Do Bond Yields Follow the Hierarchy of Risk Post-BRRD?[1]

Doriana Cucinelli[2]
University of Milano Bicocca, Italy
Department of Business and Law
E-mail address: doriana.cucinelli@unimib.it

Lorenzo Gai
University of Florence, Italy
Department of Economics and Management
E-mail address: lorenzo.gai@unifi.it

Federica Ielasi
University of Florence, Italy
Department of Economics and Management
E-mail address: federica.ielasi@unifi.it

Abstract

With a sample of 4,065 bonds issued by 63 banks from 12 euro area countries during 2013–2017, the study investigates how introducing bail-in regulation has influenced bond yields in secondary markets, by distinguishing between non–bail-inable- and different classes of bail-inable bonds. The bail-in risk premium does not follow the hierarchy of risk: it is stronger for less risky bonds. The effect on the spread between senior unsecured and non–bail-inable bonds is much higher than for subordinated bonds. Regarding subordinated bonds, the impact is higher for securities excluded from regulatory capital than for those included.

Keywords: bail-in regulation; difference-in-difference; subordinated unsecured bonds; senior unsecured bonds; market discipline

JEL Classification: G20; G21

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[2] Correspondence: Doriana Cucinelli, University of Milano-Bicocca, Via degli Arcimboldi, 8, 20126, Italy. Phone number: +39/02-64483142; E-mail address: doriana.cucinelli@unimib.it

1. INTRODUCTION

During the financial and sovereign debt crises, numerous banks experienced economic and liquidity distress and were subsequently bailed out by governments. In the European Union (EU), with the aim of preserving financial stability and public finances, as well as reducing banks' risk-taking behaviour, specific regulatory reforms were enacted through the Bank Recovery and Resolution Directive (BRRD, Directive 2014/59/EU) and the Single Resolution Mechanism (Regulation 806/2014 EU). According to the new rules, effective since January 2016, bail-in is one of the resolution tools that authorities can apply to handle a bank crisis (for a review, see Single Resolution Board, 2016; Wojcik, 2016). The bail-in regulation prescribes that all liabilities of a bank are 'bail-inable', except specific protected positions, including secured bonds (covered securities). Debts explicitly excluded from the bail-in tool are defined as non–bail-inable instruments (Philippon & Salord, 2017). For instruments classified as bail-inable, the bail-in regulation enforces loss absorption in accordance with a hierarchy of claims described in Article 48 of the BRRD and reported in Table 1.

[Table 1 here]

By enforcing loss absorption by bail-inable instruments allocated in different classes, the bail-in regulation incentivizes investors to price in the risk of specific securities issued by a bank (Crespi, Giacomini, & Mascia, 2019; Da-Rocha-Lopes, Beck, & Silva, 2018; Giuliana, 2018; Huertas, 2013; Pablos, 2019; Pigrum, Reininger, & Stern, 2016). To reinforce this objective, the Markets in Financial Instruments Directive (MiFID) II regulation (Directive 2014/65/EU) compels financial institutions to inform investors in securities with loss-absorbing capacity about their potential treatment during a resolution. Whether investors include bail-in risk in their pricing decisions, they should be able to impose market discipline on bank's risk taking (Lewrick, Serena, & Turner, 2019). In particular, given the different classes of bail-inable bonds, the bail-in framework should be able to modify bond yield risk sensitivity, affecting market discipline, in accordance with the stipulated bail-in hierarchy.

Our study aims to verify this point: the main research question is whether bond yield follows the hierarchy of risk post-BRRD. The question starts with the analysis of markets' and investors' characteristics for each class of debt securities. As is well known, subordinated bond markets generally have a narrower investor base,[3] whereas in senior bond markets the share of

[3] In the EU, rules restricting the sale of subordinated instruments with specific characteristics to retail clients have been introduced for all banks by reinforcing MIFID's provisions (Official Journal of the EU, 2014, Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments,

retail investors, less able to charge adequate risk premia, is higher (European Central Bank (ECB), 2013, 2020; Götz & Tröger, 2016). Nevertheless, given the market size, senior bonds tend to be more liquid than subordinated ones, giving investors the opportunity to respond more quickly to a change in bank risk (ECB, 2019; Lewrick et al., 2019). As a consequence, market discipline can be exerted with different strengths in each debt market.

Evolution in the supply of different bond categories post-BRRD could have heterogeneously affected yields too. Indeed, the recent bank reform has raised the need to issue securities useful for complying with regulatory constraints, rather than effectively satisfying funding needs. In particular, the BRRD requires banks to comply with a minimum requirement for own funds and eligible liabilities (MREL). Since subordinated bonds, under specific conditions can qualify for MREL compliance, issuance of this category of securities has increased in recent years, which could have affected their secondary market pricing (European Banking Authority, 2017; ECB, 2017). At the same way, the total loss absorbing capacity (TLAC) requirement imposed by the Financial Stability Board (FSB) could have determined the need for some institutions to issue subordinated debt with specific characteristics to comply with the minimum ratio, involving further potential impact on its market.

Using a difference-in-difference (DID) method, with a sample of secured bonds (non–bail-inable securities), senior unsecured bonds (fifth class in Table 1), subordinated bonds not included in regulatory capital (fourth class in Table 1), and subordinated bonds included in Tier 2 (T2) capital[4] (third class in Table 1), this research examines the effect of the introduction of bail-in from the perspective of investors in bank bonds, by analysing how different secondary bond markets reacted to the BRRD coming into force. Overall, with a sample of 4,065 bonds issued by 63 banks from 12 euro area countries during 2013–2017 and 164,641 monthly observations for bond yields, we find bail-in regulation to have a clear impact on bond yields. After bail-in was introduced, the yield spread between non–bail-inable bonds and the different categories of bail-inable bonds issued by banks increased, involving the application of a bail-in risk premium, variable across classes of securities. After 2016, investors' incentive to incorporate the bank's default probability into its bond price increased: all investors in bonds' secondary markets required a new risk premium for the case of bail-in. By implementing an orderly, hierarchical resolution mechanism in case of bank distress, this reform reduced

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May). Minimum restrictions apply to newly issued subordinated liabilities (not own funds); however, a national option is included that would allow for stricter rules (Financial Stability Board, or FSB, 2019).

[4] The eligibility requirements are defined in the European capital rules EU Directive 2013/36/EU and Regulation EU 575/2013.

‘creditor inertia’. In particular, comparing the spread against non–bail-inable bonds pre- and post- 2016, the impact of the new regulation is much greater for senior bonds than for subordinated bonds. Moreover, this impact is greater for subordinated bonds excluded from regulatory capital than for Tier 2 securities. These results highlight that the effect of the reform is inversely related to the layers of the bail-in hierarchy. After the introduction of bail-in, the increase in the perceived risk for bondholders is higher for less risky bonds. Additionally, our results show that the effect of the bail-in regulation is not driven by countries where political uncertainty is stronger.

Our study contributes to the literature in several ways. First, we focus on the impact of the introduction of bail-in regulation on the different categories of subordinated bonds, because we aim to verify whether the market-disciplining effects on bank risks are inhibited in specific debt markets or follow the hierarchy of risk after the BRRD. To the best of our knowledge, few prior studies exist on this specific topic. Previous research describes the effect of the new regulation on the yield spread between bail-inable and non–bail-inable bonds without distinguishing among the different classes of bail-inable bonds (Chan-Lau & Oura, 2016; Crespi et al., 2019; Giuliana, 2018). Other studies focus only on senior bonds, given the market size and the opportunity to compare bail-inable senior bonds with other senior bonds excluded by the bail-in tool (Lewrick et al., 2019), or just on subordinated securities, since they are the primary target of bail-in in the case of a bank crisis (Cummings, Guo, & Wu, 2019; Götz & Tröger, 2016). Very little research analyses the effect of this regulation on bond seniority levels among bail-inable bonds (Giuliana, 2018; Pablos, 2019), never distinguishing among different classes of subordinated bonds.

Compared to other studies, we do not focus on the reaction in bond issuance costs (Crespi & Mascia, 2018; Crespi et al., 2019) but, instead, examine bonds’ prices and yields in secondary markets, since our main focus is the effect of bail-in on different categories of bondholders (Giuliana, 2018; Pablos, 2019). We analyse the secondary market because this allows us to both expand the sample by including also financial institutions that issue infrequently (Birchler & Facchinetti, 2007) and verify investors’ reaction to the introduction of the bail-in regulation. Unlike other studies, more focused on how bank characteristics and macroeconomic factors explain the impact of bail-in (Pablos, 2019; Wojcik, 2016), our research deepens insight on variables related to different bond types (secured/unsecured, subordinated/senior, included/not included in regulatory capital). In studying the differences in bond yield reactions across bond types, we also control for bond characteristics, as liquidity, maturity, issue amount, and coupon ratio (Fan et al., 2003; Santos, 2014).

The paper is structured as follows. Section 2 presents the literature review and hypotheses. Section 3 introduces the sample and methodology. Section 4 discusses the main findings and robustness checks. Section 5 concludes the paper by discussing the implications for investors, bank issuers, and supervisory authorities.

2. LITERATURE REVIEW AND HYPOTHESES

Aimed at assessing the impact of bail-in risk on bond returns, our study is based on the literature on financial market discipline (starting with Flannery & Sorescu, 1996). Within this framework, many authors (e.g. Balasubramnian & Cyree, 2011; Bliss & Flannery, 2002; Covitz, Hancock, & Kwast, 2004; Jagtiani, Kaufman, & Lemieux, 2002; Morgan & Stiroh, 2000; Simion, Cavezzali, Nathan, & Rigoni, 2020) assess the link between bank funding costs and bank risks, indicating that higher bond prices and yield–risk sensitivity result from additional risks faced by financial institutions and their bondholders. Acharya, Anginer, and Warburton (2016), Flannery and Sorescu (1996), Sironi (2003), as well as Yildirim Semih, Seung-Woog Kwag, and Collins (2006) examine, in particular, the yield–risk relation after government decrees or legislative reform.

Some studies have specifically investigated the effect of the BRRD on both stock and bond markets. Regarding, in particular, debt markets, Avgouleas and Goodhart (2015) have predicted that bail-in would reinforce investors' incentives to effectively price the risk of a bank resolution. Chennells and Wingfield (2015) assert that bail-in would shift risks from taxpayers to bondholders, thus making banks' funding costs more risk sensitive. Chan-Lau and Oura (2016) use a Merton model approach to verify that the bail-in tool increases the cost spread between bail-inable and non–bail-inable bonds. Relatedly, Crespi and Mascia (2018) show that, since the BRRD was adopted, Italian banks have offered higher yields to bondholders, with a consequent increase in their cost of funding. Crespi et al. (2019) also find an increase in the spread upon the issuance of bail-inable bonds, compared to non–bail-inable bonds, and demonstrate that the increase depends partly on the intrinsic characteristics of each bank.

