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The bail-in credibility: barking dogs seldom bite

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Abstract
This paper studies the senior unsecured bondholders' bail-in expectations and market monitoring following bail-in legislative events aimed at introducing new tools for subordination. We measure bail-in expectations using a difference in differences approach that compares the reaction to bail-in events of senior unsecured bonds to the reaction of non-bailinable bonds. Similarly, we measure senior unsecured bondholders' monitoring activity by using a triple differencing analysis that compares the yield-risk sensitivity reaction of senior unsecured bonds with respect to that of non-bailinable bonds. Our results indicate unaffected bail-in expectations by senior unsecured bondholders who, accordingly, do not enhance their pricing of banks' risk.

Keywords Bail-in · Credibility · Unsecured senior bonds · Market monitoring · Bondholder's expectations

Introduction

The European bank resolution framework embeds the bail-in tool within a highly complex and technical regulatory framework that jeopardizes its effectiveness [30]. The main shortcomings are related to the different exemptions, counter-exemptions and restrictions which require many discretionary choices that involve several authorities and are also open to political pressure [16, 29].

The resulting uncertainty concerns the investment community [17, 27] which solicits, in particular, for a regulatory overhaul allowing a clearer quantification of their potential loss exposure in case of bail-in. Banks, on the other hand, require new tools to efficiently abide by the minimum requirement of own funds and eligible liabilities (MREL) as well as the recent mandatory subordination of part of its instruments which are both crucial to ensure the sufficient loss-bearing capacity needed by the bail-in to be effective.

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At the EU level, these requests are addressed by the directive 2017/2399/EU which amend the directive 2014/59/EU, also known as Bank Resolution and Recovery Directive (BRRD), as regards the ranking of unsecured debt instruments in insolvency hierarchy. In particular, the directive harmonizes the insolvency ranking of unsecured debt instruments by requiring the Member States to create a new asset class of non-preferred senior debt which ranks in insolvency above subordinated liabilities that do not qualify as Tier 2 capital but below other senior liabilities.

As designed, the asset class of unsecured senior debt is divided into two categories: non-preferred and preferred. The former is eligible to abide by the MREL subordination requirement and also helps the bank to efficiently pile up the MREL buffer as it represents a cheaper source of funding with respect to other subordinated debt. The latter, conversely, is not eligible to meet the MREL subordination requirement but it is bailinable and can count towards the MREL under specific conditions as well.

In addition, such distinction between instruments that are likely to be bailed-in and relatively safer senior bonds allows for (i) a better quantification of the amount of bailinable debt available in case of bail-in, especially for cross-border groups [10] (ii) a reduction of litigations related to the violation of the no-creditor-worse-off (NCWO) principle [3], and (iii) a better prediction of outcome by investors [30].

As a result, the directive meets both investors' expectations over a clearer quantification of their potential loss exposure in case of bail-in and the bank's urge to abide

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by the bail-in buffer requirement. The directive, however, provides for a harmonization of the above-mentioned rules across the Member States as some of them pre-empted this legal framework ahead of its entry into force in order to help their banks efficiently complying with the bail-in buffer requirements.

Nevertheless, even if a sufficient MREL may limit the distortions caused to the investors' prediction of outcomes by specific exemptions for liabilities or by the NCWO principle, they would still have to face uncertainty regarding the trigger for bail-in, the specificity of its application in each case, and the difficult evaluation of the resolved entity. In addition, a sufficient loss-bearing capacity in resolution may still be hindered by the high degree of administrative discretion embedded in the resolution framework as well as by political bullying.

As a result, despite the authorities' commitment towards improving the effectiveness of the bail-in regime, the bail-in tool still suffers from severe shortcomings. Our paper, thus, delves into debt market reaction to the events related to the implementation of the directive and its country-specific amendments, focusing on the implications in terms of bail-in credibility and market discipline.

Among debt market asset classes, we specifically focus on senior unsecured debt as it is the objective of the legal actions above mentioned and provides for a better assessment of bail-in law due to its higher risk exposure to the bail-in tool with respect to other subordinated debt which instead has been always designed to bear the losses in case of bank failure.

In line with Giuliana [13], we therefore empirically gauge bail-in credibility by employing a difference in differences (diff-in-diff) analysis that compares the yield-spread reaction between senior and non-bailinable bonds around the days after the entry into force of each legal event considered. This analysis does not detect any bond repricing by senior unsecured bondholders who do not embed higher bail-in expectations after the implementation of the amendments examined.

Again, following Giuliana [13], we test for an increase in market discipline by employing a triple differencing model to compare the yield-risk sensitivity between senior and non-bailinable bonds around the days after the entry into force of each legal event considered. Consistently with previous analysis' results, senior unsecured bondholders do not improve their monitoring activity as they do not perceive the amendments to the bail-in regime as a significant commitment towards its improvement.

We attribute the reasons underlying the failure in both resuming bail-in credibility and market monitoring to the issues inherent in the overall resolution framework which grant several authorities ample discretion regarding the implementation of bail-in and exposes the same to political bullying, therefore, jeopardizing bail-in effectiveness and its predictability by investors.

Our study significantly contributes to the existing bail-in literature as it refines both the bail-in events and bailinable classes of investors used so far by the empirical branch. In particular, and differently with prior studies, we match events of the bail-in legislative process, so far unnoticed but crucial for bail-in implementation, to the specifically concerned class of senior unsecured bondholders. As a result, we contribute to sharpening both the identification strategy, as concerns the bail-in events considered, and the sample selection strategy, as regards the class of investors examined, to derive more accurate results about bail-in credibility and investors' monitoring activity after bail-in events.

Finally, policy implications can be drawn from our results as the inertia detected among investors as regards crucial breakthroughs of the bail-in legislative process urges policymakers to account for the bail-in shortcomings highlighted by both theoretical and legal studies to design a better legislative framework for the bail-in.

The rest of the paper is organized as follows: Sect. 1 discusses the related literature; Sect. 2 describes the events under analysis; Sect. 3 presents the dataset and describes the methodology employed; Sect. 4 presents the results; Sect. 5 concludes.

Literature review

The research questions we pose regarding debt market reactions to the EU and country-specific amendments to the bail-in regime root into the branch of literature investigating bail-in credibility. This literature consists of theoretical studies bringing out the shortcomings of the bail-in regime and empirical studies gauging the market reaction to bail-in events.

Among theoretical studies, a branch delves into the bail-in decision-making process to derive the optimal strategy and point out the main obstacles. Keister and Mitkov [20] study a model where banks have control over the timing of bail-in and show that bailout expectations can provide incentives for banks to delay bail-in decisions. Colliard and Gromb [6] show that loose bail-out rules compromise private restructuring incentives but strict bail-in rules lead to costly delays in the process of debt restructuring negotiations. Walther and White [31], instead, reconcile bail-out and bail-in policies showing their complementarity and pointing out that if the former are possible then the latter are more effective. They also highlight the regulator's discretion as an obstacle to the smooth implementation of bail-in. In a similar vein, Bolton and Oehmke [5] study the trade-offs related to the implementation of bail-in by cross-border banking groups across different jurisdictions bringing out

the divergent interest that may arise among national regulators. In addition, Hadjiemmanuil [16] identifies the political discretion in imposing bail-in as a crucial driver of their credibility. National politicians might indeed back down to short-term political pressures for bailouts. Thus, regulators' as well as political discretion emerge both as obstacles to bail-in. This point is further supported by Philippon and Salord [24] which point out the vast discretion provided by the BRRD to authorities about implementing bail-in as a major shortcoming of its regime.

Legal studies addressing the tangled mass of bail-in rules complement the theoretical aspects of bail-in credibility literature. Tröger [24, 30] corroborates the thesis according to which the embeddedness of the bail-in tool in the European bank resolution framework, which grants ample discretions to authorities about implanting bail-in and is further jeopardized by political interference, undermines its effectiveness. In addition, the author further shows how this framework is threatening the key policy objective of restoring market discipline in the following of the creditor inertia, namely a lower sensitivity of banks' risk, that affected investors before the regulatory overhaul [14, 15]. Authorities' discretion, indeed, hampers the investors' predictability of outcome, therefore, compromising their risk-sensitive pricing of bank debt. In particular, a certain outcome in the case of bail-in would allow investors in bailinable debt to require a risk premium in line with their participation in losses. Actually, instead, unpredictable adjustments of MREL prescriptions by authorities change the risk profile of eligible instruments causing misalignment between the investor's required risk premium and their actual loss participation. The resulting mispricing may lead to undesirable consequences: underprizing could indeed cause moral hazard whereas overpricing could increase a bank's funding cost that would ultimately impair growth as a result of reduced lending capacity.

Thus, debt governance implications emerge as a crucial spillover of bail-in credibility issues and are often included into its empirical literature in their dimension of market monitoring, namely the process through which investors assess the bank's risk profile and embed it into securities' prices, in contrast to the market influence dimension of market discipline that investigates the process through which a change in securities' prices causes bank's managers to address the deterioration in the bank's resilience condition.

