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Market reaction to EU CRD IV regulation in the banking industry☆

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ABSTRACT

This paper aims to provide evidence on the market reaction to the EU CRD IV regulation announcements in the EU banking industry and examine their determinants at the bank and country levels. EU CRD IV came up in the aftermath of the 2008 financial crisis, and it is recognized as the most notable regulatory initiative at the European level to increase overall bank transparency. Employing an event study approach around 15 announcements between 2011 and 2013, we document a negative market reaction on a sample of 145 listed European banks, indicating that transparency increases are borne by shareholders, with detrimental impacts on bank stock prices. We show that investors negatively perceive the introduction of this regulation, with more pronounced reactions for poorly transparent, large, and complex banks located in countries with high exposure to sovereign indebtedness. Our findings contribute to the debate on bank transparency matters.

"Restoring confidence with more transparency."

[Mr. Mario Draghi, Governor of the Bank of Italy, 2009[1]]

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[1] Interview by Mr. Mario Draghi, Governor of the Bank of Italy, with the Wall Street Journal, at the World Economic Forum, Davos, 2 February 2009.

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1. Introduction

It is an open question whether market participants see transparency as main solution to avoid future financial crises in the banking industry. Although recently the tendency is to welcome a shift from the financial (financial statement approach) to the non-financial information (sustainability reports approach), nowadays financial transparency remains the most important ingredient of a recipe to establish bank stability and resilience (Giannetti, 2007).[2] In this study, we examine how investors responded to a new regulation requiring banks to increase the level of transparency by respecting new and stricter (than in the past) requirements about capital, liquidity, risk exposure, compensation, and, more broadly, governance items. We present the first empirical analysis of how stock markets respond to the new European Capital Requirements Directive (CRD IV) '*Access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms*', adopted in 2013 as the most notable regulatory change affecting the European banks after the 2008 financial crisis within the sovereign debt crisis.[3] We document, on average, a negative market reaction, indicating that investors see no marginal potential benefits from the passage of the CRD IV regulation.

Notwithstanding capital regulation is surely a cornerstone of the banking regulatory framework, the main purpose of CRD IV package was to address for the first time a comprehensive set of rules dedicated to EU banks' financial stability by promoting higher levels of transparency. In light of the financial crisis within the industry, the issue of regulation has taken center stage. Particularly, banks were criticized to be not transparent, and regulators enhanced the absolute need to fight bank opacity, as an important factor in trust erosion. Without sufficient transparency, investors, and further stakeholders, are unable to hold banks accountable for risky practices and promote the growth of healthy, sound, and socially responsible financial institutions. Transparency is defined as key to market discipline in the banking sector by allowing a decrease in equity return volatility and improving supervisors' view of the risk and relative performance of the bank. One of the main lessons from the 2008 financial crisis was that the lack of transparency by banks magnified uncertainty about the underlying value of assets and off-balance sheet exposures to structured credit products, which led to considerable reluctance by counterparties to trade and further fueled the market turmoil.[4] At that time many banks experienced liquidity shortages, and investors could not assess which banks had significant payment problems. As banks had relevant links to each other, this caused confidence problems and contributed to stress in the financial system.

Therefore, complying with these new rules of CRD IV has the potential to affect bank valuation. Regulatory strictness plays an important role in enforcing financial reporting transparency. Thus, stringent capital and liquidity standards are much more associated with better regulatory outcomes, which in turn enforce reporting transparency (Acharya and Ryan, 2016; Granja, 2018; Costello et al., 2019). After all poor transparency is risky for banks, especially when investors and depositors, based on limited information, cannot distinguish between healthy and unhealthy banks, increasing the bank contagion risk (Bowen and Khan, 2014). Yet, recent theories, such as Dang et al. (2017), emphasise the benefit of opacity in allowing banks to provide liquidity. That is, banking disclosure could also lead to unwelcome effects, such as releasing proprietary information, reduced risk-sharing, coordination of failures, and decreased production of private information and private informativeness (Goldstein and Sapra, 2013). Punctual and accurate disclosure could indicate widespread problems, leading to bank runs and contagion effects (Bryant, 1980; Diamond and Dybvig, 1983; Tadesse, 2006).

If we could hypothesize to expect that more information helps investors to know more about banks' capital, liquidity, risk exposure, compensation and other governance aspects, an overall regulatory request to do more disclosure could incentivise banks to undertake risk-shifting, incurring higher funding costs that go against shareholders' interest. In the light of these considerations, we test whether investors perceived as a benefit (cost) the announcements of CRD IV regulation for more transparency in the European banks, since this emerging type of new information empowers civil society to influence banks' actions through public pressure.

To examine how market participants react to CRD IV regulation, we use a sample of 145 EU-listed banks by employing an event-study methodology and exploit 15 official announcements by the EU institutions between 2011 and 2013 (Armstrong et al., 2010; Joos and Leung, 2013; Bowen and Khan, 2014; Khan et al., 2018). Our initial set of tests points toward negative stock price reactions to the announcements of CRD IV introduction. After these first findings, we decided to disentangle stock price reactions as announcements concerning several banking aspects from those that exclusively address to EU banks a new disclosure, such as the Country-by-Country Reporting (CbCR) as witnessed in prior research (Dutt et al., 2019).[5] In this case we do not find any reactions. Aware that an event-study methodology is not without challenges, we run a further set or robustness tests to validate our first results, also using

[2] For example, the following Directive 2014/95/UE requires large companies, including banks, to meet minimum requirements for non-financial disclosure, including information on environmental risks and strategies to address them. However, despite these efforts, there is a risk that banks may engage in "environmental window dressing," which involves increasing the environmental disclosure in their financial reports without acting as environmentally responsible lenders.

[3] Banks and investment firms – prudential supervision | EUR-Lex (europa.eu).

[4] The 2008 financial crisis taught us that bank transparency matters. This topic has emerged also recently in the aftermath of the 2020 Covid-19 health emergency. The month of March 2023 was in the news due to the collapse of Silicon Valley Bank and Credit Suisse. While SVB collapse was the second-largest failure since the 2008 financial crisis, CS bank, after several years of scandals and mismanagement, was a further important failure, because it was among the world's largest wealth managers, and one of 30 global systemically important banks, whose bankruptcy could threaten the stability of the whole financial system. During the Pandemic crisis, we assist to a relaxation of rules and adoption of relief measures to overcome the impact of the real sector turbulence in the banking industry. Transparency was no more the priority in the banking agenda by lowering monitoring activities.

[5] Specific regulation requires (new) information to be made public to stakeholders (e.g., segment disclosure, uncertain tax positions, etc.). European banks were the first worldwide to join to this new mandatory disclosure on a country-by-country basis (Hasegawa et al., 2013; Hope et al., 2013; Dyreng et al., 2016; Hoopes et al., 2018; Overesch and Wolff, 2021).

placebo events to avoid any concerns in anticipating effects. Interestingly, we also find more pronounced reactions for banks expected to become transparent (poorly transparent banks). This evidence, corroborated by an OLS panel regression analyses of banks' cumulative abnormal returns determinants, is consistent with the expectation of investors impounding the impending costs of transparency into stock prices. The effectiveness of regulation depends not only on the written rules but also on how regulators and the banks they regulate enforce and adhere to them. Thus, we additionally investigate whether specific bank and country conditions are associated with the detected market reactions in favour of establishing bank transparency. We identify as country characteristics those linked to the enforcement actions – regulatory risk, enforcement power, and sovereign indebtedness exposure – and as bank characteristics a group of large and complex banks with many foreign branches and subsidiaries spread worldwide that anticipate information required by CRD IV (Prior CbCR disclosure). We find that observed capital market reactions penalize banks when they are poorly transparent, large, and complex, and simultaneously incorporated in countries that drifted into a severe crisis as anxiety about their high indebtedness making difficult to refinance their outstanding debt.

Our work contributes to the literature in at least two ways. First, we provide estimates on the appropriateness of increasing bank transparency through an exhaustive set of new rules dedicated to the EU banking industry. We assessed the reaction of banks' stock prices by employing an event study based on the main significant steps toward the most important regulation for the EU banking system after the global financial crisis. This study contributes to the debate of regulators and academic institutions about implementing transparency rules in a weak banking system still struggling with the severe consequences of a financial crisis. Besides the papers by Leuz and Wysocki (2016) and Bischof et al. (2023) on the controversial cost-benefit relation of disclosure regulation to gain higher levels of transparency, our work shows that complying with proprietary costs in disclosing specific information during the post-crisis period prevails over the benefits of a future increase in transparency. Although the transparency regulation could result from a reaction to a crisis occasioned by deep opacity, transparency remains a good tool for preventing further crises rather than merely recovering from them (Beltratti and Stulz, 2012). Huizinga and Laeven (2012) find that banks' financial statements can offer a distorted view of their financial health, especially in times of distress, because of non-adherence to the spirit of accounting rules and regulatory forbearance. This is also confirmed in the second stage, where we find that these banks suffer in costs when they are in financial distress and are large and complex. Particularly, complexity impedes timely regulatory intervention and disposition of financial firms (Herring and Carmassi, 2010), and not lastly, increases systemic risk and worsens information and incentive problems within organizations.

Second, our paper complements prior studies that document that a negative market reaction to a regulation for higher levels of transparency at the corporate and bank levels does not mean this regulation is invalid concerning its purpose. It could represent a real shift from the shareholders to the stakeholders' value (Hombach and Sellhorn, 2019; Healy and Serafeim, 2020). Transparency is advocated by many stakeholders nowadays because bank failures generate important social welfare costs. Transparency regulation, different from opacity, could exacerbate the relationship between shareholders and managers, where the latter group could be intimidated by regulation despite shareholders' interests, like higher profits and dividends (Beltratti and Stulz, 2012; Minton et al., 2014). Furthermore, cross-country characteristics matter (La Porta et al., 2006). Bank transparency based on regulation can be achieved when, generally, there are more control and monitoring activities at the country level to protect shareholders' rights. Nevertheless, this effect dissipates when banks are poorly transparent and too fragile because of the sovereign debt crisis.

However, our study is affected by some limiting aspects of generalisability. Indeed, CRD IV is an EU-unique regulatory package globalizing Basel III pillars (already announced in 2010), the activities of banks and investment funds in different countries, and compensation experienced differently in other countries (James and Quaglia, 2019).[6] Consequently, we leverage that investors' attention is higher when they are sure the regulation will be adopted and promulgated officially at the EU country level.

The remainder of this paper is organized as follows: In Section 2, we describe the institutional background. Section 3 develops the hypotheses based on theory and prior empirical evidence. Section 4 describes the methodology, data, and sample selection. Section 5 provides the main empirical results and the results of the robustness tests. Finally, in Section 6, conclusions, limitations, and policy implications appear.

2. Institutional background

CRD IV is the most extensive regulatory change package of all time for the European banking industry. This package, including 'Basel III: Finalising post-crisis reforms', is the most comprehensive revision of supervisory provisions since the introduction of Basel II in 2006. Thanks to CRD IV, there is a shift from a unidimensional type of world where you have only capital as a prudential reference to multi-dimensional regulation and supervision, where you have capital, liquidity, and the leverage ratio. Moreover, this directive introduces for the first time new important rules covering the items of remuneration, enhanced governance, diversity, new disclosure regarding the activities of banks and investment funds in different countries, systemic risk buffer and other buffers. All these aspects

[6] The Bank of England and the Financial Services Authority allied with US and Swiss counterparts, adopting "trench warfare" to push for a stricter definition of capital, higher capital requirements, new liquidity rules and the introduction of a leverage ratio. As the debate shifted to the EU level, the Bank of England was determined to ensure that the rules were implemented in full. Worryingly, however, the European Commission's draft proposal for implementing Basel III, through the CRD IV, threatened the Bank's objectives in two respects. First, the CRD IV was significantly less stringent than Basel III. At the insistence of France and Germany, capital definitions were to be diluted to allow state support ("silent participations") and insurance subsidiaries ("double counting") to be excluded in the calculation of regulatory capital. Second, the Commission's insistence on "maximum harmonisation" would prevent the UK Financial Policy Committee from imposing higher capital requirements on UK retail banks than international or EU standards, rendering the new body "completely toothless".

should converge in gaining an enhanced transparency to avoid new future financial crises.[7] Focusing on the European post-crisis response and recovery periods in the aftermath of the 2008, the priority was to establish a new equilibrium grounded on more efficient rules to protect investors' trust and the safety of deposits. Differently from other sectors, the banking regulators perceive a crisis as an outcome of an inefficient regulatory setting, the architecture of which should be revised or completely renewed.[8]

We focus on the period starting from 2011, passing through the official announcement on the morning of 26 July 2012 by the ECB President, Mr. Mario Draghi, when he announced the need to make all possible efforts to reactivate banking lending activity as a main support for real-economy growth. Doubtless, this post-crisis period was characterized by an unprecedented effort to issue and employ a new regulatory regime for the EU banking industry. Consistent with these intentions, the European Commission promoted enhanced transparency's role in regaining investors and, more broadly, citizens' trust in the financial sector (European Commission, 2013).[9] Thus, in 2013, the European Directive CRD IV, 'Access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms', accompanying Capital Requirements Regulation (CRR) Regulation EU No 575/2013, was developed with the main purpose of implementing the Basel III standards into EU law, including capital, liquidity, and leverage requirements and new provisions regarding corporate governance and remuneration.[10] CRD IV aims to ameliorate the banking sector's ability to absorb financial and economic stress, risk management, and governance shocks and to strengthen banks' transparency and disclosure. The Basel Committee on Banking Supervision reviewed the old requirements and simultaneously developed minimum requirements to be applied to banks worldwide on a proportionality principle, whereby larger and more complex banks must disclose more information. In detail, following Pillar 3, the regulator asks banks to disclose information about their operations so that the bank's risk profile could be assessed, increasing transparency. The focus is on areas such as credit, market, liquidity, and operational risks. Thus, an important part of the review concerns liquidity risk, with new disclosure requirements on banks' short-term (LCR) and long-term (NSFR) solvency. At the same time, a further regulatory initiative on mandatory geographic disclosures requires public disclosure of important tax, operational, and financial metrics on a country-by-country basis for all financial institutions. European banks were the first worldwide to join to this new mandatory disclosure on a country-by-country (CbCR disclosure) basis wishing an immediate impact on banks' tax avoidance if banks anticipate public scrutiny (Hasegawa et al., 2013; Hope et al., 2013; Dyreng et al., 2016; Hoopes et al., 2018; Overesch and Wolff, 2021).[11] Among the CRD IV law process debated at length at the European institutions, we could identify 15 events corresponding to the announcement of every single regulatory step from 2011 to 2013 based on what the legislative observatory of the European Parliament presents (see Appendix I).

Recent literature focuses on CRD IV regulation in the EU banking sector, providing important observations about the effects on geographic segment reporting (Brown et al., 2019), transparency for lowering tax avoidance (Overesch and Wolff, 2021), income shifting and tax avoidance (Joshi et al., 2020), transparency based on material information content (Dutt et al., 2019), executive turnover, compensation design, and risk-taking (Colonnello et al., 2023). However, there is considerable debate about the merits of transparency through disclosure regulation, especially from an investor perspective since the moment that bankers could have information that investors do not have (Myers and Majluf, 1984).

3. Theory, prior evidence, and hypotheses development

3.1. Regulation for transparency in the banking industry

The 2008 financial crisis in the global financial markets, which originated in the US subprime mortgage segment and quickly spread into other market segments and countries, is considered today as one of the biggest financial crises in history. Investors and depositors became reluctant to extend funding at the height of the crisis due to the uncertainty concerning the risk banks were exposed to. Banks had a huge incentive to enhance the transparency on the risk they held, including contingent and off-balance-sheet exposures. Therefore, regulators' main purpose was to improve transparency, where disclosures on banks' positions should become more comprehensive, detailed, and timelier. Because the complexity to understand how transparency is perceived in the post-crisis period where both accounting and banking rules led to exacerbating the crisis' bad consequences, Bushman (2014) encourages researchers to investigate.

[7] More details regarding CRD IV regulation are provided in this webpage of the European Commission. ec.europa.eu/commission/presscorner/detail/en/MEMO_13_690.

[8] For instance, Mies (2024), by examining the impact of bank opacity on European financial stability, argues that the revised Basel Pillar 3 is characterized by the fact that the European Union has codified the Basel 3 requirements of the Basel Committee into European law as a supranational regulatory framework – the CRD-IV package – that has become mandatory for all EU member states only 2014. 2010 Basel become mandatory only with the adoption of CRD IV since 2014.

[9] The European Commission is the executive branch of the EU. It is responsible for running EU operations and ensuring the correct implementation of EU laws (e.g., enforcing laws by pushing individual EU countries to enforce these laws).

[10] The CRD IV also introduced systemic risk buffers, which could affect bank riskiness. However, these buffers have not been activated in those EU economies hosting most of our sample's banks (Germany, France, Italy, and Spain).

[11] Banks must disclose the following additional information: a) names, nature of activities, and geographic location; (b) turnover; (c) number of employees on a full-time equivalent basis; (d) profit or loss before tax; (e) tax on profit or loss; and (f) public subsidies received by all foreign operations. Joshi et al. (2020) witness that as a transitional arrangement, European banks are only required to disclose (a), (b), and (c) by July 1, 2014. The remaining items were not required to be made public until 2015. Moreover, the additional data requirements (items d to f) only applied to EU Global Systemically Important Institutions in 2014 and were submitted to the European Commission on a confidential basis.