This paper first aims to confirm that, other than the increase in the average cost of issuance of bail-inable bonds against securities excluded by the framework, directly affecting banks' funding costs (Crespi & Mascia, 2018; Crespi et al., 2019), market discipline also works on secondary markets (Cumming et al., 2019; Giuliana, 2018; Pablos, 2019). Following Giuliana

(2018), who demonstrates that bail-in increases investors' incentive to incorporate the bank's default probability into its bond price, we first hypothesize the following.

> **H1**: *The introduction of the bail-in mechanism increases the yield spread between bail-inable and non–bail-inable bonds in secondary markets.*

Whereas Giuliana (2018) analyses the impact of several events signalling higher (lower) commitment toward the bail-in tool, our first hypothesis concerns the actual entry into force of the regulation.

The literature demonstrates that the bail-in regulation has the greatest impact on larger banks, which have previously been regarded as 'too big to fail' and, consequently, exposed to higher public guarantee expectations, in connection with moral hazard (Allen, Carletti, Goldstein, & Leoncello, 2015; Giuliana, 2018; Gornicka & Zoican, 2016; Pablos, 2019; Pigrum et al., 2016; Zhao, 2018). Moreover, the effects depend on the probability of default of the bank involved (Andersson, Busetto, & Klaus, 2019; Crespi et al., 2019).

Our second objective is to elucidate how the new framework impacts bail-inable bonds at different levels in the bail-in hierarchy. The actual impact of bail-in depends on whether investors consider this mechanism a plausible threat to their savings (Lewrick et al., 2019). Financial prices will reflect the extent to which bail-in is valued as a credible risk by the market (Peleg-Lazar & Raviv, 2016). In case of resolution, the actual severity of losses for bondholders via bail-in depends on the specific type of securities issued by the bank.

Very few studies have explored the impact of the bail-in framework on different classes of bail-inable bonds. Giuliana (2018) distinguishes the sample of bonds by their seniority level in robustness checks. The author does not find statistically significant differences between the reactions of bonds of different categories. As in our research, the author uses a DID methodology, but the treatment analysed is unrelated to the regulation's entry into force. Compared to our research, Giuliana's study period ends in January 2016 and includes different events, showing an increase in authorities' commitment to the bail-in framework or an improvement in the flexibility of the interpretation of its principles.

Pablos (2019) has recently investigated the issue in greater detail, specifically exploring whether the bail-in framework has increased the yield spread between subordinated and senior bonds. In particular, the author analyses the evolution of spreads in secondary markets, considering issuer characteristics – that is, global systemically important bank (G-SIB) status, business model, country, and other bank-specific variables – as well as the financial environment and market conditions (overnight interest rates, volatility of the Euro Stoxx Index, economic growth prospects). Pablos' research finds no evidence of a generalized and significant increase in yield spreads as a result of higher risk perception. The author highlights how different factors contribute to a general decline in senior and subordinated bond yields, while keeping the spreads relatively constant. At the same time, the author highlights the need for additional studies on the topic. Therefore, starting with that study and focusing on euro area banks, we want to complement this literature by expanding the analysis of the differences in the reactions of bond yields, depending on their seniority. In particular, we apply an alternative methodology based on DID modelling, distinguish among classes of subordinated bonds belonging to different layers of the bail-in hierarchy, and increase the number of bond characteristics taken into account.

Considering the actual losses in the case of bail-in for different kinds of bonds, we expect to find an increase in the difference between returns from senior bonds and subordinated bonds, as well as between returns from subordinated securities belonging to regulatory capital and not. Assessing the tool's implementation in Europe, Chennells and Wingfield (2015), Eliasson, Jansson, and Jansson (2014), and Halaj, Hüser, Kok, Perales, and Van der Kraaij (2016) demonstrate that the losses of banks under resolution usually exceed equity capital. With a multi-layered network model of the securities holdings of the 26 largest euro area banking groups, Halaj et al. (2016) find that subordinated creditors will always be affected by bail-in, whereas senior unsecured creditors will be affected in only 75% of cases. Conlon and Cotter (2014) investigate the counterfactual of the bail-in framework being applied in the European banking system during the global financial crisis; they suggest that holders of equity and subordinated bonds would have been the main losers of the EUR 535 billion impairment losses suffered by failed banks. Schäfer, Schnabel, and Weder di Mauro (2016) show that, in early implementations of the bail-in mechanism, only two cases involved senior unsecured bondholders: the first in Denmark and the second in Cyprus. The losses from a bail-in thus differ for the various classes included in the bail-in hierarchy according to the regulation, which can affect the discipline imposed by the different markets for bail-inable debt.

For these reasons, we intend to deepen analysis of how the bank reforms have influenced the yield spread between subordinated and senior (both unsecured) bonds. We also introduce a new analysis aimed at verifying the reaction of two subcategories of bail-inable bonds: subordinated bonds included in T2 capital (third class in the bail-in hierarchy) and subordinated bonds not included in regulatory capital (fourth class in this hierarchy).

We do not consider additional Tier 1 bonds (second class in the bail-in hierarchy), because the introduction of bail-in has not increased their overall riskiness: by definition, these securities incorporate a structure for absorbing losses on a going-concern basis. By contrast, T2 capital is considered gone-concern capital.

Consequently, according to the bail-in hierarchy, the study tests the following hypotheses:

> **H2**: *Compared to non-bail-inable bonds, the relative increase of the yield spread following the implementation of the BRRD is lower for senior unsecured bonds than for subordinated bonds*
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> **H3**: *Compared to non-bail-inable bonds, the relative increase of the yield spread following the implementation of the BRRD is lower for subordinated bonds excluded from regulatory capital than for subordinated bonds included in the capital.*

3. DATA AND METHODOLOGY

3.1 Sample description

Our analysis focuses on bonds issued by banks located in the eurozone (Halaj et al., 2016; Pigrum et al., 2016). BRRD includes different national options that allow for stricter rules or local arrangements, as, for example, for the loss absorption waterfall. To reduce the differences among the sample analysed, we consider countries required to participate in the Single Supervisory Mechanism and within the Banking Union's jurisdiction (FSB, 2019; Götz & Tröger, 2016). To include in the analysis bonds issued in the same currency (Hofmann, Shim, & Shin, 2019; Lewrick et al., 2019), we focus on euro area banks as the main issuers of euro-denominated debt.

Furthermore, in the eurozone, we select countries according to their gross domestic product (GDP) and their aggregated banking sector liabilities positions. In particular, we exclude areas with lower levels of GDP and with less than 1% of the aggregated amount of total financial liabilities in euro area banks. We then exclude Cyprus, Estonia, Latvia, Lithuania, Malta, Slovakia, and Slovenia. We must also remember that these countries have particularly low ratios of outstanding noncovered bonds to banks' total financial liabilities, revealing a very limited contribution to bail-inable debt markets (Pigrum et al., 2016). The modest level of liquidity of these markets suggests their exclusion from our analysis.

With reference to countries included in the sample, we select all banks whose securities are listed on the secondary markets in the period under consideration. For banking groups, we select the outstanding bonds of holding companies and, when these are unavailable, the bonds of the main operating company (Bliss & Flannery, 2002; Hancock & Kwast, 2001). Despite the fact that high volumes of unsecured bonds are issued by affiliates (Crespi et al., 2018; Götz & Tröger, 2016), we exclude the operating company's securities when our sample includes bonds issued by the holding company, to avoid potential issues related to sample selection that can bias our findings. Indeed, securities issued by the operating company are often linked to bonds issued by the bank holding company, through an internal note that structurally subordinates the holding company bonds to those of its affiliates. Investors in these bonds are liable not only for the holding company's losses, but also for the subsidiaries' losses in case of resolution.[5] Consequently, the operating company's securities are not subject to bail-in, even if they are not formally exempt. This structural subordination is allowed by the BRRD and it is greatly developed (Götz & Tröger, 2016). Even in the absence of such formal subordination, among banking groups operate internal capital markets, which involve the transmission of shocks affecting one party to other organizations (Crespi et al., 2018; Houston, James, & Marcus, 1997). This is why the holding company is the resolution entity of a group according to BRRD.

Our initial sample was composed of 63 banks[6] from 12 euro area countries, for a total of 4,564 fixed-rate bonds. However, some bonds were excluded from the final sample, because it was not possible to find the bond's yield, because the bond was not treaded on the secondary market or because of missing data. We end up with data on 4,065 bonds, between 1 January 2013 and 31 May 2017, for a total of 164,641 monthly observations. We include in our sample only bonds with a maturity longer than one year.[7] All bonds are issued before and expire after 1 January 2016. The dataset used for the analysis comprises unbalanced panel data. Given that entities likely to fail are included in the sample, to consider all banks without self-selected components in our sample, the yields are winsorized at the first and 99th percentiles to minimize the influence of outliers.[8]

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[5] According to the FSB's TLAC standards, the operating company's bonds are not considered eligible for TLAC. This regulation foresees that, from January 1, 2022, onward, subordinated bonds for a resolution entity (banking group) need to be issued at the parent level (FSB, 2019).
[6] A sample description is reported in Table A of the Online Appendix.
[7] Bonds with a maturity shorter than one year do not count as fulfilling the MREL and TLAC requirements. They are therefore considered by the regulation as ineffective securities in case of resolution.
[8] As robustness checks, we run an additional analysis excluding failing banks or banks that are likely to fail.

We focus on the secondary market, knowing that the yield of bonds negotiated in this market is just a proxy variable for funding cost linked to the rollover cost. However, the use of secondary market data is due to both the limited availability of primary market data (Birchler & Facchinetti, 2007; Pablos, 2019) and the aim of focusing on investor reaction to the bail-in regulation (Cummings et al., 2019; Giuliana, 2018; Pablos, 2019). Indeed, the secondary market trend is able to incorporate investors' risk appetite. Through the comparison of secondary markets prices, we are then able to ascertain the investor pricing of bail-in risk.

Data on bond yields are collected from Datastream (both Eikon and DFO). Following previous literature (e.g. Crespi et al., 2018; Gabbi & Sironi, 2005; Iannotta, Nocera & Resti, 2013; Sironi, 2003), we exclude perpetual bonds and bonds with optional components (e.g. callable, puttable, and convertible bonds), as well as variable and floating income securities. We consider plain vanilla bullet bonds, and zero-coupon securities".

With regard to bank-specific variables, we collect quarterly data from SNL Unlimited. To align the frequency of the data, we use the linear interpolation and transform quarterly into monthly data.[9] Data on M&A operations are downloaded from the Zephyr database. Finally, to represent macroeconomic conditions, we collect data from the ECB on the 10-year Treasury bond yield at the country level, from which we measure the country spread as the difference between that country's 10-year Treasury bond and the 10-year German government bond. This variable is useful for introducing into the analysis the country's sovereign risk, which can affect investors' risk perception (Pablos, 2019).

Our bond sample is split into 3,151 bail-inable and 914 non–bail-inable bonds. Unsecured bonds are classified as bail-inable; thus, non–bail-inable bonds are secured bonds, that is, those with collateral that are not subject to the bail-in mechanism in the case of a bank crisis.