Empirical studies about bail-in credibility differ according to (i) the type of bail-in event and (ii) the asset class investigated. Early studies have adopted the yield spread between bailinable and non-bailinable bonds to gauge bail-in credibility among investors. Giuliana [13] evaluates the impact of several bail-in events, related both to the legislative process of the bail-in and its actual enforcement, over a sample of 8282 EU bonds between 2012 and 2017. His results show that the events indicating an increased commitment to bail-in increase its credibility by investors as they widen the spread between bailinable (unsecured) and non-bailinable (secured) bonds. Moreover, the results show also a higher yield-risk sensitivity of bailinable bonds after the occurrence of bail-in events, therefore, supporting the thesis of bail-in increasing the market discipline. Consistently, Crespi et al. [8] find the same results, in terms of credibility and market discipline, analyzing the introduction of the bail-in tool in January 2016 over a sample of 1,798 bonds relative to the Italian bank bonds primary market. Lewrick et al. [20], instead, refine the analysis only on senior bonds to better catch the impact of the bail-in and avoid biases that stem from the inclusion of other subordinated liabilities that may be influenced in addition by other crisis management measures. Their result points out a higher bail-in risk premium for riskier issuers, therefore, providing further evidence of an enhanced market discipline among senior debt investors.

Conversely, the study conducted by Pablos Nuevo [22] to check for the impact of the introduction and implementation of the new EU bail-in framework on a sample of 41 EU credit institutions does not show evidence of a significant and generalized increase in the so-called subordinated spread, namely the difference between subordinated bonds' yields and senior unsecured bond's yields, over the period 2014Q4-2018Q2. These results are further corroborated by Chan-Lau and Oura [5] who use extensions of simple option price models for pricing various debts and find that asset encumbrance and the introduction of new bank resolution tools only increase senior unsecured debt yields modestly for existing banks under distressed market conditions in 2013.

However, more recent studies, specifically focused on unsecured senior debt, have overturned the results again. In particular, the paper by Cucinelli et al. [8] shows that for a sample of 4065 bonds issued by 63 banks from 12 euro area countries during 2013–2017 bail-in regulation has had a strong effect on the spread between senior unsecured and non-bailinable bonds. Moreover, using a sample of 4855 bonds issued by 45 banks from January 2006 to December 2016, Gai et al. [12] find an increase in the risk premium for unsecured bonds, and senior unsecured bonds show the greatest effect on yields and yield spread when bail-in regulation came into force.

The novelty of our paper with respect to previous studies consists of analyzing a series of bail-in events related to its legislative process so far unnoticed by scholars but that represent a crucial step towards a more effective bail-in tool. The events concerned lay down the basis for a thorough overhaul of the bank capital structure that should counter the bail-in shortcomings in terms of uncertainty regarding the actual stock of bailinable liabilities available in case of bail-in and issues related to the violation of the NCWO principle. The amendments further provide investors in bailinable debt with the sufficient loss-bearing capacity needed for the

bail-in to work and put them in a position to actually perform the debt governance suggested in the resolution framework and previously undermined by the aforementioned severe shortcomings. Moreover, the events under investigation are expected to ease the application of bail-in beyond the scope of traditional subordinated debt thereby specifically interesting investors in unsecured senior debt.

In short, the commitment expressed by the events under analysis towards the enhancement of the bail-in regime and their focus on a specific assets class are the two main pillars around which this paper develops his analysis of the credibility of bail-in and contributes to a literature whose wider approach has provided mixed results do far. Based on the above, we thus develop the following hypothesis about bail-in credibility.

H_0 = Unsecured senior investors do not reprice bond yields following the legislative bail-in events considered in this study.

If this hypothesis is verified, then unsecured senior investors do not modify their bail-in expectations following the enactment of bail-in regime amendments as they are neither perceived as an enhancement nor as a threat. If the null hypothesis is rejected, we test the following further hypotheses:

H_1 = Unsecured senior investors positively reprice bond yields following the legislative bail-in events considered in this study.

If this hypothesis is verified, then unsecured senior investors discount higher expectations of bail-in being implemented in case of distress. In detail, investors perceive the amendments as a crucial commitment towards the bail-in and a plausible threat to their investment in case of insolvency.

H_2 = Unsecured senior investors negatively reprice bond yields following the legislative bail-in events considered in this study.

If this hypothesis is verified, then unsecured senior investors discount lower expectations of bail-in being implemented in case of distress. In detail, investors perceive the amendments as a step back towards the implementation of an effective bail-in regime. Moreover, we further develop the following hypotheses regarding market discipline.

H_A = Unsecured senior investors do not enhance market monitoring following the legislative events that aim to improve the efficacy of the bail-in tool.

In detail, senior investors do not perceive those acts as an enhancement of the bail-in regime; therefore, they simply do not intend to better reflect bank's risk into securities prices. If the null hypothesis is rejected, we test the following further hypotheses:

H_B = Unsecured senior investors enhance market monitoring following the legislative events that aim to improve the efficacy of the bail-in tool.

In detail, senior investors perceive those acts as a crucial commitment towards a well-designed and consistent bail-in tool that if triggered may write off their investment. As a result, senior investors start better embedding banks' risk into securities prices.

H_C = Unsecured senior investors reduce market monitoring following the legislative events that aim to improve the efficacy of the bail-in tool.

In detail, senior investors perceive those acts as a step back towards an efficient bail-in and thereby feel confident to reduce their monitoring activity.

Regulatory framework

As part of the regulatory overhaul implemented by legislators in the afterward of the Great Financial Crisis, several tools have been deployed to enhance the crisis management of failing banks.

On 9 November 2015, the Financial Stability Board (FSB) establishes international principles and a term sheet (the FSB TLAC Term Sheet) that set out internationally agreed rules regarding the total loss-absorbing capacity (TLAC) for global systemically important banks (G-SIBs). Accordingly, cross-border banking groups of systemic relevance, whose failure may threaten the stability of the entire financial system, have been required to pile up a buffer of securities and other liabilities that should be promptly available in case of distress to bear the losses in place of taxpayers.

Moreover, according to the subordination requirement, G-SIBs are required to comply with the TLAC minimum requirement, with certain exceptions, with subordinated liabilities that rank in insolvency below liabilities excluded from TLAC. The TLAC principles set out by the FSB (2015) discipline three potential methods for subordination: structural, contractual, and statutory subordination.

The first approach is based on the role of the issuing institutions within the banking group, in particular when the issuer is a non-operative holding or sub-holding that transfers capital to the operating subsidiaries and gets revenue from their dividends. Given that all subsidiaries' claims have to be settled up, in case of insolvency, before capital is upstreamed to the holding company, the creditors of the latter result subordinated in structural terms. Regarding the contractual subordination, the issuing institution and the creditor contractually agree that capital and interest are paid only, in case of insolvency, after all senior claims have been settled up. Statutory subordination, instead, is set up by a legal provision of national insolvency law. The latter envisages that, in the case of insolvency, payments on interests and capital on subordinated liabilities have to be settled up only after those of liabilities that rank senior to them.

The new model of crisis management hinges on the bail-in tool that disciplines the write-off and/or conversion of a bank's liabilities. A bank should therefore ensure that it has enough bailinable liabilities available in case of distress not only to bear the losses but also to recapitalize the institute whose operational continuity must be ensured at any cost.

In parallel, the European Authority introduced in 2014 with the Bank Recovery and Resolution Directive (BRRD) the bail-in tool and the Minimum Requirement of own funds and Eligible Liabilities (MREL), namely the European counterpart of TLAC. The BRRD applies MREL to all credit institutions in the EU on an individual and consolidated basis, while the TLAC applies to G-SIBs only.

Initially, its provisions did not provide for mandatory subordination of MREL instruments although the competent Resolution Authority or the Single resolution Board could have set a subordination requirement on a case-by-case basis. Moreover, the BRRD loosely defined the eligibility criteria for an instrument to qualify as MREL, provided for specific exemptions of certain liabilities and gave the misleading idea that almost the entire position of the liability side of a bank balance sheet could have been bailed-in.

All these shortcomings in the design of the bail-in tool undermined its efficiency and its credibility by investors. As a response, the European Commission drafted a proposal, included in the 2016 Banking Package and finalized in the Directive 2017/2399 (hereafter Directive) that entered into force on 28/12/2017, that envisages the harmonization of creditor claims for senior unsecured debt for the EU Member States by differentiating the asset class of unsecured senior debt between unsecured senior preferred and non-preferred debt. The latter is eligible to the MREL subordination requirement, whereas the former is bailinable only.

Amended as such, provisions allow banks to efficiently cope with the subordination requirement. Indeed, non-preferred senior debt ranks above subordinated liabilities that do not qualify as Tier 2 but below senior preferred debt. As a result, banks can fulfill the subordination requirement by paying a lower spread than that charged on subordinated liabilities whilst they can use the preferred solution for their regular funding.

In short, the overhaul of the bank capital structure as designed clarifies the actual stock of bailinable liabilities, reduces the risk stemming from the violation of the NCWO principle and also helps banks pile up efficiently a sufficient MREL buffer. This, ultimately, provides banks with sufficient loss-absorbing capacity in case of bail-in thereby mitigating doubts about its eventual application in case of bank failure by investors.

