

European Insurance Regulation and Emergence of a New Market for Perpetual Subordinated Debt

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14th September, 2020

Abstract

We examine a new class of debt instruments that have loss-absorbing features and are eligible for regulatory capital of European insurance companies under Solvency II regulation. We aim to assess the prices and liquidity of those assets in terms of yield and bid-ask spread. According to our findings, eligible bonds tend to be traded at significantly lower prices and higher yields compared to non-eligible instruments. Moreover, we show that the announcement of transitional measures for a smooth transition between Solvency I and II has lowered the yield spreads and widened the bid-ask spreads of eligible bonds relatively to non-eligible bonds. Further, we aim to analyze whether the yield spreads of eligible bonds are reasonable considering the write-down risk that investors bear, i.e. whether there is an evidence of market discipline with regard to eligible bonds.

Keywords: Solvency II · Regulatory Capital · Bail-in · Perpetual Debt · Liquidity · Regulatory Asset Pricing

1 Introduction

In the aftermath of the financial crisis 2007/2008, the global corporate bond market has considerably grown in size. According to the OECD Capital Market report from 2019, global corporate issuances reached 1.7 trillion per year between 2008 and 2018 which is almost twice the annual average during pre-crisis time. Although the US bond market remains the largest market, European countries experienced a

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significant increase in corporate bond issuance. There are several reasons for growing corporate borrowing. First of all, more prudent financial regulation has led to a decrease in bank loans, and thus, resulted in the substitution of bank loans by corporate bonds (Becker and Ivashina, 2014). Second, low interest rates made borrowing more attractive. Moreover, a number of non-monetary measures undertaken by the European Central Bank (ECB) including several asset purchase programs incentivized firms to issue fixed income securities (Pelizzon et al., 2019). And finally, risk-based capital requirements under capital regulation imposed on financial institutions have also provided incentives for banks and insurance companies to issue debt instruments eligible for the regulatory capital.

The main focus of this paper is the impact of the financial regulation in the insurance sector on the issuance of fixed income securities and on investor-driven market discipline. The European financial regulation framework has been undergoing some important changes for the last two decades. Since early 2000 both banking and insurance sectors have been involved in developing new regulatory initiatives that aimed at harmonizing the European regulatory framework and ensuring financial stability of the whole sector. The financial crisis 2007/2008 revealed some serious shortcomings of the supervision of financial institutions and markets in the European Union, and brought about some significant changes in the design of the new framework. How did it affect the European insurance companies?

In this paper, we aim to show how the role of insurers has changed in light of new regulation. Insurance companies are usually seen as large institutional investors, who invest primarily in safe long-term assets, i.e. long-term investment-grade corporate bonds and sovereign bonds, and therefore, providing long-term funding to the economy. There are a number of reasons for such an investment strategy. First, insurance companies have a high fraction of long-term liabilities, thus, they need to maintain a certain fraction of long-term investments to match the duration of assets and liabilities and minimize the impact of change in interest rates on insurers' liabilities. Second, insurance companies play an important role in the society by ensuring risk sharing and risk transferring, and thus contributing to the economic growth and well-being of individuals. Therefore, insurers are often required by supervision authorities to invest in low-risk assets to ensure the safety of policyholders' liabilities. However, the role of insurers as long-term investors has now changed due to new regulation framework.

In our paper, we focus on the role of insurance companies as providers of liquidity in form of long-term and perpetual subordinated debt. According to the

Omnibus II Directive that was adopted in March 2014, during the transitional period, i.e. between 2014 and 2016, European insurers were allowed to issue subordinated and hybrid debt compliant with a previous regulation, i.e. Solvency I, and grandfather it for a maximum period of 10 years. We will show that this resulted in increased issuance volume of compliant subordinated debt. Further, we analyze the liquidity and pricing of eligible instruments that incorporate loss-absorbing features with other (non-eligible) debt instruments that European insurers issue using a difference-difference approach. We find that the change in the regulation has a significant impact on prices, yields, yield spreads and bid-ask spreads of eligible bonds. According to our findings, eligible bonds tend to be traded at significantly lower prices and have higher yields compared to non-eligible instruments, which is consistent with economic theory. Interestingly, we find that eligible bonds tend to have lower bid-ask spreads and lower yield spreads compared to non-eligible bonds which in turn indicates that eligible bonds tend to be more liquid. We also find that the announcement of transitional measures for a smooth transition between Solvency I and II has resulted in even higher yields and in higher prices. Moreover, it further lowered the yield spreads and widened the bid-ask spreads of eligible bonds relatively to non-eligible bonds. Further, we plan to analyze whether the yield spreads of eligible bonds are reasonable considering the write-down risk that investors bear, i.e. whether there is an evidence of market discipline with regards to eligible bonds.