Among the sample's bail-inable bonds are three different risk classes: a) 137 subordinated bonds included in T2 capital, b) 800 subordinated bonds not included in T2 capital, and c) 2,214 senior unsecured bonds. It is worth noting that bail-inable bonds constitute 77.52% of the sample (Table 2). In Appendix we report the full descriptions of issuers' and bonds' characteristics.

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[9] We prefer transforming quarterly data into monthly data to obtain a longer time series after 1 January 2016. In fact, the transformation of monthly into quarterly data leads to the loss of data and to only six observations after the introduction of the BRRD. However, to control for the robustness of our results, we also run the regression using quarterly data.

[Table 2 here]

Figure 1 shows the time series of the monthly average yields of the bail-inable and non–bail-inable bonds. The time window starts in January 2013 and ends in May 2017. The yields for both types show a general downward trend, particularly during 2014, when the ECB adopted nonconventional monetary policies. The yield spread increased in 2015, coinciding with the approval of the BRRD by different European countries: from 1 January 2015, all EU Member States were required to transpose the BRRD into national law. Moreover, after 2016, Figure 1 shows a strong increase in yield spread. Therefore, Figure 1 supports the prediction of H1, that introduction of the bail-in mechanism would increase the yield spread between bail-inable and non–bail-inable bonds. Since investors perceive an increase in the risk attributed to bonds that could be used to cover losses in the case of bank resolution, they impose a higher risk premium than before, improving market discipline.

[Figure 1 here]

3.2 Methodology

To detect the impact of bail-in regulation on bank bond yields in the euro area, we run a DID regression to investigate the difference between bail-inable bonds and non–bail-inable bonds both before and after the new regulation was introduced, and the DID, that is, the difference in bond yield attributable to treatment. We chose DID to distinguish the two groups of observations within a period containing a specific treatment. We split the timeline into two periods: the first before the treatment, and the second afterward. One group of bonds is impacted by the treatment and the other, the control group, is not. The DID method reveals the difference between the control group and the treated group before and after treatment. In our analysis, the treatment is the new regulation on bank bail-in. The treated group comprises bail-inable bonds (subordinated bonds and senior unsecured bonds) and the control group comprises non–bail-inable bonds (secured bonds not subject to the new regulation).

Our analysis is structured in three steps. In the first step, we investigate the difference between the bond yield for bail-inable and non–bail-inable bonds before and after the BRRD. This analysis assesses whether the new regulation affected the bank bond yield. In the second and third steps, we measure the effect of the introduction of the bail-in regulation on different subgroups of unsecured bonds.

The regression model is as follows:

$$BY_{i,c,t} = \alpha + \beta_1 TIME_t + \beta_2 TREATED_{i,c,t} + \beta_3 TIME_t\, xTREATED_{i,c,t} + \beta_4 BANK\_CONTROL_{i,t} + \beta_5 BOND\_CONTROL_{i,t} + \beta_6 SPREAD_{c,t} + \beta_7 INDIVIDUAL\_FE + \beta_8 YEAR\_FE + \varepsilon_i \quad (1)$$

where the dependent variable is the bond yield (*BY*) of bank *i* in country *c* at time *t*, and *TIME* is a dummy variable that equals one from 1 January 2016 to the end of our sample period, and zero otherwise.

The *TREATED* variable changes in the different analyses. In the first analysis, we study the effect of the introduction of the bail-in regulation on bail-inable bonds in general, without distinguishing among the different classes of bail-inable bonds. Therefore, *TREATED* is a dummy variable equal to one if the bond is bail-inable, and zero otherwise.

In the second analysis, we observe the pre- and post-2016 results comparing less risky against more risky bonds. First, using an ordinary least squares (OLS) regression with time and country fixed effects, we compare senior unsecured bonds and non–bail-inable ones, and, second, we compare subordinated unsecured bonds and non–bail-inable ones. In this analysis, *TREATED* is, respectively, a dummy variable equal to one if the bond is senior unsecured, and zero otherwise, or a dummy variable equal to one if the bond is subordinated unsecured, and zero otherwise.

As the last step of our analysis, we investigate the bond yield spread between two categories of unsecured subordinated bonds. We distinguish subordinated bail-inable bonds according to their level of risk, separating those included in T2 capital from those excluded therefrom. In this third analysis, *TREATED*, first, equals one if the bond is subordinated unsecured excluded from T2 capital, and zero otherwise; second, *TREATED* is equal to one if the bond is a subordinated unsecured bond included in T2 capital, and zero otherwise. After 2016, we expect an increase in the difference between the two bond categories, because, although the bail-in regulation affects all subordinated bonds, securities included in T2 capital are higher in the bail-in hierarchy than other subordinated bonds. Consequently, the increase in their perceived risk is greater than for other bonds.

With regard to the other variables, *TIME*×*TREATED* is an interactive variable combining time and the treated status. To control for bank-specific characteristics and bond characteristics, we add two vectors of variables, *BANK_CONTROL* and *BOND_CONTROL*, respectively (Iannotta & Navone, 2008; Pais & Stork, 2013). As bank-specific characteristics

(*BANK_CONTROL*), we include several variables: i) The first variable is bank size (*SIZE*), measured with the natural logarithm of total assets, and we expect a negative relationship between bank size and bond's yield, because larger banks are better at diversifying their business activities and, in addition, benefit from the too-big-to-fail guarantee (Crespi et al., 2019; Lewrick et al., 2019; Sironi, 2003; Ueda & Weder Di Mauro, 2013). ii) The second variable is the return on average equity (*ROAE*), as a measure of bank performance, and its relation with the bond's yield could be both positive and negative. A higher return on average equity could even reflect the greater risk propensity of banks, and, in this case, the results could underline a positive correlation with the bond's yield (Flannery & Sorescu, 1996). Otherwise, more profitable banks could pay a lower yield due to their higher efficiency (Crespi et al., 2019). iii) The third variable is the Tier 1 capital ratio (*TIER 1*), as a measure of capital requirement, which should have a negative relation with the bond's yield, because better-capitalized banks have a lower probability of default. iv) The fourth variable is nonperforming loans over gross loans (*NPL_GL*), as a proxy of credit portfolio quality, which should have a positive relation with the bond's yield. Banks more exposed to impaired loans are perceived as riskier by investors, who expect a higher yield from their investment (Crespi et al., 2019; Flannery & Sorescu, 1996). v) We also include the ratio of gross loans over total assets (*GL_TA*) to proxy for the bank business model (Beltratti & Stulz, 2012; Cummings et al. 2019; Pablos, 2019). Financial institutions specialized in corporate and investment banking, as well as trading or asset management, have a financial structure that is more unbalanced towards wholesale funding, compared to commercial banks, affecting their exposure to risk (Collin-Dufresne, Goldstein, & Martin, 2001; Elton, Gruber, Agrawal, & Mann, 2001). vi) the bank's rating (*RATING*), proxied by a category variable value from one to 19, where one represents the lowest rating (e.g. the riskiest banks) and 19 the highest (e.g. the safest banks), is included among a bank's characteristics (Crespi et al., 2019; Lewrick et al., 2019). The ratings issued by the main international agencies continue to play a key role for investors in fixed-income securities (Andersson et al., 2019). We expect investors to ask for higher returns from bonds issued by riskier banks. vii) Additionally, we include in the analysis a control for merger and acquisition (M&A) operations (*M&A*),[10] proxied by a dummy variable equal to one when the bank is involved in an M&A operation, and zero otherwise (Pablos, 2019). All bank characteristics are introduced at time *t* - 1 to reduce potential endogeneity problems.

[10] We consider M&A operations to be mainly the acquisition and sale/acquisition portions of business. In our sample, we do not have any mergers during the period analysed. There are no outgoing banks during the time horizon investigated.

As bond characteristics (BOND_CONTROL), we include four variables: i) The first variable is maturity (*MATURITY*) as the natural logarithm of the number of years left until the bond's expiry, which should impact positively on bond yield. Theoretically, bonds with a longer redemption horizon should pay more than others (Crespi et al., 2019; Lewrick et al., 2019). ii) The second variable is bond liquidity (*LIQUIDITY*), measured by the natural logarithm of the difference between the bid and ask prices. More illiquid bonds earn higher yields, and an improvement in liquidity causes a reduction in yields (Chen, Leasmond, & Wei, 2007), therefore we expect a positive relationship between the bid-ask spread and the bond's yield. iii) The third variable is the coupon rate (*COUPON*), representing the presence of a coupon linked to the bond and the percentage that the coupon pays. All other things being equal, the higher the coupon rate, the higher the bond's yield (Cummings et al., 2019). iv) The last variable is the issue amount (*ISSUE*), measured by the natural logarithm of the amount issued for each bond. We expect that larger amounts negatively affect bond yield, inasmuch as banks can decrease issuing costs due to better economies of scale (Crespi et al. 2019; Götz & Tröger, 2016).

To control for macroeconomic conditions, we include the monthly spread between the 10-year Treasury bond of each country and the 10-year German Treasury bond (*SPREAD*). The greater the country spread, the higher the bond's yield, because investors perceive banks that operate in a riskier country as riskier than banks with similar characteristics but operating in a safer country (Mikosek, 2016; Schäfer et al., 2016).

Moreover, we insert two vectors representing individual and year fixed effects, *INDIVIDUAL* and *YEAR*, respectively. In the first case we control, alternatively, for country fixed effects and bank fixed effects, to control for average differences across both countries and banks; in the second vector, we control for average differences across periods in any observable or unobservable predictors. The fixed effect coefficients absorb all the cross-group action, leaving only the within-group action. We thus greatly reduce (but do not eliminate) the threat of omitted variable bias.

Regarding the coefficients, β_1 is the expected mean change in outcome from before to after the onset of the intervention in the control group. It reflects the pure effect of the passage of time in the absence of actual intervention. The coefficient β_2 is the estimated mean difference in *BY* between the treated and control groups prior to the intervention; it represents whatever baseline differences existed between the groups before the intervention was applied to the treated group. The coefficient β_3 is the difference between the control and treated groups before and after treatment. We focus on this coefficient because it reveals whether the expected mean change

in outcome from before to after differs between the two groups. Finally, the sum of β_2 and β_3 is the difference between the untreated and treated groups post-treatment.
We use robust standard errors to obtain unbiased standard errors of the OLS coefficients under heteroscedasticity. However, rerunning all the analyses using standard errors clustered at the firm level produced similar results. In particular, the coefficients referring to bail-inable status - dummy variables and interactive variables - have the same signs and significances.

4. RESULTS

4.1 Descriptive statistics

Descriptive statistics are reported in Table 3 and underline that, on average, our sample is mainly composed of bail-inable bonds and, among them, senior unsecured bonds. Moreover, looking at the bank characteristics, on average, we find our sample is composed of large banks, with high capitalization (14%), good profitability (2.9%), and good credit portfolio quality (4.5% of impaired loans, on average). The banks in our sample are mainly commercial banks oriented to lending activity, as underlined by the ratio of gross loans to total assets (54%, on average). The rating underlines low bank credit risk, with an average value of around 14 in a range from one to 19, where 19 is the best rating. Moreover, as reported in the Table 1 in Online Appendix, the correlation matrix shows no high Pearson correlations among the independent variables.