Barth and Landsman (2010) argue that more transparency in banks' financial reporting would probably have mitigated the consequences of the crisis. However, the information disclosure problem is relevant to the banking industry (Frolov, 2007). At one side, the 'Transparency-Stability View' holds that transparency is essential to promote and guarantee financial stability. The increase in transparency generally enhances market discipline, whereas bank transparency increases the sensitivity of the bank's funding terms to the risk it takes (Bushman and Williams, 2012; Bushman, 2014). Risks and monitoring efforts are accurately observable only when transparency increases (Cordella and Yeyati, 1998; Boot and Schmeits, 2000; Nier, 2005). At the other side, the 'Transparency-Fragility View' holds that disclosure regulation may engender banking system instability because it may highlight banks' problems punctually as an indicator of more widespread problems, leading to bank runs or stock market collapse grounded on investors' lost trust (Tadesse, 2006; Guiso et al., 2008; Lins et al., 2017). Taking the two views (Transparency-Stability and Transparency-Fragility) together, we can imagine the complexity involved in a bank's gaining an optimal level of transparency (Moreno and Takalo, 2016) and why researchers still question the role of transparency in the banking industry. The presence of frictions leads to information asymmetries, a tendency for banks to become overly leveraged, and a higher probability of banking crises, all of which reduce social welfare. Regulatory disclosure policies are powerful to intervene and correct for these market failures and increase social welfare. These can act as a complement to prudential regulation, allowing both market participants and regulators to take responsibility for ensuring that bank managers' incentives are aligned with those of their stakeholders, and leaving regulators to address any externalities to which stakeholders do not attend. Following this regulatory power, CRD IV regulation comes up as a need to enhancing transparency and soundness of the European banking sector embracing and ameliorating many issues affecting tremendously European banks during the financial crisis.[12] Based on these considerations, we intend to test our first hypothesis:

H1. CRD IV announcements affect EU-listed banks' stock prices.

3.2. Bank transparency

More transparency makes it easier for investors and other stakeholders to assess the financial position of banks and the risks they take. Contrary to this, opacity leads to weakened market discipline, meaning that participants need more information on the accumulating risks; and it contributes to financial stress and, thereby, to financial crises. However, a lack of transparency does not necessarily mean too little information. Information that is not material may also make it more difficult to assess banks' risks accurately. The information provided must, therefore, be clear, relevant, and understandable to the counterparty, which also requires it to be harmonised and comparable. Generally, the benefits include liquidity (Verrecchia, 2001) and lower cost of capital (Amihud and Mendelson, 1986; Diamond and Verrecchia, 1991; Lambert et al., 2007), while the costs include both the direct costs of gathering and processing information and various indirect costs, such as litigation and proprietary costs (Verrecchia, 1983; Feltham et al., 1992; Evans and Sridhar, 2002).

During the post-crisis period European banks suffer particularly because of their financial distress. EU regulators' reaction was to promote transparency with the risk to unveil what banks could hide until that time. Verrecchia (2001) argues that regulatory disclosures oblige firms to reveal information in good times and bad attracting both investors and depositors' interest. Suppose banks choose accounting policies ex-ante to maximise firm value. In that case, imposing binding constraints on reporting choices through mandated rules will shift disclosure equilibrium, leading to declining firm values. Moreover, the mandated requirements could impose greater costs on firms by increasing contracting costs, compliance costs, proprietary costs, estimation risk, or prospects for opportunistic managerial behavior. As a result, ex-ante managerial choices may be suboptimal; promulgating mandatory regimes could improve social welfare, particularly if the contracting costs they impose are smaller than the private contracting costs of voluntary accounting choices (Watts and Zimmerman, 1986). Alternatively, imposing private costs on banks, particularly those with higher risk exposure, might have the unintended consequence of reducing the attractiveness of public capital markets for those banks, as broadly described (for listed firms) by Hombach and Sellhorn (2019) and Healy and Serafeim (2020). Thus, beyond understanding how markets respond to CRD IV regulation's announcements, we investigate whether the level of bank transparency amplify or mitigate CRD IV shareholder wealth effects. Economic intuition and prior work on regulation, both disclosure and governance ones, suggest that bank-specific characteristics warrant further investigation. We focus on characteristics that capture the motivation behind CRD IV regulation: more transparency, less opacity. CRD IV could represent a shock for less transparent banks, because they may be forced to change their asset-liability sides of their balance sheet to improve liquidity ratios and capital regulatory ratios issuing equity and move toward long-term borrowing. Less transparent banks may benefit of new regulation (greater positive stock price reactions) to become immediately more transparent, but they could also attract greater negative stock price reactions as these banks are more likely to suffer from an increase in proprietary costs, like every time regulatory disclosure is required. Because the direction of this association between CRD IV regulatory intervention and bank transparency is not clear ex ante, we decide to test the following hypothesis:

H2. CRD IV announcements affect EU-listed banks' stock prices when banks are poorly transparent.

[12] Contemporarily, other regulatory initiatives are in progress to be issued and taken effect. The International Accounting Standards Board (IASB) is working on a new international accounting standard, IFRS 9 (replacing the old IAS 39 and taking effect in 2018), which focuses on a new financial instrument classification and a new impairment model, the expected credit loss model, to ensure more timely recognition of credit losses (Dong and Oberson, 2022). A further increase in bank disclosure comes from the EBA stress tests and information about the credit risk exposures of major European banks (Bischof and Daske, 2013; Petrella and Resti, 2013).

3.3. Country characteristics

Country-specific characteristics could also amplify or mitigate shareholder wealth effects. European banks come from different banking regulatory experiences depending on the country where they are headquartered. The overall cost-benefits analysis induced by CRD IV regulation, which aims to improve investor confidence and ameliorate bank-level transparency, must be weighted with the imposed compliance costs at the bank-country-specific level. Countries present different institutional characteristics influencing investors' valuations and their final capital allocation choices (La Porta et al., 2006).[13] The institutional framework includes formal and informal characteristics; the first are more legally based, while the second are more culturally based. We identify three main areas allowing us to capture both dimensions: *regulatory risk*, *enforcement power*, and *financial distress due to sovereign debt exposure*[14].

For example, after the last financial crisis, several countries introduced levies on bank borrowing, such as a non-interest expense in the income statements (Overesch and Wolff, 2021). This happened between 2010 and 2012 in Austria, Belgium, Cyprus, France, Germany, Hungary, Latvia, Portugal, Romania, Slovakia, Slovenia, Sweden, Netherlands, and the U.K. This policy approach aims to discourage banks from taking higher risks and to mitigate the burden on taxpayers, minimising the future reliance on public funds to bail out financial institutions.[15]

Following La Porta et al.'s (2006) investigation of cross-country differences, we consider the level of public enforcement grounded on the quality of a country's legal framework. In general, a weak legal system (i.e., law in the books) can be ameliorated by strong and effective legal enforcement. Therefore, effective courts and legal enforcement can protect investors against managers and controlling shareholders. For this reason, we leverage the public enforcement index, focusing on supervisor characteristics, rule-making power, investigative power, order, and criminality.

The level of financial distress drives another aspect because of the sovereign debt crisis affecting the country in question. European countries like Portugal, Italy, Ireland, Greece, and Spain drifted into a severe crisis as anxiety about their indebtedness made it increasingly difficult to refinance their outstanding debt (Petrella and Resti, 2013). More disclosure about banks' assets and losses can help investors better understand risks and value. Petrella and Resti (2013) show that banks disclosing risk information with lower exposure to sovereign debt experience a better price reaction. Based on these last considerations, we propose the following hypothesis:

H3. Country characteristics like regulatory risk, enforcement power, and sovereign debt exposure are associated with the likelihood of passing CRD IV regulation.

3.4. Bank characteristics

In Mishkin's (2001) '*Too big to fail*' doctrine, we learn that the moral hazard problem becomes more severe for larger banks, which may take on risky investments under a government's safety net. Consequently, if these banks start disclosing their risk exposure, they are penalised much more severely in case of higher risk-taking behaviours (Nier and Baumann, 2006). Banks tend to engage in moral hazard behaviours around the trade-off between bank opacity and financial stability. Particularly, moral hazard arises when managers derive utility from actions that do not coincide with shareholder interests (Jensen and Meckling, 1976; Berle and Means, 1991). Focusing on required disclosure for banks, Granja (2018) shows that the imposition of disclosure regulation for state banks operating in their own state reduces the failure rate of those banks relative to national banks operating in the same state and state banks operating in contiguous states. In our case, we see that CRD IV regulation could impact indistinctly any type of banks in terms of size, from public-listed conglomerates to private small banks, wherever they are located within the EU area.

Examining EU banks' annual reports between 2011 and 2013, we find that some banks voluntarily anticipated a country-by-country report (CbC reports). This group of banks is concentrated on large and complex banks with foreign branches and subsidiaries worldwide (Herring and Carmassi, 2010) located in countries like Germany, Spain, Denmark, France, Italy, Sweden, Portugal, and the Netherlands, and their foreign subsidiaries spread worldwide. These banks have a more sophisticated organization because

[13] Although a regulatory framework for EU-listed banks is much more homogeneous after the EU banking union in 2014, we leverage the main indexes at the country level to capture characteristics and differences between following La Porta et al. (2006). CRD IV package is an EU directive by law that needs to be assessed by national regulation in a further moment at the EU country level once the EU Commission has adopted it. Member states need to implement directives within a predetermined and relatively short time period, resulting in country-specific entry-into-force dates that are spread over 2–3 years. There is variation in when EU countries adopt EU directives because of the differences in countries' legislative processes. Moreover, EU directives apply to all member states. The regulatory act itself is held constant across countries. However, its transposition (i.e., the process by which E.U. member states implement E.U. directives into national law), the design of supervision, the penalties for violations, and the actual supervision are left to the EU member states (Christensen et al., 2016).

[14] Bank- and market-oriented financial structures exist because the civil- and common-law systems entail two fundamentally different contract and law enforcement environments. In this case we concentrate on the level of enforcement and not legal origin, because the first one could shape more investors' preferences and perceptions about the speed to adopt CRD IV regulation at country level. For example, in terms of enforcement, we see that civil-law courts are less effective in settling disputes than common-law courts not because they lack the laws and regulations that common-law courts have but because they are incapable of enforcing the rules that are already in the books. In other words, enforcement level also absorbs the legal origin characteristics.

[15] Regulatory bank levies provide incentives for banks to reduce leverage, as they are typically designed as a tax on liabilities. At the same time, corporate income taxation makes funding through debt more attractive because interest on debt is tax-deductible in most countries while return on equity is not.

they are the first to be pressured to establish foreign subsidiaries in tax havens to satisfy their customers' tax planning needs and to meet investors' expectations to reduce tax expenses (Gallemore et al., 2019). Indeed, these banks become perfect tax planning players, since the moment they are good intermediaries in shifting money from their home countries to subsidiaries or branches abroad. Before some tax scandals, bank secrecy laws assured no disclosure about corporate and individual income to the home country[16] (Huizinga and Laeven, 2012; Bouvatier et al., 2019). Then, under public pressure coming from some activists, these banks started providing geographic segment disclosure before the time CbCR becomes mandatory within the CRD IV. We leverage this subgroup of large and complex banks anticipating disclosure of CbC reports to do further considerations. These banks that could be more transparent because by default they are large banks, providing more information, and more scrutinized, are less pressed to adjust the asset–liability balance sheet composition, and consequently we could expect shareholder wealth effects to be smaller (or not significant) in magnitude. Differently, because bank complexity increases systemic risk and worsens information and incentive problems within organizations, we could expect shareholder wealth effects to be larger (and negatively significant) in magnitude. Nevertheless, if investors could appreciate whenever banks operate in favour of higher profits and dividends through income shifting abroad (Beltratti and Stulz, 2012; Minton et al., 2014), we could expect shareholder wealth effects to be negative (and significant) for banks not disclosing priorly CbCR information and obliged to do it once CRD IV takes effect. Contrary to this, we could expect shareholder wealth effects to be positive (and significant) for banks disclosing priorly CbCR information because it responds to the need to lower any reputational risks sharing the monitoring responsibility among market participants. Based on these last considerations, we build the following hypothesis:

H4. CRD IV announcements do (not) affect EU-listed banks' stock prices when banks anticipate CbC reports.

4. Methodology, data, and sample selection

4.1. Event study

We employ an event study methodology to test our first hypothesis (H1). To estimate the market reaction to the events increasing the likelihood of passage for this disclosure regulation, we compute the cumulative abnormal returns (CAR), relying on the Fama–-French three-factor model. This is consistent with prior works using event studies (Meek, 1991; Haw et al., 2000; Kothari and Warner, 2007) that focus on the behavior of firms' stock prices around corporate events. Event studies generally allow measuring the magnitude of abnormal performance at the time of an event and the impact of this type of event on the firms' claim holders. Based on the efficiency market assumption, we should verify an immediate reaction to the events on the announcement date and no further reaction on subsequent trading days (Brown and Warner, 1985; Fama, 1991). Event studies are recurrent in accounting and finance domains and have been applied to various firm-specific and economy-wide events (MacKinlay, 1997; Cornett et al., 2011; Petrella and Resti, 2013; Gao et al., 2018; Khan et al., 2018).

We identify 15 events during 2011–2013 based on a list of announcements reported on the European Parliament's legislative observatory webpage (see Appendix I). After the first reading of the CRD IV document at the European Parliament (Event 1: September 13, 2011), there were several sessions of debate in Council about the CRD IV transparency goals draft. On March 5, 2013 (Event 12), the EU Council endorsed the outcome of the most recent political trialogue with the European Parliament. Then, on April 16, 2013 (Event 13), the final Directive indicated that from January 1, 2015, the EU member states should require each financial institution to disclose their CbC reports annually. The final act of this Directive was signed on June 26, 2013 (Event 14). The official date when CRD IV entered into force was July 16, 2013 (Event 15). We checked all the initiatives published on websites related to the CRD IV regulation were discussed in the press. We see that for each of these announcements there was a press-conference with main referent of the EU Institutions divulgated online from Brussels and Strasbourg. Fig. 1 realized using Google Trend tool shows an interest in the media about CRD IV regulation' works among the period between 2011 and 2013.[17] We consider all these 15 announcements as notable events for a new regulation dedicated to the transparency for the EU banking industry. All the events are detailed and described in Appendix I.

After identifying the date events, we proceed to compute CAR, adopting a Fama–French three-factor model (Viale et al., 2009) based on the following data: daily stock price, market value, the book value of equity for each listed bank, and the daily price of the main financial market indexes. Following Bruno et al. (2018), we focus on the following short event windows: 3-day (− 1, + 1) and

[16] Tax havens have also attracted the attention of not just investors but also of policymakers during these last years because of the recent taxation scandals such as 'Panama Papers' and 'Bahamas Leaks', both in 2016; 'Swiss Leaks' in 2015; and 'Offshore Leaks' in 2013. In all these cases, banks acted as agents to shelter corporate and private wealth from public scrutiny, involving intermediaries such as lawyers and tax advisory firms. The biggest European banks have facilitated this business, particularly in the direction of three main tax havens (Switzerland, Hong Kong, and Luxembourg), reflecting the disproportion under two corporate perspectives of international tax competition and tax avoidance. Before the EU introduced the CbCR mandatory disclosure for all the European financial institutions, OECD persuaded tax haven countries to agree to information-sharing arrangements. However, the impact of introducing these arrangements remains uncertain and specifically insignificant, examining the foreign portfolio investment in the Cayman Islands and other tax haven countries (Kudrle, 2008).

[17] We check the media's interest in the CRD IV topic relative to EU banks on Google Trends (see Fig. 1) for all the periods considered in our sample. Google Trends data provides an unfiltered sample of search requests made to Google. In addition, it supplies an index for search intensity by topic over the period requested in a geographical area (Brodeur et al., 2021).

Fig. 1. This figure shows the interest in CRD IV covering a time period from January 2010 to December 2015 using the tool Google Trend Search. We can see that there is an increasing interest in this topic starting from the middle year 2011. Numbers of y-axis represent search interest relative to the highest point on the chart in time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term. Thus, before the first announcement of CRD IV regulation in September 23, 2011is quite close to zero.

5-day event windows (-2, + 2) and (-1, + 3) as proposed by Aït-Sahalia et al. (2012), and the estimation period based on 25 working days before the announcement (− 30 to − 5).[18] We then provide estimators for the parameter of the normal return model that is not influenced by the returns around the event. Including the event window in estimating the normal model parameters could lead to the event returns having a large influence on the normal return measure. The normal and abnormal returns would capture the event's impact in this situation. Specifically, Fama and French (1993) developed the three-factor model, assuming that market beta does not encapsulate every dimension of risk borne by an investment. They assessed the impact of additional variables, namely size and book-to-market ratio, to explain stock returns. The model, given in Eq. (1), is estimated as follows. The factors in the three-factor model are market return (R_t^{MKT}), size portfolio return (SMB_t), and book-to-market portfolio return (HML_t):

$$R_{it} = \beta_0 + \beta_1 R_{i,t}^{MKT} + \beta_2 SMB_{i,\ t} + \beta_3 HML_{i,t} + \varepsilon_{it} \quad (1)$$

where

β_0 = the intercept of the model;

$R_{i,t}^{MKT}$ = the excess return on the market;

HML (high-minus-low) and *SMB* (small-minus-big) = average returns on two factor-mimicking portfolios for size and book-to-market equity; and

$R_{i,t}^{MKT}$, $SMB_{i,\ t}$, $HML_{i,t}$ = the results of a multivariate regression of the returns of security *I* on the three factors $R_{i,t}^{MKT}$, *SMB*, and *HML* for the estimation period.