To the best of our knowledge, there is a lack of literature on the impact of regulation on the issuance behavior of European insurers as well as on the market discipline with respect to subordinated debt yields in the insurance sector. We aim to address this research gap by employing hand-collected issuance and trading data from Bloomberg and Thomson Reuters and conducting an empirical analysis of the change of issuance behavior of insurers. We also aim to analyze the design and liquidity of the instruments that are eligible for regulatory capital under Solvency II, its assessment in terms of riskiness by investors and its possible impact on the corporate debt market.

The remainder of this paper is structured as follows. In Section 2, we discuss some important aspects of the Solvency II regulatory framework and transitional measures associated with the issuance of subordinated debt as well as its eligibility as regulatory capital. Section 3 covers related literature on financial regulation and market discipline. In Section 4, we discuss the data and the methodology. Section 5 presents the empirical results. Section 6 discusses the policy implications of the

regulation. Section 7 contains a discussion of possible changes and limitations of the research as well as suggestions for future research.

2 Policy Context

Solvency II is a risk-based regulatory framework, the main objective of which is to ensure that insurance companies hold capital in relation to their risk profiles – the higher are the risks inherited in the business, the higher are the capital requirements – in order to guarantee that they have enough financial resources to withstand any financial distress. Under Solvency II, insurance companies are required to maintain a solvency ratio of at least 100% which is calculated by dividing *own funds* of an insurance company, a surplus that is left after deducting liabilities from total assets, by the *solvency capital requirement (SCR)*, the economic capital that is required to be held by insurers to fulfil the obligations to policyholders and beneficiaries and is calibrated at a Value-at-Risk (VaR) with a 99.5% confidence level.

There are several ways for insurance company to comply with Solvency II requirements and improve their solvency position. On the one hand, the insurer might change its investment portfolio allocation or uses reinsurance in order to lower SCR, and thus increase its solvency ratio. On the other hand, the insurer might also boost the solvency ratio by increasing the amount or the quality of its own funds, e.g. by raising capital externally in form of equity, hybrid capital or subordinated debt. As known from traditional corporate finance theory, raising debt is cheaper than raising equity due to lower vulnerability to asymmetric information, tax benefits and priority in terms of repayment of claims in case of bankruptcy. Moreover, the current low interest rate environment pushes costs of issuing debt even lower, which make debt financing even more attractive.

Own funds under Solvency II serve as a solvency buffer that is used to cover the solvency capital requirements and to absorb significant losses in case of financial distress. Own funds consist of basic own funds and ancillary own funds. Basic own funds consist of the excess of assets over liabilities valued in accordance with market consistent valuation principles, and subordinated liabilities. Similar to the Basel regulatory framework for banks, own funds are further divided in three Tiers according to the quality of the capital (Tier 1 being of highest quality) and are subject to a number of quantitative limits and eligibility criteria that define whether certain own funds items might be used to cover the Solvency Capital Requirement (SCR) or the Minimum Capital Requirement (MCR). Article 93(1) of Directive 2009/138/EC

specifies two characteristics that need to be considered for the classification of own funds into tiers:

1. *Permanent availability characteristic*: Full absorption in a going concern as well as in winding up.
2. *Subordination characteristic*: In case of winding up, the total amount is available to absorb losses and the repayment only occurs after all other obligations towards insurance policyholders have been met.
3. *Maturity*: In order to be classified as Tier 1, debt securities should be perpetual. For Tier 2 and Tier 3, the maturity should be at least 10 years or 5 years, respectively.

In order to assess to which extent the characteristics are met, the following three features should be considered:

1. whether the item is free from requirements or incentives to redeem the nominal sum (*absence of incentives to redeem*);
2. whether the item is free from mandatory fixed charges (*absence of mandatory servicing costs*);
3. whether the item is clear of encumbrances (*absence of encumbrances*).

In the following, we will focus on perpetual subordinated bonds that are potentially eligible for Tier 1 capital and have loss-absorbing capacity. At this point, it is important to distinguish subordinated debt that does not have any conversion features from convertible debt that can be converted into common shares according to conversion ratio when a pre-determined threshold, i.e. with respect to stock price, is reached. Contingent convertibles (CoCos) are hybrid debt instruments designed to help financial institutions to absorb capital losses and are mainly popular among European investors¹ due to higher yields that they offer compared to other fixed-income instruments. In contrast, we examine subordinated debt eligible for Tier

¹According to a letter from Cleary Gottlieb Steen & Hamilton LLP to the Securities and Exchange Commission (SEC) from March 25th, 2019: "No banks in the United States have issued contingent convertible capital securities to date. Although the DoddFrank Wall Street Reform and Consumer Protection Act commissioned a study of such securities by the Financial Stability Oversight Council, the Federal Reserve has not introduced contingent capital requirements. Moreover, potentially unfavorable U.S. tax treatment in respect of interest payments also makes the issuance of such securities unattractive for U.S. banks." Retrieved on January 27, 2020, from: <https://www.sec.gov/divisions/corpfin/cf-noaction/2019/contingent-convertible-capital-securities-032819-501a-incoming.pdf>

1 capital does not include any conversion features and is affected in case of MCR or SCR breach, which might result in deferral of coupon payments, reduction of principal, reduction of future coupon payments that follows the principal reduction, and complete loss of principal.² Hence, it is important to assess the perception of the new debt instruments by debt holders, in other words, whether they anticipate possible write-down risk and the risk of coupon deferrals³ and require a higher risk premium for it.