We run, additionally, a *t*-test to confirm that the bail-inable and non–bail-inable bonds are independent samples from a population with the same distribution. As reported in Table 4, our findings emphasize that, on average, bail-inable bonds pay a higher yield than non–bail-inable ones. Moreover, with regard to bond characteristics, bail-inable bonds are associated with a shorter maturity and a lower issue amount, coupon rate, and liquidity than non–bail-inable bonds. Regarding bank characteristics, bail-inable bonds are, on average, issued by banks that are larger and have lower Tier 1 capital ratio and lower profitability but higher ratings than non–bail-inable bonds. The ratio of nonperforming loans is the only variable that does not show a statistically significant difference from the mean.
In Table 5, we report the analysis of variance (ANOVA) results. We run this test to verify the difference in variances of the three different groups of bail-inable bonds: senior unsecured, subordinated excluded from capital, and subordinated included in T2 capital. All the differences are found to be statistically significant. Regarding yield, we observe that, on

average, riskier bonds pay a higher yield than other bail-inable bonds, while senior unsecured bonds pay the lowest yield. Regarding bond characteristics, our data show that the higher the bond's risk, the higher the average issue amount; with regard to the coupon rate and liquidity, the higher the risk associated to the bond (from senior bonds as the less risky, up to subordinated bonds included in T2 capital as the riskiest), the higher the coupon rate paid and the lower the liquidity of the bonds. Subordinated bonds excluded from capital show, on average, the shortest maturity. Finally, with regard to bank characteristics, our findings suggest that, on average, smaller banks are more willing to issue riskier bonds, whereas larger banks are more willing to issue senior unsecured bonds. Banks with a higher Tier 1 ratio (higher capital requirement) issue more senior unsecured bonds, whereas less capitalized banks are more willing to issue riskier bonds. Referring to profitability, banks with higher performance issue more senior unsecured bonds than others. In terms of credit portfolio quality, banks that issue subordinated bonds have a higher nonperforming loans ratio than banks that issue senior unsecured bonds. Additionally, banks with a higher credit rating issue more senior unsecured bonds than other banks. Banks more oriented to lending activity are more likely to issue subordinated bonds, and, among these, subordinated bonds included in Tier 2 capital. Focusing on subordinated bonds, we observe that subordinated bonds included in T2 capital are mainly issued by banks with higher profitability, capitalization and rating, and lower ratio of nonperforming loans.

[Table 3 here]

[Table 4 here]

[Table 5 here]

4.2 Empirical results

In the first test, we analyse the bond yields before and after 1 January 2016, to detect whether the bail-in regulation led to a higher increase in yields on bail-inable bonds than on non–bail-inable bonds. As reported in Table 6, we run three models. In the first, we include only three variables: the time dummy, where the dummy refers to treated and untreated bonds, and, finally, the interactive variable. In the second model, we also add bank- and bond-specific characteristics and country and year fixed effects. Finally, in the third model, we substitute for country fixed effects with bank fixed effects. Our results highlight that the yield spread between bail-inable and non–bail-inable bonds is greater post-treatment. Before the treatment, the yield is 0.514 higher on bail-inable bonds than on non–bail-inable bonds, and this difference is explained by the different levels of risk for unsecured and secured bonds. After treatment, the yield is 0.994 (Mod_0) higher on bail-inable bonds than on non–bail-inable bonds. The difference attributable to the bail-in regulation is thus equal to 0.480. The results are also confirmed when we include bank and bond characteristics in Mod_1 and Mod_2, respectively. In all cases, the coefficients are high and statistically significant at 1%.

[Table 6 here]

In the second and third analyses, to compare regression coefficients across models (senior unsecured versus subordinated bonds and subordinated unsecured included in Tier 2 capital versus those not included), we estimate the simultaneous (co)variance of the coefficients of the models and test whether the differences between the coefficients are statistically significant (Clogg et al., 1995). As underlined by the column for Prob > chi2 in Tables 7 and 8, the results suggest that the coefficients are statistically significant, and we can reject the hypothesis of the equality of the corresponding coefficients across models.

The second analysis focuses on the difference between senior unsecured and subordinated unsecured bonds compared to non–bail-inable bonds (Table 7). We observe that, in the pre-treatment period, senior unsecured bonds pay a higher yield than non–bail-inable bonds, with a difference of only 0.426 (Mod_0 Senior Unsecured). Subordinated unsecured bonds pay a yield 1.105 higher than non–bail-inable bonds (Mod_0 Subordinated bonds).

The yield spread both between senior unsecured and non–bail-inable bonds and between subordinated unsecured bonds and non–bail-inable ones increases in the period after bail-in is introduced, with senior unsecured bonds paying a yield 0.951 more than that of non–bail-inable bonds and subordinated unsecured bonds paying a yield 1.388 more than that of non–bail-inable bonds after 2016. The differences attributable to the bail-in regulation are 0.525 for senior bonds and 0.283 for subordinated bonds. Therefore, unlike our expectation, the introduction of the bail-in mechanism increased the yield spread between senior unsecured and non–bail-inable bonds more than the spread between subordinated and non–bail-inable bonds.

When we include both bank and bond characteristics, the coefficients of time and of the treated and interactive variables decrease in magnitude but always remain statistically significant at 1%. This finding suggests that the introduction of the bail-in regulation impacts senior unsecured bonds more heavily than subordinated bonds. Therefore, the bond market perceives a greater increase in risk in the senior unsecured bonds, which, although not included in the regulatory capital, became bail-inable in 2016.

[Table 7 here]

Finally, the third analysis compares two classes of subordinated bonds to non–bail-inable bonds: those excluded from T2 capital (lower risk) and those included therein (higher risk). As reported in Table 8, the results show the impact of regulation on both subordinated bonds excluded from T2 and those included in T2 capital.

Regarding the period before 2016, subordinated bonds excluded from T2 capital pay a 0.496 higher yield than non–bail-inable bonds, while subordinated bonds included in T2 capital pay a 2.387 higher yield than non–bail-inable bonds (Mod_0, Table 6). After the bail-in regulation is introduced, the difference in yield between subordinated bonds excluded from T2 capital and non–bail-inable bonds grows to 0.800; accordingly, the difference attributable to treatment is 0.304. With regard to subordinated bonds included in T2 capital, the difference in yield between these bonds and non–bail-inable bonds in that period grows to 2.624; therefore, the difference attributable to treatment is 0.237. To compare the coefficients, we test the statistical significance of the difference of the coefficients. The results underline the statistical significance.

Contrary to what we expected, the results indicate that the introduction of the bail-in mechanism increased the yield spread between subordinated bonds excluded from the regulatory capital and non–bail-inable bonds more than the spread between subordinated bonds included in the capital and non–bail-inable bonds. These findings are also confirmed in Model 1 and Model 2, in which we add the bank and bond characteristics.

[Table 8 here]

Finally, in all three analyses, the bank- and bond-specific control variables emphasize that the bond yield depends on the type of bank issuing the bond and the characteristics of the bond itself, thus confirming the main findings of Crespi et al. (2019) and Giuliana (2018) for the euro area secondary bond markets. Generally, our research demonstrates that bonds with longer maturity, less liquidity, smaller issue amounts, and a higher coupon ratio have higher yields. Moreover, larger banks with lower capitalization, lower profitability, higher credit risk, and a lower credit rating pay higher bond yields.

With regard to the macroeconomic control variable, consistent with our expectation and the findings of Mikosek (2016) and Schäfer et al. (2016), the Treasury bond spread positively affects the bond yield: the higher the spread, the higher the risk of a bond or asset class of this country and, in turn, the higher the bank bond yield. Lastly, the *TIME* dummy variable, referring to the pure effect of the passage of time (without the introduction of the bail-in mechanism), we find the coefficients are statistically significant and negative in all three analyses. This result suggests that, during the period under investigation, bank bond yields decreased, on average, thus also reducing banks' funding costs, given that bond yields in secondary markets are directly linked to bonds' issue prices in primary markets. This finding could be due to the nonconventional monetary policies adopted by the ECB since June 2014. These policies first impacted long-term sovereign bonds, consequently producing spill overs to bank bond yields. To the extent that market-based funding has been replaced with ECB nonconventional funding, these policies have contributed to reducing the supply of bank bonds and, consequently, to the flatness of the yield curve (ECB, 2017).[11]

4.3 Robustness checks

In this section, we run a series of additional analyses to check the robustness of our main findings. Most of the tables referred to in this section are in the Online Appendix. As for the main analysis, as well as in the robustness check, we estimate the simultaneous (co)variance of the coefficients of different models and test the statistical significance of the difference of the coefficients. In all cases, a significant difference is confirmed.

First, to alleviate the concern that the observed increase in bond yield is led by the bank's relatively high riskiness, we exclude from our sample riskier banks and those likely to fail (e.g.

[11] For more information, see https://www.ecb.europa.eu/pub/economicbulletin/html/eb201701.en.html#IDofArticle1.

banks with a rating lower than four).[12] In this analysis, the yields are not winsorized and there is no outlier correction. The results, reported in Table 2 in the Online Appendix, broadly corroborate our main findings. In this case, also, the bail-in regulation impacts the yield on bail-inable bonds more than that on non–bail-inable ones, and, among bail-inable bonds, the effect is stronger for senior unsecured bonds than for subordinated unsecured ones.

Second, to check whether our results hold for individual countries and do not depend only on specific countries where political uncertainty during the sovereign debt crisis (2011–2012) was stronger, we include in the regression model a dummy variable equal to one if the bank is located in Greece, Italy, Portugal, Spain, or Ireland (i.e. GIIPS countries), and we split our sample between the GIIPS countries and other EU countries. The results, reported in Table 3 in the Online Appendix, indicate that bonds issued by banks located in GIIPS countries show a higher yield than others banks, confirming the higher risk perceived by investors for banks in these countries. Looking at the results for the two subsamples, we find that, although the treated and interactive variables are higher in the GIIPS subsample, the bail-in regulation also affected the bonds issued by banks located in other EU countries.

The third additional analysis involves a subsample whose post-shock period has the duration as the pre-shock period. We split the period and we run the analysis on a subperiod that spans from June 2014 to May 2017. The findings, reported in Table 4 of the Online Appendix, strongly confirm our main analysis. Before the treatment, the yields respect the hierarchy, where senior unsecured yields are lower than subordinated bonds that are not included in T2 capital yields, which are lower than subordinated bonds included in T2 capital yields. However, also in this analysis, the interactive variable shows a higher coefficient for senior unsecured bonds than for the other bail-inable bonds, suggesting that the impact of the bail-in regulation does not follow the bond hierarchy.