As the directive harmonizes the rules on insolvency ranking of unsecured senior debt across the EU Member States, it also eases bail-in applications for cross-border banking groups. This further permits to tackle the existing competitive distortions in the internal market, consisting of different banks' costs to comply with the MREL subordination requirement and investors' costs to buy the relative debt instruments that stem from different national rules on the insolvency ranking of unsecured senior debt.

The process of harmonization further enabled domestic systemically important banks (D-SIBs), whose countries did not autonomously amend the rules on insolvency ranking of unsecured senior debt under their national insolvency law, to comply with the MREL subordination requirement using non-preferred senior debt. Indeed, given the high issuance requirements posed by the TLAC/MREL frameworks, some Member States pre-empted the EU approach amending their national legal framework to allow their institutions to comply with the MREL requirement more efficiently.

France moved first by implementing the statutory subordination solution. Non-preferred senior debt has been introduced with the publication of the Sapin 2 Law in the Official Journal of the Republic of France on 10 December 2016. Specifically, Article 151 of the law on transparency, anti-corruption and the modernization of the economy, the so-called Sapin 2 Law, differentiates senior bondholders into two categories: holders of senior preferred notes and holders of senior non-preferred notes. Amending article L.613–30–3, the law modifies the creditor hierarchy of credit institutions in order to ease the application of the bail-in tool. It gives preference to outstanding senior debt which will rank as senior preferred in the event of insolvency.

In November 2015, the German legislator passed the Resolution Mechanism Act which introduces Sect. 46f (5) et seqq. of the German Banking Act. This Section sets up the mandatory subordination of certain unsecured debt instruments with respect to general unsecured senior liabilities. In short, it splits the heterogeneous class of unsecured senior debt and creates a layer that would enhance the loss-absorbing capacity of the issuer. Subordination, so stipulated, ensures that these unsecured debt instruments bear the losses before other unsecured senior liabilities in case of resolution if the bail-in tool is applied. In its opinion, the ECB endorses the German approach recognizing the advantage provided by the law in making certain existing debt instruments eligible to meet the loss-absorbing requirements thereby sparing German credit institutions to take action issuing large volumes of contractually subordinated debt.

Similarly, to the general statutory subordination of senior unsecured bonds set out by the German legislator, Italy introduces with the Legge di Bilancio [21] a general depositor preference into national insolvency law to protect those depositors not covered by deposit Guarantee Scheme (DGS) and that are not private or small and medium enterprises (SMEs). Specifically, the law amends article 12-bis of Testo Unico Bancario (TUB) introducing non-preferred senior bonds as unsecured instruments of Level 2 that rank above

Tier 2 instruments but below other senior debt. The article then aligns bonds' characteristics with those set out in the Directive. The law further amends the Testo Unico della Finanza (TUF) allowing also financial services companies to issue non-preferred senior bonds.

Spain had only partially amended its legislation with the Royal Decree n. 1012/2015 that develops Law 11/2015 about Recovery And Resolution Of Credit Institutions And Investment Service Companies. The provisions set out a category of Level 3 debt called senior subordinated debt that in case of insolvency ranks above Tier 2 instruments. However, the provisions were so ambiguous that Spanish banks were only able to issue senior non-preferred bonds following the contractual subordination.

Banks in Switzerland, UK and the Netherlands followed the structural subordination approach. This choice is dictated by the legal structure of their banks that are organized according to a holding company structure. In this case, senior debt issued by the holding qualifies as structurally subordinated to that issued by operating subsidiaries.

In the Nordics, Swedish banks faced some uncertainty as the Swedish National Debt Office (SNDO) did not specify the type of subordination it would have recommended as all three solutions had their own shortcomings. In particular, structural subordination would have been difficult to implement as Swedish banks are not organized in a holding company structure. The statutory solution would not be possible to implement under Swedish law. Also, the contractual subordination was not feasible as the contractual terms of some outstanding Tier 2 instruments prevent the issuance of subordinated instruments with a higher priority. However, the SNDO's opinion prefers the structural and statutory approach given the advantages of these two in terms of legal status and market functionality compared to the contractual approach. Nevertheless, the SNDO pledged to follow the proposal of the Directive into its policy position regard the subordinations approach. The same uncertainty has been faced by Danish and Norwegian banks whose respective Countries did not promptly address the subordination question.

Data and methodology

From Thomson Reuters Eikon, we first download both active and matured non-bailinable bonds issued by European banks. Non-bailinable bonds include "secured", "senior secured" and "asset-backed" bonds. We thus select active and matured bailinable bonds issued by banks resulting from the prior stage. Bailinable bonds include "senior unsecured", "senior preferred", "senior non-preferred", "senior subordinated", "subordinated" and "junior subordinated" bonds. As a result, each bank included in the sample has at least one bailinable bond and one non-bailinable bond.

For each event, the sample selection strategy produced a database with an average of 198 bonds for Austria, 7 for Finland, 1763 for Germany, 215 for Italy, 14 for Luxembourg, 268 for the Netherlands, 43 for Spain, 23 for Sweden, and 516 for the UK.

In line with bond market event studies Bessembinder et al. [3] and Ederington et al. [9], we create three value-weighted portfolios of bonds for each bank and each date: the "average unsecured senior bonds",the "average subordinated bonds"; and the "average non-bailinable bonds".

In particular, the daily yield to maturity of the "average unsecured senior bonds" is the value-weighted average of the yields of all unsecured senior bonds for each bank and each date. The weight of each single unsecured senior bond depends on its value at issuance (where the sum of the weights of all unsecured senior bonds for each bank is equal to one). The "average unsecured senior bonds" summarizes the information about "senior unsecured", "senior preferred", "senior non-preferred" bonds. On average, unsecured senior bonds account for 74% of bonds for each event.

Correspondingly, the daily yield to maturity of the "average subordinated bonds" is the value-weighted average of the yields of all subordinated bonds. The "average subordinated bonds" summarize the information about "senior subordinated", "subordinated" and "junior subordinated" bonds. On average, subordinated bonds account for 11% of bonds for each event.

Finally, the daily yield to maturity of the "average non-bailinable bonds" is the value-weighted average of the yields of all non-bailinable bonds. The average non-bailinable bonds summarize the information about "secured", "senior secured" and "asset-backed" bonds. On average, non-bailinable bonds account for 15% of bonds for each event.

The final sample consists of 13 banks for Austria, 1 for Finland, 19 for Germany, 8 for Italy, 1 for Luxembourg, 6 for the Netherlands, 5 for Spain, 3 for Sweden and 8 for the UK. Table 1 shows the banks included in the sample. About two-thirds of the sample (66%) consists of banks whose total assets are consistent with the threshold of 50 billion which is commonly assumed to distinguish banks that follow a bail-in strategy from those that follow an alternative one [11].

We first empirically address the research question about whether the bail-in amendments, which are objects of this study, have increased bail-in expectations by senior unsecured bondholders. We test for bail-in credibility measuring the reaction of the yield-spread between senior unsecured and secured bonds to the entry into force of the above-mentioned amendments. The yield-spread between bailinable and non-bailinable bonds is indeed recognized by literature as a good proxy of sentiment among investors regarding bail-in credibility. Events that indicate the authorities'