Why is this seemingly specific regulation so important? As we have mentioned above, it changes the role of insurance companies from solely being big investors on the market, representing a big fraction of demand for long-term securities, to the providers of liquidity in form of subordinated debt with long maturity and perpetual subordinated debt. Another important aspect that is worth mentioning is that Solvency II design replicates the Basel III regulation for banks in some aspects. More specifically, both insurers and banks issue similar types of fixed income securities, e.g. perpetual bonds eligible for Tier 1 capital⁴, that can be classified as regulatory capital. The main intention of the regulators is to prevent taxpayer bailouts, which happened during the global financial crisis. In the last years both banks and insurers

²Below is an example of subordinated debt specification from the AXA Annual Report 2014:

"In particular, most of the Company's TSS [undated deeply subordinated notes] include loss absorption mechanisms which provide that under certain circumstances where the Company does not meet its regulatory capital requirements, the *principal amount of each of the relevant TSS will be written down*. In such event, *interest will become payable on the reduced principal amount only*. The principal may be reinstated when the Company returns to financial health, as defined under the terms and conditions of the TSS. In addition, for most of the Company's TSS, upon the occurrence of certain events relating to the Company's consolidated net earnings and shareholders' equity, the Company *is required to defer payment of interest*. In such events, the Company may choose to pay such deferred interest by way of alternative coupon settlement mechanisms within five years (such as, issuance of new shares or other securities including TSS or preference shares, sale of treasury shares, or an increase in the principal amount of the relevant notes, subject to applicable limits), failing which the interest is *orts basis*, in certain circumstances including redemption of the notes, liquidation of the Company, payment of a dividend or interest on any other TSS, any share buyback outside the Company's buy-back program, or any redemption or repurchase of other TSS. Finally, under its TSS, the Company has an *option to cancel payments of interest upon the deterioration of its financial position*, unless certain events have occurred in the preceding year (e.g. a dividend payment or interest payment on any TSS, any share buy-back outside the Group share buy-back program or a repurchase or redemption of any TSS)."

³On September 8, 2015, Moody's Investors Service published a report about the risks for hybrid bond holders, where it shares a concern that the risks might increase in the midterm due to volatile solvency ratios and more frequent regulatory interventions, which might result in coupon deferrals, especially, after the end of the transitional period when more stringent rules will be in place.

⁴Under Basel III, this debt is called Additional Tier 1 (AT1) and can be issued in form of subordinated or hybrid bonds, while under Solvency II, a similar class of debt eligible for regulatory capital is called Restricted Tier 1 (RT1).

issued a significant amount of perpetual debt to comply with new regulation and to strengthen their capital positions. Interestingly, even though the issued instruments are very illiquid due to their perpetuality or long maturities, these instruments became very popular for investors due to the current low yield environment.⁵ Hence, due to increase in supply of perpetual and long-term debt, a thorough analysis of this new type of fixed income securities is necessary to understand if investors are aware of all the risks, and thus, if they price them accordingly.

In our paper we aim to analyze the impact of regulation on the issuance behavior of European insurers with a focus on the characteristics of those securities – such as liquidity, prices and yields – and discuss its policy implications. To measure the liquidity of bonds bid-ask-spreads are employed, while yield spreads are calculated as difference between yields to maturity of corporate bonds and sovereign bonds with the same maturities. The main challenge of conducting an analysis of the European bond market is the scarcity and the fragmentation of European corporate bond data. The lack of data on bond quotes, i.e. trading volumes, hinders a more thorough analysis of liquidity.

Another challenge of the analysis is to isolate the impact of insurance regulation from other events that affected the whole European market such as the European sovereign debt crisis, non-monetary policy measures implemented by the European Central Bank, specifically, European collateral framework and corporate sector purchase program (CSPP), and other measures that are aimed to improve the liquidity and lower yields. We further discuss limitations of our research more thoroughly in Section 7.

3 Related Literature

Our paper is primarily related to two large strands of literature: (1) on the regulation of financial institutions and its impact on the financial markets; and (2) on the market discipline that might emerge from increased issuance of subordinated debt. In general, there is no consensus among the researchers neither about the role of regulation nor about the disciplining role of subordinated debt.