The model estimates the raw returns on the firm's stock, the market returns, the small-minus-big market capitalization portfolio returns (*SMB*), and the high-minus-low book equity/market equity portfolio returns (*HML*). We compute the abnormal returns as a direct measure of an unexpected change in a stock price associated to the event under consideration. An abnormal stock price effect associated with an unanticipated event should be observed if the event has information content. The calculation of the abnormal returns corresponds to the difference between the observed returns and the expected returns obtained with the different model, as

[18] We could not consider longer estimation windows as proposed in other studies employing the event study design, because the list of events included in our design are very close to each other. Consequently, we come up with a solution of a 25-day estimation window.

given in Eq. (2):

$$AR_{it} = R_{it} - E(R_{it}) \tag{2}$$

where AR_{it} is the abnormal return for stock i on day t. EU institutions' announcements represent an exogenous shock in an economic context, as (a) they can significantly change banks' behavior or incentives, and (b) the same banks of our sample are not directly forced to adopt CRD IV and are affected *a priori* by this shock (Atanasov and Black, 2021). Consistent with previous literature, we aggregate the AR_{it} over each event window and finally, calculate the CAR for each bank stock price:

$$CAR_{i,t} = \sum_{t=1}^{n} AR_{it} \tag{3}$$

To test the CAR's statistical significance, we employ a t-test constructed as the ratio of the event CAR and the standard deviation of the pre-event CAR. The latter are defined as the CAR for each three-day window in the pre-event period (Johannesen and Larsen, 2016). In the absence of abnormal returns, the test statistic is typically assumed to follow a unit normal distribution (Kothari and Warner, 2007).[19]

The literature lacks consensus on the choice of estimation method for abnormal returns. We decide to also employ a standard market model, computing first the returns and excess returns as follows:

$$R_{i,t} = \beta_0 + \beta_1 R_{m,t} + \varepsilon_{i,t} \tag{4}$$

where $R_{i,t}$ and $R_{m,t}$ are the daily returns of the bank stock i and the market m, at time t, respectively. We then estimate the abnormal returns and the cumulative abnormal returns following the same approach of the corresponding equations (Eq. (2) and Eq. (3)). We maintain the same parameters for the identification of the estimation window as well as the event-windows. Brown and Warner (1985) stress that short event-window models based on estimation of the security's beta (such as the market model or the capital asset pricing model) do not lead to significantly more precise estimates for the abnormal returns. For these reasons, we estimate cumulative abnormal returns (CAR) following the standard market model and then the cumulative market-adjusted returns (CMAR) using a market-adjusted model. For CMAR, we compute the market-adjusted return (MAR)[20] as the difference between the log return of the security ($R_{i,t}$) and the log return of the proxy for the market portfolio ($R_{m,t}$):

$$MAR_{i,t} = R_{i,t} - R_{m,t} \tag{5}$$

While we compute CAR as the sum of the abnormal returns, CMAR is the output of the sum of the market-adjusted return among the days of each event windows we identify. When we employ the standard market model and the adjusted market model, we use equal-weighted (EW) and market-weighted (MW) portfolios of the bank stocks in our sample. The former weighs all firms equally while the latter weighs firms by their market capitalization. The equally weighted results provide insights about the abnormal returns in the average firm, while the market-weighted results mirror the experience of a large institutional investor who is constrained to allocate funds in proportion to each stock's market capitalization due to liquidity reasons. Using all these methodologies, Fama-French three factor model, standard market model and market-adjusted model, we adopt first as market index the Stoxx Europe 600 as proxy for the market portfolio. This proxy is suggested, because it is less subject to bias than national indices, since the moment that national indices could reflect further country characteristics following where banks are located. We compute CAR and CMAR as the aggregate effect of the CRD IV regulation by considering the total effects and the average of all events over the 15 events, followed by tests for the only events concerning "new disclosure" like the mandatory request of the Country-by-Country reports (Events 11, and 13 – *CbC Disclosure events*).

However, event studies are generally affected by limitations and caveats. First, identifying the correct events is crucial: non-events introduce noise, excluded events reduce power, and both ultimately introduce bias (Armstrong et al., 2010). We acknowledge that we cannot be completely certain that we have identified all events. However, such an omission is more likely to reduce our ability to observe a market reaction and bias our results downwards. Second, we cannot completely remove the possibility that other confounding events drive our results. To mitigate this concern, following Armstrong et al. (2010), we rely on bootstrap simulations to evaluate the significance of the cumulative effect of all 15 events. This step is repeated 800 times. Finally, we run some placebo tests that assume the events considering the CAR and CMAR occur 5 trading days before each of the actual events.[21] These tests show whether the results are driven by a downward trend in returns of bank stocks relative to the market in the days surrounding the events. Moreover, these analyses rule out anticipation effects that may have occurred before the event windows.

4.2. OLS panel regression tests based on bank-country characteristics

We start with a fixed effect panel data regression that exploits variation in investor reactions depending on bank and country factors, since the level of compliance to future rules could vary because of a bank's experienced background and institutional features

[19] We describe in detail all the significance tests employed in this study in Section 5.4. dedicated to the "Robustness tests".

[20] Bradley et al. (2003) highlight that the MAR is free of bias resulting from significant events in the estimation period, which undermines the beta estimation.

[21] These steps ensure that the simulated data represent the distribution of CAR and CMAR under the null hypothesis because they are estimated for nonevent trading days.

of each country's banking system. Panel data models consider time and cases simultaneously, whereas other models have the limitation of only expressing these heterogeneities across units or over time. Moreover, panel data models are better at capturing the heterogeneity involved both in cross-section units and time dimensions, in reducing estimation bias and multicollinearity (Wooldridge, 2010). Thus, we comprehensively investigate the impact of the CRD IV regulation's announcement by modeling the returns and excess returns as a function of transparency and several banks' characteristics as follows to test the second hypothesis (H2):

$$CAR_{(i,t)} = \beta_0 + \beta_1 R2_{(t-1)} + Controls_{(t-1)} + Fixed\ Effects + \varepsilon_t \tag{6}$$

where the variable $CAR_{i,t}$ is the abnormal return measure accumulated over days − 1 to + 1, where day 0 is the event date using as market index Stoxx Europe 600, for bank *i* during year *t* minus stock *i*'s benchmark returns for year *t*. Our main variable of interest is *R2*. We rely on plausible approximations of bank transparency following Chen et al. (2022), where they identify transparency as the adjusted R2 for each bank-year from the regression:

$$Write\ Off_{(t,\ t+1)} = \alpha_0 + \sum_{j=1}^{2} \gamma_j LLP_{(t-j)} + \sum_{j=1}^{2} \beta_j EBLLP_{(t-j)} + \rho \Delta NPL_{(t-1)} + \delta Capital_{(t-1)} + \varepsilon_t, \tag{7}$$

estimated using the bank's observations from year t to year t – 1, where *LLP* is loan loss provisions, *EBLLP* is earnings before loan loss provision at the beginning of year t, Δ*NPL* is the change in non-performing loans in year t-1 from year t, *Capital* is shareholders' equity divided by total assets. Key non-earnings variables (Δ*NPL* and *Capital*) are expected to contain information about asset quality: *NPL* are defined by banking regulators to be loans that are 90-days past due. An increase in *NPL* therefore indicates deterioration in loan quality. *NPL*, computed as the amount of non-performing loans divided by total loans at the end of the year, reflects that if a bank's loan portfolio quality suddenly deteriorates, this could threaten the bank's solvency, affecting bank transparency. Furthermore, *NPL* are less vulnerable to managerial manipulation because of the mechanical definition, and for this reason, they provide material information. *Capital* is also important because it affects managers' incentive for risk-taking and thus potentially contains information about asset quality and future default. Low R2 doesn't necessarily imply that banks are riskier. This is because the R2 measures the proportion of the uncertainty that investors can resolve about banks' future loan portfolio performance. This measure (R2) is important and well-known in finance and accounting literature because it represents a precise and sensitive barometer to value banks for investors and depositors. Finally, we identify poorly transparent banks as a dummy variable equal to 1 when R2 is lower the median, 0 otherwise.

Then, because the overall cost-benefits analysis induced by CRD IV regulation must be driven by the imposed compliance costs at the bank-country-specific level, we decide to test whether country-specific characteristics amplify or mitigate shareholder wealth effects (H3). First, we test the single-country characteristics (*regulatory risk*, *enforcement power*, and *PIIGS countries*) on CAR with the following model:

$$CAR_{(i,t)} = \beta_0 + \beta_1 Cross - country\ characteristics_{(t-1)} + Controls_{(t-1)} + Fixed\ Effects + \varepsilon_t \tag{8}$$

Then, we employ transparency proxy and country characteristics by adding a set of interaction terms as explanatory variables in the following model:

$$\begin{aligned} CAR_{(i,t)} = {} & \beta_0 + \beta_1 R2_{(t-1)} + \beta_2 Cross - country\ characteristics_{(t-1)} + \beta_3 R2_{(t-1)} \\ & * Cross - country\ characteristics_{(t-1)} + Controls_{(t-1)} + Fixed\ Effects + \varepsilon_t \end{aligned} \tag{9}$$

where the variable $CAR_{i,t}$ is the abnormal return measure accumulated over days − 1 to + 1, where day 0 is the event date using as market index Stoxx Europe 600, for bank *i* during year *t* minus stock *i*'s benchmark returns for year *t*. $\beta_1 R2$ indicates poorly transparent banks as a dummy variable equal to 1 when R2 is lower the median, 0 otherwise. The variable β_2 *Cross-country characteristics* reflects three levels of observation. Based on Overesch and Wolff (2021), we identify *regulatory risk* as a dummy variable equal to 1 when EU-listed banks are incorporated in countries with an implemented bank levy to face high regulatory risk starting from 2010 (Austria, Belgium, France, Germany, Portugal, Sweden, and The Netherlands), 0 otherwise. A second proxy to identify country characteristics is *enforcement power* based on the public enforcement index following La Porta et al. (2006), which equals to 1 when the arithmetic mean of (1) supervisor characteristics index, (2) rule-making power index, (3) investigative powers index, (4) orders index, and (5) criminal index is above the average; 0 otherwise. A third proxy is *PIIGS countries*, a dummy variable equal to 1 when EU-listed banks are in Portugal, Italy, Ireland, Greece, and Spain, i.e., the European countries that drifted into severe crisis as anxiety about their high indebtedness made it increasingly difficult to refinance their outstanding debt, 0 otherwise. The variable of our interest is β_3 $(R2_{(t-1)} * Cross - country\ characteristics_{(t-1)})$, an interaction term to capture the incremental effect of poorly transparent banks when they are located in countries with different characteristics on the assessment of CRD IV market reaction.

Examining the EU banks' annual reports between 2011 and 2013, we see that a small group of banks anticipated voluntarily the country-by-country report in 2013, such as before the CRD IV took effect. This sample is composed of 22 large banks (*Prior CbCR disclosure*) headquartered in countries such as Germany, Spain, Denmark, France, Italy, Sweden, Portugal, and the Netherlands, and their foreign subsidiaries spread worldwide. These are large and complex banks, under stakeholders' pressure strongly oriented to preserve social welfare by lowering reputational risks. Consistent with prior research (Horton et al., 2018) that examined the determinants of market reaction to events affecting the likelihood of regulatory passage (in our case, EU CRD IV regulation), we decide to test a further hypothesis (H4) employing the following model:

$$CAR_{(i,t)} = \beta_0 + \beta_1 R2_{(t-1)} + \beta_2 Prior\ CbCR\ disclosure_{(t-1)} + \beta_3 R2_{(t-1)} * Prior\ CbCR\ disclosure_{(t-1)} + Controls_{(t-1)} + Fixed\ Effects + \varepsilon_t \quad (10)$$

where β_2 is a dummy variable equal to 1 if banks have disclosed priorly CbCR information, are large banks and complex given the hundreds or thousands of foreign branches and subsidiaries, and 0 otherwise. β_3 is the variable of our interest, capturing the incremental effect of different levels of bank transparency and disclosing CbCR prior to CRD IV announcements on the market reaction.

Further models have been employed by interacting first the country characteristics with large and complex banks (*Regulatory risk* * *Prior CbCR Disclosure*; *Enforcement power* * *Prior CbCR Disclosure*; *PIIGS countries* * *Prior CbCR Disclosure*) and then by including all explanatory variables and all the interaction terms to verify which combinations of banks and country characteristics could determine investors' valuation.

In all our panel regression models, we control for a number of factors (*Controls*) that are potentially correlated with CRD IV regulatory stock price returns, bank transparency, and country characteristics commonly employed in the banking literature when assessing banks' returns (Bruno et al., 2018). To identify problem banks, bank examiners focus on performance in several areas, including rapid growth, management oversight, risk management, off-balance-sheet exposures, asset quality, allowance for loan, and liquidity (Dal Maso et al., 2018, 2020). To capture these categories, we include the following bank-level variables: *Size* (the logarithm of the total assets) because large banks could be more under the supervisor's lens and thus could be more prone to be more transparent *a priori*. While the likelihood of a run by insured depositors is low, banks can encounter liquidity problems if uninsured depositors run (either through withdrawal or failure to rollover) or if borrowers unexpectedly draw down on credit lines. Hence, we control for: *Deposits* (total deposits to total assets) and *Cashflow* (change of profit before taxes and loan loss provisions divided by total assets at the end of the year). Then, we include *Tier*1 (the total regulatory capital ratio at the end of the year); fees and net commissions (Fee_{Rev}); loan loss allowances (*LLA* : loan loss reserve divided by total assets at the end of the year); loans growth as change in loans ($\Delta Loans$ computed as total loans at $t+1$ minus total loans at t divided by total assets at the end of the year). We include change in ROA (ΔROA, where ROA is computed as profit before taxes plus loan loss provisions divided by total assets at the end of the year) since poor quality management should be less profitable and exhibit lower earnings growth on average. This set of control variables have been selected under the criterion that a rapid or aggressive growth indicates a bank may have increased its exposure to risk and therefore its susceptibility to a sudden change in economic conditions. A further control variable is the percentage of institutional ownership (*Inst_own* %) computed following Asquith et al. (2005) as the sum of shares held by institutions of the institutional ownership of the year 2010 divided by shares outstanding. Prior research finds that banks tend to take more risks when the structure of the ownership is represented by institutional investors for majority (Barry et al., 2011; De Masi et al., 2023). All the control variables are measured as of each calendar year end relative to the CRD IV event dates in the prior year (t - 1) (see Appendix II for detailed definitions of the variables). We winsorize all variables that have the potential to be unbounded at the 1st and 99th percentiles of their empirical distributions. We account for variation in CRD IV regulatory intervention and time trend factors clustering standard errors at the bank and year levels to control for potential bias in the estimates and via the inclusion of several types of fixed effects (Petersen, 2008). The fixed effects account for all time-invariant cross-sectional effects may then be observed or unobserved. We include *year-fixed effects* estimator accounts for all time-invariant factors. We include *bank fixed effects*, which help control for time-independent differences in the different bank business models absorbing any diversification strategies as well as country-specific time-independent factors. To alleviate the possibility that CRD IV adoption announcements may be endogenously determined by other country-specific characteristics and to prevent biasing the coefficient estimates due to unobserved heterogeneity across countries, we also employ *country-fixed effects* for all banks headquartered in a specific country.

4.3. Data and sample selection

We study European banks because they come out very fragile from the 2008 financial crisis in comparison with international peers, making them less prepared than U.S. banks to meet the requirements in Basel III. At that time European banks' uncertainty was due to greater underlying volatility and poor-quality information leading to experience the sovereign debt crisis between 2010 and 2012. Although our empirical work considers listed banks, CRD IV regulation extends to all banks, irrespective of their listing. European banks have a unique heterogeneity in comparison with other banking systems because of their country characteristics making national governments respond differently to the new rules adopted at European level. On the base of the availability data we select the first large listed European banks (145 banks), retrieving such market data as the daily banks' stock price, market value, and book equity value, market capitalization and several European market indices (Stoxx Europe 600 used in the main analyses of the event study, and then replaced by other indices to conduct robustness tests - Stoxx Europe 50, S&P Euro, FTSE Eurotop 100, FTSE Eurofrst100, FTSE Eurofirst 80) from the data source Refinitiv Eikon Thomson Reuters.[22]

The period covers the years 2011–2013 because of the key 15 events leading to the entry into force of CRD IV rules until July 2013.

[22] We restricted our coverage to the 145 largest banks in the EU area in terms of 2010 assets, so smaller (typically regional) banks are not included in the database for these countries (this reduces especially the coverage of the banks active in Germany, Italy, and France). Then, since including bank holding companies can lead to double counting, as both the holding company and the bank itself are often included in Bankscope, we excluded the holding company if the bank itself was represented in the database. The restriction is also determined by the identification strategy about transparency proxy following Chen et al. (2022): the data availability regarding write-offs is mainly for the largest EU-listed banks. For all countries, we cover this way at least 66 % of the banking system in terms of market share (see Table 1 Panel A).

Our event dates refer exclusively to official announcements by the EU institutions that result in proposed or actual changes in CRD IV regulation. This choice is a restrictive, yet plausible, criterion. Any other news and debates regarding the introduction of this regulation are based on and influenced by the debates within the EU institutions and its representatives. The selection of event dates proceeds as follows. First, we use public information from the webpage of the legislative observatory of the European Parliament (data source: Procedure File: 2011/0203(COD) | Legislative Observatory | European Parliament (europa.eu)) to determine all events and dates leading up to the CRD IV regulation. We conduct a media search to ascertain that the events we focus on convey significant information to the market. This media search helps rule out anticipation effects, a key concern for event-study analysis. To this end, we carefully search major international media outlets (e.g., European reports, Financial Times, Plus Media Solutions, Only Strategic Banking news link, Institutional Asset Manager) via LexisNexis for up to 1 week after each of the 15 event dates (see Appendix I).

Then, we download EU banks' annual financial accounting data from Orbis Bank Focus (Bureau Van Dijk). To avoid double-counting, we retain observations only for consolidated financial statements (Dal Maso et al., 2020). We control for location: the selected EU-listed banks all have headquarters in the EU countries affected by the new CRD IV regulation. Finally, we check whether banks included in our sample have foreign subsidiaries, focusing on the availability of the CbCR data. We verify that some EU-listed banks anticipate CbC reports, that become mandatory once CRD IV takes effect. These banks (commercial banks, cooperative banks, and saving banks[23]) are large groups with foreign branches or subsidiaries as reported also in the Orbis Bank Focus database, using consolidated annual reports, and providing CbCR information on banks' official websites. By using the ISIN identifier, we could match our datasets, obtaining a final sample of 2175 observations (on 145 banks), where we identify for each announcement a date event equals to 1 measuring banks' cumulative abnormal returns in a 3-day event window around the event (i.e., (-1, + 1).