Table 1 The sample by banks

Country	Bank name	Totala assets (in Millions)	Country	Bank name	Total assets (in Millions)
Austria	Allgemeine Sparkasse Oberoesterreich Bankaktiengesellschaft	12,092	Germany	UniCredit Bank AG	299,965
Austria	BAWAG PSK Bank fuer Arbeit und Wirtschaft und Oesterreichische Post-sparkasse AG	40,495	Italy	Banca Carige SpA Cassa di Risparmio di Genova e Imperia	27,104
Austria	Erste Group Bank AG	209,543	Italy	Banca Monte dei Paschi di Siena SpA	153,782
Austria	HYPO NOE Landesbank fuer Niederoes-terreich und Wien AG	15,218	Italy	Banco BPM SpA	166,959
Austria	Hypo Vorarlberg Bank AG	13,470	Italy	Bper Banca SpA	65,852
Austria	Kommunalkredit Austria AG	3872	Italy	Intesa Sanpaolo SpA	732,819
Austria	Landes hypothekenbank Steiermark AG	3780	Italy	Mediobanca Banca di Credito Finanziario SpA	70,325
Austria	Oberoesterreichische Landesbank AG	8482	Italy	UniCredit SpA	852,252
Austria	Raiffeisen Bank International AG	120,479	Italy	Unione di Banche Italiane SpA	118,987
Austria	Raiffeisen Landesbank Steiermark AG	14,574	Luxembourg	NORD LB Luxembourg Covered Bond Bank SA	15,710
Austria	Raiffeisenlandesbank Oberoesterreich AG	39,001	Netherlands	ABN Amro Bank NV	398,342
Austria	Raiffeisenverband Salzburg Egen	6904	Netherlands	Achmea Bank NV	15,085
Austria	UniCredit Bank Austria AG	133,854	Netherlands	Cooperatieve Rabobank UA	648,137
Finland	Aktia Bank Abp	9639	Netherlands	ING Bank NV	897,410
Germany	Aareal Bank AG	47,188	Netherlands	NIBC Bank NV	23,006
Germany	Bayerische Landesbank	214,128	Netherlands	de Volksbank NV	61,723
Germany	Berlin Hyp AG	27,340	Spain	Banco Bilbao Vizcaya Argentaria SA	723,923
Germany	Commerzbank AG	488,103	Spain	Banco de Sabadell SA	214,161
Germany	DVB Bank SE	25,889	Spain	Banco Santander SA	1,374,563
Germany	DZ BANK AG Deutsche Zentral Genos-senschaftsbank Frankfurt am Main	474,461	Spain	Bankia SA	203,690
Germany	Deutsche Bank AG	1,565,333	Spain	Caixabank SA	358,456
Germany	Deutsche Kreditbank AG	75,758	Sweden	Skandiabanken AB (publ)	64,538
Germany	Deutsche Pfandbriefbank AG	62,461	Sweden	Skandinaviska Enskilda Banken AB	2,557,839
Germany	Hamburg Commercial Bank AG	83,907	Sweden	Sparbanken Skane AB (publ)	59,334
Germany	Landesbank Baden Wuerttemberg	238,449	UK	ANZ New Zealand Intl Ltd (London Branch)	21,135
Germany	Landesbank Berlin AG	46,061	UK	Bank of Scotland PLC	353,363
Germany	Landesbank Hessen Thueringen Girozen-trale	165,902	UK	Barclays Bank PLC	1,154,675
Germany	Landesbank Saar	13,917	UK	Credit Suisse International	327,650
Germany	Muenchener Hypothekenbank eG	38,504	UK	Investec Bank PLC	18,220
Germany	Norddeutsche Landesbank Girozentrale	173,207	UK	Lloyds Bank PLC	823,645
Germany	Sparkasse Hannover	14,162	UK	Santander Financial Services PLC	92,922
Germany	Sparkasse Koelnbonn	26,560	UK	Santander UK PLC	299,561

This table displays the banks covered in this study with their relative total assets

commitment towards the bail-in widen the yield-spread between bailinable and non-bailinable bonds while events that question its credibility narrow the spread. According to Chan-Lau and Oura [5], this is due to the fact that bail-in makes bailinable debt junior with respect to non-bailinable debt thereby increasing the cost difference between the two asset classes.

The empirical analysis consists of a difference-in-differences (diff-in-diff) where the "average unsecured senior bonds" portfolios represent the treatment group and the "average non-bailinable bonds" portfolios represent the control group. We design the regression model 1 as follows:

$$yld_{ijt} = \alpha + \alpha_j + \beta_1 \times uns_{ij} \times post_t + \delta_1 \times uns_{ij} + \delta_2 \times ttm_{it} + day_t + \varepsilon_{ijt} \quad (1)$$

where yld_{ijt} is the outcome variable, namely the daily yield to maturity of bailinable status i of bank j at time t. The variable uns_{ij} is a dummy variable assuming value one for the "average unsecured senior bonds" portfolios and zero for the "average non-bailinable bonds" portfolios. The variable $post_t$ is a dummy variable that, consistently with Schäfer et al. [26], takes value one for the first closing-day yield after the event, and zero for the seven days before. The variable day_t indicates time-fixed effects and accounts for all time-varying macroeconomics factors. The variable ttm_{it} represents the time to maturity. The variable α_j represents the bank fixed effects and accounts for bank-specific and time-invariant (within the event window) components in the unsecured senior and non-bailinable bond yields.

The estimator β_1 (also referred to as the D-D estimate) is the diff-in-diff estimator which we interpret as the difference between two differences. The first difference is between the daily yield to maturity of an "average unsecured senior bonds" portfolio after the event and the respective yield before the event. The second difference is between the daily yield to maturity of an "average non-bailinable bonds" portfolio after the event and the respective yield before that time.

A positive coefficient would indicate that investors' expectations embed into unsecured senior bonds yields a higher probability of bail-in being triggered if resolution kicks in. Conversely, a negative estimator would signal a misalignment between market expectations and authorities' commitment towards bail-in which may result in a disruptive outcome in case of bail-in employment in resolution.

We then complement this analysis with a placebo difference in differences analysis test which gauges the yield-spread reaction between unsecured senior bonds and subordinated bonds. This test aims to ensure that the reaction of the spread between unsecured senior bonds and non-bailinable bonds is due to a change in bail-in expectations among investors instead of generic risk. If our results are driven by the latter, we should observe a significative yield-spread reaction between two bailinable subcategories. Otherwise, the test would corroborate our thesis regarding bail-in regulation being the only driver of our results.

The model employed for the placebo test replicates model 1 but replaces non-bailinable bonds with subordinated bonds. The regression model 2 is as follows:

$$yld_{ijt} = \alpha + \alpha_j + \beta_2 \times sub_{ij} \times post_t + \delta_3 \times sub_{ij} + \delta_4 \times ttm_{it} + day_t + \varepsilon_{ijt} \quad (2)$$

The subscripts i, j, and t refer to seniority, the bank, and the day, respectively. Model 2 differs from Model 1 only for the dummy variable indicating the bailinable status. uns_{ij}, indeed, takes value one for the "average subordinated bonds" portfolios, and zero for the "average unsecured senior bonds" portfolios.

The estimator β_2 would provide information regarding the yield-spread reaction between subordinated bonds and unsecured senior bonds. In particular, a significative estimator would indicate that the bail-in events have increased or decreased the yield-spread of subordinated bonds compared to senior unsecured bonds. If the estimator is insignificant, it instead indicates that subordinated bonds' yields do not react differently from unsecured senior bonds' yields, therefore, supporting the thesis according to which the bail-in events do not cause a yield reaction between bailinable bonds of different seniority. This result would then corroborate our hypothesis regarding the fact that the estimator β_1 of model 1 is driven by bail-in regulation instead of generic risk.

We then empirically address the research question about whether the bail-in amendments, which are objects of this study, have enhanced market monitoring by disentangling their impact on the risk sensitivity of unsecured senior bonds' yields. Thus, in line with previous studies ([1]; [11] we shape a difference-in-differences regression through a triple differencing model in order to gauge the reaction of the risk sensitivity of unsecured senior bonds' yields. The treatment group consists of the "average unsecured senior bonds" portfolios, whereas the control group consists of the "average non-bailinable bonds" portfolios. The regression model 3 is:

$$\begin{aligned} yld_{ijt} =& \alpha + \alpha_i + \beta_3 \times risk_{jt} \times uns_i \times post_t \\ &+ \gamma_1 \times risk_{jt} \times uns_i + \gamma_2 \times risk_{jt} \times post_t \\ &+ \gamma_3 \times uns_i \times post_t + \delta_5 \times risk_{jt} \\ &+ \delta_6 \times uns_i + \delta_7 \times ttm_{ijt} + day_t + \mu_{ijt} \end{aligned} \quad (3)$$

where yld_{ijt} is the outcome variable, namely the daily yield to maturity of bailinable status i of bank j at time t. The variable uns_{ij} is a dummy variable assuming value one for the "average unsecured senior bonds" portfolios and zero for the "average non-bailinable bonds" portfolios. The variable $post_t$ is a dummy variable that takes value zero for the seven days before the event and one for the first closing-day yield after the event. The variable *risk* identifies the measure of bank risk and it is proxied by Bloomberg's 1-year default probability. This measure is a daily proxy of default probability resulting from a model that uses the following nine inputs: CDS spread, the volatility of the stock price, the net income, non-performing loans, market-to-book ratio, total assets, short-term leverage, long-term leverage, and loan losses reserves. The variable day_t represents the time fixed effects and captures all the time-varying macroeconomic factors. The variable ttm_{it} represents the time to maturity. The bank fixed effects αj controls for bank-specific and

time-invariant (within the event window) components in the unsecured senior and non-bailinable bond yields.

The triple differencing estimate β_3 (also referred to as the D-D-D estimate) provides information regarding the yield-risk sensitivity. In particular, a significantly positive coefficient indicates an improved market monitoring activity by senior unsecured investors. On the contrary, a significantly negative coefficient indicates that the event has decreased the risk sensitivity of unsecured senior bonds' yields. More specifically, the coefficient β_3 indicates whether the risk premium component of unsecured senior bond yields grows in response to the event, where we subtract form this time series growth the growth of the risk premium component of non-bailinable bond yields as they are not exposed to the bail-in. As a result, this netting permits to accurately attribute the effect on market monitoring described by β_3 to the legal specificity of the bail-in. Appendix 1 provides further details about the interpretation of β_3.