The literature on financial regulation mainly focuses on the impact of various regulations on banks (Park, 2007; Duffie, 2012; Houston et al., 2012; Angeloni and Faia, 2013; Behn et al., 2015; Barth et al., 2017; Bao et al., 2018). The literature

⁵Apart from that, some European countries – such as Belgium, Austria and Ireland – started to issue “ultra-long” sovereign bonds with maturities between 40 and 100 years with the main objective to lock in extremely low interest rates.

on insurance regulation focuses mainly on the investment behavior on the asset side of insurers' balance sheet. For example, Becker and Ivashina (2015) find that insurers tend to reach for yield in choosing their investments while complying with the regulation requirements otherwise, while Ellul et al. (2011) show that regulatory pressure together with the downgrade of corporate bonds might lead to fire sales due to collective divestment on the side of insurance companies. Koijen and Yogo (2015, 2016) show that regulation along with financial frictions resulted in underpricing of long-term policies and in the emergence of shadow insurance. Our paper contributes to the literature on the insurance regulation by shedding light on the liability side of insurers' balance sheet.

The liability side of insurers' balance sheet mainly consists of technical provisions, i.e. the liabilities towards policyholders that arise from the portfolio of insurance contracts. Hence, premium revenues are considered in the insurance literature as the main source of funds for financing. Traditional financial debt is most of the time ignored in the insurance literature due to its limited use by insurers. However, under Solvency II regulation European insurers are allowed to issue subordinated and hybrid debt with loss-absorbing features and classify it as own funds, it leads to a paradigm shift in the funding of insurance companies. To the best of our knowledge, there is a lack of research on the issuance behavior of insurance companies under Solvency II regulation.

Since new financial regulation results in the emergence of debt instruments new to the market, it is important to assess the investors' valuation of those instruments in order to draw some policy implications. There is a vast body of literature on market discipline⁶ in financial services sector. Eling (2012) provides an extensive overview of literature on market discipline both in insurance and banking sectors⁷, whereby he also highlights the limited use of financial debt by insurers in the past and divides market discipline into three main categories: *investor-driven market discipline* through equity prices (e.g. Fenn and Cole, 1994; Halek and Eckles, 2010), *customer-driven market discipline* through the prices of insurance contracts (e.g. Sommer, 1996), sum of premiums (e.g. Epermanis and Harrington, 2006), number of contracts, lapse (e.g. Zanjani, 2002); and other sources of market discipline through impact of guarantee funds and opaqueness (e.g. Lee et al., 1997; Brewer

⁶Following Eling (2012), we define market discipline as an ability of customers, investors and intermediaries to monitor and influence a company's management, e.g. with regards to financing or investment decisions.

⁷Eling (2012) reviews 62 empirical papers on market discipline in total: 20 papers from the insurance literature and 42 papers from the banking literature.

et al., 1997; Pottier and Sommer, 2006). Interestingly, the use of subordinated debt and its spreads are not considered as a channel of market discipline in the insurance literature. In contrast, more than a quarter of the reviewed banking studies on market discipline examine subordinated debt prices and yield spreads and provide mixed evidence for market discipline (e.g. Pettway, 1976; Gorton and Santomero, 1990; Flannery and Sorescu, 1996 ; Evanoff and Wall, 2001; Blum, 2002; Sironi, 2002 & 2003; Krishnan et al., 2005; Balasubramanian and Cyree, 2011). We argue that due to the change in the insurance regulation and the resemblance of capital requirements with respect to subordinated debt, it is important to assess the evidence for market discipline in the insurance sector that propagates through debt prices and yield spreads channel.

Finally, the paper also contributes to the extensive literature on bond market liquidity (Battalio and Schultz, 2011) and corporate bond yields (Longstaff et al., 2005; Huang and Huang, 2012;). Following Chen et al. (2007), who find that liquidity is priced in yield spreads, we also use the yield spreads of corporate bonds as one measure for liquidity. Further, we employ bid-ask spreads to measure the liquidity of eligible bonds (Roll, 1984; Amihud and Mendelson, 1986).

4 Data and Methodology

4.1 Data

To examine the impact of regulation on the fraction of bond market that is constituted by bonds issued by European insurers, we rely on Bloomberg and Thomson Reuters for corporate bonds data. First, we obtain issuance data (i.e. issuer name, amount issued, par value, coupon, currency, issuance date, maturity, country of domicile) and ISINs of all bonds issued by insurance companies in Europe from 2000 to 2018 from Bloomberg and Thomson Reuters. As a second step, we obtain daily trading data (bid and ask prices, quote dates, yields to maturity with respect to mid-price) available on Bloomberg and match it with the issuance data using ISINs.

Moreover, we use the yields of German Sovereign bonds in order to derive a piecewise linear interpolation of the yield curve for the risk-free interest rate. With the help of this yield curve, we calculate the yield spread for bonds for the corresponding remaining maturity. Further, we excluded all bonds which are not denoted in Euro from our sample. Hence, we use hand-collected daily European corporate bond data

to design a unique pooled cross-sectional dataset for studying the liquidity of bonds eligible as regulatory capital under new regulation.

4.2 Descriptive Analysis

Next, we take a look on the descriptive statistics of our dataset. Table 1 presents descriptive statistics for a subsample of bonds quoted⁸ between 2011 and 2018 by European insurers.⁹ Addressing the eligibility of bonds, we can say that bonds eligible for Tier 1 have on average lower prices, higher bid-ask spreads and yields to maturity. Interestingly, eligible bonds in our sample tend to exhibit on average lower credit spreads than non-eligible bonds which is not consistent with its riskiness due to loss-absorbing features. The main variables of interest of our analysis are mid prices, yields to maturity, credit and bid-ask spreads of corporate bonds.