Table 1, Panel A reports the sample composition of 145 EU-listed banks based on the country distribution employed in the event study covering 2011–2013 (columns 1 and 2). The countries reporting the largest number of listed banks included in our sample are: Italy, France, Denmark, and Germany. Column 3 reports the number of those banks anticipating the country-by-country reports, with the majority located in Italy. We focus on specific country characteristics fitted with our post-financial crisis period to capture the regulatory environment at country-level. In Column 4, *Regulatory risk* indicates when EU-listed banks are incorporated in countries with an implemented bank levy to face high regulatory risk starting from 2010 (Austria, Belgium, France, Germany, Portugal, Sweden, and The Netherlands). In Column 5, *Enforcement power* indicates the countries where the arithmetic mean of the supervisor characteristics index, rule-making power index, investigative powers index, orders index, and criminal index is above the average (France, Italy, Netherlands, Portugal, and Sweden). In Column 6, *PIIGS* indicates that the EU-listed bank is in Portugal, Italy, Ireland, Greece, or Spain – the countries that drifted into severe crisis as anxiety about their high indebtedness made it increasingly difficult to refinance their outstanding debt.

Table 1, Panel B reports the scores of the legal framework adopted by countries of the EU-listed banks included in our sample, based on the study by La Porta et al. (2006). For each country, we find scores about supervisor characteristics index (Column 1), rule-making power index (Column 2), investigative powers index (Column 3), orders index (Column 4), and criminal index (Column 5). Finally, in Column 6, we compute the index of public enforcement equals the arithmetic mean of all the indexes reported in the prior columns. Each index is detailed in La Porta et al. (2006). We show that the countries with higher scores following the index of public enforcement equal to the arithmetic mean of all the indexes (supervisor characteristics index, rule-making power index, investigative powers index, orders index, and criminal index) are France (0.77), Portugal (0.58), Sweden (0.50), and Italy (0.48).

5. Empirical results

5.1. Event day cumulative abnormal returns by CRD IV regulation

We first provide empirical evidence of the capital market perceptions about the cost-benefit trade-off using banks' cumulative abnormal stock returns surrounding the promulgation of CRD IV regulation (15 announcements – see description in Appendix I). Table 2 (Panel A, Panel B, and Panel C) presents the results of estimating abnormal market reactions (i.e., a test of H1). Panel A reports the results obtained by employing an event study following the Fama–French three-factor model, while Panel B reports the results of the market reaction by employing a standard market model showing the behavior of equal-weighted (EW) and market-weighted (MW) cumulative abnormal returns (CAR). Panel C reports the results of market-adjusted cumulative abnormal returns (CMAR) splitted on equal-weighted (EW) and market-weighted (MW). We compute CAR and CMAR based on one 25-day estimation window (− 30 to − 5), checking not to include any overlapping and confounding events, and several event windows around each announcement and using the Stoxx Europe 600 market index. In Table 2 in Panels A, B, and C, the columns report the results based on different event windows ((− 1, + 1) (-2, + 2) (-1, + 3)), while the rows indicate the way in which CAR (or CMAR) are obtained: 1) total all events, 2) average all events, 3) CbC disclosure events' bucket (events 11 and 13), 4) bootstrapping. Then we indicate the results also by doing some placebo tests anticipating occurring 5 trading days before each of the actual events. In Panel A, concentrating our view around the closest 3-day

[23] We decide to include these EU-listed banks with these business models (commercial banks, cooperative banks, and saving banks), because they reflect different bank characteristics and regulatory environments. Commercial banks are shareholder banks that distribute profits to their shareholders. Therefore, maximizing shareholder value is a common objective of commercial banks. On the contrary, cooperative banks are not strictly profit-oriented. They make limited profit distributions or no distributions at all, and finally they have lower risk-taking incentives. Furthermore, cooperative and savings banks have less cyclical loan loss provisions (LLPs) than their commercial counterparts. For example, Italian cooperative banks' LLPs are less cyclical than Italian commercial banks from 2006 to 2012 (Alessi et al., 2014).

Table 1
Sample selection: EU-listed banks.

Panel A. This table reports the sample composition of 145 EU-listed banks (commercial, saving, and cooperative banks) based on the country distribution employed in the event study covering the period 2011–2013 (see columns 1 and 2). In column 3, we report the mean of the market share computed as the assets of a bank divided by the assets of all banks included in a country (data about banking total assets at the country level retrieved from Consolidated banking data | ECB Data Portal (europa.eu). In cross-border consolidation, information on branches and subsidiaries located (from the reporting country's perspective) outside the domestic market is included in the data reported by the parent institution. In column 4 we report the number of those banks disclosing country-by-country reports before CRD IV takes effect: large banks located in Germany, Spain, Denmark, France, Italy, Sweden, Portugal, and the Netherlands, and their foreign branches and subsidiaries spread worldwide. We focus on specific bank-country characteristics fitted with our post-financial crisis period. In Column 5, *Regulatory risk* is a dummy variable equal to 1 when EU-listed banks are incorporated in countries with an implemented bank levy to face high regulatory risk starting from 2010 (Austria, Belgium, France, Germany, Portugal, Sweden, and The Netherlands), 0 otherwise. In Column 6, *Enforcement power* is a dummy variable equal to 1 when the arithmetic means of supervisor characteristics index, rule-making power index, investigative powers index, orders index, and criminal index is above the average, 0 otherwise (for details, see Table I - Panel B). In Column 7, PIIGS countries is a dummy variable equal to 1 when EU-listed banks in European countries (Portugal, Italy, Ireland, Greece, and Spain) drifted into a severe crisis as anxiety about their high indebtedness made it increasingly difficult to refinance their outstanding debt, 0 otherwise.

Country	*(1)Country code*	*(2) No. listed banks*	*(3) Market share (mean)*	*(4)No. listed banksanticipating disclosure*	*(5)Regulatory risk (dummy)*	*(6) Enforcement power (dummy)*	*(7)PIIGScountries (dummy)*
Austria	AT	8	0.906	0	1	0	0
Belgium	BE	8	0.889	0	1	0	0
Germany	DE	17	0.523	1	1	0	0
Denmark	DK	22	0.430	2	0	0	0
Spain	ES	8	0.444	3	0	0	1
Finland	FI	6	0.901	0	0	0	0
France	FR	21	0.900	3	1	1	0
Greece	GR	8	0.337	0	0	0	1
Ireland	IE	6	0.677	0	0	0	1
Italy	IT	23	0.901	8	0	1	1
Netherlands	NL	6	0.565	1	1	1	0
Portugal	PT	4	0.273	1	1	1	1
Sweden	SE	8	0.852	3	1	1	0
Total Banks		145	0.661	22			

Panel B. This table reports the scores of the legal framework adopted by countries of the EU-listed banks included in our sample based on the study by La Porta et al. (2006). For each country, we find scores about supervisor characteristics index (Column 1); rule-making power index (Column 2); investigative powers index (Column 3); orders index (Column 4); and criminal index (Column 5). Finally, in Column 6, we compute the index of public enforcement equals the arithmetic mean of all the indexes reported in the prior columns. Each index is detailing described in La Porta et al. (2006).

Country	*(1)Supervisor characteristics index*	*(2)Rule-making power index*	*(3)Investigative powersindex*	*(4)Orders index*	*(5) Criminalindex*	*(6)Publicenforcement power index*
Austria	0.33	0.00	0.00	0.00	0.50	0.17
Belgium	0.00	0.00	0.25	0.00	0.50	0.15
Germany	0.33	0.00	0.25	0.00	0.50	0.22
Denmark	0.00	1.00	0.50	0.33	0.00	0.37
Spain	0.67	0.00	0.50	0.00	0.50	0.33
Finland	0.67	0.00	0.25	0.17	0.50	0.32
France	1.00	0.50	1.00	1.00	0.33	0.77
Greece	0.67	0.00	0.25	0.17	0.50	0.32
Ireland	0.00	1.00	0.00	0.00	0.83	0.37
Italy	0.67	1.00	0.25	0.00	0.50	0.48
Netherlands	0.33	1.00	0.50	0.00	0.50	0.47
Portugal	0.67	1.00	1.00	0.25	0.00	0.58
Sweden	0.00	1.00	0.25	0.67	0.58	0.50

event window (-1, + 1), our results for all events point toward negative and significant wealth effects arising from the CRD IV announcements (-0.025), while the results are not significant when we concentrate the attention on CbC disclosure events bucket (-0.017). Also, by bootstrapping 800 times, the p-value remain statistically significant. The magnitude of CAR decreases to (-0.010) when we consider a 5-day event window (-2, + 2), and to (-0.020) when we consider the 5-day event window (-1, + 3). Panel B shows the results by employing a standard market model. Equal weighted CAR are still negative and significant when computing for all events (-0.020) and on the average effects (-0.013) around a 3-day event window (-1, + 1), while the magnitude is higher in case of market-adjusted cumulative abnormal returns (-0.021; − 0.015). We find consistency with different magnitudes also for equal weighted CAR around 5-day windows (-0.018; − 0.016), although the price reaction is stronger for the market-weighted portfolios (-0.041; − 0.031). Panel C shows the results obtained by employing a market-adjusted market model. In the case of equal-weighted CMAR for all events, the range goes from (-0.034) to (-0.077), while for market-weighted CMAR, the range goes from (-0.052) to (-0.072). Panels A, B, and C also contain tests based on placebo events that assume the events considering the CAR and CMAR occur 5 trading days before each of the actual events. These tests help demonstrate whether the results are driven by a downward trend in returns of bank stocks relative to the market in the days surrounding the events. Moreover, these analyses rule out anticipation effects that may have occurred before the event windows. We see that all placebo events in Panels A, B and C of Table 2 remain insignificant at the 5 % level. These tests suggest

Table 2
Stock market reactions to the events leading to CRD IV adoption for EU-listed banks.

Panel A. This table presents event-study evidence for all 15 announcements about the effect of CRD IV banking regulation for a sample of listed banks from the European Union (e.g., a test of H1). The event study follows the Fama-French (FF) three-factor model $R_{it} = \beta_0 + \beta_1 R_{i,t}^{MKT} + \beta_2 SMB_{i,t} + \beta_3 HML_{i,t} + \varepsilon_{it}$ to estimate the cumulative abnormal returns. We identify a twenty-five days' estimation window (− 30, − 5) and a three-day event window (− 1, + 1- Column 1) alternatively to a five-day event window (− 2, + 2 – Column 2) and (− 1, + 3 – Column 3) around each announcement. We present CAR for 1) the total of all events; 2) the average of all events; 3) the event dates that entail only initiatives on the country-by-country (CbC) disclosure (Events 11 and 13); 4) the p-value for the average CAR calculated according to 800 bootstrap simulations for all events. Following, we report the results of the parametric t-test and the Boehmer et al. (1991) test, the non-parametric generalized sign test of Cowan (1992), and the Corrado and Zivney (1992) rank test. We also add a placebo test around all events on the five trading days earlier. All the data related to the daily stock price, the market index price Stoxx Europe 600, the market value, and the book value of equity are retrieved from Refinitiv Eikon Thomson Reuters. Reported values: coefficient (p-value) (***) (**) (*) indicate significance levels at 1 %, (5 %) (10 %), t-statistics in brackets.

	(1)CAR (− 1, + 1) FF	(2)CAR (− 2, + 2) FF	(3)CAR (− 1, + 3) FF
Actual events			
Total (all events)	− 0.025**	− 0.010**	− 0.020*
	[− 2.19]	[− 2.00]	[− 1.95]
Average (all events)	− 0.020***	− 0.015***	− 0.012***
	[− 10.93]	[− 4.59]	[− 2.01]
Total (CbC Disclosure events)	− 0.017	− 0.015	− 0.007
	[− 1.66]	[− 1.21]	[− 1.49]
Bootstrap p-value (all events)	0.000	0.057	0.000
t-test	− 1.646**	− 0.521**	− 1.448*
Boehmer test	− 1.053**	− 0.988**	− 1.096*
Generalized sign test	− 1.775**	− 1.006**	− 1.667*
Corrado and Zivney rank test	− 0.152*	− 0.117*	− 0.122
Placebo events (5 trading days earlier)			
Total (all events)	0.012	0.114	0.011
	[0.94]	[0.76]	[0.14]
Average (all events)	0.003	0.001	0.006
	[0.66]	[0.66]	[0.01]
Total (CbC Disclosure events)	0.047	0.038	0.056
	[1.78]	[0.56]	[1.81]
Bootstrap p-value (all events)	0.118	0.616	0.386
t-test	0.620	0.201	0.010
Boehmer test	1.535	2.382	2.372
Generalized sign test	0.173	0.667	0.143
Corrado and Zivney rank test	0.056	0.093	0.052

Panel B. This table presents event-study evidence for all 15 announcements about the effect of CRD IV banking regulation for a sample of listed banks from the European Union (e.g., a test of H1). The event study follows the market model to estimate first the returns ($R_{i,t} = \beta_0 + \beta_1 R_{m,t} + \varepsilon_{i,t}$), then the abnormal returns, and finally, the cumulative abnormal returns. The columns report equal weighted (EW) cumulative abnormal returns (Column 1 with event window − 1, + 1; Column 2 with event window − 2, + 2; Column 3 with event window − 1, + 3) and market weighted (MW) cumulative abnormal returns (Column 4 with event window − 1, + 1; Column 5 with event window − 2,+ 2; Column 6 with event window − 1, + 3). We present CAR for 1) the total of all events; 2) the average of all events; 3) the event dates that entail only initiatives on the country-by-country (CbC) disclosure (Events 11 and 13); 4) the p-value for the average CAR calculated according to 800 bootstrap simulations for all events. Following, we report the results of the parametric t-test and the Boehmer et al. (1991) test, the non-parametric generalized sign test of Cowan (1992), and the Corrado and Zivney (1992) rank test. We also add placebo tests around all events on the five trading days earlier. All the data related to the daily stock price and the market index price Stoxx Europe 600 are retrieved from Refinitiv Eikon Thomson Reuters. Reported values: coefficient (p-value) (***) (**) (*) indicate significance levels at 1 %, (5 %) (10 %), t-statistics in brackets.

	(1)CAR(− 1, + 1) EW	(2)CAR(− 2, + 2) EW	(3)CAR (− 1, + 3) EW	(4)CAR (− 1, + 1) MW	(5)CAR (− 2, + 2) MW	(6)CAR (− 1, + 3) MW
Actual events						
Total (all events)	− 0.020***	− 0.018***	− 0.016***	− 0.021***	− 0.041***	− 0.031***
	[− 10.93]	[− 8.92]	[− 4.83]	[− 9.06]	[− 8.45]	[− 8.15]
Average (all events)	− 0.013***	− 0.012**	− 0.003**	− 0.015***	− 0.033**	− 0.025***
	[− 2.74]	[− 2.02]	[− 7.93]	[− 2.74]	[− 2.02]	[− 9.73]
Total (CbC Disclosure events)	0.025	0.002	0.040	0.062	0.009	0.084
	[1.80]	[0.22]	[1.71]	[1.06]	[1.73]	[1.22]
Bootstrap p-value (all events)	0.000	0.000	0.001	0.000	0.000	0.001
t-test	− 1.440***	− 1.320***	− 1.200***	− 1.476***	− 1.601***	− 1.501***
Boehmer test	− 1.090***	− 1.075***	− 1.066***	− 1.087***	− 1.256***	− 1.099***
Generalized sign test	− 2.005**	− 1.219**	− 1.095**	− 1.996**	− 2.401**	− 2.200**
Corrado and Zivney rank test	− 0.113**	− 0.100**	− 0.099**	− 0.110**	− 0.229**	− 0.195**
Placebo events (5 trading days earlier)						
Total (all events)	0.012	0.019	0.063	0.049	0.034	0.072
	[1.12]	[1.33]	[1.12]	[1.62]	[0.88]	[0.04]
Average (all events)	0.003	0.009	0.053	0.046	0.018	0.021
	[0.72]	[0.94]	[1.06]	[0.33]	[0.06]	[1.11]
Total (CbC Disclosure events)	0.037	0.060	0.026	0.072	0.077	0.067
	[0.11]	[1.75]	[1.72]	[1.68]	[1.79]	[1.80]
Bootstrap p-value (all events)	0.245	0.737	0.484	0.119	0.412	0.431

(*continued on next page*)

Table 2 (*continued*)

t-test	0.661	0.701	0.980	0.975	0.834	1.381
Boehmer test	1.595	1.049	1.906	1.601	1.510	1.849
Generalized sign test	1.988	1.399	2.319	2.200	1.826	2.502
Corrado and Zivney rank test	0.056	0.061	0.108	0.095	0.074	0.116

Panel C. This table presents event-study evidence for all 15 announcements about the effect of CRD IV banking regulation for a sample of listed banks from the European Union (e.g., a test of H1). The event study follows the market model to estimate the market-adjusted cumulative abnormal returns (*CMAR*). We first compute the market-adjusted return ($MAR_{i,t}$) as the difference between the log return of the security ($R_{i,t}$) and the log return of the proxy for the market portfolio ($R_{m,t}$). We then compute the market-adjusted cumulative abnormal return ($CMAR_{i,t} = \sum_{t=t1}^{t2} MAR_{i,t}$). The columns report equal weighted (EW) *CMAR* (Columns 1, 2, 3) and market-weighted (MW) *CMAR* (Columns 4, 5, 6), respectively, based on different event windows (− 1, + 1), (− 2, + 2), and (− 1, + 3), and an estimation window of a twenty-five-day window (− 30, − 5). We present *CMAR* for 1) the total of all events; 2) the average of all events; 3) the event dates that entail only initiatives on the country-by-country CbC disclosure (Events 11 and 13); 4) the p-value for the average CAR calculated according to 800 bootstrap simulations for all events. Following, we report the results of the parametric t-test and the Boehmer et al. (1991) test, the non-parametric generalized sign test of Cowan (1992), and the Corrado and Zivney (1992) rank test. We also add a placebo test around all events on the five trading days earlier. All the data related to the daily stock price, the market index price Stoxx Europe 600, the market value, and the book value of equity are retrieved from Refinitiv Eikon Thomson Reuters. Reported values: coefficient (p-value) (***) (**) (*) indicate significance levels at 1 %, (5 %) (10 %), t-statistics in brackets.