Moreover, we transform the monthly yield data into quarterly data to check the robustness of our main analysis. The results are reported in Table 5 of the Online Appendix. Our findings corroborate the results obtained in the main analysis, in which we use monthly data. In this case, also, the bail-in regulation affects bond yield, with a stronger effect for senior unsecured bonds than for subordinated unsecured bonds. Among subordinated unsecured bonds, distinguishing between those included in Tier 2 capital and not, our results confirm that the

[12] A bank rating lower than four means a rating lower than B1 in Moody's rating scale. Therefore, banks with a rating in the C class are excluded from the analysis.

effect of the bail-in regulation is stronger for those bail-inable bonds not included in Tier 2 capital than for subordinated unsecured bonds included in the regulatory capital.

We also run a placebo test: commonly adopted in conjunction with DID regression, it defines so-called false lagged reforms to show that the results are not driven purely by the research design. In other words, by examining the outcomes before the policy of interest was implemented and eliminating data referring to the post-implementation period, null results are presented as evidence that the functional form of the DID was appropriately specified.

Our placebo test uses the period prior to the introduction of regulation. We exclude data from 1 January 2016 onward, anticipate treatment in January 2015, and re-estimate the DID with *TIME2* equal to one after January 2015, and zero otherwise. January 2015 was randomly chosen for a fake shock. Moreover, we test the anticipation effect hypothesis. Some authors (e.g. Crespi et al., 2019; Schäfer et al., 2016) highlight that new legislation could also affect the market before the regulation's entry into force. Accordingly, we rerun our analysis to test for the anticipation of the introduction of bail-in from May 2014, when the European Parliament established the framework for the recovery and resolution of credit institutions and investment firms. We set the *TIME3* dummy variable equal to one after May 2014, and to zero otherwise. Although not yet effective in May 2014, bail-in was defined and presented to the market at that point. In addition, we test the anticipation effect on a second date, in November 2015, when the Italian government published Law 180/2015 aimed at a burden-sharing approach to resolve four small banks (Crespi et al., 2019). The results are reported in Table 6 in the Online Appendix. With regard to the placebo test, our findings underline that i) bond yields decrease during the observed period (*TIME2* is significant and negative), and ii) the difference between bail-inable and non–bail-inable bonds is statistically significant. The nonsignificant finding for the interactive variable suggests that the effect does not exist when it 'should not', confirming that the results obtained in the main analysis are attributable to the implementation of the bail-in mechanism.

Finally, referring to the anticipation effects, our findings indicate that the market's reaction to the bail-in regulation had already started before January 2016. Even from May 2014 on and also from November 2015 on, our results show an increase in the yield spread between bail-inable and non–bail-inable bonds, compared to before this event.

5. DISCUSSION AND CONCLUSIONS

The bail-in mechanism is applied hierarchically, requiring that those who invest in riskier financial instruments sustain losses before others, by writing down their securities or converting them into shares. In our study, we analyse the operation of market discipline, verifying if the effect of bail-in on bond yield follows the hierarchy of risk post-BRRD or whether secondary debt markets react at a different speed, regardless the bond seniority.

After comparing the yield spreads between bail-inable and non–bail-inable bonds, we use the DID method to investigate whether the effect differs between senior unsecured bonds and subordinated unsecured bonds (both subject to bail-in, but at different levels). In the third part of our analysis, we investigate the bail-in effect for different classes of subordinated bonds, distinguishing between securities included in T2 capital and subordinated bonds excluded therefrom.

In line with the literature, our results demonstrate that, after the introduction of bail-in, bail-inable bonds show an increase in yield spreads against non–bail-inable bonds, compared to the prior period, and that this increase is attributable to the bail-in regulation.

In sight of this, we also investigate the bail-in effect on different categories of bail-inable bonds. We first explore how the bond yield spread of bail-inable bonds changes after the introduction of bail-in, distinguishing between senior unsecured bonds and subordinated bonds. Unlike expected, the introduction of the bail-in mechanism increased the yield spread between senior unsecured and non–bail-inable bonds more than the spread between subordinated and non–bail-inable bonds. In the same way, our findings suggest that the yield spread between subordinated bonds excluded from regulatory capital and non–bail-inable bonds increased more than subordinated bonds included therein.

Both senior unsecured and subordinated bondholders appear to be demanding, after 2016, a risk premium for the resolution event, thus exerting meaningful market discipline on financial institutions. Nevertheless, the impact of the new bail-in risk premium does not follow the hierarchy of risk, but it is stronger for less risky securities. According to the results of the DID analysis, we observe that the effect of bail-in regulation is much higher for, first, senior unsecured bonds, then for subordinated unsecured bonds excluded from T2 capital, and lastly for subordinated unsecured bonds included in the regulatory capital. Consequently, the BRRD has improved the role of senior bonds as loss absorption securities, according to investors' perceptions. Our findings are confirmed for both GIIPS and non-GIIPS countries. The results are then not driven only by countries where political uncertainty and debt sustainability concerns could have contributed to an increase in bond spreads.

Despite a significant share of senior bondholders being represented by not sophisticated investors, the senior bond market shows an adequate capacity to charge risk premia for bail-in, demonstrating how investors in less risky assets, belonging to lower layers of loss-absorbing debt, are particularly sensitive to the issuer's risk of distress. This capacity to charge the bail-in premium can be facilitated by the greater liquidity of senior bond bail-in debt (Lewrick et al., 2019).

Our findings have interesting implications for bank issuers and supervisory authorities. A higher return for bondholders in secondary markets can reflect higher funding costs for bank issuers when they need to issue new bonds or roll over securities. The reform of bank recovery and resolution, modifying the loss absorption capacity of bonds, increases the funding costs for financial institutions, with a different impact according to the specific layer of the bail-in hierarchy to which bonds belong. In December 2017, a fast-tracked amendment to the original regulation, BRRD2, was published (EU Directive 2017/2399), with the purpose of implementing a new hierarchy of unsecured creditors in the case of resolution. This amendment, in force since 1 January 2019, introduced a class of nonpreferred senior bonds with a higher level of risk compared to other senior securities.[13] In the hierarchy of creditors, in the case of resolution, nonpreferred senior bonds rank below subordinated bonds but above other senior unsecured liabilities. These bail-inable securities are also eligible for MREL and TLAC, representing a new opportunity for bank funding. Given our main results, a bail-in risk premium will be requested on these bonds, similar to subordinated ones. Given their layer in the hierarchy in the case of insolvency and resolution, the spread for bail-in risk is expected to be lower compared to that of other senior unsecured bonds. Future studies should focus on enhancing this topic.

In conclusion, our results elucidate the effect of the introduction of the bail-in mechanism on bank bond returns. We highlight the fact that, despite the decrease in bank bond yields due to the ECB's unconventional monetary policies (involving all categories of bonds), the yields spread of different bond categories have been differently impacted by the introduction of the bail-in mechanism. Our results from analysing different categories of bail-inable bonds confirm

[13] Each EU Member State has been required to implement legislation allowing for nonpreferred senior bonds by the end of 2018. Some European countries also introduced this category of securities before this rule. For example, in France their issuance was provided for as a new type of senior debt through legislation introduced in late 2016.

the effectiveness of the bank reform in improving market discipline, for less risky bonds as well, potentially affecting the design of banks' funding structures and costs.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article.

ORCID

Doriana Cucinelli https://orcid.org/0000-0002-1649-5437

Lorenzo Gai https://orcid.org/0000-0001-8407-0847

Federica Ielasi https://orcid.org/0000-0002-5971-0192

REFERENCES

Acharya, V., Anginer, D., & Warburton, J. (2016). *The end of market discipline? Investor expectations of implicit government guarantees*. Retrived from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1961656

Allen, F., Carletti, E., Goldstein, I., & Leonello, A. (2015). Moral Hazard and Government Guarantees in the Banking Industry. *Journal of Financial Regulation, 1*, 30-50.

Andersson, M., Busetto, F., & Klaus, B. (2019). *Recent developments in and the outlook for global bank ratings*. ECB Financial Stability Review, 29 May 2019.

Avgouleas, E., & Goodhart, C. (2015). Critical Reflections on Bank Bail-ins. *Journal of Financial Regulation*, *1*, 3–29.

Balasubramnian, B., & Cyree, K. (2011). Market Discipline of Banks: Why are Yield Spreads on Bank-Issued Subordinated Notes and Debentures Not Sensitive to Bank Risks. *Journal of Banking & Finance, 35*, 21-35.

Beltratti, A. & Stulz, R. (2012). The credit crisis around the globe: Why did some banks perform better? *Journal of Financial Economics, 105*, 1–17.

Birchler, U., & Facchinetti, M. (2007) Can bank supervisors rely on market data? A critical assessment from a Swiss perspective. *Swiss Journal of Economics and Statistics*, *143(2)*, 95-132.

Bliss, R.R., & Flannery, M.J. (2002). Market Discipline in the Governance of U.S. Bank Holding Companies: Monitoring vs. Influencing. *Review of Finance*, *6 (3)*, 361–396.

Chan-Lau, J. A., & Oura, H. (2016). Bail-In Power, Depositor Preference, and Asset Encumbrance: The End of Cheap Senior Unsecured Debt? A Structural Pricing Perspective. *A Structural Pricing Perspective (March 1, 2016).*

Chen, L., Lesmond, D. A., & Wei, J. (2007). Corporate yield spreads and bond liquidity. *The Journal of Finance*, *62*(1), 119-149.

Chennells, L., & Wingfield, V. (2015). *Bank Failure and Bail-in: an Introduction* (Bank of England Quarterly Bulletin, Vol. Q3, pp. 228-241).

Clogg, C.C., Petkova, E., & Haritou, A. (1995). Statistical Methods for Comparing Regression Coefficients Between Models. *The American Journal of Sociology, 100(5),* 1261-1293.

Conlon, T., & Cotter, J. (2014). Anatomy of a Bail-in. *Journal of Financial Stability, 15*, 257-263.

Collin-Dufresne, P., Goldstein, R., & Martin, J. (2001). The determinants of credit spread changes, *Journal of Finance, 56*, 2177–2207.

Covitz, D.M., Hancock, D., & Kwast, M.L. (2004). A reconsideration of the risk sensitivity of US banking organization subordinated debt spreads: A sample selection approach. *FRBNY Economic Policy Review*, 73-92.

Crespi, F., Giacomini, M., & Mascia, D. (2019). Bail-In Rules and the Pricing of Italian Bank Bonds. *European Financial Management, 25(5),* 1-27, DOI:10.1111/eufm.12206.

Crespi, F., & Mascia, D.V. (2018). *The Bail-in effect: how the cost of funding through bonds has changed after the introduction of the BRRD*, in: Bank Funding Strategies. Palgrave Macmillan Studies in Banking and Financial Institutions. Palgrave Macmillan, Cham.

Cummings, J.R., Guo, Y. & Wu, E. (2019). *Do the Basel III bail-in rules increase investors' incentives to monitor banking risks? Evidence from the subordinated debt market*, Working Paper. Retrieved from sbfc.sydney.edu.au

Da-Rocha-Lopes, S., Beck, T., & Silva, A.F. (2018). *Sharing the pain? Credit supply and real effects of bank bail-ins.* EBA Staff Paper Series, N.1, June, pp. 1-62.