Table 1: Descriptive Statistics for Tier 1 eligible and non-eligible bonds quoted from 2011 to 2018

	<i>Tier 1</i>			<i>Other</i>		
	Mean	Std.Dev.	Obs	Mean	Std.Dev.	Obs
<i>Pricing data</i>						
BidPrice	92.24	17.68	90778	108.70	11.83	185747
AskPrice	93.54	17.21	90778	109.68	11.79	185747
Mid Price	92.89	17.43	90778	109.19	11.80	185747
LogReturn	0.01	0.73	90740	0.01	0.46	185608
Yield to Maturity	4.38	1.38	66521	3.75	2.19	182299
RollSpread	0.37	0.77	36838	0.25	0.40	77462
Bid-Ask Spread	1.60	2.11	90778	0.92	0.73	185747
Credit Spread	3.01	1.31	47569	3.15	1.85	113710
<i>Issuance Data</i>						
Coupon	3.64	2.01	125443	4.70	2.57	214813
AmountIssuedinMil	554.07	501.75	119329	670.26	510.51	193288
ParAmt	41288.98	51969.55	119329	330709.72	2480342.42	194046
TimetoMaturity	100.00	0.00	125443	21.35	11.07	219459
<i>Additional Data</i>						
Eurozone	1.00	0.00	125443	1.00	0.00	219459
Perpetual	1.00	0.00	125443	0.00	0.00	219459
Subordinated	1.00	0.00	125443	0.67	0.47	219459
EUR	0.71	0.46	120612	0.74	0.44	195407
Omnibus	0.28	0.45	125443	0.41	0.49	219459

⁸Note that here we consider quote dates and not issue dates since we are mainly interested in assessing the possible impact of regulation on price level and liquidity of bonds.

⁹Here we exclude the period prior to 2011 due to the possible impact of the global financial crisis which might distort the values of descriptive statistics. The descriptive statistics for the period prior to 2011 can be found in Appendix.

4.3 Methodology

The aim of this paper is to gain insights into a new class of instruments that European insurers use to comply with current regulation. For this purpose, we employ an OLS regression model in order to conduct a pooled cross-section analysis. Within this analysis, we use a difference-in-difference (DID) approach to investigate the relationship between the announcement of transitional measures for own funds in the first quarter of 2014 and price and liquidity characteristics of eligible bonds in order to assess the impact of the regulation. All bonds eligible for Tier 1 capital, i.e. perpetual subordinated bonds, are considered as a treatment group and all bonds that are not eligible are considered as a control group. The time of treatment is defined by the announcement of transitional measures within Omnibus II framework in the first quarter of 2014. The main variables of interest are quoted bond prices and yields as well as different bond liquidity measures. The correlation matrix between the main dependent variables is reported in Table 7 in the Appendix. We conduct four pooled cross section models with mid price (1), yield to maturity (2), credit spread (3) and quoted bid-ask spread (4) as dependent variables and a number of control variables. For this part of the analysis we employ a subsample of data containing only bonds issued by European insurers from 2000 to 2018 and quoted after 2010. The difference-in-difference models looks as follows:

$$Price_{it} = \alpha_0 + \gamma_t + \epsilon_i + \delta \mathbf{IssueYear}_i + \beta_1 Tier1_{it} + \beta_2 Tier1_{it} \times Omnibus_t + \beta_3 \mathbf{X}_{it} + v_{it} \quad (1)$$

$$YTM_{it} = \alpha_0 + \gamma_t + \epsilon_i + \delta \mathbf{IssueYear}_i + \beta_1 Tier1_{it} + \beta_2 Tier1_{it} \times Omnibus_t + \beta_3 \mathbf{X}_{it} + v_{it} \quad (2)$$

$$CS_{it} = \alpha_0 + \gamma_t + \epsilon_i + \delta \mathbf{IssueYear}_i + \beta_1 Tier1_{i,t} + \beta_2 Tier1_{it} \times Omnibus_t + \beta_3 \mathbf{X}_{it} + v_{it} \quad (3)$$

$$BAS_{it} = \alpha_0 + \gamma_t + \epsilon_i + \delta \mathbf{IssueYear}_i + \beta_1 Tier1_{it} + \beta_2 Tier1_{it} \times Omnibus_t + \beta_3 \mathbf{X}_{it} + v_{it} \quad (4)$$

where $Price_{it}$ is a quoted mid-price of bond i at time t that is equal to $\frac{Bid+Ask}{2}$; YTM_{it} is yield to maturity of bond i at t ; CS_{it} is a yield spread calculated by matching each European bond i with the corresponding risk-free yield of the interpolated yield curve of German Sovereign bonds; BAS_{it} is a quoted bid-ask spread