In line with the analysis employed to study bail-in credibility, to ensure that the D-D-D estimates are driven by the bail-in law instead of generic risk, we also perform a placebo test where we compare the yield-risk sensitivity reaction of two bailinable subcategories: unsecured senior bonds and subordinated bonds. The model employed for the placebo test replicates model 3 with the exception that it compares two categories of bailinable bonds. Regression model 4 is as follows:

$$\begin{aligned} yld_{ijt} =& \alpha + \alpha_i + \beta_4 \times risk_{jt} \times sub_i \times post_t \\ &+ \gamma_4 \times risk_{jt} \times sub_i + \gamma_5 \times risk_{jt} \times post_t \\ &+ \gamma_6 \times sub_i \times post_t + \delta_8 \times risk_{jt} \\ &+ \delta_9 \times sub_i + \delta_{10} \times ttm_{ijt} + day_t + \mu_{ijt} \end{aligned} \tag{4}$$

The subscripts i, j and t refer to seniority, the bank and the day, respectively. All the variables are equal to those of model 3 except *sub*. The latter is a dummy variable that takes value one for the "average subordinated bonds" portfolios, and zero for the "average unsecured senior bonds" portfolios. A significantly positive (negative) β_4 indicates that the bail-in event has increased (decreased) the risk sensitivity of subordinated bonds' yields compared to senior ones. Conversely, an insignificant coefficient indicates that the risk sensitivities of senior and subordinated bonds do not react differently following the bail-in events. This would support the thesis that changes in the yield-risk sensitivity between bailinable and non-bailinable bonds, described by β_3, are driven by bail-in law instead of generic risk.

Table 2 shows the descriptive statistics of the variables used in this study broken down by country for each event.

The reliability of the diff-in-diff analysis is supported by the validity of the parallel trend assumption that states that the trend in yields to maturity between unsecured senior bonds and non-bailinable bonds would have not changed if the event considered had not occurred. We, therefore, provide hereafter a statistical assessment of the parallel trend assumption as a simple visual inspection of it would not be much informative given the complex structure of our sample that consists of multiple issues belonging to multiple banks and countries and time periods as well. We provide a formal test of the parallel trend assumption interacting the treatment variable with time dummies in the following equation [23]:

$$\begin{aligned} yld_{ijt} = \alpha_j + day_t + \sum_{t=-10}^{-2} \delta_t(\beta_t \bullet uns_{ij}) \\ + \sum_{t=0}^{+10} \delta_t(\beta_t \bullet uns_{ij}) + uns_{it} + ttm_{ij} + \varepsilon_{ijt} \end{aligned} \tag{5}$$

where differently from Eq. (1), β_t are dummy variables which assume value 1 for each day of the time window and δ_t are diff-in-diff estimators which are expressed relative to the omitted period of the day before the entry into force of the law. This test assesses whether the diff-in-diff estimators in the period before the event are not statistically significant which would mean that the yields' trends of unsecured senior bonds and non-bailinable bonds are the same. Figure 1 provides the graphical results of estimates assessed in Eq. (5). Results show that there is not a statistically significant difference in the yield's trends between unsecured senior bonds and non bailinable bonds prior to each event which confirms the validity of the parallel trend assumption.

Results

We first perform the regression models 1 and 2 over the aggregate sample to test hypotheses H_0, H_1 and H_ 2 about investors' credibility of the bail-in tool. Table 3 presents the results. Panel A shows the D-D estimates relative to β_1 of model 1. According to our hypothesis, a significantly positive (negative) estimate would indicate an increase (decrease) of unsecured senior bonds' yields with respect to non-bailinable bonds' yields which would suggest a higher (lower) bail-in credibility by unsecured senior bondholders. Insignificant estimates would instead indicate that the bail-in amendments do not modify unsecured senior bondholders' expectations over bail-in as they do not represent a significant enhancement for the bail-in regime. Panel B shows the placebo D-D estimates relative to β_2 of model 2. These estimates are expected to be insignificant in order to support the thesis according to which the eventual repricing by senior unsecured bondholders captured by β_1 is driven by bail-in law instead of generic risk.

The analysis, although conducted on the aggregate sample, which provides only for an overview of the results,

Table 2 Descriptive statistics of the variables used in the regression models

Events		The RMA enters into force				The Resolution Mechanism Act (RMA)				Total Loss-Absorbing Capacity (TLAC) Term Sheet			
Countries	Statistics	Yield to maturity	Time to maturity (days)	1-Year Probability of Default	Bailinable Status	Yield to maturity	Time to maturity (days)	1-Year Probability of Default	Bailinable Status	Yield to maturity	Time to maturity (days)	1-Year Probability of Default	Bailinable Status
Austria													
	Mean	2.028	9.065	0.0024	0.667	2.465	9.595	0.0014	0.667	2.464	9.639	0.0014	0.667
	Median	1.621	7.420	0.0015	1	2.266	8.310	0.0015	1	2.332	8.292	0.0015	1
	St.Dev	1.422	4.674	0.0022	0.472	1.565	4.465	0.0004	0.472	1.555	4.505	0.0004	0.472
	N	480	480	200	480	420	420	140	420	420	420	140	420
Germany													
	Mean	1.441	7.578	0.0089	0.636	1.766	9.074	0.0058	0.650	1.749	9.065	0.0058	0.650
	Median	0.771	6.830	0.0064	1	1.105	7.716	0.0072	1	1.094	7.752	0.0072	1
	St.Dev	1.453	2.756	0.0091	0.481	1.598	3.532	0.0044	0.477	1.598	3.527	0.0044	0.477
	N	880	880	640	880	800	800	600	800	800	800	600	800
Italy													
	Mean	2.599	6.345	0.0303	0.650	2.512	6.993	0.0041	0.632	2.469	6.963	0.0043	0.632
	Median	2.549	6.223	0.0092	1	2.461	6.585	0.0034	1	2.405	6.566	0.0035	1
	St.Dev	1.796	1.563	0.0613	0.478	1.270	1.656	0.0034	0.483	1.265	1.629	0.0037	0.483
	N	400	400	400	400	380	380	380	380	380	380	380	380
Netherlands													
	Mean	2.227	9.791	0.0022	0.667	2.807	10.924	0.0025	0.643	2.873	10.844	0.0025	0.667
	Median	1.465	7.992	0.0014	1	1.927	8.657	0.0019	1	1.967	8.704	0.0018	1
	St.Dev	1.560	4.982	0.0020	0.472	1.979	5.276	0.0028	0.480	1.945	5.102	0.0027	0.472
	N	300	300	240	300	280	280	180	280	300	300	180	300
Spain													
	Mean	2.978	7.072	0.0028	0.750	2.965	48.996	0.0021	0.667	3.103	7.628	0.0022	0.667
	Median	2.670	6.436	0.0027	1	2.972	8.198	0.0021	1	2.951	7.012	0.0022	1
	St.Dev	2.274	1.897	0.0009	0.434	1.086	92.390	0.0002	0.473	1.409	1.192	0.0001	0.473
	N	160	160	160	160	120	120	120	120	120	120	120	120
UK													
	Mean	3.435	8.791	0.0014	0.650	5.484	7.911	0.0013	0.667	5.478	7.892	0.0013	0.667
	Median	2.615	6.335	0.0010	1	2.448	7.265	0.0011	1	2.456	7.246	0.0011	1
	St.Dev	4.438	7.106	0.0010	0.478	10.816	2.102	0.0009	0.472	10.818	2.102	0.0009	0.472
	N	400	400	320	400	300	300	260	300	300	300	260	300
Total													
	Mean	2.171	8.017	0.0098	0.654	2.666	10.911	0.0037	0.650	2.669	8.795	0.0037	0.653
	Median	1.619	6.832	0.0027	1	1.961	7.789	0.0019	1	1.960	7.821	0.0019	1
	St.Dev	2.347	4.303	0.0297	0.476	4.290	22.941	0.0037	0.477	4.280	3.698	0.0037	0.476

Table 2 (continued)

