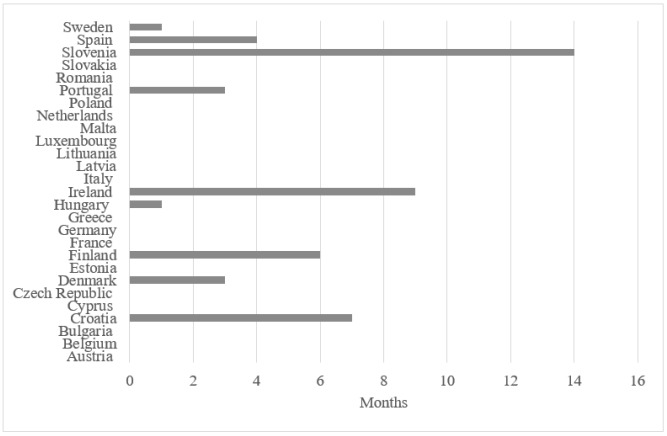
(c) DGSD

Figure OA2: Implementation duration: Time span between first date of legal document on directive and date of main law

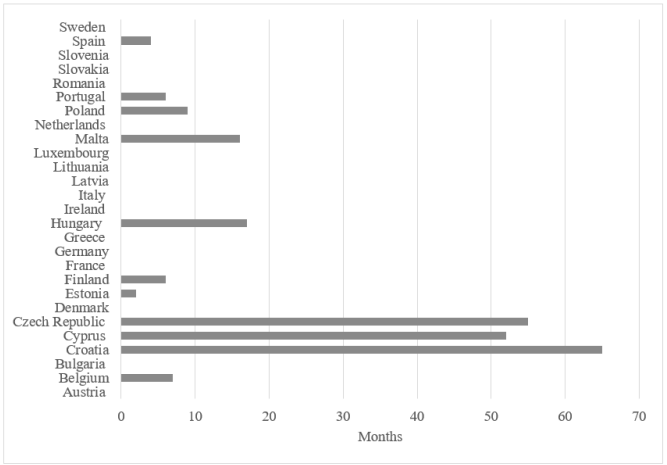
Notes: This figure shows directive implementation duration for each member state. The panels show the difference in fully passed months between the publication date of the first legal document related to the directive and the date of the main law. Source: EURLex and own calculations.