	(1)CMAR(− 1, + 1) EW	(2)CMAR(− 2, + 2) EW	(3)CMAR (− 1, + 3) EW	(4)CMAR (− 1, + 1) MW	(5)CMAR (− 2, + 2) MW	(6)CMAR (− 1, + 3) MW
Actual events						
Total (all events)	− 0.061***	− 0.034***	− 0.077***	− 0.052***	− 0.072***	− 0.065***
	[− 2.74]	[− 7.80]	[− 2.86]	[− 5.65]	[− 5.05]	[− 6.63]
Average (all events)	− 0.055***	− 0.017***	− 0.071***	− 0.002***	− 0.001***	− 0.001***
	[− 2.83]	[− 9.47]	[− 9.73]	[− 5.62]	[− 5.59]	[− 5.32]
Total (CbC Disclosure events)	0.062	0.086	0.078	0.009	0.011	0.012
	[0.11]	[0.15]	[0.76]	[0.47]	[1.20]	[1.26]
Bootstrap p-value (all events)	0.000	0.000	0.000	0.000	0.000	0.000
t-test	− 0.089***	− 0.055**	− 0.098**	− 0.079**	− 0.106**	− 0.097**
Boehmer test	− 2.750***	− 2.238**	− 2.579**	− 2.300**	− 2.500**	− 2.720**
Generalized sign test	− 2.621***	− 2.039**	− 2.861**	− 2.018**	− 2.786**	− 2.901**
Corrado and Zivney rank test	− 0.054***	− 0.015**	− 0.066**	− 0.080**	− 0.058**	− 0.041***
Placebo events (5 trading days earlier)						
Total (all events)	0.023	0.044	0.077	0.051	0.048	0.068
	[1.79]	[1.21]	[1.72]	[1.05]	[0.01]	[1.14]
Average (all events)	0.015	0.041	0.076	0.003	0.000	0.001
	[1.55]	[1.74]	[1.07]	[1.02]	[1.02]	[1.19]
Total (CbC Disclosure events)	0.079	0.097	0.098	0.012	0.013	0.011
	[1.79]	[1.52]	[1.55]	[0.59]	[0.40]	[0.52]
Bootstrap p-value (all events)	0.111	0.156	0.125	0.341	0.304	0.159
t-test	0.018	0.046	0.098	0.064	0.044	0.073
Boehmer test	0.280	0.301	0.470	0.390	0.384	0.435
Generalized sign test	0.324	0.383	0.629	0.580	0.577	0.605
Corrado and Zivney rank test	0.012	0.062	0.078	0.072	0.062	0.070

Panel D. This table presents event-study evidence at the country level for all 15 announcements about the effect of CRD IV banking regulation for a sample of listed banks from the European Union. We obtain the cumulative abnormal returns (*CAR*) around each event following three steps according to the Fama-French (FF) three-factor model methodology: 1) we use the first model (Eq. (1)) to compute the returns (R_{it}), 2) the second model (Eq. (2)) to compute the abnormal returns (AR_{it}) and finally 3) the third model (Eq. (3)) to compute the cumulative abnormal returns ($CAR_{i,t}$). The model measures the raw returns on a firm's stock, the market returns, the small-minus-big market capitalization portfolio returns (*SMB*), and the high-minus-low book equity/market equity portfolio returns (*HML*). The *CAR* are computed on three-day event windows (− 1, + 1 - Column 1), alternatively to (− 2, + 2 – Column 2), and (− 1, + 3 – Column 3) around each announcement and an estimation window of a twenty-five-day window (− 30, − 5). The columns report the results by events for each country. Reported values: coefficient (p-value) (***) (**) (*) indicate significance levels at 1 %, (5 %) (10 %), t-statistics in brackets.

Country	(1)CAR (− 1, + 1) FF	(2)CAR (− 2, + 2) FF	(3)CAR(− 1, + 3) FF
Austria	− 0.042***	− 0.023***	− 0.008***
	[− 6.32]	[− 2.80]	[− 2.67]
Belgium	− 0.109***	− 0.053*	− 0.215*
	[− 9.31]	[− 1.96]	[− 4.30]
Germany	− 0.007	− 0.013***	− 0.002**
	[1.23]	[− 6.13]	[− 2.29]
Denmark	0.018	0.066	0.075
	[1.75]	[1.30]	[1.55]
Spain	− 0.077***	− 0.026***	− 0.096*
	[− 10.14]	[− 6.99]	[− 1.99]
Finland	0.010**	0.001**	0.028***
	[2.03]	[2.18]	[5.46]
France	− 0.055***	− 0.002***	− 0.019*
	[− 14.43]	[− 2.96]	[− 1.98]
Greece	− 0.101***	− 0.072*	− 0.091***
	[− 7.20]	[− 1.95]	[− 3.11]
Ireland	0.093***	0.001	0.001

(*continued on next page*)

Table 2 (*continued*)

	[4.47]	[0.97]	[0.01]
Italy	− 0.020***	− 0.003***	− 0.074***
	[− 4.23]	[− 2.52]	[− 7.72]
Netherlands	0.010***	0.013	0.071
	[2.53]	[1.64]	[1.58]
Portugal	− 0.047***	− 0.001***	− 0.048***
	[− 2.25]	[− 14.05]	[− 4.30]
Sweden	− 0.023*	− 0.003*	− 0.018*
	[− 1.91]	[− 1.96]	[− 1.98]

the absence of anticipation effects and alleviate the concern that the significance of the results for the actual events is due to short-run trends in the CAR and CMAR. These results indicate that because CRD IV was developed during a period marked by a tremendous banking fragility, this led shareholders to identify higher processing and proprietary costs in providing more transparency for EU listed banks.

Panel D (Table 2) reports the results of the event study by employing the Fama-French three factor model at country level computing the cumulative abnormal returns for all events around 3-day instead of 5-day event windows. Restricting the observation around the 3-day event window (-1, + 1) we can see that investors identify benefits only for banks in countries like Finland (0.010), Ireland (0.093), and Netherlands (0.010), while many more costs have been identified for banks located in Greece (− 0.101), Belgium (− 0.109), Spain (-0.077), France (− 0.055), and Portugal (− 0.047). These results are interesting if we consider that all these countries, except for Greece and Finland, have been equally hit by the 2008 systemic banking crisis (Laeven and Valencia, 2020).[24]

5.2. Descriptive statistics

Table 3, Panel A reports the descriptive statistics for each variable related to the sample of the EU-listed banks employed in our cross-country analyses where the dependent variable is CAR, such as the output of the event study around the key events leading to the CRD IV–CbCR adoption in EU banking industry by employing the Fama-French three-factor model on a 3-day event window (-1,+ 1). The description of all variables is reported in Appendix II. We report the summary statistics (mean, standard deviation, 25th percentile, median and 75th percentile) for each variable. Focusing on R2 that capture the level of bank transparency we see that the mean and the median indicate a low value (0.015, 0.027)), meaning that EU-listed banks are affected by uncertainty on the period we consider. On the basis of the average, we build a dummy variable equal to 1 when bank have R2 lower than 0.027 (poorly transparent banks), 0 otherwise. Although the sample is composed of a heterogeneous group of banks, the mean of size (*SIZE*), corresponding to the logarithm of total assets, is equal to 16.57. In contrast, the change in *ROA* (where ROA is computed as the profit before taxes plus loan loss provisions divided by total assets at the end of the year) is negative (-0.029). If the EU-listed banks seem not to give any growth signals, the regulatory capital is, on average, robust and indicates certain financial stability (*Tier1*: 12.40).

Table 3, Panel B shows the correlation coefficients between the dependent variable of our model (*CAR*) and the independent variables. We document a negative and significant correlation between *CAR* and banks located in countries with higher regulatory risk (-0.098), and banks disclosing priorly CbC reports (-0.111), size (-0.153), and loan loss allowances (-0.193), while there is a positive and significant correlation between CAR and change in ROA (0.151).

5.3. Results of OLS panel regressions

In Table 4, Panels A–D present the results of the OLS panel regressions to test hypotheses (H2), (H3), and (H4) by including several interaction terms and fixed effects. We begin our analysis by estimating whether and how bank and country specific factors are associated with shareholder wealth effects of CRD IV regulation's announcements. Panel A shows our main result in column (1), indicating that poorly transparent banks (R2) are negatively and significantly (-0.053) associated with CAR, consistently with the expectation of investors impounding the impending costs of transparency into the stock price. On the wave of La Porta et al. (2006), there has been an increased interest in finance and accounting literature on differences in the legal system and its influence on investors' decision-making processes. The market response to a regulatory change can be shaped by underlying institutional factors at the country level characterising the European banking post-crisis period. Therefore, in Panel B, we document in column (1) with the interaction term (*R2 * Regulatory risk*), that poorly transparent banks in countries with high regulatory risk can benefit on average 7.1 percentage points from the new transparency regulation compared to those in countries with low regulatory risk, where regulatory risk regards EU-listed banks incorporated in countries with an implemented bank levy to face high regulatory risk starting from 2010 (Austria, Belgium, France, Germany, Portugal, Sweden, and The Netherlands). These results indicate that investors see beneficial effects of CRD IV regulation for those banks that, although not transparent, are in a high regulatory environment, inducing banks to

[24] Laeven and Valencia (2020) provide an updated database about 151 systemic banking crisis episodes around the globe during 1970–2017 to include information on crisis dates, policy responses to resolve banking crises, and their fiscal and output costs. According to our sample of EU-Listed banks, Greece was the only country involved in the sovereign debt crisis in December 2012. Nevertheless, Finland was involved in neither the 2008 systemic banking crisis nor the sovereign debt crisis in 2012.

Table 3
Descriptive statistics.

Panel A. This table reports the summary statistics of the variables employed in our empirical tests for the sample of 145 European listed banks (2175 observations) considered in this event study covering the years 2011–2013. The reported CAR is the output of the event study by employing a Fama-French three factor model restricting to the 3-day event window (− 1,+ 1). N refers to the number of observations, sd is the standard deviation, p25 and p75 are the 25th and 75th percentiles. The description of all variables is reported in Appendix II.

	N	mean	sd	p25	median	p75
CAR	2175	− 0.025	0.090	− 0.051	− 0.020	0.004
R2	2175	0.015	4.984	0.012	0.027	0.114
Regulatory risk	2175	0.354	0.478	0	0	1
Enforcement power	2175	0.275	0.447	0	0	1
PIIGS countries	2175	0.275	0.447	0	0	1
Prior CbCR Disclosure	2175	0.319	0.466	0	0	1
Size	2175	16.57	2.414	15.00	16.50	18.09
Deposits	2175	0.117	0.026	0.105	0.122	0.134
Fee_Rev	2175	0.323	0.218	0.186	0.275	0.420
LLA	2175	0.022	0.019	0.009	0.017	0.029
Tier1	2175	12.40	4.378	10.20	11.60	14.00
Cashflow	2175	0.002	0.022	0.001	0.005	0.010
ΔROA	2175	− 0.029	0.665	− 0.332	0.041	0.314
ΔLoans	2175	0.022	0.186	− 0.028	0.016	0.064
Inst_own%	2175	41.52	28.67	17.40	35.35	58.40

Panel B. The table presents the results of the Pearson correlation matrix for the full sample employed for the event study covering the years 2011–2013. The reported CAR is the output of the event study by employing a Fama-French three factor model restricting to the 3-day event window (− 1,+ 1). All the variables are defined in detail in Appendix II. *, **, and *** show significance at the 10 %, 5 %, and 1 % levels, respectively.

	CAR	R2	Regulatory risk	Enforcement power	PIIGS countries	Prior CbCR Disclosure	Size	Deposits	Fee_Rev	LLA	Tier1	Cashflow	ΔROA	ΔLoans	Inst_own %
CAR	1														
R2	− 0.002	1													
Regulatory risk	− 0.098*	− 0.082	1												
Enforcement power	− 0.075	− 0.108*	0.833***	1											
PIIGS countries	− 0.017	0.060	− 0.396***	− 0.381***	1										
Prior CbCR Disclosure	− 0.111*	0.019	− 0.086	− 0.046	0.043	1									
Size	− 0.153**	− 0.038	0.129**	0.127**	0.077	0.189***	1								
Deposits	0.001	0.051	− 0.242***	− 0.369***	0.154***	− 0.030	− 0.256***	1							
Fee_Rev	0.062	0.024	0.002	0.078	0.037	− 0.010	− 0.488***	0.214***	1						
LLA	− 0.193**	0.034	− 0.256***	− 0.314***	0.237***	− 0.036	− 0.038	0.242***	− 0.127*	1					
Tier1	0.083	− 0.001	0.062	0.125	− 0.322***	0.091	− 0.283***	− 0.113	0.048	− 0.262***	1				
Cashflow	− 0.014	0.020	0.283***	0.271***	− 0.241***	0.034	− 0.137*	− 0.114	0.142*	− 0.396***	0.280***	1			
ΔROA	0.151*	0.141*	0.039	0.016	− 0.045	0.016	− 0.114	− 0.072	0.058	− 0.073	0.194*	0.288***	1		
ΔLoans	0.026	− 0.044	0.074	0.088	− 0.027	− 0.039	− 0.016	0.032	0.038	− 0.136*	− 0.206**	0.094	0.126	1	
Inst_own%	0.036	0.087	0.210***	0.276***	− 0.110	0.036	− 0.151*	0.044	0.303***	− 0.060	0.064	0.134	0.101	− 0.002	1

Table 4
OLS panel regressions on bank and country characteristics.

Panel A. – Tests H2–H4. The coefficients for controls and the intercept are untabulated.Columns (1, 6, 11) - Model (1): $CAR_{(i,t)} = \beta_0 + \boldsymbol{\beta_1 R2}_{(t-1)} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$Columns (2, 7, 12) - Model (2): $CAR_{(i,t)} = \beta_0 + \boldsymbol{\beta_1 Regulatory\ risk}_{(t-1)} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$Columns (3, 8, 13) – Model (3): $CAR_{(i,t)} = \beta_0 + \boldsymbol{\beta_1 Enforcement\ power}_{(t-1)} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$Columns (4, 9, 14) - Model (4): $CAR_{(i,t)} = \beta_0 + \boldsymbol{\beta_1 PIIGS\ countries}_{(t-1)} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$Columns (5, 10, 15) – Model (5): $CAR_{(i,t)} = \beta_0 + \boldsymbol{\beta_1 Prior\ CbCR\ Disclosure}_{(t-1)} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$

	CAR(− 1, + 1) FF				
	(1)	(2)	(3)	(4)	(5)
R2	− 0.053**				
	[− 2.22]				
Regulatory risk		0.001			
		[0.05]			
Enforcement power			0.027*		
			[1.96]		
PIIGS countries				− 0.013	
				[− 1.28]	
Prior CbCR Disclosure					− 0.019
					[− 0.78]
Observations	2175	2175	2175	2175	2175
Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Cluster SE	Bank & Year	Bank & Year	Bank & Year	Bank & Year	Bank & Year
adj. R^2	0.645	0.189	0.207	0.199	0.195
	CAR(− 2, + 2) FF				
	(6)	(7)	(8)	(9)	(10)
R2	− 0.006				
	[− 1.17]				
Regulatory risk		− 0.025****			
		[− 3.45]			
Enforcement power			0.019**		
			[2.04]		
PIIGS countries				− 0.019****	
				[− 3.55]	
Prior CbCR Disclosure					− 0.028**
					[− 2.17]
Observations	2175	2175	2175	2175	2175
Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Cluster SE	Bank & Year	Bank & Year	Bank & Year	Bank & Year	Bank & Year
adj. R^2	0.744	0.222	0.159	0.192	0.169
	CAR(− 1, + 3) FF				
	(11)	(12)	(13)	(14)	(15)
R2	0.004				
	[0.69]				
Regulatory risk		− 0.018**			
		[− 2.48]			
Enforcement power			0.003		
			[0.29]		
PIIGS countries				− 0.012	
				[− 1.48]	
Prior CbCR Disclosure					− 0.024
					[− 1.49]
Observations	2175	2175	2175	2175	2175
Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Cluster SE	Bank & Year	Bank & Year	Bank & Year	Bank & Year	Bank & Year
adj. R^2	0.729	0.168	0.128	0.224	0.571

Panel B. Tests H2–H4 by interacting poorly transparent banks with country characteristics. The coefficients for controls and the intercept are untabulated. Columns (1, 5, 9) - Model (6): $CAR_{(i,t)} = \beta_0 + \beta_1 R2_{(t-1)} + \beta_2 Regulatory\ risk_{(t-1)} + \boldsymbol{\beta_3 R2}_{(t-1)} * \boldsymbol{Regulatory\ risk}_{(t-1)} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$ Columns (2, 6, 10) - Model (7): $CAR_{(i,t)} = \beta_0 + \beta_1 R2_{(t-1)} + \beta_2 Enforcement\ power_{(t-1)} + \boldsymbol{\beta_3 R2}_{(t-1)} * \boldsymbol{Enforcement\ power}_{(t-1)} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$Columns (3, 7, 11) - Model (8): $CAR_{(i,t)} = \beta_0 + \beta_1 R2_{(t-1)} + \beta_2 PIIGS\ countries_{(t-1)} + \boldsymbol{\beta_3 R2}_{(t-1)} * \boldsymbol{PIIGS\ countries}_{(t-1)} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$Columns (4, 8, 12) - Model (9): $CAR_{(i,t)} = \beta_0 + \beta_1 R2_{(t-1)} + \beta_2 Prior\ CbCR\ Disclosure_{(t-1)} + \boldsymbol{\beta_3 R2}_{(t-1)} * \boldsymbol{Prior\ CbCR\ Disclosure}_{(t-1)} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$

		CAR (− 1, + 1) FF		
	(1)	(2)	(3)	(4)
R2	− 0.018	0.013	0.030*	0.005
	[− 1.16]	[0.93]	[2.00]	[0.41]
Regulatory risk	− 0.018			

(*continued on next page*)

Table 4 (*continued*)