Events		The RMA enters into force				The Resolution Mechanism Act (RMA)				Total Loss-Absorbing Capacity (TLAC) Term Sheet			
Countries	Statistics	Yield to maturity	Time to maturity (days)	1-Year Probability of Default	Bailinable Status	Yield to maturity	Time to maturity (days)	1-Year Probability of Default	Bailinable Status	Yield to maturity	Time to maturity (days)	1-Year Probability of Default	Bailinable Status
	N	2720	2720	2020	2720	2340	2340	1720	2340	2360	2360	1720	2360
Events		Publication of the Sapin 2 Law				Proposal of Directive 2017/2399				Directive 2017/2399 enters into force			
Countries	Statistics	Yield to maturity	Time to maturity	1-Year Probability of Default	Bailinable Status	Yield to maturity	Time to maturity	1-Year Probability of Default	Bailinable Status	Yield to maturity	Time to maturity	1-Year Probability of Default	Bailinable Status
Austria													
	Mean	2.178	16.683	0.0026	0.667	2.129	8.994	0.0028	0.667	1.392	7.755	0.0018	0.625
	Median	1.708	7.580	0.0016	1	1.754	7.529	0.0017	1	1.066	6.186	0.0011	1
	St.Dev	1.417	37.012	0.0024	0.472	1.403	4.676	0.0026	0.472	1.167	4.467	0.0021	0.485
	N	480	480	200	480	480	480	200	480	640	640	280	640
Germany													
	Mean	1.463	7.795	0.0095	0.643	1.446	7.840	0.0091	0.643	1.148	6.857	0.0043	0.633
	Median	0.774	6.902	0.0067	1	0.721	6.939	0.0068	1	0.681	6.047	0.0027	1
	St.Dev	1.498	2.729	0.0102	0.479	1.510	2.737	0.0098	0.479	1.076	2.747	0.0043	0.482
	N	840	840	600	840	840	840	600	840	980	980	700	980
Italy													
	Mean	2.727	6.379	0.0326	0.650	2.708	6.424	0.0341	0.650	1.950	5.763	0.0089	0.636
	Median	2.648	6.294	0.0100	1	2.632	6.386	0.0125	1	1.688	5.501	0.0079	1
	St.Dev	1.880	1.563	0.0599	0.478	1.913	1.575	0.0589	0.478	1.441	1.609	0.0098	0.482
	N	400	400	400	400	400	400	400	400	440	440	440	440
Netherlands													
	Mean	2.300	9.847	0.0023	0.667	2.254	9.897	0.0024	0.667	1.589	8.343	0.0017	0.667
	Median	1.494	8.048	0.0015	1	1.437	8.101	0.0015	1	0.851	6.884	0.0006	1
	St.Dev	1.600	4.983	0.0021	0.472	1.561	4.983	0.0022	0.472	1.286	4.726	0.0022	0.472
	N	300	300	240	300	300	300	240	300	300	300	240	300
Spain													
	Mean	3.052	7.125	0.0031	0.750	2.402	6.775	0.0035	0.714	1.723	7.240	0.0020	0.727
	Median	2.686	6.493	0.0028	1	1.768	6.459	0.0031	1	1.648	8.096	0.0018	1
	St.Dev	2.316	1.892	0.0010	0.434	1.588	1.675	0.0010	0.453	1.176	2.088	0.0009	0.446
	N	160	160	160	160	140	140	140	140	220	220	220	220
UK													
	Mean	3.483	8.848	0.0014	0.650	3.373	7.657	0.0016	0.647	3.316	7.868	0.0010	0.650
	Median	2.635	6.392	0.0010	1	2.345	6.207	0.0011	1	2.486	5.109	0.0006	1

Table 2 (continued)

Events		Publication of the Sapin 2 Law				Proposal of Directive 2017/2399				Directive 2017/2399 enters into force			
Countries	Statistics	Yield to maturity	Time to maturity	1-Year Probability of Default	Bailinable Status	Yield to maturity	Time to maturity	1-Year Probability of Default	Bailinable Status	Yield to maturity	Time to maturity	1-Year Probability of Default	Bailinable Status
	St.Dev	4.379	7.106	0.0010	0.478	4.694	4.618	0.0011	0.479	5.296	7.089	0.0008	0.478
	N	400	400	320	400	340	340	260	340	400	400	360	400
Total													
	Mean	2.229	9.409	0.0103	0.654	2.122	7.899	0.0109	0.652	1.617	7.046	0.0037	0.638
	Median	1.563	6.877	0.0028	1	1.462	6.872	0.0031	1	0.995	5.931	0.0018	1
	St.Dev	2.361	16.343	0.0296	0.476	2.319	3.742	0.0299	0.477	2.283	4.061	0.0057	0.481
	N	2720	2720	2020	2720	2640	2640	1940	2640	3200	3200	2340	3200

This table shows the summary statistics by country for each event relative to: yield to maturity (expressed in percentage), the time to maturity, the Bloomberg's 1-year probability of default and the bailinable status

points out a clear pattern that supports hypothesis H_0 about the ineffectiveness of the bail-in amendments in increasing bail-in expectations among unsecured senior bondholders. In detail, the D-D estimates are statistically insignificant and very close to zero for each bail-in event of analysis. The D-D estimates are coherent with those of the analyses conducted by Giuliana [13] but significantly lower as the bail-in events examined in this study do not appear to enhance bail-in credibility by unsecured senior bondholders, therefore, causing any bond repricing. Finally, placebo D-D estimates are statistically insignificant and close to zero, therefore, supporting the hypothesis that bail-in law is the only driver of the yield spread reaction to the bail-in events captured by β_1.

Given that this level of aggregation only provides for an overview of the results, we further proceed with disentangling the yield-reaction to the bail-in amendments across each country. We, therefore, perform the regression models 1 and 2 for each country and each event. Table 4 presents the results. Each panel shows the D-D estimates relative to β_1 of model 1 for each country. Depending on whether the authority which mandates the amendment is national or supranational, we should expect a bond repricing only for domestic banks in the former case whereas a bond repricing also for banks in other countries in the latter case, as multiple countries fall under the remit of supranational authorities.

However, each of the bail-in events examined in this study represents a step of the legislative process aimed at providing banks with new tools to achieve subordination to improve the effectiveness of the bail-in regime. It starts with the international guidelines on how to subordinate instruments within a G-SIBs-level buffer and continues with the European implementation of such provision, further extended to the other categories of banks, that sees initially some Member States taking the lead and finally the European Commission providing EU harmonized rules. Given that each event paves the way for the following one and EU national events influence other Member States' decisions as well as the final agreement on harmonized EU rules, amendments implemented by domestic authorities may therefore generate a bond repricing also for foreign banks.

Consistently with aggregate results, the D-D estimates of the state-level analysis are statistically insignificant and very close to zero. In detail, each event under analysis does not impact the yield spread neither of domestic nor of foreign banks. These results corroborate hypothesis H_0 about steady bail-in expectations among unsecured senior bondholders following the bail-in amendments examined.

We then perform the regression models 3 and 4 over the aggregate sample to test for hypotheses H_A, H_B and H_C about the sensitivity of unsecured senior bonds' yields to banks' risk. Table 5 presents the results. Panel A shows the D-D-D estimates relative to β_3 of model 3. According to our hypothesis, a significantly positive (negative) estimate would

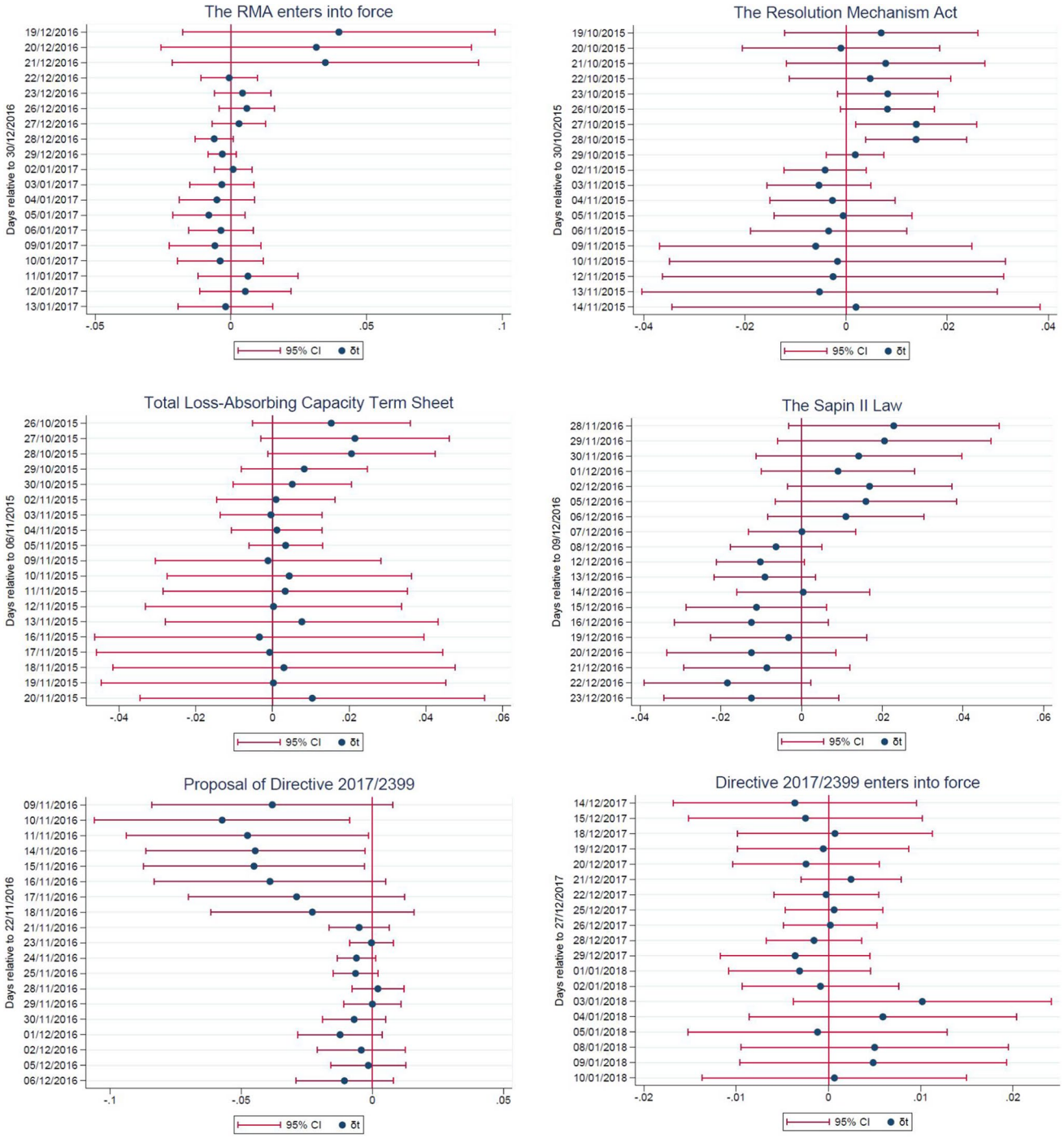

Fig. 1 Parallel trend. Each figure provides the graphical results of estimates assessed in Eq. (5)

indicate an increase (decrease) of the yield-risk sensitivity of unsecured senior bonds with respect to that of non-bailinable bonds which would suggest a higher (lower) monitoring by unsecured senior bondholders. Insignificant estimates would instead indicate that the bail-in amendments do not modify the unsecured senior bondholders' monitoring as they do not represent a significant enhancement for the bail-in regime.