Directive (EU) 2014/59 of the European Parliament and of the Council of 15 May 2014. Official Journal of the European Union.

Directive (EU) 2014/65 of the European Parliament and of the Council of 15 May 2014. Official Journal of the European Union.

Directive (EU) 2017/2399 of the European Parliament and of the Council of 12 December 2017. Official Journal of the European Union.

EBA (2017). *Quantitative Update of the MREL Report,* December.

ECB (2013) *The Eurosystem Household Finance and Consumption Survey. Results from the first wave,* Statistics Paper Series, No. 2, April.

ECB (2017). *MREL: financial stability implications*, Macroprudential Bulletin, December.

ECB (2019). *Financial Stability Review*, Box 5, May, Available at https://www.ecb.europa.eu/pub/financial-stability/fsr/html/ecb.fsr201905~266e856634.en.html

ECB (2020). *Securities Holding Statistics*, Available at http://sdw.ecb.europa.eu/

Eliasson, E., Jansson, E., & Jansson, T. (2014). The bail-in tool from a Swedish perspective. *Sveriges Riksbank Economic Review, 2*, 23-51.

Elton, E., Gruber, M., Agrawal, D., & Mann, C. (2001). Explaining the rate spread on corporate bonds. *Journal of Finance, 56*, 247–77.

Fan, R., Joseph, G., Haubrich, P.R., & Thomson, J. B. (2003). Getting the most out of a mandatory subordinated debt requirement. *Journal of Financial Services Research, 24(2/3),* 149-179.

Financial Stability Board (2019). *Review of the technical implementation of the Total Loss-Absorbing Capacity (TLAC) standard*. July

Flannery, M. J., & Sorin, M.S. (1996). Evidence of Bank Market Discipline in Subordinated Debenture Yields: 1983-1991. *Journal of Finance, 51*, 1347-77.

Gabbi, G., & Sironi, A. (2005). Which factors affect corporate bonds pricing? Empirical evidence from eurobonds primary market spreads. *The European Journal of Finance, 11*, 59–74.

Giuliana, R. (2018). *Impact of bail-in on banks' bond yields and market discipline.* Retrieved from SSRN: http://dx.doi.org/10.2139/ssrn.2935259.

Gornicka, L.A, & Zoican, M.A. (2016). Too international to fail? Supranational bank resolution and market discipline. *Journal of Banking and Finance, 65*, 41-58.

Götz, M., & Tröger, T. (2016). *Should the marketing of subordinated debt be restricted/different in one way or the other? What to do in the case of mis-selling?* White Paper No. 35. SAFE – Sustainable Architecture for Finance in Europe, Goethe University.

Halaj, G, Huser, A.C, Kok, C, Perales, C., & Van Der Kraaij, A. (2016). Systemic implications of the European bail-in tool: a multi-layered network analysis. *Financial Stability Review*, 120-129.

Hancock, D. & Kwast, M. (2001). Using Subordinated Debt to Monitor Bank Holding Companies: Is it Feasible? *Journal of Financial Services Research, 20(2-3),* 147–187.

Hofmann, B., Shim, I., & Shin, D. (2019). *Bond risk premia and the exchange rate*. BIS Working Papers, No. 775, March.

Huertas, T.F. (2013). *The Case for Bail-ins*. in Kenadjian, P. S., Ed. The Bank Recovery and Resolution Directive, De Gruyter, e-book.

Houston, J., James, C., & Marcus, D. (1997). Capital market frictions and the role of internal capital markets in banking. *Journal of Financial Economics, 46(2),* 135–164.

Iannotta, G., & Navone, M. (2008). Which Factors Affect Bond Underwriting Fees? The Role of Banking Relationships. *European Financial Management, 14(5),* 944–961.

Iannotta, G., Nocera, G., & Resti, A. (2013). Do investors care about credit ratings? An analysis through the cycle. *Journal of Financial Stability, 9,* 545–555.

Jagtiani, J.G., Kaufman, & Lemieux, C. (2002). The Effect of Credit Risk on Bank and Bank Holding Company Bond Yields: Evidence from the Post-FDICIA Period. *Journal of Financial Research, 25*, 559-575.

Lewrick, U., Serena, J.M. & Turner, G. (2019). *Believing in bail-in? Market discipline and the pricing of bail-in bonds*. BIS Working Papers, Monetary and Economic Department, No. 831, December, pp. 1-36.

Mikosek, M. (2016). *Free market in death? Europe's new bail-in regime and its impact on bank funding.* Deutsche Bank Research, April 29.

Morgan, D.P., & Stiroh, K.J. (2000). *Bond Market Discipline of Banks: Is the Market Tough Enough?* Federal Reserve Bank of New York, Staff Report.

Pablos I. (2019). *Has the New Bail-In Framework Increased the Yield Spread Between Subordinated and Senior Bonds?,* Retrieved from SSRN Electronic Journal, 10.2139/ssrn.3378073, pp. 1-31.

Pais, A., & Stork, P.A. (2013). Bank Size and Systemic Risk. *European Financial Management*, *19(3)*, 429–451.

Peleg-Lazar, S. & Raviv, A. (2016). Bank Risk Dynamics Where Assets are Risky Debt Claims. *European Financial Management, 23(1)*, 3-31.

Philippon, T., & Salord, A. (2017). *Bail-ins and Bank Resolution in Europe: A Progress Report.* Geneva Reports on the World Economy Special Report 4.

Pigrum, C., Reininger, T. & Stern, C. (2016). *Bail-in: Who Invests in Noncovered Debt Securities Issued by Euro Area Banks?* OesterreichischeNationalbank (OeNB), Financial Stability Report, Vol. 32, pp. 101-119.

Regulation (EU) No. 805/2014 of the European Parliament and of the Council of 15 July 2014.

Santos, J. (2014). Evidence from the bond market on banks' 'too-big-to-fail' subsidy. *FRBNY Economic Policy Review, 20,* 29–39.

Schäfer, A., Schnabel, I., & Weder di Mauro, B. (2016). *Bail-in Expectations for European Banks: Actions speak Louder than Words*. Discussion Paper N. 11061, CEPR.

Simion, G., Cavezzali, E., Nathan, S., & Rigoni, U. (2020). Market Discipline on Bank Bond Issues Through the Lens of a New Forward – Looking Measure of Loan Quality. *European Financial Management,* April, https://doi.org/10.1111/eufm.12262.

Single Resolution Board (2016). *The single resolution mechanism: Introduction to resolution planning*. Available at: https://srb.europa.eu/en/content/introduction-resolution-planning

Sironi, A. (2003). Testing for Market Discipline in the European Banking Industry: Evidence from Subordinated Debt Issues. *Journal of Money, Credit and Banking, 35,* 443-472.

Ueda, K., & Weder di Mauro, B. (2013). Quantifying structural subsidy values for systemically important financial institutions. *Journal of Banking & Finance, 37*, 3830–3842.

Yildirim, H. S., Kwag, S.A., & Collins, M. C. (2006). An examination of the equity market response to the Gramm-Leach-Bliley Act across commercial banking, investment banking, and insurance firms. *Journal of Business Finance and Accounting, 33(9)*, 1629-1649.

Wojcik, K.P. (2016). Bail-in in the Banking Union. *Common Market Law Review, 53*, 91-138.

Zhao, L. (2018). Market-based estimates of implicit government guarantees in European financial institutions. *European Financial Management*, *24(1)*, 79–112.

Table 1: Sequence of write down and conversion in the bail-in procedure

1.	Common equity Tier 1 (CET1) items
2.	Additional Tier 1 (AT1) instruments
3.	Tier 2 (T2) instruments
4.	Subordinated debt that is not Additional Tier 1 or Tier 2 capital
5.	The rest of eligible liabilities, in accordance with the hierarchy of claims in normal insolvency proceedings, such as unsecured senior bonds[14].

Source: EU Bank Recovery and Resolution Directive (BRRD Directive 2014/59/EU), Article 48

Table 2 Bond distribution

This Table reports the distribution of bonds across the different categories. We distinguish between bail-inable and Non-bail-inable. Bail-inable are divided between Subordinated Unsecured Bonds and Senior Unsecured Bonds. Finally Subordinated Unsecured Bonds are divided between bonds included in Tier2 capital and bonds not included in Tier 2 capital.

Seniority	**Number of bonds**	**%**
Non-bail-inable	**914**	**22,48%**
Bail-inable	**3,151**	**77,52%**
Subordinated Unsecured Bonds	937	*29,73%*
of which:		
Included in Tier2 capital	*137*	*6,25%*
Not included in Tier 2 capital	*800*	*25,38%*
Senior Unsecured Bonds	2,214	*70,26%*
Total	**4,065**	**100%**

Table 3 Descriptive statistics

This Table reports the descriptive statistics of variables used in the regression models. NON-BAIL-INABLE is a dummy variable equal to 1 if bond is excluded from the bail-in mechanism and 0 otherwise; BAIL-INABLE is a dummy variable equals 1 if bond is bail-inable and 0 otherwise; Senior unsecured is a category of bail-inable bonds and is a dummy variable equals 1 if bond is bail-inable bond but not included in the regulatory capital; Subordinated Bond is a dummy variable equals 1 if bond belongs to the subordinated bonds included and not included in Tier 2 capital; Subordinated bonds are divided into two groups: bail-inable included in Tier 2 capital and bail-inable not included in Tier 2 capital that differ from Senior Unsecured bonds. Yield is the bond monthly return expressed in percentage; the maturity (MATURITY) is the natural logarithm of the years left to the expiry of the bond; the coupon rate equals the rate paid by bonds; bond liquidity is measured with two different variables: the natural logarithm of the difference between the bid price and the ask price (LIQUIDITY), and the natural logarithm of the issue amount (ISSUE); the coupon rate is the variable that expresses the presence of a coupon linked to the bond and the amount in percentage that the coupon pays (COUPON). As bank specific characteristics, we include the bank size (SIZE) proxied by the natural logarithm of total assets; the return on average equity

[14] According to the European Directive n. 2017/2399, all deposits, for the amount exceeding 100,000 euro, are included in classes below senior unsecured bonds, according to the nature of the depositors.

(ROAE) as a measure of bank performance; the tier 1 ratio (TIER1) as a measure of capital requirement; and lastly, the non-performing loans over gross loans(NPL_GL) as proxy of the credit portfolio quality; GL_TA as proxy of bank business model; RATING is a category variable that span from 1 up to 19, where 1 is the lowest rating and 19 the highest (e.g. bank is safer with higher rating). M&A is a dummy variable equals 1 if bank is involved in a M&A operation and 0 otherwise. Finally, in order to control for macroeconomic conditions, we also consider in the regression model the monthly spread (SPREAD) between the 10-year treasury bond of each country and the 10-year German treasury bond.