	[− 1.51]			
Enforcement power		0.002		
		[0.15]		
PIIGS countries			− 0.002	
			[− 0.21]	
Prior CbCR Disclosure				− 0.037
				[− 1.36]
R2 × Regulatory risk	0.071***			
	[3.17]			
R2 × Enforcement power		0.063***		
		[2.82]		
R2 × PIIGS countries			− 0.058**	
			[− 2.71]	
R2 × Prior CbCR Disclosure				− 0.050
				[− 1.44]
Observations	2175	2175	2175	2175
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster SE	Bank & Year	Bank & Year	Bank & Year	Bank & Year
adj. R^2	0.235	0.232	0.221	0.201
		CAR (− 2, + 2) FF		
	(5)	(6)	(7)	(8)
R2	0.002	0.006	0.011*	0.009*
	[0.52]	[0.89]	[1.99]	[1.96]
Regulatory risk	− 0.007*			
	[− 1.97]			
Enforcement power		− 0.018		
		[− 1.48]		
PIIGS countries			− 0.009*	
			[− 1.93]	
Prior CbCR Disclosure				0.024
				[1.65]
R2 × Regulatory risk	0.011*			
	[1.93]			
R2 × Enforcement power		0.002*		
		[1.97]		
R2 × PIIGS countries			− 0.018*	
			[− 1.95]	
R2 × Prior CbCR Disclosure				0.013
				[0.62]
Observations	2175	2175	2175	2175
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster SE	Bank & Year	Bank & Year	Bank & Year	Bank & Year
adj. R^2	0.218	0.170	0.207	0.191
		CAR (− 1, + 3) FF		
	(9)	(10)	(11)	(12)
R2	− 0.000	0.002	0.003	0.001
	[− 0.13]	[0.42]	[0.53]	[0.28]
Regulatory risk	− 0.016			
	[− 1.77]			
Enforcement power		0.002*		
		[1.95]		
PIIGS countries			− 0.007	
			[0.21]	
Prior CbCR Disclosure				− 0.032
				[− 1.83]
R2 × Regulatory risk	0.001*			
	[1.92]			
R2 × Enforcement power		0.002***		
		[2.64]		
R2 × PIIGS countries			− 0.010***	
			[− 2.77]	
R2 × Prior CbCR Disclosure				− 0.021
				[− 0.68]
Observations	2175	2175	2175	2175
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster SE	Bank & Year	Bank & Year	Bank & Year	Bank & Year
adj. R^2	0.244	0.213	0.231	0.241

Panel C. Tests H2–H4 by interacting poorly transparent banks and country characteristics, and then country characteristics with large and complex banks anticipating CbC reports.Columns (1, 3, 5) - Model (10): $CAR_{(i,t)} = \beta_0 + \beta_1 R2_{(t-1)} + \beta_2 Regulatory\ risk_{(t-1)} + \beta_3 Enforcement\ power_{(t-1)} + \beta_4\ PIIGS\ countries_{(t-1)} + \beta_5 Prior\ CbCR\ Disclosure_{(t-1)} + \boldsymbol{\beta_6\ R2_{(t-1)} * Regulatory\ risk_{(t-1)}} + \boldsymbol{\beta_7\ R2_{(t-1)} * Enforcement\ power_{(t-1)}} + \boldsymbol{\beta_8\ R2_{(t-1)} * PIIGS\ countries_{(t-1)}} + \boldsymbol{\beta_9\ R2_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)}} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$ Columns (2, 4, 6) – Model (11): $CAR_{(i,t)} = \beta_0 + \beta_1 R2_{(t-1)} + \beta_2 Regulatory\ risk_{(t-1)} + \beta_3 Enforcement\ power_{(t-1)} + \beta_4\ PIIGS\ countries_{(t-1)} + \beta_5 Prior\ CbCR\ Disclosure_{(t-1)} + \beta_6\ R2_{(t-1)} * Regulatory\ risk_{(t-1)} + \beta_7\ R2_{(t-1)} * Enforcement\ power_{(t-1)} + \beta_8\ R2_{(t-1)} * PIIGS\ countries_{(t-1)} + \beta_9\ R2_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)} + \boldsymbol{\beta_{10}\ Regulatory\ risk_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)}} + \boldsymbol{\beta_{11}\ Enforcement\ power_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)}} + \boldsymbol{\beta_{12}\ PIIGS\ countries_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)}} + Controls_{(t-1)} + Year\ FE + \varepsilon_t$

	CAR(− 1, + 1) FF		CAR(− 2, + 2) FF		CAR(− 1, + 3) FF	
	(1)	(2)	(3)	(4)	(5)	(6)
R2	0.014	0.013	− 0.016	− 0.001	− 0.016	− 0.002
	[1.84]	[1.80]	[− 1.44]	[− 0.16]	[− 1.00]	[− 0.32]
Regulatory risk	− 0.031	− 0.042	− 0.020	− 0.009	− 0.023***	− 0.021***
	[− 1.40]	[− 1.76]	[− 1.40]	[− 0.87]	[− 3.43]	[− 3.02]
Enforcement power	0.079***	0.088***	0.017	0.007	0.032**	0.034**
	[2.68]	[2.79]	[0.93]	[0.54]	[2.32]	[2.32]
PIIGS countries	− 0.009	− 0.004	− 0.002	− 0.003	− 0.001	− 0.001
	[− 0.60]	[− 0.26]	[− 0.29]	[− 0.71]	[− 0.12]	[− 0.15]
Prior CbCR Disclosure	0.006	0.010	0.016	0.025	0.022	0.027
	[0.26]	[0.16]	[1.23]	[1.52]	[1.44]	[0.83]
R2 × Regulatory risk	− 0.019	− 0.025	− 0.016	− 0.026	− 0.002	− 0.017
	[− 0.27]	[− 0.33]	[− 0.63]	[− 1.29]	[− 0.11]	[− 1.24]
R2 × Enforcement power	− 1.333	− 1.375	0.004	0.006	0.011	0.007
	[− 1.73]	[− 1.78]	[0.14]	[0.23]	[0.66]	[0.38]
R2 × PIIGS countries	− 0.015	0.012	− 0.027**	− 0.006	− 0.026	− 0.010
	[− 0.42]	[0.34]	[− 2.05]	[− 0.85]	[− 1.55]	-[1.12]
R2 × Prior CbCR Disclosure	− 1.148**	− 1.045**	− 1.010*	− 0.005	− 0.044	− 0.045
	[− 2.52]	[− 2.20]	[− 1.96]	[− 0.24]	[− 1.00]	[− 1.10]
Regulatory risk × Prior CbCR Disclosure		0.077		0.061*		0.045
		[1.04]		[1.86]		[1.15]
Enforcement power × Prior CbCR Disclosure		− 0.550**		− 0.325**		− 0.431***
		[− 2.09]		[− 2.16]		[− 3.77]
PIIGS countries × Prior CbCR Disclosure		− 0.013		− 0.006		− 0.000
		[− 0.20]		[− 0.35]		[− 0.01]
Size	− 0.013***	− 0.013***	− 0.003*	− 0.003*	− 0.004***	− 0.004***
	[− 4.28]	[− 4.19]	[− 1.82]	[− 1.68]	[− 2.90]	[− 3.02]
Deposits	− 0.016	− 0.019	− 0.002	− 0.000	− 0.034	− 0.034
	[− 0.55]	[− 0.64]	[− 0.13]	[− 0.04]	[− 1.65]	[− 1.65]
Fee_Rev	− 0.037	− 0.035	− 0.021	− 0.001	− 0.022	− 0.021
	[− 1.19]	[− 1.09]	[− 1.06]	[− 0.07]	[− 1.11]	[− 1.05]
LLA	− 0.871	− 0.714	− 0.607*	− 0.426*	− 0.384*	− 0.355*
	[− 1.03]	[− 0.83]	[− 1.87]	[− 1.82]	[− 1.78]	[− 1.66]
Tier 1	− 0.005***	− 0.005***	− 0.002*	− 0.001	− 0.002**	− 0.002**
	[− 3.64]	[− 3.50]	[− 1.95]	[− 1.54]	[− 2.47]	[− 2.20]
Cashflow	− 0.142	− 0.091	− 0.103	− 0.136*	− 0.111	− 0.090
	[− 0.59]	[− 0.37]	[− 0.96]	[− 1.68]	[− 0.95]	[− 0.76]
ΔROA	0.015*	0.015*	0.005	0.006**	0.002	0.004
	[1.76]	[1.72]	[1.47]	[2.30]	[0.49]	[0.92]
ΔLoans	− 0.041	− 0.038	− 0.007	− 0.004	− 0.006	− 0.005
	[− 1.29]	[− 1.13]	[− 0.43]	[− 0.21]	[− 0.31]	[− 0.27]
Inst_own%	0.049	0.055**	0.013	0.003	0.003	0.005
	[1.88]	[2.12]	[1.11]	[0.37]	[0.28]	[0.37]
_cons	0.303***	0.301***	0.382*	0.364	0.379*	0.388*
	[3.94]	[3.88]	[1.85]	[1.65]	[1.75]	[1.88]
Observations	2175	2175	2175	2175	2175	2175
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE	Bank & Year	Bank & Year	Bank & Year	Bank & Year	Bank & Year	Bank & Year
adj. R^2	0.251	0.249	0.287	0.279	0.258	0.251

Panel D. Tests H2–H4 by including triple interactions between poorly transparent banks and country characteristics and large and complex banks anticipating CbC reports.Columns (1, 2, 3) - Model (12): $CAR_{(i,t)} = \beta_0 + \beta_1 R2_{(t-1)} * Regulatory\ risk_{(t-1)} + \beta_2 R2_{(t-1)} * Enforcement\ power_{(t-1)} + \beta_3 R2_{(t-1)} * PIIGS\ countries_{(t-1)} + \beta_4 R2_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)} + \beta_5\ Regulatory\ risk_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)} + \beta_6\ Enforcement\ power_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)} + \beta_7\ PIIGS\ countries_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)} + \boldsymbol{\beta_8\ R2_{(t-1)} * Regulatory\ risk_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)}} + \boldsymbol{\beta_9\ R2_{(t-1)} * Enforcement\ power_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)}} + \boldsymbol{\beta_{10}\ R2_{(t-1)} * PIIGS\ countries_{(t-1)} * Prior\ CbCR\ Disclosure_{(t-1)}} + Controls_{(t-1)} + Bank\ FE + Year\ FE + Country\ FE + \varepsilon_t$

	CAR(− 1, + 1) FF	CAR(− 2, + 2) FF	CAR(− 1, + 3) FF
	(1)	(2)	(3)
R2 × Regulatory risk	− 0.306***	− 0.036**	− 0.031***
	[− 3.22]	[− 2.01]	[− 2.80]
R2 × Enforcement power	− 0.458*	− 0.017	− 0.036***
	[− 1.80]	[− 0.78]	[− 2.90]

(*continued on next page*)

Table 4 (*continued*)

R2 × PIIGS countries	− 0.089***	− 0.012**	− 0.007
	[− 4.56]	[− 1.99]	[− 1.00]
R2 × Prior CbCR Disclosure	0.461**	0.024**	0.022
	[2.62]	[2.14]	[1.08]
Regulatory risk × Prior CbCR Disclosure	0.556*	0.077**	0.095***
	[1.89]	[2.18]	[4.12]
Enforcement power × Prior CbCR Disclosure	− 0.278**	− 0.415**	− 0.201***
	[− 2.23]	[− 2.00]	[− 2.90]
PIIGS countries × Prior CbCR Disclosure	0.143**	0.004	0.017
	[2.43]	[0.46]	[0.97]
R2 × Regulatory risk × Prior CbCR Disclosure	0.244	0.222	0.204
	[1.11]	[0.88]	[1.25]
R2 × Enforcement power × Prior CbCR Disclosure	− 0.307	− 0.201	− 0.301
	[− 1.12]	[− 0.56]	[− 0.10]
R2 × PIIGS countries × Prior CbCR Disclosure	− 0.486**	− 0.667*	− 0.418***
	[− 2.67]	[− 1.88]	[− 5.36]
Size	− 0.003	− 0.002	− 0.004***
	[− 0.11]	[− 1.40]	[− 2.77]
Deposits	0.178**	0.001	0.020
	[2.43]	[0.06]	[1.35]
Fee_Rev	− 0.089	− 0.006	− 0.031
	[− 0.60]	[− 0.38]	[− 1.64]
LLA	− 2.714	− 0.479*	− 0.457*
	[− 1.38]	[− 1.75]	[− 1.96]
Tier 1	− 0.007*	− 0.001*	− 0.001*
	[− 1.71]	[− 1.88]	[− 1.82]
Cashflow	− 0.290	− 0.165*	0.055
	[− 0.41]	[− 1.82]	[0.53]
ΔROA	0.024*	0.006*	0.003
	[1.94]	[1.88]	[0.75]
ΔLoans	0.023	0.020	0.009
	[0.44]	[0.73]	[0.40]
Inst_own%	0.055	0.002	0.003
	[1.84]	[0.25]	[0.22]
_cons	0.010	0.056	0.077*
	[0.02]	[1.32]	[1.69]
Observations	2175	2175	2175
Bank FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Cluster SE	Bank & Year	Bank & Year	Bank & Year
adj. R^2	0.589	0.552	0.553

These tables (Panels A–D) present the results of a set of OLS panel regressions at bank and country levels based on (Eqs. (6), (8), and (9)) to test H2–H4. Our dependent variable for all the empirical tests is *CAR,* choosing the return measure accumulated over days (-1, + 1), (-2, + 2), and (-1, + 3) where day 0 is the event date employing the Fama – French three-factor model and using as market index Stoxx Europe 600. The independent variable is *R2* as a proxy to measure bank transparency following Chen et al. (2022). We compute *R2* for each bank year from the regression $Write\ Off_{(t,t+1)} = \alpha_0 + \sum_{j=1}^{2} \gamma_j LLP_{(t-j)} + \sum_{j=1}^{2} \beta_j EBLLP_{(t-j)} + \rho \Delta NPL_{(t-1)} + \delta Capital_{(t-1)} + \varepsilon_t$ estimated using the bank's observations from year t to year t – 1, where LLP is loan loss provisions EBLLP is earnings before loan loss provision at the beginning of year t, ΔNPL is the change in non-performing loans in year t-1 from year t, Capital is shareholders' equity divided by total assets. We also include the following proxies capturing cross-country differences: *Regulatory risk* is a dummy variable equal to 1 when EU-listed banks are incorporated in countries with an implemented bank levy to face high regulatory risk starting from 2010 (Austria, Belgium, France, Germany, Portugal, Sweden, and The Netherlands), 0 otherwise. *Enforcement power* is a dummy variable equal to 1 when the arithmetic mean of (1) supervisor characteristics index; (2) rule-making power index; (3) investigative powers index; (4) orders index; and (5) criminal index is above the average, 0 otherwise. The *PIIGS countries* capturing the consequences of the sovereign debt crisis and credit crunch exposure is a dummy variable equal to 1 when EU-listed banks in European countries (Portugal, Italy, Ireland, Greece, and Spain) drifted into a severe crisis as anxiety about their high indebtedness made it increasingly difficult to refinance their outstanding debt, 0 otherwise. Then, we include a dummy variable, Prior CbCR Disclosure, which is equal to one if (large and complex) European banks disclose country-by-country reports voluntarily before the mandatory regulatory change in 2013. Finally, we include a set of interaction terms and triple interactions to capture the incremental effects between bank transparency, country characteristics and anticipatory banking features on CRD IV market reaction. For all the regressions, we include the control variables (see definition in Appendix II) and the fixed effects (bank, year, and country) using clustered standard errors (bank and year levels). All continuous variables are winsorized at the top and bottom 1 %. Reported values: coefficient (p-value) *** (**) (*) indicate significance levels at 1 %, (5 %) (10 %), two-tailed t-statistics in brackets.

decrease their leverage.

We document similar results in column (2) by interacting the two terms (*R2 * Enforcement power*), indicating that poorly transparent banks in countries with high enforcement power can benefit on average 6.3 percentage points of CRD IV regulation compared to those countries with low enforcement power, where enforcement power is a dummy variable equal to 1 when the arithmetic mean of (1) supervisor characteristics index, (2) rule-making power index, (3) investigative powers index, (4) orders index, and (5) criminal index is above the average; 0 otherwise. This indicates that investors see again benefits thanks to CRD IV adoption for poorly transparent banks in a strong legal enforcement environment where banks' activities can be constantly monitored and controlled. Differently, we find a negative and significant association in column (3) between the interaction term (*R2 * PIIGS countries*) and CAR on average 5.8 percentage points, where PIIGS countries, capturing the consequences of the sovereign debt crisis and credit crunch exposure, is a dummy variable equal to 1 when EU-listed banks are located in Portugal, Italy, Ireland, Greece, and Spain, 0 otherwise. In this case the poorly, it's hard to see a benefit following investors' valuation for transparent banks suffering of weak macroeconomic conditions because the countries, where they are incorporated, are drifted into a severe crisis as anxiety about their high indebtedness. Column (4) shows no significant results for banks that are poorly transparent, large, and complex, anticipating CbC reports before CRD IV takes effect (*R2 * Prior CbCR Disclosure*). Investors seem to perceive neither benefits nor costs for these banks that, for size and scrutiny, are surely more protected than other banks following the "*Too big to fail*" doctrine. In all these analyses, we always cluster standard errors at bank and year levels, and we include year-fixed effects, and the results also hold when we employ the other event windows (-2, + 2), (-1, + 3).

Panel C adds further results to this first set of analyses. Thus, in column (1), we see that once we include all these variables and their interaction terms with poor transparency at the bank level, we find mainly a negative association between the interaction (*R2 * Prior CbCR Disclosure*) and CAR (-1.148). In Column (2), we add further interaction terms between country characteristics and those large and complex banks anticipating CbC reports, and we find a negative effect for large and complex banks in countries with high enforcement power (-0.550). Our interpretation is that these banks have such complexity that within the country's regulatory environment, it makes slow and costly the adoption of CRD IV regulation. Again, in all these analyses, we always cluster standard errors at bank and year levels, and we include year-fixed effects and the results also hold when we employ the other event windows (-2, + 2), (-1, + 3).