Panel B shows the placebo D-D-D estimates relative to β_4 of model 4. These estimates are expected to be insignificant in order to support the thesis according to which the eventual change in unsecured senior bondholders' monitoring captured by β_3 is driven by bail-in law instead of generic risk.

In line with our results about unaffected bail-in expectations among unsecured senior bondholders, the analysis

Table 3 Difference-in-differences and placebo difference-in-differences for the entire sample

Date	Event	Authority	Panel A			Panel B		
			Diff-in-Diff—Entire sample			Placebo—Entire sample		
			D-D	N	Adj.R2	D-D	N	Adj.R2
02/11/2015	TheResolution Mechanism Act (RMA)	National	− 0.011	640	0.69	0.002	560	0.57
09/11/2015	Total Loss-Absorbing Capacity (TLAC) Term Sheet	Supranational	− 0.003	656	0.69	0.003	576	0.56
23/11/2016	Proposal of Directive 2017/2399	Supranational	0.026	736	0.70	0.006	640	0.70
10/12/2016	Publication of the Sapin 2 Law	National	− 0.016	752	0.71	− 0.007	672	0.71
01/01/2017	The RMA enters into force	National	0.000	752	0.71	0.000	672	0.70
28/12/2017	Directive 2017/2399 enters into force	Supranational	− 0.001	928	0.71	− 0.003	704	0.63

The D-D coefficient in Panel A is the estimate of β_1 relative to the model $yld_{ijt} = \alpha + \alpha_j + \beta_1 \times uns_{ij} \times post_t + \delta_1 \times uns_{ij} + \delta_2 \times ttm_{it} + day_t + \varepsilon_{ijt}$; N is the number of observations in the (− 7;0) window (We also use windows of (− 7;+1) and (− 7;+2) and the results are robust); the Adj.R^2 is the adjusted R-squared. The D-D-D coefficient in Panel B is the estimate of β_2 relative to the model $yld_{ijt} = \alpha + \alpha_j + \beta_2 \times sub_{ij} \times post_t + \delta_3 \times sub_{ij} + \delta_4 \times ttm_{it} + day_t + \varepsilon_{ijt}$. Standard errors are adjusted for heteroscedasticity. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively

points out insignificant and close to zero D-D-D estimates for each bail-in event of analysis which supports hypothesis H_A about the ineffectiveness of bail-in amendments in restoring market monitoring. Finally, placebo D-D-D estimates are statistically insignificant and close to zero, therefore, supporting the hypothesis that bail-in law is the only driver of the yield-risk sensitivity reaction to the bail-in events captured by β_3.

We then proceed also for this analysis disentangling the yield-risk sensitivity reaction to the bail-in amendments across each country. We, therefore, perform the regression models 3 and 4 for each country and each event. Table 6 presents the results. Each panel shows the D-D-D estimates relative to β_3 of model 3 for each country. Consistently with aggregate results, the D-D-D estimates of the state-level analysis are statistically insignificant and very close to zero. In detail, each event under analysis does not impact the yield-risk sensitivity of unsecured senior bondholders neither of domestic nor foreign banks. These results corroborate hypothesis H_A about the unaffected monitoring of unsecured senior bondholders following the bail-in amendments examined.

Discussion

Each legal act considered in this study contributes to improve the effectiveness of the bail-in tool by promoting the creation of an asset class that helps banks to comply with both the bail-in buffer requirement and the subordination requirement that concerns some of its instruments. Moreover, investors benefit from these amendments thanks to the clearer distinction between bailinable and non-bailinable instruments that permits them to quantify their potential loss exposure in case of bail-in.

Although the effectiveness of these measures signals a clear and material commitment towards the enhancement of the bail-in tool, our analysis indicates that bondholders' expectations of bail-in remained unchanged following the implementation of each legal act examined. This result is in contrast to the assumption that bail-in prescriptions should encourage bondholders to require a higher risk premium, as their payoffs worsen being risk transferred from taxpayers to them. Nevertheless, a possible interpretation suggested by several studies [26, [11] is that, as actions speak louder than words, events related to the legislative process of the bail-in might not drive bondholders' expectations as much as actual bail-ins.

Our result is also in contrast to the branch of literature that studies the credibility of bail-in and provides evidence of bond yields repricing in the following of bail-in events related to both its legislative process and actual implementation. However, as regards the legal acts examined by these studies, we argue that the identification strategy used does not allow for a clear measurement of authorities' bail-in commitment. Legal events such as the implementation of the BRRD or its transposition within national jurisdictions incorporate a multitude of prescriptions different from the bail-in that may hamper its actual identification. Moreover, as regards bonds yield repricing, these studies usually focus on classes of investors that consider all the bank creditors that could be involved by bail-in which may provide confounding results finally. In detail, investors such as subordinated bondholders were always meant to absorb losses in case of bank failure thus their reaction to bail-in legal acts might be limited compared to senior investors. As a result,

Table 4 Country-level difference-in-differences

Date	Event	Authority	Panel A			Panel B			Panel C			Panel D			Panel E			Panel H		
			Austria			Germany			Italy			Netherlands			Spain			U.K		
			D-D	N	Adj.R2	D-D	N	Adj.R2	D-D	N	Adj.R2	D-D	N	Adj.R2	D-D	N	Adj.R2	D-D	N	Adj.R2
02/11/2015	The Resolution Mechanism Act (RMA)	National	− 0.022	112	0.79	0.003	224	0.79	− 0.053	96	0.93	− 0.008	80	0.76	0.014	32	0.99	− 0.003	80	0.67
09/11/2015	Total Loss-Absorbing Capacity (TLAC) Term Sheet	Supranational	− 0.008	112	0.78	0.015	224	0.80	− 0.018	112	0.93	0.030	80	0.76	− 0.258	32	0.98	0.033	80	0.66
23/11/2016	Proposal of Directive 2017/2399	Supranational	0.022	128	0.73	0.007	240	0.74	0.080	112	0.93	− 0.004	80	0.95	0.007	32	0.99	0.040	96	0.78
10/12/2016	Publication of the Sapin 2 Law	National	− 0.036	128	0.73	− 0.008	240	0.74	− 0.094	112	0.92	0.034	80	0.95	− 0.037	32	0.99	0.030	112	0.82
01/01/2017	The RMA enters into force	National	0.009	128	0.77	0.003	256	0.80	− 0.006	112	0.91	− 0.011	80	0.96	− 0.008	32	0.99	0.001	112	0.81
28/12/2017	Directive 2017/2399 enters into force	Supranational	0.008	192	0.60	− 0.002	288	0.72	0.001	128	0.92	0.004	80	0.95	0.012	48	0.93	− 0.014	112	0.83

The D-D coefficient is the estimate of β_1 relative to the model $yld_{ijt} = \alpha + \alpha_j + \beta_1 \times uns_{ij} \times post_t + \delta_1 \times uns_{ij} + \delta_2 \times ttm_{it} + day_t + \varepsilon_{ijt}$; N is the number of observations in the (− 7;0) window; the Adj. R^2 is the adjusted R-squared. The variable Authority indicates whether the bail-in event involves the participation of national or supranational authorities. Standard errors are adjusted for heteroscedasticity. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively

Table 5 Triple-differencing and Placebo Triple-differencing for the entire sample

Date	Event	Authority	Panel A			Panel B		
			Triple-Diff—Entire sample			Placebo—Entire sample		
			D-D-D	N	Adj.R2	D-D-D	N	Adj.R2
02/11/2015	The resolution mechanism Act (RMA)	National	0.049	464	0.76	− 0.003	448	0.56
09/11/2015	Total Loss-Absorbing Capacity (TLAC) Term Sheet	Supranational	0.018	464	0.76	− 0.004	448	0.56
23/11/2016	Proposal of Directive 2017/2399	Supranational	0.026	512	0.78	− 0.021	528	0.70
10/12/2016	Publication of the Sapin 2 Law	National	− 0.070	512	0.73	0.000	560	0.70
01/01/2017	The RMA enters into force	National	− 0.014	528	0.76	− 0.009	560	0.70
28/12/2017	Directive 2017/2399 enters into force	Supranational	0.068	640	0.77	0.000	592	0.65