of bond i at time t equal to $\frac{Bid+Ask}{Mid}$. The main explanatory variables are: $Tier1_i$ is a dummy variable for treatment group that is equal 1 if bond is perpetual and subordinated (or junior), and thus, eligible for Tier 1 capital; $Omnibus_t$ is a dummy for a treatment time that is equal 1 for a quote date after the announcement of transitional measures; and an interaction term between the treatment time and treatment group dummies, $Tier1_i \times Omnibus_t$, an estimated coefficient of which captures the difference-in-differences, i.e. the treatment effect. The vector $\mathbf{X}_{i,t}$ includes a vector of control variables, while γ_t represents quarter fixed effects and ϵ_i covers company specific fixed effects. The term $\delta \mathbf{IssueYear}_i$ measures issue year fixed effects. Here, $\mathbf{IssueYear}_i$ is a vector consisting of the dummy variables for the issue years of the bonds in the dataset.

The hypotheses that we state with respect to bonds eligible for regulation reflect their subordination and perpetuity nature are formulated as follows:

H1: Eligible bonds tend to have higher yields than non-eligible due to their perpetuity and subordination.

H2: Eligible bonds tend to have higher yield spreads than non-eligible bonds due to higher risks that result from the inherited uncertainty with regards to future interest rates, call by issuer and long-term creditworthiness of issuer.

H3: Eligible bonds tend to have higher bid-ask spreads than non-eligible bonds, and thus lower liquidity, since there might be limited demand for them due to a rather new security design.

The last hypothesis is derived from **H2** and **H3** and is formulated as follows:

H4: Eligible bonds tend to have lower prices than non-eligible bonds due to lower liquidity and higher yield spreads.

However, the main goal of the regression analysis is to estimate the treatment effect of the regulation on eligible bonds. In other words, how the introduction of the Solvency II regulatory framework and related transitional measures affected a class of potentially eligible bonds.

5 Empirical Results

Tables 2-5 contain the results of the four regressions models discussed above, whereby each column represents a regression model with different number of covariates: at

each step we add predictor variables and fixed effects (time and company fixed effects) to the model. As we can see from the tables, Column (6) represents a model which includes all predictor variables as well as fixed effects, whereby controlling for additional variables and fixed effects tends to gradually increase R^2 . Note that the coefficients for the treatment group dummy and the treatment time should be interpreted with caution in the presence of interaction term. More specifically, if we add an interaction term, single dummy coefficients measure a change in dependent variable if we change one dummy from 0 to 1 while holding another dummy equal to 0. Eligible bonds ($Tier1_{it}=1$) that European quoted before the announcement of Omnibus II ($Omnibus_t = 0$) seem to have significantly lower prices and higher yields than non-eligible bonds ($Tier_i=0$) issued around the same time (both coefficients are significant at 1% significance level). Interestingly, we find that eligible bonds seem to have significantly lower credit spreads and bid-ask spreads than non-eligible bonds before the treatment.

However, the coefficients of the interaction term are more important for our analysis since it measures the magnitude of the regulation impact on eligible bonds. Coefficients β_3 of the interaction term are significant in all four regressions models at 1% significance level, which suggests that difference in prices, yields, yield spreads and bid-ask spreads between eligible and non-eligible bonds depends significantly on the regulation. Eligible bonds that were issued after the announcement of regulation tend to have higher prices and higher yields than non-eligible bonds issued around the same time. These findings are in line with **H1** and **H4** hypotheses: Eligible bonds tend to have higher yields and lower prices due to their perpetuity and subordination. Interestingly, the announcement also results in even lower credit spreads for newly issued eligible bonds suggesting that investors see those instruments as less risky and/or more liquid, which contradicts **H2** hypothesis. One possible explanation for that is that since eligible bonds are perpetual, and thus, do not have maturity, the yield spreads are calculated with respect to the first call date, which for eligible bonds is minimum after 5 years after the issuance. Hence, investors might anticipate that eligible bonds might be redeemed in the future. Another possible reason might be reporting and disclosure requirements that constitute Pillar III of Solvency II: European insurers are obliged not only provide annual reports to the supervising authorities but also disclose information on solvency and financial condition to the public. At the same time, eligible bonds issued after the announcement tend to have higher bid-ask spreads than non-eligible bonds which suggests that those bonds are more illiquid, which is consistent with **H3** hypothesis. This can be explained by

a possible lack of demand for those instruments due to their design and increased issuance from the side of insurers (and banks) which might result in oversupply of this instruments on the market. This finding suggests that the regulation resulted in higher bid-ask spreads compared to the period before the announcement.