(a) CRD IV



(b) BRRD

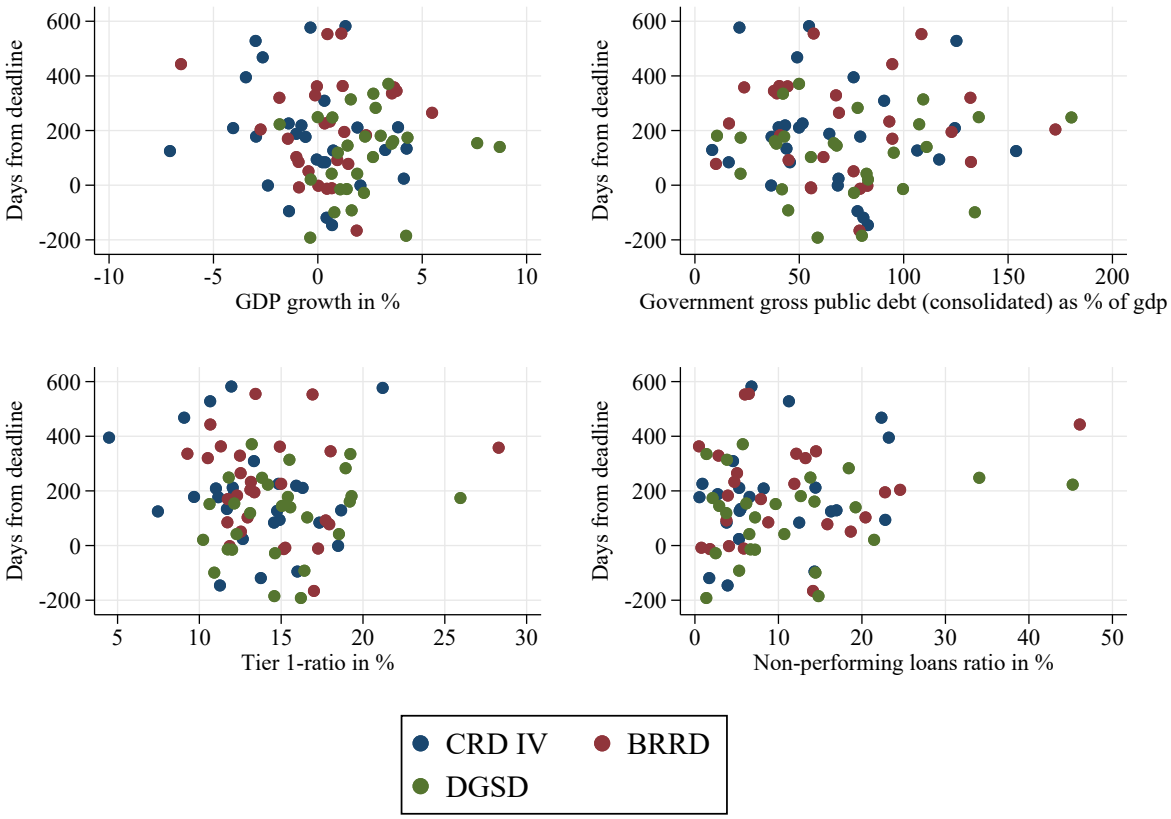


(c) DGSD

Figure OA3: Implementation duration: Time span between date of main law and date of the last legal document

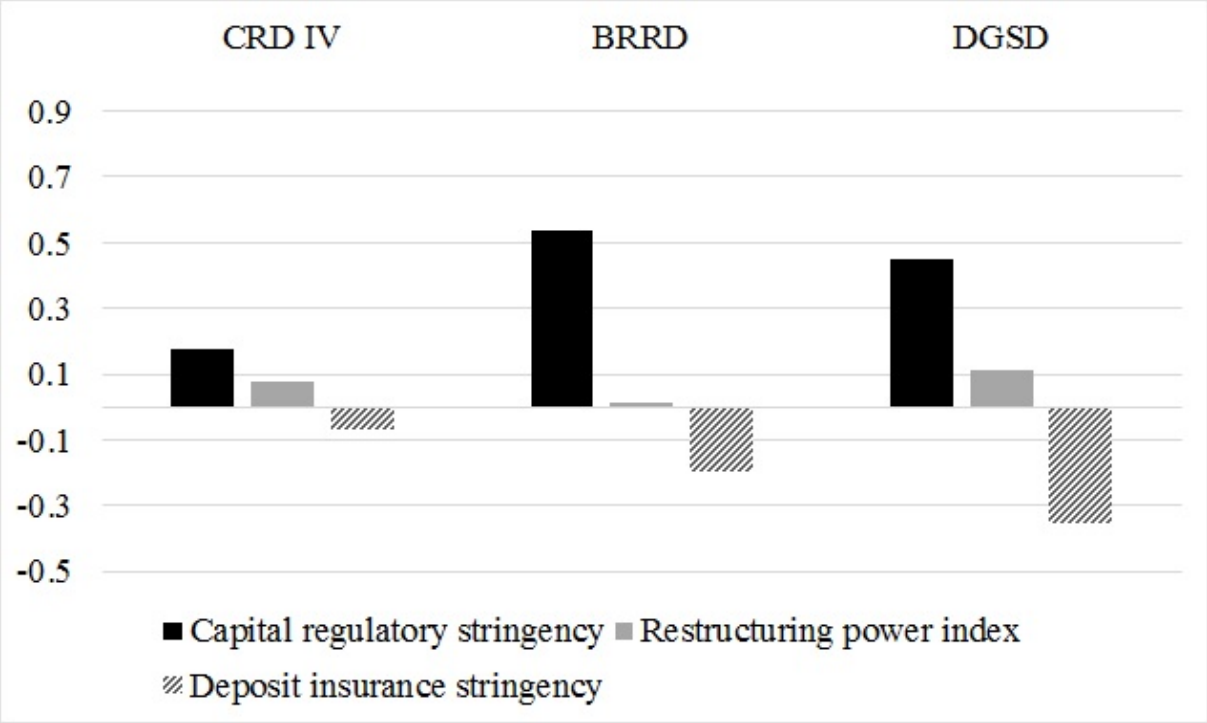
Notes: This figure shows directive implementation duration for each member state. The panels show the difference in fully passed months between the date of the main law and the publication date of the last legal document related to the directive. Source: EURLex and own calculations.