The D-D-D coefficient in Panel A is the estimate of $\beta_3$relative to the model $yld_{ijt} = \alpha + \alpha_i + \beta_3 \times risk_{jt} \times uns_i \times post_t + \gamma_1 \times risk_{jt} \times uns_i + \gamma_2 \times risk_{jt} \times post_t + \gamma_3 \times uns_i \times post_t + \delta_5 \times risk_{jt} + \delta_6 \times uns_i + \delta_7 \times ttm_{ijt} + day_t + \mu_{ijt}$; N is the number of observations in the (− 7;0) window (We also use windows of (− 7;+1) and (− 7;+2) and the results are robust); the Adj. R^2 is the adjusted R-squared. The D-D-D coefficient in Panel B is the estimate of β_4 relative to the model $yld_{ijt} = \alpha + \alpha_i + \beta_4 \times risk_{jt} \times sub_i \times post_t + \gamma_4 \times risk_{jt} \times sub_i + \gamma_5 \times risk_{jt} \times post_t + \gamma_6 \times sub_i \times post_t + \delta_8 \times risk_{jt} + \delta_9 \times sub_i + \delta_{10} \times ttm_{ijt} + day_t + \mu_{ijt}$. Standard errors are adjusted for heteroscedasticity. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively

their inclusion within bailinable bonds might lead to deceptive results.

Our study, instead, matches events of the bail-in legislative process with the specifically targeted bailinable investors that are also the most affected by the overhaul of the bank crisis management framework. In detail, the events examined implement a thoroughly overhaul of the senior debt asset class that clearly aims to increase bail-in expectations among senior bondholders. As the latter were always meant to absorb losses on a gone concern, contrarily to the going concern loss absorbency of subordinated bondholders, they are the most exposed to bail-in risk and their reaction to such legal events should provide a more precise estimate of bail-in expectations following authorities' commitment.

Our analysis reports no statistically significant reaction among senior bondholders' expectations of bail-in following the implementation of the bail-in amendments examined. This result is in line with legal and theoretical studies disentangling the severe shortcomings suffered by the bail-in tool as implemented within the European bank resolution framework. In detail, scholars indicate as major concerns undermining the implementation of bail: (i) the regulatory discretion about bail-in policies [31]; (ii) the political pressure that may endorse bail-out strategies [16]; and (iii) the funding repercussions should senior debt being bailed-in [25]. Thus, although the material enhancement of the bail-in framework provided by the amendments examined, credibility is still severely undermined by such structural issues that explain our results.

The evidence reported by our analysis is also relevant as it addresses recent calls [19] that encourage to report all results in social sciences [19]. Finding no statistically significant result is, indeed, a crucial breakthrough in the literature about the credibility of bail-in as it: (i) provides empirical support to the theoretical and law studies suggesting the non-credibility of the bail-in tool, and (ii) questions the existing empirical literature about the credibility of bail-in and complement it as opposite branch.

Conclusions

This paper examines the senior unsecured bondholder's reaction to the events of the bail-in legislative process related to the implementation of new tools to achieve subordination. In detail, we focus on both the senior unsecured bondholders' expectations of bail-in and monitoring of the bank's risk. We specifically focus on senior unsecured bondholders as they are strictly concerned by the bail-in events examined and are also more exposed to bail-in risk with respect to other subordinated debt.

To study bail-in credibility, we perform a difference in differences to compare the reaction of senior unsecured bonds' yields with respect to those of non-bailinable bonds. In a similar vein, we investigate senior unsecured bondholders' monitoring employing a triple differencing model that compares the yield-risk sensitivity reaction of senior unsecured bonds with respect to that of non-bailinable ones. A placebo test is also performed to link the results to the legal specificities of the bail-in instead of generic risk.

Our results indicate steady senior unsecured bondholders' expectations of bail-in as well as monitoring activity. Despite providing a significant enhancement to the bail-in regime, these events do neither increase bail-in credibility nor restore market monitoring. We attribute the reasons for investor's skepticism about bail-in to the highly complicated resolution framework in which it is embedded that provides multiple authorities with ample discretion about its

Table 6 State-level triple-differencing

Date	Event	Authority	Panel A			Panel B			Panel C			Panel D			Panel E			Panel H		
			Austria			Germany			Italy			Netherlands			Spain			U.K		
			D-D-D	N	Adj.R2	D-D-D	N	Adj.R2	D-D-D	N	Adj.R2	D-D-D	N	Adj.R2	D-D-D	N	Adj.R2	D-D-D	N	Adj.R2
02/11/2015	The Resolution Mechanism Act (RMA)	National	0.091	32	0.99	0.018	160	0.91	0.026	112	0.93	− 0.077	48	0.99	− 1.373	32	0.99	− 0.047	64	0.97
09/11/2015	Total Loss-Absorbing Capacity (TLAC) Term Sheet	Supranational	− 0.147	32	0.99	− 0.007	160	0.92	− 0.036	112	0.93	− 0.081	48	0.99	16.382	32	0.99	0.027	64	0.97
23/11/2016	Proposal of Directive 2017/2399	Supranational	0.076	48	0.99	0.041	160	0.93	0.022	112	0.95	− 0.085	64	0.99	− 7.608	32	0.99	1.146	64	0.98
10/12/2016	Publication of the Sapin 2 Law	National	0.224	48	0.99	0.009	160	0.91	− 0.072	96	0.95	− 0.301	64	0.99	1.777	32	0.99	− 0.004	80	0.92
01/01/2017	The RMA enters into force	National	− 0.014	48	0.99	0.114	176	0.94	− 0.011	112	0.94	− 0.117	64	0.99	0.004	32	0.99	− 0.707	80	0.92
28/12/2017	Directive 2017/2399 enters into force	Supranational	0.022	80	0.84	− 0.015	192	0.77	0.189	128	0.96	0.026	64	0.99	0.287	48	0.98	0.079	96	0.94

The D-D-D coefficient is the estimate of β_3 relative to the model $yld_{ijt} = \alpha + \alpha_i + \beta_3 \times risk_{jt} \times uns_i \times post_t + \gamma_1 \times risk_{jt} \times uns_i + \gamma_2 \times risk_{jt} \times post_t + \gamma_3 \times uns_i \times post_t + \delta_5 \times risk_{jt} + \delta_6 \times uns_i + \delta_7 \times ttm_{ijt} + day_t + \mu_{ijt}$; N is the number of observations in the $(-7;0)$ window; the Adj. R^2 is the adjusted R-squared. The variable Authority indicates whether the bail-in event involves the participation of national or supranational authorities. Standard errors are adjusted for heteroscedasticity. ***, **, and * indicate significance at the 1%, 5%, and 10% two-tailed levels, respectively

implementation and further exposes them to political pressure, therefore, hampering both the investors' predictability of outcome in case of bail-in and its own smooth application.

Appendix 1

The triple differencing empirical model is:

$$\begin{aligned} yld_{ijt} =& \alpha + \alpha_i + \beta_3 \times risk_{jt} \times uns_i \times post_t \\ &+ \gamma_1 \times risk_{jt} \times uns_i + \gamma_2 \times risk_{jt} \times post_t \\ &+ \gamma_3 \times uns_i \times post_t + \delta_5 \times risk_{jt} \\ &+ \delta_6 \times uns_i + \delta_7 \times ttm_{ijt} + day_t + \mu_{ijt} \end{aligned}$$

We can assume that bank risk can take only two values ($risk = s = safe$ or $rsk = r = risky$), that *post* can take two values ($post = pre =$ before treatment or $post = post =$ after treatment), that uns can take two values (uns = u = senior unsecured or uns = n = non-bailinable) and that $E(u|\text{uns}, post, risk, X) = 0$ (where X is the set of control variables in the DDD regression model). It can be shown (by calculating the expectations relative to the triple differencing empirical model) that the β_3 is the difference between two time-series changes in sensitivities:

$$\begin{aligned} \beta_1 =& \left[\left(yield_{|rupost} - yield_{|supost}\right) + \left(yield_{|rupre} - yield_{|supre}\right)\right] \\ &- \left[\left(yield_{|rnpost} - yield_{|snpost}\right) + \left(yield_{|rnpre} - yield_{|snpre}\right)\right] \end{aligned}$$

where ($yld|r$ u $post - yld|s$ u $post$) is a difference in expected values describing the sensitivity of the yield of a senior unsecured bond to an increase in risk from s to r, after the bail-in event. ($yld|r$ u $pre - yld|s$ u pre) is a difference in expected values describing the sensitivity of the yield of a senior unsecured bond to an increase in risk from s to r, before the bail-in event. ($yld|r$ n $post - yld|s$ n $post$) is a difference in expected values describing the sensitivity of the yield of a non-bailinable bond to an increase in risk from s to r, after the bail-in event. ($yld|r$ n $pre - yld|s$ n pre) is a difference in expected values describing the sensitivity of the yield of a non-bailinable bond to an increase in risk from s to r, before the bail-in event.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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