Variables	Obs	Mean	Std. Dev.	Min	Max
Non-bail-inable	164,641	0.224	0.417	0	1
Bail-inable	164,641	0.776	0.417	0	1
Senior Unsecured	164,641	0.515	0.500	0	1
Subordinated	164,641	0.236	0.424	0	1
Bail-inable included in Tier 2 Capital	164,641	0.201	0.401	0	1
Bail-inable not included in Tier 2 capital	164,641	0.035	0.183	0	1
Bond's characteristics					
Yield	164,641	0.017	0.019	-0.014	0.180
Maturity (ln)	160,588	1.502	0.658	0.000	3.611
Issue (ln)	164,294	17.739	2.012	9.210	29.017
Coupon	164,641	0.023	0.017	0.000	0.125
Liquidity (ln)	108,874	-0.958	1.157	-6.908	4.863
Bank characteristics					
Bank size (ln)	164,641	18.895	1.733	9.158	21.595
Tier 1 ratio	126,779	0.148	0.028	0.058	0.247
ROAE	126,462	0.029	0.140	-0.147	0.195
NPL_GL	124,947	0.045	0.044	0.005	0.505
GL_TA	124,947	0.540	0.125	0.010	0.994
Rating (category variable)	164,641	13.982	2.794	1.000	19.000
M&A (dummy)	164,641	0.257	0.437	0.000	1.000
Macroeconomic control					
Spread	164,641	0.405	0.755	-0.513	14.630

Table 4 Descriptive statistics and T-test bail-inable vs non-bail-inable bonds

This Table reports the descriptive statistics of variables used in the regression models, running the t-test to verify whether the differences of means between bail-inable and non-bail-inable are significant. Yield is the bond monthly return expressed in percentage; the maturity (MATURITY) is the natural logarithm of the years left to the expiry of the bond; the coupon rate equals the rate paid by bonds; bond liquidity is measured with two different variables: the natural logarithm of the difference between the bid price and the ask price (LIQUIDITY), and the natural logarithm of the issue amount (ISSUE); the coupon rate is the variable that expresses the presence of a coupon linked to the bond and the amount in percentage that the coupon pays (COUPON). As bank specific characteristics, we include the bank size (SIZE) proxied by the natural logarithm of total assets; the return on average equity (ROAE) as a measure of bank performance; the tier 1 ratio (TIER1) as a measure of capital requirement; and lastly, the non-performing loans over gross loans(NPL_GL) as proxy of the credit portfolio quality; RATING is a category variable that span from 1 up to 19, where 1 is the lowest rating and 19 the highest (e.g. bank is safer with higher rating). M&A is a dummy variable equals 1 if bank is involved in a M&A operation and 0 otherwise.. Finally, in order to control for macroeconomic conditions, we also consider in the regression model the monthly spread (SPREAD) between the 10-year treasury bond of each country and the 10-year German treasury bond. The asterisks refer to the p-value significance with *** p<0.01, ** p<0.05, * p<0.1.

	Non-bail-inable					Bail-inable					*t-test*
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	*P-value*
Bond characteristics											
YIELD	36,951	0.013	0.017	-0.014	0.181	127,690	0.018	0.020	-0.014	0.181	***
MATURITY	35,816	1.597	0.673	0.000	3.466	124,772	1.475	0.651	0.000	3.611	***
ISSUE	36,686	18.411	2.021	9.530	23.026	127,608	17.546	1.967	9.210	29.017	***
COUPON	36,951	0.025	0.018	0.000	0.086	127,690	0.022	0.017	0.000	0.125	***
LIQUIDITY	27,285	-1.425	1.189	-6.908	4.093	81,589	-0.802	1.103	-6.908	4.863	***
Bank characteristics											
SIZE	36,951	18.636	2.068	9.158	21.092	127,690	18.971	1.616	9.158	21.595	***
TIER 1 RATIO	28,431	0.154	0.036	0.058	0.247	98,348	0.146	0.026	0.058	0.223	***
ROAE	28,410	0.059	0.108	-0.147	0.195	98,052	0.021	0.147	-0.147	0.165	***
NPL_GL	28,035	0.045	0.044	0.005	0.452	96,912	0.045	0.045	0.007	0.505	
GL_TA	28,035	0.594	0.107	0.010	0.994	96,912	0.524	0.126	0.010	0.987	***
RATING	36,951	13.725	2.488	1.000	18.000	127,690	14.057	2.872	2.000	19.000	***
M&A	36,951	0.132	0.339	0.000	1.000	127,690	0.293	0.455	0.000	1.000	***
Macroeconomic factors											
SPREAD	36,951	0.565	0.884	0.000	14.636	127,690	0.359	0.707	-0.513	14.636	***

Table 5. Descriptive statistics and ANOVA test of Senior unsecured, Subordinated bonds excluded from capital and Subordinated bonds included in Tier 2 capital

This Table reports the descriptive statistics of variables used in the regression models, running the ANOVA test to verify whether the differences of means between Senior unsecured bonds, Subordinated included in the T2 capital and Subordinated not included in T2 capital are significant. Yield is the bond monthly return expressed in percentage; the maturity (MATURITY) is the natural logarithm of the years left to the expiry of the bond; the coupon rate equals the rate paid by bonds; bond liquidity is measured with two different variables: the natural logarithm of the difference between the bid price and the ask price (LIQUIDITY), and the natural logarithm of the issue amount (ISSUE); the coupon rate is the variable that expresses the presence of a coupon linked to the bond and the amount in percentage that the coupon pays (COUPON). As bank specific characteristics, we include the bank size (SIZE) proxied by the natural logarithm of total assets; the return on average equity (ROAE) as a measure of bank performance; the tier 1 ratio (TIER1) as a measure of capital requirement; and lastly, the non-performing loans over gross loans(NPL_GL) as proxy of the credit portfolio quality; GL_TA as proxy of bank business model; RATING is a category variable that span from 1 up to 19, where 1 is the lowest rating and 19 the highest (e.g. bank is safer with higher rating). M&A is a dummy variable equals 1 if bank is involved in a M&A operation and 0 otherwise. Finally, in order to control for macroeconomic conditions, we also consider in the regression model the monthly spread (SPREAD) between the 10-year treasury bond of each country and the 10-year German treasury bond. The asterisks refer to the p-value significance with *** p<0.01, ** p<0.05, * p<0.1.

	Senior unsecured bonds					Subordinated not included in T2					Subordinated included in T2					*ANOVA*
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	*P-value*
Bond characteristics																
YIELD	88,912	0.015	0.015	-0.014	0.181	33,051	0.025	0.025	-0.014	0.181	5,727	0.037	0.023	-0.010	0.181	***
MATURITY	86,891	1.497	0.646	0.000	3.611	32,312	1.387	0.644	0.000	3.555	5,569	1.654	0.697	0.000	3.526	***
ISSUE	88,859	17.457	1.923	10.820	29.017	33,051	17.617	1.975	9.210	24.919	5,698	18.528	2.294	13.816	24.525	***
COUPON	88,912	0.021	0.016	0.000	0.092	33,051	0.023	0.016	0.000	0.100	5,727	0.040	0.025	0.000	0.125	***
LIQUIDITY	52,620	-0.852	1.210	-6.908	4.863	24,465	-0.738	0.829	-6.908	2.604	4,504	-0.569	1.053	-4.711	3.616	***
Bank characteristics																
SIZE	88,912	18.989	1.681	9.158	21.433	33,051	18.975	1.115	15.621	21.102	5,727	18.664	2.658	9.158	21.595	***
TIER 1 RATIO	61,669	0.160	0.019	0.090	0.223	31,411	0.122	0.017	0.058	0.158	5,268	0.134	0.026	0.058	0.223	***
ROAE	62,058	0.036	0.060	-0.467	0.165	30,722	-0.012	0.232	-1.476	0.117	5,272	0.029	0.187	-1.476	0.165	***
NPL_GL	61,635	0.027	0.034	0.007	0.505	30,162	0.080	0.043	0.007	0.334	5,115	0.057	0.045	0.007	0.270	***
GL_TA	61,635	0.479	0.118	0.010	0.987	30,162	0.616	0.083	0.205	0.780	5,115	0.547	0.127	0.010	0.987	***
RATING	88,912	14.715	2.229	3.000	19.000	33,051	12.426	3.494	2.000	19.000	5,727	13.259	3.683	2.000	19.000	***
M&A	88,912	0.260	0.439	0.000	1.000	33,051	0.401	0.490	0.000	1.000	5,727	0.188	0.391	0.000	1.000	***
Macroeconomic factors																
SPREAD	88,912	0.116	0.488	-0.513	14.636	33,051	0.956	0.807	0.000	3.780	5,727	0.681	0.773	0.000	3.678	***

Table 6 - DID Bail-inable vs Non-bail-inable bonds

This Table reports the findings referring to the first equation model in which we compare bail-inable and non-bail-inable bonds. TIME is a dummy variable equals 1 in the period after 2016 and 0 otherwise; TREATED is a dummy variable equals 1 if bond is bail-inable and 0 otherwise; TIMExTREATED is the interactive variable between the TIME and BAIL-INABLE variable; the maturity (MATURITY) is the natural logarithm of the years left to the expiry of the bond; the coupon rate equals the rate paid by bonds; bond liquidity is measured with two different variables: the natural logarithm of the difference between the bid price and the ask price (LIQUIDITY), and the natural logarithm of the issue amount (ISSUE); the coupon rate is the variable that expresses the presence of a coupon linked to the bond and the amount in percentage that the coupon pays (COUPON). As bank specific characteristics, we include the bank size (SIZE) proxied by the natural logarithm of total assets; the tier 1 capital ratio (TIER1) as a measure of capital requirement; the return on average equity (ROAE) as a measure of bank performance; and lastly, the non-performing loans (NPL_GL) over gross loans as proxy of the credit portfolio quality; GL_TA as proxy of bank business model; RATING is a category variable that span from 1 up to 19, where 1 is the lowest rating and 19 the highest (e.g. bank is safer with higher rating). M&A is a dummy variable equals 1 if bank is involved in a M&A operation and 0 otherwise. Finally, in order to control for macroeconomic conditions, we also consider in the regression model the monthly spread (SPREAD) between the 10-year treasury bond of each country and the 10-year German treasury bond. YEAR_FE is a vector of variables that refers to a series of dummy variables for each year considered in our analysis; COUNTRY_FE is a vector of dummy variables for each country considered in our analysis; BANK_FE is a vector of dummy variables for each bank included in our sample. The asterisks refer to the p-value significance with *** p<0.01, ** p<0.05, * p<0.1 and robust standard errors in parentheses.