Figure OA4: Implementation delay versus banking system health



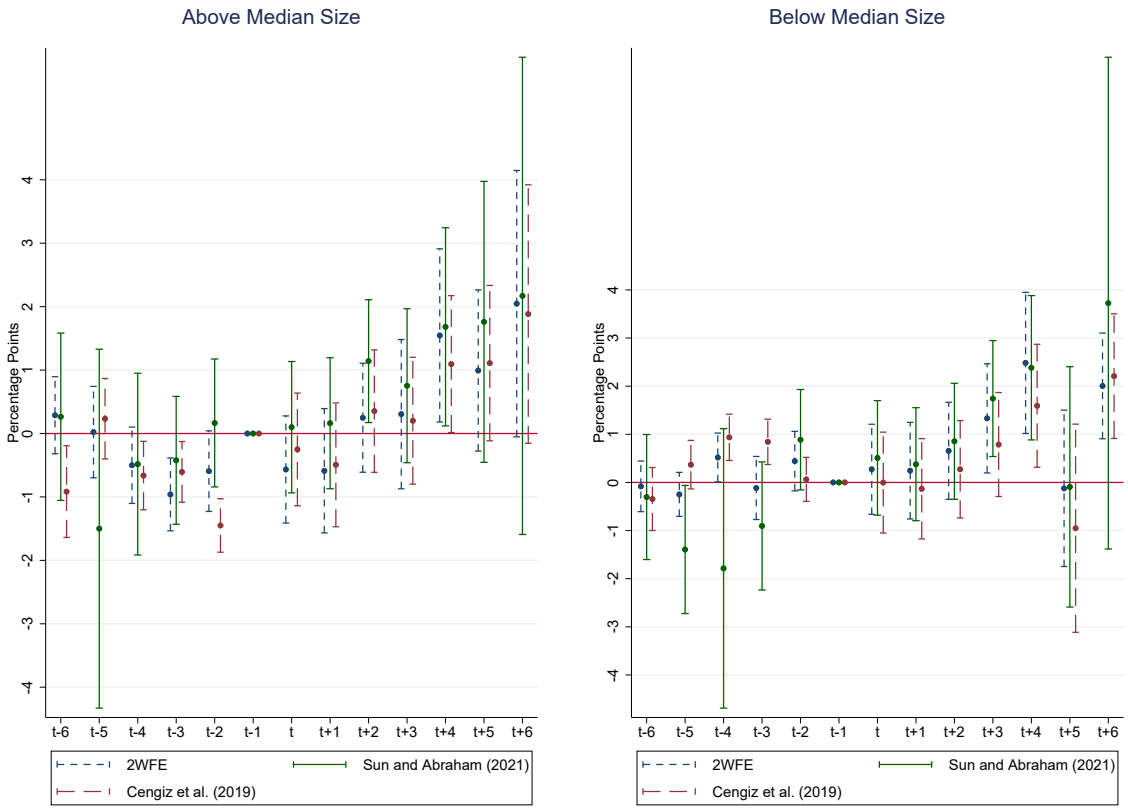
Notes: This figure shows scatter plots between the three directives' implementations delays across countries and variables related to the stance of the banking sector. Implementation delay is defined as the difference (in days) between a country's c national implementation of the law and the EU's transposition deadline. The country-level controls are defined as shown in Table 2 whereas we use values as of the year preceding the respective directive's transposition deadline. E.g., for the CRD IV, the transposition deadline is end of 2013 such that we use data as of 2012.