Table 2

	(1)	(2)	(3)	(4)	(5)	(6)
	Mid Price	Mid Price	Mid Price	Mid Price	Mid Price	Mid Price
Tier 1 Eligible	-33.87*** (-186.57)	-23.60*** (-128.38)	-27.49*** (-161.04)	-22.24*** (-113.50)	-30.28*** (-90.32)	-30.58*** (-91.11)
Tier 1 x Omnibus	21.82*** (112.05)	11.97*** (62.08)	10.94*** (61.99)	8.625*** (50.01)	5.121*** (29.75)	5.089*** (29.55)
Coupon		3.687*** (286.80)	4.671*** (355.98)	4.449*** (174.06)	8.006*** (278.22)	8.007*** (277.86)
Remaining Maturity x Non Tier 1		-0.144*** (-62.53)	-0.401*** (-169.70)	-0.299*** (-77.57)	-0.788*** (-79.97)	-0.799*** (-81.14)
Fixed Coupon					-8.861*** (-72.71)	-8.889*** (-72.88)
Bid-Ask Spread					-0.848*** (-19.30)	-0.853*** (-19.38)
Credit Spread					-4.554*** (-53.59)	-4.758*** (-53.81)
Yield to Maturity					-0.508*** (-5.94)	-0.313*** (-3.57)
Bund Yield 1y						-1.029*** (-3.50)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Issue Year FE	No	No	No	Yes	Yes	Yes
Company FE	No	No	Yes	Yes	Yes	Yes
Observations	175447	175447	175447	175447	95764	95336
R^2	0.533	0.722	0.841	0.855	0.923	0.923

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3

	(1)	(2)	(3)	(4)	(5)	(6)
	Yield to Maturity	Yield to Maturity	Yield to Maturity	Yield to Maturity	Yield to Maturity	Yield to Maturity
Tier 1 Eligible	-0.224*** (-4.83)	2.474*** (51.33)	2.359*** (57.01)	2.239*** (51.97)	1.442*** (130.36)	1.465*** (139.55)
Tier 1 x Omnibus	1.040*** (22.16)	-0.713*** (-14.73)	-0.433*** (-10.79)	-0.530*** (-13.34)	0.0417*** (8.34)	0.0445*** (10.01)
Coupon		0.474*** (236.75)	0.374*** (225.94)	0.471*** (165.48)	0.0266*** (13.30)	0.0193*** (9.94)
Remaining Maturity x Non Tier 1		0.0527*** (139.25)	0.0755*** (229.66)	0.0606*** (126.79)	0.0513*** (150.58)	0.0522*** (157.62)
Subordinated					0.177*** (28.75)	0.170*** (28.31)
Fixed Coupon					0.0749*** (14.13)	0.0876*** (16.88)
Bid-Ask Spread					0.00883*** (8.70)	0.0112*** (12.26)
Credit Spread					0.952*** (705.25)	0.963*** (752.92)
Mid Price					-0.00104*** (-6.19)	-0.000610*** (-3.85)
Bund Yield 1y						0.760*** (74.73)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Issue Year FE	No	No	No	Yes	Yes	Yes
Company FE	No	No	Yes	Yes	Yes	Yes
Observations	152970	152970	152970	152970	95764	95336
R^2	0.240	0.649	0.852	0.875	0.992	0.993

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4

	(1)	(2)	(3)	(4)	(5)	(6)
	Credit Spread	Credit Spread	Credit Spread	Credit Spread	Credit Spread	Credit Spread
Tier 1 Eligible	-0.609*** (-12.95)	0.860*** (17.38)	0.560*** (13.04)	0.365*** (7.93)	-1.782*** (-183.64)	-1.766*** (-192.75)
Tier 1 x Omnibus	0.677*** (14.15)	-0.683*** (-13.79)	-0.413*** (-10.19)	-0.506*** (-12.89)	-0.0179*** (-3.47)	-0.0227*** (-4.97)
Coupon		0.448*** (171.09)	0.384*** (180.45)	0.495*** (134.60)	0.0737*** (43.50)	0.0722*** (44.35)
Remaining Maturity x Non Tier 1		-0.00489*** (-9.71)	0.0118*** (23.10)	-0.00417*** (-5.87)	-0.0623*** (-209.08)	-0.0619*** (-213.67)
Fixed Coupon					-0.214*** (-42.82)	-0.213*** (-43.82)
Bid-Ask Spread					-0.0142*** (-12.88)	-0.0162*** (-16.77)
Yield to Maturity					0.930*** (779.18)	0.928*** (800.27)
Mid Price					-0.00865*** (-55.30)	-0.00826*** (-56.24)
Bund Yield 1y						-0.806*** (-82.96)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Issue Year FE	No	No	No	Yes	Yes	Yes
Company FE	No	No	Yes	Yes	Yes	Yes
Observations	95959	95959	95959	95959	95764	95336
R^2	0.187	0.459	0.754	0.803	0.989	0.990