Panel D reports the results of our tests by including several interaction terms between banks' poor transparency, country characteristics, and further bank characteristics and bank, year, and country fixed effects to absorb any heterogeneity problems between and within banks and countries. In this last OLS panel regression reported in column (1), we find that investors value negatively on average (-0.486) poorly transparent, large, and complex banks in countries affected by the severe consequences of the sovereign debt crisis. The market reaction to CRD IV regulation's announcements indicates that increased transparency will penalize banks still struggling with poor liquidity conditions and credit crunch, weakening any potential strategy to resurrect from a heavy crisis never experienced before that time. Moreover, we can see how even any consideration about enforcement actions disappears in the face of very weak macroeconomic country conditions. Thus, given the fragile macroeconomic conditions at the country level, CRD IV regulation could exacerbate an alignment between bank boards and shareholders' interests, especially when the question is relative to assuming more risks for more profits and dividends (Minton et al., 2014). In this case, the increase in the informational environment could increase agency costs and bank run risk. These last findings speak up to academics, regulators, and practitioners, whose expectations to increase bank transparency based on a regulatory change should be balanced with bank and country characteristics that could reflect detrimental effects on the banking system.

5.4. Results of robustness tests

Using alternative measurement approaches, we check the robustness of our main findings by employing the Fama-French three-factor model around a 3-day event window (-1, + 1). For example, we follow prior literature (Bruno et al., 2018), and we use alternative market indexes at the European level, like Stoxx Europe 50, S&P Euro, FTSE Eurotop 100, FTSE Eurofrst100, and FTSE Eurofirst 80. We propose the results of these tests in Table 5 Panel A, showing consistency in the direction and magnitude of the cumulative abnormal returns (CAR).

Then, following MacKinlay (1997) we should also run a set of tests by enlarging the estimation window. Indeed, to check the robustness of the first results, we run all the specifications using alternative estimation windows of 250, 200, and 150 trading days. We first consider the longest estimation window of 250 trading days. We performed the event study over this estimation window, i.e., the window to estimate the betas being the (-260, − 10), instead of alternative estimation windows (-210, − 10), and (-160, − 10), time interval, where the moment t=0 is the event date. Table 5, Panels B, C, and D report the cumulative abnormal returns (CAR) when we employ the longest 250-day estimation window and the three event windows (-1, + 1), (-2, + 2), and (-1, + 3) around each announcement. These results confirm the first findings.[25]

A necessary set of significance tests of cumulative abnormal returns (CAR) should be also conducted by using parametric and nonparametric tests. We add the results of these tests in Table 2 Panels A–C, and Table 5 Panels B–D. Particularly, we employ the parametric t-test; the Boehmer et al. (1991) test; the non-parametric generalized sign test of Cowan (1992); and the Corrado and Zivney (1992) rank test.

[25] The results obtained by employing the alternative estimation windows (-210, − 10), and (-160, − 10), and the three event windows (-1, + 1), (-2, + 2), and (-1, + 3) around each announcement, confirm the first findings and are untabulated.

Table 5
Robustness tests.

Panel A. This table presents the results of further robustness tests linked to the estimation of abnormal market reactions (e.g., a test of H1), where we employ the Fama-French three-factor model to estimate the cumulative abnormal returns (*CAR*). We identify one twenty-five-day estimation window (− 30, − 5) and a three-day event window (− 1, + 1) around each announcement. We replace the market index price Stoxx Europe 600 in 1) model 1 with the market index price STOXX Europe 50; 2) model 2 with the market index price of the S&P euro; 3) model 3 with the market index price Ftse Eurotop 100; 4) model 4 with the market index price Ftse Eurofirst 100; and 5) model 5 with the market index price Ftse Eurofirst 80. Further details about the description of the events are reported in Appendix I. All the data related to the daily stock price and the market indexes price are retrieved from Refinitiv Eikon Thomson Reuters. Reported values: coefficient (p-value) (***) (**) (*) indicate significance levels at 1 %, (5 %) (10 %), t-statistics in brackets.$CAR_{i,t} = \sum_{t=1}^{n} AR_{it}$ (Eq. (3))

			CAR (− 1, + 1) FF		
No. Event	(1)STOXX Europe 50	(2) S&Peuro	(3) Ftse Eurotop 100	(4) Ftse Eurofirst 100	(5)Ftse Eurofirst80
Total (all events)	− 0.025***	− 0.026***	− 0.029***	− 0.026***	− 0.027***
	[− 7.02]	[− 7.87]	[− 9.40]	[− 7.35]	[− 8.38]

Panel B. This table presents event-study evidence for all 15 announcements about the effect of CRD IV banking regulation for a sample of listed banks from the European Union (e.g., a test of H1). The event study follows the Fama-French (FF) three-factor model $R_{it} = \beta_0 + \beta_1 R_{i,t}^{MKT} + \beta_2 SMB_{i,t} + \beta_3 HML_{i,t} + \varepsilon_{it}$ to estimate the cumulative abnormal returns. We replace the twenty-five days' estimation window (− 30, − 5) with a longer estimation window (− 260, − 10) following MacKinlay (1997). We identify a three-day event window (− 1, + 1 - Column 1) alternatively to a five-day event window (− 2, + 2 – Column 2) and (− 1, + 3 – Column 3) around each announcement. All the data related to the daily stock price, the market index price Stoxx Europe 600, the market value, and the book value of equity are retrieved from Refinitiv Eikon Thomson Reuters. We present CAR for 1) total all events; 2) the average of all events; 3) the event dates that entail only initiatives on the country-by-country (CbC) disclosure (Events 11 and 13); 4) the p-value for the average CAR calculated according to 800 bootstrap simulations for all events; 5) the results of the parametric t-test and the Boehmer et al. (1991) test, the non-parametric generalized sign test of Cowan (1992), and the Corrado and Zivney (1992) rank test. Reported values: coefficient (p-value) (***) (**) (*) indicate significance levels at 1 %, (5 %) (10 %), t-statistics in brackets.

	(1)CAR (− 1, + 1) FF	(2)CAR (− 2, + 2) FF	(3)CAR (− 1, + 3) FF
Total (all events)	− 0.010**	− 0.015***	− 0.006***
	[− 2.57]	[− 7.60]	[− 5.65]
Average (all events)	− 0.008***	− 0.012***	− 0.008***
	[− 3.22]	[− 4.84]	[− 3.22]
Total (CbC Disclosure events)	− 0.011	− 0.010	− 0.006
	[− 1.59]	[− 1.00]	[− 1.40]
All events			
Bootstrap p-value	0.000	0.000	0.000
t-test	− 0.075**	− 0.088**	− 0.024*
Boehmer test	− 0.104**	− 0.162**	− 0.151*
Generalized sign test	− 0.333**	− 0.143**	− 0.092*
Corrado and Zivney rank test	− 0.065**	− 0.049*	− 0.002

Panel C. This table presents event-study evidence for all 15 announcements about the effect of CRD IV banking regulation for a sample of listed banks from the European Union (e.g., a test of H1). The event study follows the market model to estimate first the returns ($R_{i,t} = \beta_0 + \beta_1 R_{m,t} + \varepsilon_{i,t}$), then the abnormal returns, and finally, the cumulative abnormal returns. We replace the twenty-five-day estimation window (− 30, − 5) with a longer one (− 260, − 10). The columns report equal weighted (EW) cumulative abnormal returns (Column 1 with event window (− 1, + 1); Column 2 with event window (− 2, + 2); Column 3 with event window (− 1, + 3)), and market-weighted (MW) cumulative abnormal returns (Column 4 with event window (− 1, + 1); Column 5 with event window (− 2, + 2); Column 6 with event window (− 1, + 3)). All the data related to the daily stock price, the market index price Stoxx Europe 600, the market value, and the book value of equity are retrieved from Refinitiv Eikon Thomson Reuters. We present CAR for 1) total all events; 2) the average of all events; 3) the event dates that entail only initiatives on the country-by-country (CbC) disclosure (Events 11 and 13); 4) the p-value for the average CAR calculated according to 800 bootstrap simulations for all events; 5) the results of the parametric t-test and the Boehmer et al. (1991) test, the non-parametric generalized sign test of Cowan (1992), and the Corrado and Zivney (1992) rank test. Reported values: coefficient (p-value) (***) (**) (*) indicate significance levels at 1 %, (5 %) (10 %), t-statistics in brackets.

	(1)CAR(− 1, + 1) EW	(2)CAR(− 2, + 2) EW	(3)CAR (− 1, + 3) EW	(4)CAR (− 1, + 1) MW	(5)CAR (− 2, + 2) MW	(6)CAR (− 1, + 3) MW
Total (all events)	− 0.014***	− 0.015***	− 0.014***	− 0.019***	− 0.044***	− 0.066***
	[− 5.29]	[− 6.26]	[− 5.29]	[− 3.04]	[− 3.04]	[− 3.04]
Average (all events)	− 0.002***	− 0.004**	− 0.001**	− 0.010***	− 0.011***	− 0.003***
	[− 6.10]	[− 5.29]	[− 5.99]	[− 2.74]	[− 2.95]	[− 2.99]
Total (CbC Disclosure events)	0.001	0.001	0.001	0.014	0.021	0.009
	[1.07]	[1.09]	[1.07]	[1.09]	[0.99]	[1.80]
All events						
Bootstrap p-value	0.000	0.000	0.000	0.000	0.000	0.000
t-test	− 1.060***	− 1.110***	− 1.044***	− 1.268***	− 1.884***	− 1.575***
Boehmer test	− 1.073***	− 1.073***	− 1.039***	− 1.091***	− 1.057***	− 1.094***
Generalized sign test	− 2.064**	− 1.002**	− 1.038**	− 1.031**	− 1.028**	− 1.181**
Corrado and Zivney rank test	− 0.030**	− 0.037**	− 0.027**	− 0.054**	− 0.078**	− 0.092**

(*continued on next page*)

Table 5 (*continued*)

Panel D. This table presents event-study evidence for all 15 announcements about the effect of CRD IV banking regulation for a sample of listed banks from the European Union (e.g., a test of H1). The event study follows the market model to estimate the market-adjusted cumulative abnormal returns (*CMAR*). We first compute the market-adjusted return ($MAR_{i,t}$) as the difference between the log return of the security ($R_{i,t}$) and the log return of the proxy for the market portfolio ($R_{m,t}$). We then compute the market-adjusted cumulative abnormal return ($CMAR_{i,t} = \sum_{t=t1}^{t2} MAR_{i,t}$). The columns report equal weighted (EW) *CMAR* (Columns 1, 2, 3) and market-weighted (MW) *CMAR* (Columns 4, 5, 6), respectively, based on different event windows (− 1, + 1), (− 2, + 2), and (− 1, + 3), and a longer estimation window (− 260, − 10). All the data related to the daily stock price, the market index price Stoxx Europe 600, the market value, and the book value of equity are retrieved from Refinitiv Eikon Thomson Reuters. We present CAR for 1) the total of all events; 2) the average of all events; 3) the event dates that entail only initiatives on the country-by-country (CbC) disclosure (Events 11 and 13); 4) the p-value for the average CAR calculated according to 800 bootstrap simulations for all events; 5) the results of the parametric t-test and the Boehmer et al. (1991) test, the non-parametric generalized sign test of Cowan (1992), and the Corrado and Zivney (1992) rank test. Reported values: coefficient (p-value) (***) (**) (*) indicate significance levels at 1 %, (5 %) (10 %), t-statistics in brackets.

	(1)CMAR(− 1, + 1) EW	(2)CMAR(− 2, + 2) EW	(3)CMAR (− 1, + 3) EW	(4)CMAR (− 1, + 1) MW	(5)CMAR (− 2, + 2) MW	(6)CMAR (− 1, + 3) MW
Actual events						
Total (all events)	− 0.055***	− 0.077***	− 0.071***	− 0.012***	− 0.011***	− 0.073***
	[− 5.88]	[− 5.07]	[− 6.28]	[− 5.14]	[− 7.20]	[− 3.04]
Average (all events)	− 0.012***	− 0.019***	− 0.022***	− 0.002***	− 0.007***	− 0.014***
	[− 5.20]	[− 5.83]	[− 5.29]	[− 5.60]	[− 5.02]	[− 5.22]
Total (CbC Disclosure events)	0.062	0.092	0.089	0.009	0.002	0.002
	[1.80]	[1.73]	[1.06]	[0.47]	[1.21]	[1.21]
All events						
Bootstrap p-value	0.000	0.000	0.000	0.000	0.000	0.000
t-test	− 0.057***	− 0.084**	− 0.082**	− 0.025**	− 0.022**	− 0.079**
Boehmer test	− 2.423***	− 2.339**	− 2.157**	− 2.081**	− 2.017**	− 2.306**
Generalized sign test	− 2.312***	− 2.371**	− 2.328**	− 2.007**	− 1.905**	− 2.359**
Corrado and Zivney rank test	− 0.033**	− 0.055**	− 0.078**	− 0.023**	− 0.019**	− 0.058**

Panel E. This table presents the results of estimating abnormal market reactions (e.g., a test of H1). The event study follows the Fama-French three-factor model to estimate the cumulative abnormal returns (*CAR*). Further details about the description of the events are reported in Appendix I. All the data related to the daily stock price, the market index price Stoxx Europe 600, the market value, and the book value of equity are retrieved from Thomson Reuters - Datastream Eikon. T-statistics in parentheses. We identify one twenty-five days' window (− 30, − 5) checking not to include any overlapping and confounding events. We identify three event windows (− 1, + 1), (− 2, + 2), and (− 1, + 3) around each announcement. We obtain the CAR around each event following three steps according to the Fama-French three-factor model methodology: 1) we use the first model (Eq. 1) to compute the returns (R_{it}), 2) the second model (Eq. 2) to compute the abnormal returns (AR_{it}) and finally 3) the third model (Eq. (3)) to compute the CAR ($CAR_{i,t}$). The model measures the raw returns on firm's stock, the market returns, the small-minus-big market capitalization portfolio returns (*SMB*), and the high-minus-low book equity/market equity portfolio returns (*HML*). The columns report the results of returns (*R* - Column 1), abnormal returns (*AR* - Column 2), and cumulative abnormal returns for three event windows (− 1, + 1), (− 2, + 2), and (− 1, + 3) (*CAR* - Columns 3, 4, and 5). Reported values: coefficient (p-value) (***) (**) (*) indicate significance levels at 1 %, (5 %) (10 %), t-statistics in brackets.

	Predicted sign	*(1)R*	*(2)AR*	*(3)CAR(− 1, + 1)*	*(4)CAR(− 2, + 2)*	*(5)CAR(− 1, + 3)*
Event_1	+ /-	0.014***	0.009***	− 0.007***	− 0.017***	− 0.009***
		[5.02]	[3.64]	[− 2.64]	[− 6.03]	[− 3.31]
Event_2	+ /-	0.023***	− 0.003	− 0.017***	− 0.026***	− 0.016***
		[6.79]	[− 1.00]	[− 3.33]	[− 5.71]	[− 2.68]
Event_3	+ /-	− 0.011***	− 0.009***	− 0.018***	− 0.019***	− 0.001
		[− 5.06]	[− 4.12]	[− 3.40]	[− 3.48]	[− 0.26]
Event_4	+ /-	− 0.017***	− 0.009***	− 0.025***	− 0.031***	− 0.009
		[− 6.22]	[− 3.82]	[− 4.63]	[− 4.94]	[− 1.29]
Event_5	+ /-	− 0.011***	0.002	− 0.029***	− 0.043***	− 0.011
		[− 5.15]	[1.26]	[− 4.95]	[− 5.51]	[− 1.42]
Event_6	+ /-	0.003	− 0.001	− 0.033***	− 0–054***	− 0.011
		[1.19]	[− 0.67]	[− 5.33]	[− 6.41]	[− 1.03]
Event_7	+ /-	− 0.004	0.001	− 0.032***	− 0.050***	− 0.018
		[− 3.47]	[0.69]	[− 4.79]	[− 5.36]	[− 1.62]
Event_8	+ /-	0.004	0.003	− 0.038***	− 0.060***	− 0.021
		[1.92]	[1.43]	[− 4.45]	[− 5.72]	[− 1.53]
Event_9	+ /-	− 0.001	0.001	− 0.028***	− 0.046***	− 0.010
		[− 0.10]	[0.91]	[− 3.21]	[− 4.19]	[− 0.74]
Event_10	+ /-	0.001	0.001	− 0.022***	− 0.042***	− 0.011
		[0.13]	[0.72]	[− 2.40]	[− 3.60]	[− 0.83]
Event_11	+ /-	− 0.007***	− 0.004***	− 0.013	− 0.040	− 0.007
		[− 4.71]	[− 2.84]	[− 1.47]	[− 1.15]	[− 0.52]

(*continued on next page*)

Table 5 (*continued*)

Event_12	+ /-	− 0.012***	− 0.001	− 0.017*	− 0.005	− 0.018
		[− 5.48]	[− 0.54]	[− 1.90]	[− 1.64]	[− 1.17]
Event_13	+ /-	− 0.004	0.002	− 0.020	− 0.002	− 0.014
		[− 1.49]	[0.81]	[− 1.55]	[− 1.00]	[− 0.76]
Event_14	+ /-	− 0.010***	− 0.002	− 0.021*	− 0.077*	− 0.023
		[− 2.82]	[− 0.82]	[− 1.94]	[− 2.00]	[− 1.18]
Event_15	+ /-	− 0.003***	− 0.001*	− 0.024*	− 0.008**	− 0.036***
		[− 2.09]	[− 0.26]	[− 2.00]	[− 2.04]	[− 2.93]

To determine their statistical significance, we employ the cross-sectional t-test. The widely used t-test typically rejects the null hypothesis of no abnormal performance when it is true (i.e., the Type I error) at approximately the significance level of the test. However, it is based on the assumption that the residuals are not correlated across securities. Then, we employ several other tests. For instance, Boehmer et al. (1991) proposed a test of standardized residuals corrected for event-induced changes in volatility and return autocorrelation. The test is based on the standardization procedure considering the heteroskedasticity of event-window abnormal returns.