VARIABLES	Mod_0	Mod_1	Mod_2
Constant	0.908***	2.496***	8.29***
	(0.03)	(0.09)	(1.49)
TIME	-0.697***	-0.680***	-0.690***
	(0.02)	(0.02)	(0.03)
TREATED	0.514***	0.405***	0.539***
	(0.01)	(0.01)	(0.01)
TREATEDxTIME	0.480***	0.199***	0.263***
	(0.02)	(0.02)	(0.02)
SIZE	-	0.065***	0.131*
		(0.00)	(0.07)
TIER1	-	-0.019***	-0.085***
		(0.00)	(0.00)
ROAE	-	-0.001***	-0.004***
		(0.00)	(0.00)
NPL_GL	-	0.047***	0.063***
		(0.00)	(0.00)
RATING	-	-0.003***	0.001
		(0.00)	(0.00)
GL_TA	-	0.001	0.042**
		(0.01)	(0.01)
M&A	-	-0.126***	-0.001
		(0.00)	(0.00)
MATURITY	-	0.553***	0.541***
		(0.008)	(0.01)
ISSUE	-	-0.064***	-0.062***
		(0.00)	(0.00)
LIQUIDITY	-	0.088***	0.110***
		(0.00)	(0.01)
COUPON	-	0.194***	0.193***
		(0.00)	(0.00)

SPREAD	-	0.979***	0.929***
		(0.03)	(0.03)
YEAR FE	YES	YES	YES
COUNTRY FE	YES	YES	NO
BANK FE	NO	NO	YES
Observations	164,641	81,952	81,952
R-squared	0.211	0.421	0.480

Table 7 – Senior unsecured and subordinated bonds

This Table reports the findings referring to the analysis in which we compare, firstly, senior unsecured and untreated bonds and, secondly, subordinated bonds and untreated bonds. The bond yield is the dependent variable. TIME is a dummy variable equals 1 in the period after 2016 and 0 otherwise; TREATED is a dummy variable equals 1 if bond is senior unsecured and 0 otherwise (Mod 2); while TREATED is equal to 1 if bond is subordinated unsecured and 0 otherwise (Mod 3); TIMExTREATED is the interactive variable between the TIME and TREATED variable; the maturity (MATURITY) is the natural logarithm of the years left to the expiry of the bond; the coupon rate equals the rate paid by bonds; bond liquidity is measured with two different variables: the natural logarithm of the difference between the bid price and the ask price (LIQUIDITY), and the natural logarithm of the issue amount (ISSUE); the coupon rate is the variable that expresses the presence of a coupon linked to the bond and the amount in percentage that the coupon pays (COUPON). As bank specific characteristics, we include the bank size (SIZE) proxied by the natural logarithm of total assets; the tier 1 capital ratio (TIER1) as a measure of capital requirement; the return on average equity (ROAE) as a measure of bank performance; and lastly, the non-performing loans (NPL_GL) over gross loans as proxy of the credit portfolio quality; RATING is a category variable that span from 1 up to 19, where 1 is the lowest rating and 19 the highest (e.g. bank is safer with higher rating). M&A is a dummy variable equals 1 if bank is involved in a M&A operation and 0 otherwise. Finally, in order to control for macroeconomic conditions, we also consider in the regression model the monthly spread (SPREAD) between the 10-year treasury bond of each country and the 10-year German treasury bond. YEAR FE is a vector of variables that refers to a series of dummy variables for each year considered in our analysis; COUNTRY FE is a vector of dummy variables for each country considered in our analysis; BANK_FE is a vector of dummy variables for each bank included in our sample. The asterisks refer to the p-value significance with *** p<0.01, ** p<0.05, * p<0.1 and robust standard errors in parentheses.

	Senior Unsecured			Subordinated bonds		
VARIABLES	Mod_0	Mod_1	Mod_2	Mod_0	Mod_1	Mod_2
Constant	1.863***	2.020***	4.594***	1.561***	2.826***	7.480***
	(0.02)	(0.12)	(0.92)	(0.02)	(0.10)	(2.08)
TIME	-0.676***	-0.941***	-0.798***	-0.660***	-0.622***	-0.703***
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
TREATED	0.426***	0.452***	0.184***	1.105***	0.906***	0.906***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
TREATEDxTIME	0.525***	0.434***	0.338***	0.283***	0.105***	0.192***
	(0.01)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
SIZE	-	0.061***	0.191**	-	0.002	-0.107
		(0.00)	(0.08)		(0.00)	(0.11)
TIER1	-	-0.013***	-0.044***	-	-0.011***	-0.053***
		(0.00)	(0.00)		(0.00)	(0.01)
ROAE	-	-0.003***	-0.004***	-	-0.005***	-0.002***
		(0.00)	(0.00)		(0.00)	(0.00)
NPL_GL	-	0.009***	0.032***	-	0.077***	0.071***
		(0.00)	(0.00)		(0.00)	(0.00)
GL_TA	-	-0.009***	-0.001*	-	0.002***	-0.001
		(0.00)	(0.00)		(0.00)	(0.00)
RATING	-	-0.099***	-0.024***	-	-0.071***	-0.026***
		(0.00)	(0.00)		(0.00)	(0.00)
M&A	-	0.102***	0.015	-	-0.092***	0.074***
		(0.01)	(0.01)		(0.02)	(0.02)

MATURITY	-	0.499***	0.478***	-	0.623***	0.631***
		(0.01)	(0.01)		(0.01)	(0.01)
ISSUE	-	-0.045***	-0.063***	-	-0.121***	-0.115***
		(0.00)	(0.00)		(0.00)	(0.00)
LIQUIDITY	-	0.104***	0.111***	-	0.002	-0.014
		(0.00)	(0.01)		(0.01)	(0.01)
COUPON	-	0.182***	0.190***	-	0.248***	0.235***
		(0.00)	(0.00)		(0.00)	(0.00)
SPREAD	-	0.741***	0.857***	-	0.915***	0.872***
		(0.03)	(0.04)		(0.043)	(0.041)
YEAR FE	YES	YES	YES	YES	YES	YES
COUNTRY FE	YES	YES	NO	YES	YES	NO
BANK FE	NO	NO	YES	NO	NO	YES
Observations	125,863	57,973	57,973	79,900	47,341	47,341
R-squared	0.136	0.402	0.461	0.263	0.499	0.528
Prob > chi2	0.000	0.000	0.001	0.000	0.000	0.001

Table 8 - Subordinated bonds: included in capital vs excluded from capital

This Table reports the findings referring to the third analysis in which we compare subordinated bonds excluded from Tier 2 and untreated bonds, and secondly the subordinated bonds included in the regulatory capital and untreated bonds. The bond yield is the dependent variable. TIME is a dummy variable equals 1 in the period after 2016 and 0 otherwise; TREATED is a dummy variable equals 1 if bond is subordinated unsecured bonds not included in Tier 2 and 0 otherwise (Mod 4); while TREATED is equal to 1 if bond is subordinated unsecured bond included in Tier 2 capital and 0 otherwise (Mod 5); TIMExTREATED is the interactive variable between the TIME and TREATED variable; the maturity (MATURITY) is the natural logarithm of the years left to the expiry of the bond; the coupon rate equals the rate paid by bonds; bond liquidity is measured with two different variables: the natural logarithm of the difference between the bid price and the ask price (LIQUIDITY), and the natural logarithm of the issue amount (ISSUE); the coupon rate is the variable that expresses the presence of a coupon linked to the bond and the amount in percentage that the coupon pays (COUPON). As bank specific characteristics, we include the bank size (SIZE) proxied by the natural logarithm of total assets; the tier 1 capital ratio (TIER1) as a measure of capital requirement; the return on average equity (ROAE) as a measure of bank performance; and lastly, the non-performing loans (NPL_GL) over gross loans as proxy of the credit portfolio quality; GL_TA as proxy of bank business model; RATING is a category variable that span from 1 up to 19, where 1 is the lowest rating and 19 the highest (e.g. bank is safer with higher rating). M&A is a dummy variable equals 1 if bank is involved in a M&A operation and 0 otherwise. Finally, in order to control for macroeconomic conditions, we also consider in the regression model the monthly spread (SPREAD) between the 10-year treasury bond of each country and the 10-year German treasury bond. YEAR FE is a vector of variables that refers to a series of dummy variables for each year considered in our analysis; COUNTRY FE is a vector of dummy variables for each country considered in our analysis; BANK_FE is a vector of dummy variables for each bank included in our sample. The asterisks refer to the p-value significance with *** p<0.01, ** p<0.05, * p<0.1 and robust standard errors in parentheses.

	Subordinated not included in T2			**Subordinated included in T2**		
VARIABLES	**Mod_0**	**Mod_1**	**Mod_2**	**Mod_0**	**Mod_1**	**Mod_2**
Constant	2.439***	2.905***	9.768***	1.437***	2.788***	5.067***
	(0.02)	(0.10)	(2.01)	(0.01)	(0.11)	(1.10)
TIME	-1.488***	-0.601***	-0.719***	-0.732***	-0.939***	-0.874***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
TREATED	0.496***	0.600***	0.564***	2.387***	2.020***	2.136***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)
TREATEDxTIME	0.304***	0.171***	0.266***	0.237***	0.141***	0.161***
	(0.03)	(0.02)	(0.02)	(0.06)	(0.05)	(0.05)

SIZE	-	-0.001	-0.198*	-	0.002	-0.228**
		(0.00)	(0.10)		(0.00)	(0.11)
TIER1	-	-0.008**	-0.037***	-	-0.058***	-0.016**
		(0.00)	(0.00)		(0.00)	(0.00)
ROAE	-	-0.003***	-0.002***	-	-0.010***	0.001
		(0.00)	(0.00)		(0.00)	(0.00)
NPL_GL	-	0.082***	0.064***	-	0.026***	0.052***
		(0.00)	(0.00)		(0.00)	(0.00)
GL_TA	-	0.002***	-0.001**	-	0.002***	-0.001*
		(0.00)	(0.00)		(0.00)	(0.00)
RATING	-	-0.061***	-0.047***	-	-0.061***	-0.012
		(0.00)	(0.00)		(0.00)	(0.01)
M&A	-	-0.032	0.129***	-	-0.086***	-0.057**
		(0.02)	(0.02)		(0.02)	(0.02)
MATURITY	-	0.540***	0.557***	-	0.545***	0.534***
		(0.01)	(0.01)		(0.01)	(0.01)
ISSUE	-	-0.128***	-0.120***	-	-0.164***	-0.165***
		(0.00)	(0.00)		(0.00)	(0.00)
LIQUIDITY	-	0.049***	0.060***	-	0.055***	0.059***
		(0.00)	(0.01)		(0.01)	(0.01)
COUPON	-	0.222***	0.222***	-	0.222***	0.215***
		(0.00)	(0.00)		(0.00)	(0.00)
SPREAD	-	0.947***	0.852***	-	0.763***	0.794***
		(0.04)	(0.04)		(0.04)	(0.04)
YEAR FE	YES	YES	YES	YES	YES	YES
COUNTRY FE	YES	YES	NO	YES	YES	NO
BANK FE	NO	NO	YES	NO	NO	YES
Observations	74,173	43,666	43,666	46,849	27,037	27,037
R-squared	0.267	0.512	0.546	0.359	0.594	0.618
Prob > chi2	0.000	0.003	0.009	0.000	0.003	0.009

List of Figure

Figure 1 Reaction of European banks' bond yields to the bail-in mechanism introduction

This Figure depicts the monthly unconditional means of the yields of unsecured bail-inable bonds and secured non-bail-inable bonds issued by European banks. The yield is expressed in percentage (%).