Figure OA5: Correlations between delay and regulatory indices



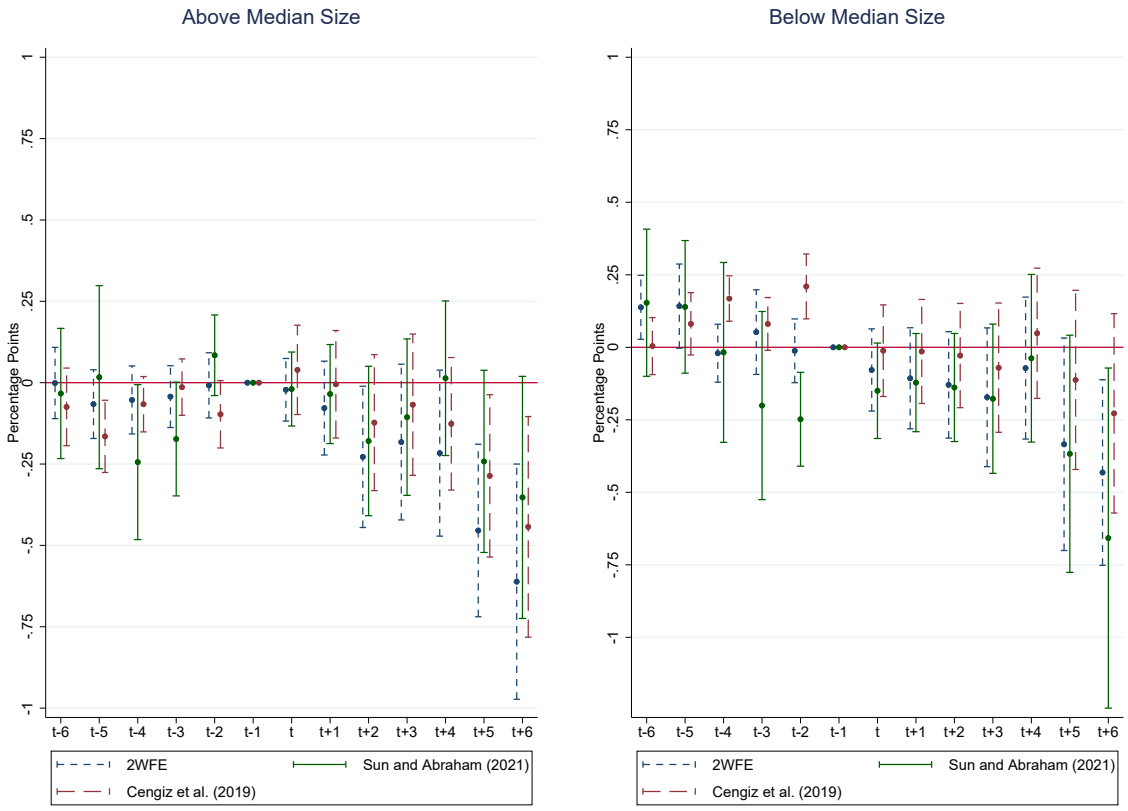
Notes: This figure shows correlation coefficients between the three directives' implementations delays and variables related to the stance of the banking sector. A directive's implementation delay is defined as the difference (in days) between a country's c national implementation of the law and the EU's transposition deadline. The country-level controls are defined as shown in Table 2 whereas we use values as of 2011 for the regulatory indices.

Figure OA6: Heterogeneous treatment effects conditional on bank size on cost of equity