We also use the generalized sign test proposed by Cowan (1992) as a non-parametric test. The advantage of this kind of test is that it is not based on particular assumptions concerning the distribution of the abnormal returns of stocks. According to Cowan (1992), the generalized sign test has the advantage of being robust in the presence of skewed returns and is well-specified when cross-sectional abnormal returns are not symmetric. We also follow Corrado and Zivney (1992), introducing the rank test corrected for event-induced changes in the volatility of rankings and cross-correlation due to event day clustering. This test is robust to skewed returns and better specified than the regular t-test when testing for one-day abnormal returns (Corrado and Zivney, 1992). We apply the aggregation procedure from Cowan (1992) by cumulating daily ranks of abnormal returns within the CAR and CMAR.

Finally, we want to verify whether the market reaction is much more pronounced for some announcements than others (see Table 5 Panel E). Performing the event study following the Fama French three-factor model based on the twenty-five days' window (-30, − 5) and three event windows (-1, + 1), (-2, + 2), and (-1, + 3) around each announcement, we report CAR for each event. The significance level of CAR tends to dissipate with the broadening of the event window (-1, + 3).

6. Conclusion

Transparency's benefits are theoretically ambiguous ('Transparency-Stability' view vs. 'Transparency-Fragility' view). The 2008 financial crisis challenged investors' trust in banking institutions and their transparency (Acharya and Ryan, 2016). In response to the need to regain investors' trust, regulators enhanced the absolute need to fight bank opacity by passing the EU CRD IV regulation in 2013 dedicated to the EU banking system. In this study, we consider this regulation, because it represents the most notable regulatory initiative at the European level to increase overall bank transparency through stringent rules affecting capital, liquidity, risk exposure, compensation, and, more broadly, governance items. We examine the market response to the likelihood and degree of implementation of EU CRD IV, employing a sample of 145 EU-listed banks and following event study methodologies around 15 events between 2011 and 2013. We document on average, a negative market reaction, indicating that investors see no marginal potential benefits from the passage of the CRD IV regulation. Particularly, we do not find any significance when we focus on the events' bucket of CbCR mandatory disclosure as witnessed in prior studies (Dutt et al., 2019). In a second moment, running several OLS panel data regression analyses, we show that investors negatively perceive the introduction of this regulation for higher levels of bank transparency, with more pronounced reactions for poorly transparent, large, and complex banks located in countries with high exposure to sovereign indebtedness.

Although the CRD IV regulation adoption has potentially the power to increase the level of the informational environment, endogenous costs associated with transparency could be detrimental to the banking system. In this case, complying with proprietary costs in providing new specific information prevails over the benefits of a future increase in transparency during the post-crisis period. The increase in the regulatory environment thanks to CRD IV leads to unveiling a sort of "Pandora's box" when the main purpose of banks being opaque is to conceal excessive risk-taking to avoid regulatory intervention or to facilitate regulatory forbearance. This is consistent with the intuition from Morrison and White (2013) that regulators may prefer transparency ex-ante but opt for opacity during a crisis as it allows them to forbear secretly without investors and depositors knowing. Relatedly, Nicoletti (2018), studying loan loss provisioning during the boom period from 1997 to 2005, finds that regulators prefer greater transparency during boom periods to facilitate monitoring and market discipline and reduce the chance of a banking crisis.

In conclusion, our study contributes to the ongoing debate about the role of banking transparency (Bushman, 2014). These findings have important policy implications and expand the existing knowledge on the consequences of banking transparency to guide banks' behavior, drive policy interventions, and contribute to enhancing supervisory effectiveness. We do not intend to document that this regulation cannot produce good results in the future, since the results highlight a shift from shareholder to stakeholder wealth (Healy and Serafeim, 2020; Hombach and Sellhorn, 2019).

Furthermore, as policy implications, our findings suggest that regulators should consider how a combination of bank and country characteristics could shape investors' reactions differently from their expectations. This point is instructional, given the ongoing discussion regarding the need for more bank transparency and the role played by EU supervisory authorities in discouraging opaque practices. Lastly, because EU countries absorb European directives at different speeds (Christensen et al., 2016) and the unified EU

banking sector is highly heterogeneous, we conclude that banking transparency is not automatically achievable through new regulation when internal banking fragility overrides any form of coordination between regulation, supervision, and enforcement actions.

CRediT authorship contribution statement

Michele Fabrizi: Supervision. **Antonio Parbonetti:** Supervision. **Sara Longo:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

APPENDIX I. Description of the key events leading to the CRD IV adoption in EU banking industry

Key events (*)	Date	Description
Event 1	September 13, 2011	Committee referral announced in Parliament, 1st reading CRD IV document. sec 2011 1289 en.pdf (europa.eu) – Media search: (September 20, 2011, Tuesday). Single rule book a threat to EU stability. *Financial Times (London, England).* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:53V5-JW91-JBFS-D501-00000-00&context=1516831.
Event 2	November 30, 2011	The Council noted a progress report from the presidency on proposals for a fourth amendment of the EU' s rules on capital requirements for banks and investment firms ("CRD IV"). Media search: States News Service. (November 29, 2011, Tuesday). PREPARATION OF EUROGROUP AND ECONOMIC AND FINANCE MINISTERS COUNCIL, BRUSSELS, 29–30 NOVEMBER 2011. *States News Service.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:54C6-BGH1-JCBF-S0DY-00000-00&context=1516831.
Event 3	May 2, 2012	The Council carried out a detailed examination of proposals to amend the EU's rules on capital requirements for banks and investment firms, the so-called "CRD IV" package, to start a negotiation with European Parliament to adopt the texts at first reading. – Media search: (May 2, 2012). Capital Requirements Directive IV - Too many cooks spoil CRD IV liquidity broth. *The Banker.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:55JV-DHT1-DYX2-T2GH-00000-00&context=1516831.
Event 4	May 15, 2012	Debate in Council - The draft Directive introduces additional prudential requirements to establish financial stability. – Media search: (May 15, 2012). ECOFIN COUNCIL: CRD IV: PRESIDENCY AIMS FOR WIDEST POSSIBLE CONSENSUS. *European Report.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:55NJ-K8R1-DYV1-936B-00000-00&context=1516831.
Event 5	May 30, 2012	Committee reported tabled for plenary, 1st reading/single reading. The text introduces the definition of "systemic institution" which means an institution which in case of failure or malfunction, could lead to systemic risk at global, European, or domestic level. In addition, the definition of systemic risk has been included and shall mean a risk of disruption in the financial system with the potential to have serious negative consequences for the financial system and the real economy. – Media search: (June 7, 2012, Thursday). World: Fitch Says CRD Reform Will Benefit Small Covered Bond Issuers. *Thai News Service.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:57NX-9BW1-JB5P-J11G-00000-00&context=1516831.
Event 6	July 10, 2012	The Council was briefed by the Presidency on progress in negotiations with the European Parliament on two proposals amending the EU's rules on capital requirements for banks and investment firms ("CRD IV"). – Media search: (July 13, 2012). BANKING: CRD IV: TWO LIQUIDITY RATIOS UNDER NEGOTIATION. *European Report.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:5645-3Y01-JCBY-K2V3-00000-00&context=1516831.
Event 7	October 9, 2012	The Council held an exchange of views and confirmed its intention to reach a political agreement on the package before the end of the year. However, several issues have yet to be resolved in the negotiations with the Parliament. – Media search: (October 9, 2012, Tuesday). Draft EU proposals on closer integration: in full; Europe needs "openness and transparency" and "fair treatment and representation of both euro and non-euro area Member States" as the eurozone moves towards closer integration, draft EU summit documents obtained by the Telegraph show. Here is its 13-point plan in full. *telegraph.co.uk.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:56SP-C7J1-DXDT-64GP-00000-00&context=1516831.
Event 8	November 13, 2012	Parliament's political groups prepared for the plenary sessions in Strasbourg, where there will be votes on the 2013 EU Budget, a resolution on a genuine economic and monetary union, the capital requirements directive (CRD IV). – Media search: (November 14, 2012, Wednesday). Eurex Clearing introduces CCP service for bilateral securities lending market. *MarketLine NewsWire (Formerly Datamonitor).* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:5722-B9K1-JC0X-H031-00000-00&context=1516831.
Event 9	December 4, 2012	The Council discussed progress in negotiations with the European Parliament on two draft regulations aimed at further improving economic governance in the eurozone. a regulation for enhanced monitoring and assessment of draft budgetary plans of eurozone member states, especially those subject to an excessive deficit procedure. a regulation on enhanced surveillance of eurozone member states that are experiencing severe financial disturbance or request financial assistance.-

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Key events (*)	Date	Description
		Media search: (December 7, 2012). PRUDENTIAL RULES FOR BANKS: CRD IV: PARLIAMENT AND COUNCIL MAKE PROGRESS. *European Report.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:5796-H651-DYV1-94DJ-00000-00&context=1516831.
Event 10	February 19, 2013	The bonus cap had been agreed. – Media Search: (February 25, 2013, Monday). Bank reform is gathering pace. *FT.com.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:57V4-BKR1-JCM7-G4CT-00000-00&context=1516831.
Event 11	February 27, 2013	In a trialogue between the Presidency of the European Council, the European Parliament and the European Commission on this day, it was decided to incorporate the new reporting obligation of the Country-by-Country Reporting in the CRD IV. – Media search: (March 1, 2013). PRUDENTIAL BANKING RULES (CRD IV): TENTATIVE DEAL STRICTLY LIMITS BONUSES. *European Report.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:57W0-BVD1-DYV1-93W8-00000-00&context=1516831.
Event 12	March 5, 2013	The Council broadly endorsed the outcome of the most recent political trialogue with the European Parliament on the "CRD IV package" of legislation amending the EU's rules on capital and liquidity requirements for banks and investment firms. The package sets out to amend and replace existing capital requirements Directive with two new legislative instruments: 1) a regulation establishing prudential requirements that institutions must fulfil, and b) a directive governing access to deposit-taking activities. - Media search: Emily Perryman. (May 7, 2013, Tuesday). Firms still have much to do to complete preparations for CRR/CRD IV. *Institutional Asset Manager.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:58PG-CPK1-JB9M-K31T-00000-00&context=1516831.
Event 13	April 16, 2013	Decision by Parliament, 1st reading - The directive provides that from 1st January 2015 Member States shall require each institution to disclose annually, specifying by Member State and by third country in which it has an establishment, the following information on a consolidated basis for the financial year: a) name nature of activities and geographical location; b) turnover; c) number of employees on a full time equivalent basis; d) Profit or loss before tax; e) tax on profit or loss; d) public subsidies received. Article 89 | European Banking Authority (europa.eu); – Media search: (April 17, 2013). CRD IV-CRR: MEPS ENDORSE PRUDENTIAL RULES FOR BANKS. *European Report.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:5870-TTT1-DYV1-903B-00000-00&context=1516831.
Event 14	June 26, 2013	Final act signed - end of procedure in Parliament - publication of the directive CRD IV. -Media search: (June 28, 2013). Deloitte says publication of revised EU capital and liquidity framework gives banks much needed clarity. *Banking Newslink.* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:58S5-JMJ1-F159-50M6-00000-00&context=1516831.
Event 15	July 16, 2013	CRD IV enters officially into force. - Media search: Intervention makes sense; Business Editor's Commentary. *The Times (London).* https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:58X0-PRT1-DY9P-N34C-00000-00&context=1516831.

(*) All the events are identified through the webpage of the legislative observatory of the European Parliament (data source: Procedure File: 2011/0203(COD) | Legislative Observatory | European Parliament (europa.eu)). All these institutional events are followed by press conferences divulgated online from Brussels and Strasbourg at EU institutions and further other media channels. We conduct a media search through via LexisNexis for up to 1 week after each of the 15 event dates.

APPENDIX II. Variable definitions

Variable	Definition	Source
Dependent variable		
CAR (FF)	Cumulative abnormal returns based on Fama-French 3 factor model: we first compute returns $R_{it} = \beta_0 + \beta_1 R_{i,t}^{MKT} + \beta_2 SMB_{i,t} + \beta_3 HML_{i,t} + \varepsilon_{it}$. The model measures the raw returns on firm's stock, the market returns, the small-minus-big market capitalization portfolio returns (*SMB*), and the high-minus-low book equity/market equity portfolio returns (*HML*). Then we compute the abnormal returns $AR_{it} = R_{it} - E(R_{it})$. Finally, we compute the cumulative abnormal return $CAR_{i,t} = \sum_{t=1}^{n} AR_{it}$. We identify a twenty-five days' estimation window (− 30, − 5) and a three-day event window (− 1,+ 1) alternatively to a five-day event window (− 2, + 2) and (− 1, + 3) around each CRD IV announcement. The bank stock price (the daily stock price of the listed European banks), the Market value, and the Book value of equity (for each listed European bank), the Market stock price (the daily market stock price of the following market indexes: Stoxx Europe 600 - for further robustness tests we replace this market index with STOXX Europe 50, S&P euro, Ftse Eurotop 100, Ftse Eurofirst 100, and Ftse Eurofirst 80) are retrieved from Refinitiv Eikon Thomson Reuters. *CAR* is the dependent variable used for all the cross-sectional analyses based on this event study methodology.	Refinitiv EikonThomson Reuters
CAR - CMAR	We also employ a simple market model to compute the cumulative abnormal returns (*CAR*) and the cumulative market adjusted returns (*CMAR*). The model is based on a first computation of the returns ($R_{i,t} = \beta_0 + \beta_1 R_{m,t} + \varepsilon_{i,t}$), then the abnormal returns $AR_{it} = R_{it} - E(R_{it})$ and finally the cumulative abnormal returns $CAR_{i,t} = \sum_{t=1}^{n} AR_{it}$. We select market index and two benchmark options. Researchers have a choice between the equally weighted (EW) and the market weighted index (MW). The former weighs all firms equally while the latter weighs firms by their market capitalization. The equally weighted results provide insights about the abnormal returns in the average firm, while the value-weighted results mirror the experience of a large institutional investor who is constrained to allocate funds in proportion to each stock's market capitalization due to liquidity reasons. For the cumulative market-adjusted abnormal returns we first compute the market adjusted return ($MAR_{i,t}$) as the difference between the log return of the security ($R_{i,t}$) and the log return of the proxy for the market portfolio ($R_{m,t}$). We then compute	Refinitiv EikonThomson Reuters

(*continued on next page*)

(*continued*)

Variable	Definition	Source
	the market adjusted cumulative abnormal return based on the following model ($CMAR_{i,t} = \sum_{t=t1}^{t2} MAR_{i,t}$). We identify a twenty-five days' estimation window (− 30, − 5) and a three-day event window (− 1,+ 1) alternatively to a five-day event window (− 2, + 2) and (− 1, + 3) around each CRD IV announcement. The bank stock price (daily stock price of the listed European banks), the Market stock price (the daily market stock price of the Stoxx Europe 600), and the market capitalization of each bank for each year are retrieved from Refinitiv Eikon Thomson Reuters.	
Variables of interest		
R2	R2 is a dummy variable equal to 1 if bank transparency is lower the median indicating poorly transparent banks, 0 otherwise. Following Chen et al. (2022), we approximate bank transparency computing the adjusted r-squared for each bank-year from the regression: $Write\ Off_{(t,t+1)} = \alpha_0 + \sum_{j=1}^{2} \gamma_j LLP_{(t-j)} + \sum_{j=1}^{2} \beta_j EBLLP_{(t-j)} + \rho \Delta NPL_{(t-1)} + \delta Capital_{(t-1)} + \varepsilon_t$ estimated using the bank's observations from year t to year t – 1, where LLP is loan loss provisions, EBLLP is earnings before loan loss provision at the beginning of year t, ΔNPL is the change in non-performing loans in year t− 1 from year t, Capital is shareholders' equity divided by total assets. Low R2 doesn't necessarily imply that banks are riskier. This is because the R2 measures the proportion of the uncertainty that depositors can resolve about banks' future loan portfolio performance.	Orbis Bank Focus (Bureau Van Dijk)
Regulatory risk	A dummy variable equals to 1 when EU-listed banks are incorporated in countries with an implemented bank levy to face high regulatory risk starting from 2010 (Austria, Belgium, France, Germany, Portugal, Sweden, and The Netherlands), 0 otherwise	Overesch and Wolff, (2021)
Enforcement power	Proxy based on the public enforcement index following La Porta et al., (2006), which equals to 1 when the arithmetic mean of (1) supervisor characteristics index; (2) rule-making power index; (3) investigative powers index; (4) orders index; and (5) criminal index is above the average, 0 otherwise.	La Porta et al.,(2006)
PIIGS countries	A dummy variable equals to 1 when EU-listed banks are in European countries (Portugal, Italy, Ireland, Greece, and Spain) drifted into a severe crisis as anxiety about their high indebtedness made it increasingly difficult to refinance their outstanding debt, 0 otherwise.	
Prior CbCR disclosure	A dummy variable equals to 1 when a European listed bank discloses voluntarily the Country-by-Country Reporting before the mandatory adoption ruled out by the EU Commission at the end of 2013, 0 otherwise. For each financial statement we check the presence of references or reports about CbC information (i.e., the turnover, the number of employees, the profit or loss before tax, tax on profit or loss, and public subsidies received). We also do a double check to verify the presence of foreign subsidiaries for banks included in our sample according to the data reported in Orbis Bank Focus (Bureau Van Dijk).	Hand Collection&Orbis Bank Focus(Bureau Van Dijk)
Control variables		
Size	The logarithm of total assets at the end of the year.	Orbis Bank Focus (Bureau Van Dijk)
Deposits	Total deposits to total assets.	
Fee_Rev	The fees and net commissions divided by operating income at the end of the year.	
LLA	The amount of loan loss reserve divided by total assets at the end of the year.	
Tier1	The total regulatory capital ratio at the end of the year.	
Cashflow	The change of profit before taxes and loan loss provisions divided by total assets at the end of the year.	
ΔROA	The change in ROA, where ROA is computed as the profit before taxes plus loan loss provisions at $t+1$ minus profit before taxes plus loan loss provisions at t divided by total assets at the end of the year.	
ΔLoans	The total loans at $t+1$ minus total loans at t divided by total assets at the end of the year.	
Inst_own%	Institutional ownership (%) is the sum of shares held by institutions of the year 2010 divided by shares outstanding.	

Data availability

Data will be made available on request.

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