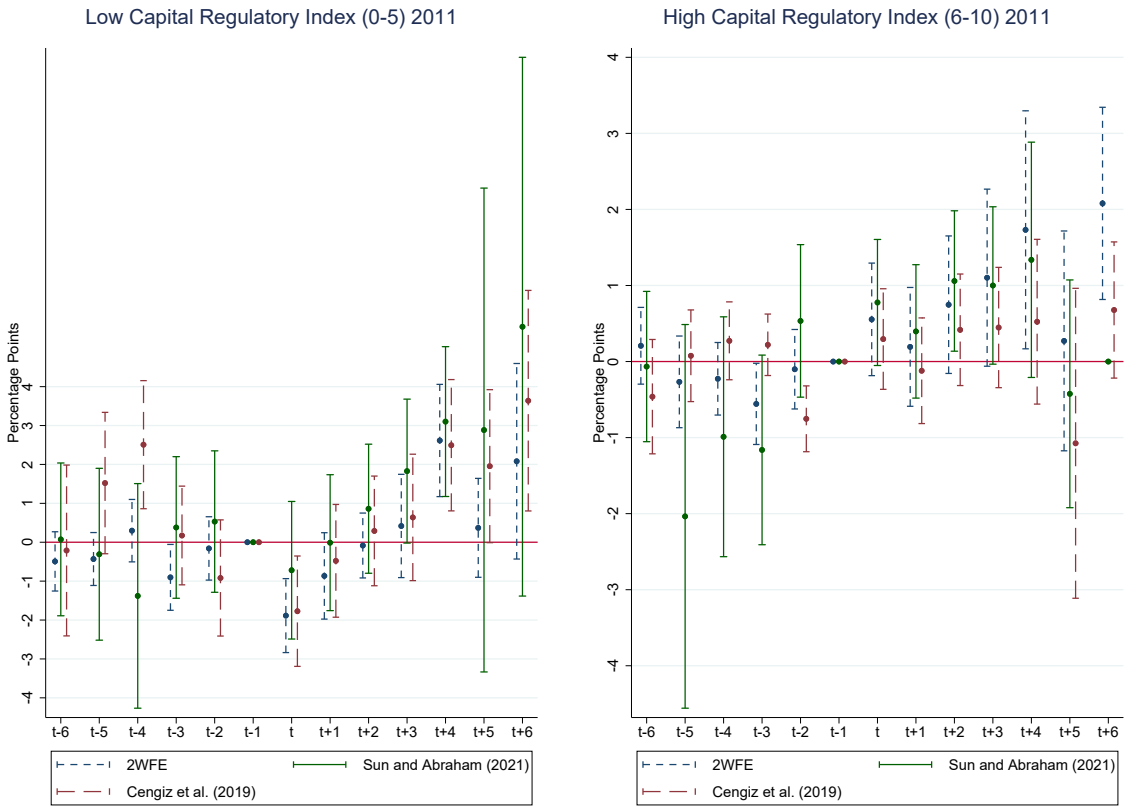
Notes: This figure represents the dynamic impact of the CRD IV on the Cost of Equity of banks conditional on whether the bank is above the median of the size distribution (Total Assets) over the sample period. It reports the results of three different estimators: TWFE, Sun and Abraham (2021), and Cengiz et al. (2019). The regression specifications in equation (1), (2), and (3) are extended to include an interaction with an indicator for banks above median size. The two graphs for each directive report the dynamic marginal effects of treatment conditional on whether the bank is above the median (left) or not (right). The dependent variable is Cost of Equity (in %). The sample includes all banks listed in Table OA8. The observation period includes the seven quarters before and six quarters after publication of the national law for each of those banks. Standard errors are clustered at the bank level. Coefficient estimates are surrounded by 90% confidence bands.

Figure OA7: Heterogeneous treatment effects conditional on bank size on cost of debt



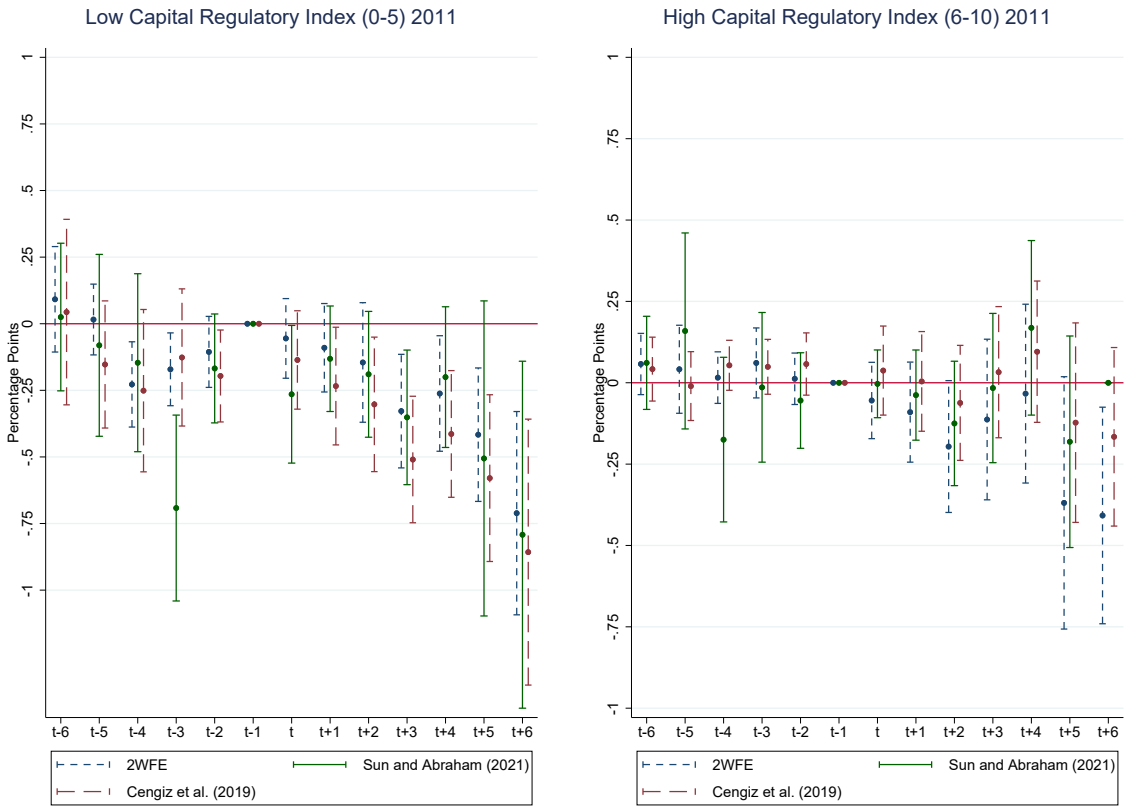
Notes: This figure represents the dynamic impact of the CRD IV on the Cost of Debt of banks conditional on whether the bank is above the median of the size distribution (Total Assets) over the sample period. It reports the results of three different estimators: TWFE, Sun and Abraham (2021), and Cengiz et al. (2019). The regression specifications in equation (1), (2), and (3) are extended to include an interaction with an indicator for banks above median size. The two graphs for each directive report the dynamic marginal effects of treatment conditional on whether the bank is above the median (left) or not (right). The dependent variable is Cost of Debt (in %). The sample includes all banks listed in Table OA8. The observation period includes the seven quarters before and six quarters after publication of the national law for each of those banks. Standard errors are clustered at the bank level. Coefficient estimates are surrounded by 90% confidence bands.

Figure OA8: Heterogeneous treatment effects conditional on ex-ante regulatory stringency on cost of equity



Notes: This figure represents the dynamic impact of the CRD IV on the Cost of Equity of banks conditional on whether the bank reside in countries with high or low regulatory stringency. It reports the results of three different estimators: TWFE, Sun and Abraham (2021), and Cengiz et al. (2019). The regression specifications in equation (1), (2), and (3) are extended to include an interaction with an indicator for low regulatory stringency (i.e., a score below 6). The two graphs for each directive report the dynamic marginal effects of treatment conditional on whether the bank is in a low stringency country (left) or not (right). The dependent variable is Cost of Equity (in %). The sample includes all banks listed in Table OA8. The observation period includes the seven quarters before and six quarters after publication of the national law for each of those banks. Standard errors are clustered at the bank level. Coefficient estimates are surrounded by 90% confidence bands.

Figure OA9: Heterogeneous treatment effects conditional on ex-ante regulatory stringency on cost of debt



Notes: This figure represents the dynamic impact of the CRD IV on the cost of debt of banks conditional on whether the bank reside in countries with high or low regulatory stringency. It reports the results of three different estimators: TWFE, Sun and Abraham (2021), and Cengiz et al. (2019). The regression specifications in equation (1), (2), and (3) are extended to include an interaction with an indicator for low regulatory stringency (i.e., a score below 6). The two graphs report the dynamic marginal effects of treatment conditional on whether the bank is in a low stringency country (left) or not (right). The dependent variable is Cost of Debt (in %). The sample includes all banks listed in Table OA8. The observation period includes the seven quarters before and six quarters after publication of the national law for each of those banks. Standard errors are clustered at the bank level. Coefficient estimates are surrounded by 90% confidence bands.

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