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5

	(1)	(2)	(3)	(4)	(5)	(6)
	Bid-Ask Spread	Bid-Ask Spread	Bid-Ask Spread	Bid-Ask Spread	Bid-Ask Spread	Bid-Ask Spread
Tier 1 Eligible	1.303*** (50.52)	1.102*** (41.34)	1.204*** (44.86)	0.528*** (15.80)	-0.170** (-2.67)	-0.256*** (-4.06)
Tier 1 x Omnibus	-0.471*** (-16.49)	-0.207*** (-6.94)	-0.187*** (-6.35)	0.190*** (5.98)	0.312*** (7.71)	0.310*** (7.68)
Coupon		-0.105*** (-68.59)	-0.166*** (-80.26)	-0.157*** (-36.59)	0.0747*** (6.56)	0.0774*** (6.80)
Remaining Maturity x Non Tier 1		0.00864*** (38.84)	0.0175*** (67.52)	0.0224*** (39.13)	0.00708*** (3.60)	0.00403* (2.11)
Fixed Coupon					0.199*** (7.66)	0.190*** (7.38)
Credit Spread					-0.230*** (-14.43)	-0.288*** (-19.25)
Yield to Maturity					0.128*** (8.36)	0.179*** (12.23)
Mid Price					-0.0262*** (-20.52)	-0.0263*** (-20.61)
Bund Yield 1y						-0.577*** (-7.04)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Issue Year FE	No	No	No	Yes	Yes	Yes
Company FE	No	No	Yes	Yes	Yes	Yes
Observations	175447	175447	175447	175447	95764	95336
R^2	0.142	0.156	0.345	0.403	0.657	0.657

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6 Policy Implications and Discussion

A class of debt instruments eligible for regulatory capital is a relatively new to the market: it has emerged in light of the financial regulation after the global financial crisis. Perpetual subordinated bonds are primarily issued by banks and insurance companies and can be accounted for Tier 1 capital and is put on the same level as equity capital. Since regulatory capital (also called *own funds* for insurers) serves as a capital buffer for times of financial distress, it is wiped out in case of the breach of insurer's solvency ratio.

The global financial crisis resulted in a paradigm shift from bail-out to bail-in approach in the regulation of financial institutions. Hence, in case of insolvency of financial institutions the burden is carried by investors and not by taxpayers. It is very important to assess the consequences of this paradigm change not only for insurers but also for investors, e.g. those who invest in eligible bonds issued by

insurers. In contrast to equity-holders, debt-holders of eligible bonds do not benefit from the upside potential in case of an increase in firm value, however, they bear the same downside risks in case of insolvency of a borrower, i.e. insurance company that issued debt. Moreover, issuer might also cancel or defer coupon payments on a non-cumulative basis in case of risk of the breach of solvency capital ratio. Since the supply of perpetual subordinated bonds is growing due to increased issuance from the side of insurers and banks in the last years and considering that debt grandfathering conditions will come to an end in 2026 which implies further growth in supply of Tier 1 eligible bonds, it is important to assess its impact on the market.

There is a number of important questions that need to be answered to this end. Are the investors aware of the risks of new debt instruments? Are those risks priced accordingly? According to our findings, eligible bonds tend to have lower prices and higher yields than other non-eligible instruments issued after 2011, which is consistent with initially stated hypotheses with respect to prices and yields of perpetual subordinated bonds. However, the announcement of Omnibus II regulation that introduced transitional measures, such as grandfathering debt issued prior to Solvency II (before January 1, 2016) as eligible for Tier 1 capital, seems to positively affect the prices of eligible instruments, which might suggest increased demand for those instruments. However, change in the regulation also results in widened bid-ask spreads of eligible bonds relative to non-eligible which is in turn not consistent with high demand for those instruments. Our finding with respect to credit spreads suggest that investors might consider eligible instruments less risky. One possible explanation for that: Accounting eligible debt as regulatory capital does indeed boost the solvency ratios of insurers which makes them less risky, however, in case of financial distress subordinated debt-holders will bear all the losses together with equity-holders due to the instrument design. Hence, the complexity and loss potential of eligible bonds have to be estimated and taken into account by pricing those assets.

Another important question is: Who is allowed to invest in eligible bonds? Due to the scarcity of trading data for European insurers, it is almost impossible to track corporate bonds, e.g. Bloomberg does not provide information about dealers and customers. However, this information is crucial since eligible bonds can play an important role in transmission of shocks in times of financial distress, especially if those bonds are locked up in asset portfolios of other financial institutions resulting in increasing interconnectedness and systemic risk.

7 Limitations and Future Research Suggestions

The analysis of European corporate bond market might be rather challenging. First of all, European corporate bonds trading data is very scarce and fragmented, which impedes more thorough analysis of prices and liquidity of new debt instruments. Second, it is important to isolate the impact of insurance regulation from other events that might have affected the whole European market such as European sovereign debt crisis, non-monetary policy measures implemented by European Central Bank, specifically, European collateral framework and corporate sector purchase program (CSPP), and other measures that are aimed to improve the liquidity and lower the yields. To the best of our knowledge, none of those events had a direct impact on perpetual subordinated bonds, however, it might have had an indirect effect through other bonds which are non-eligible for regulatory capital. Third, it is necessary to consider the difference in maturity between eligible and non-eligible bonds and conduct some robustness check that would exclude the impact of maturity, i.e. maturity risk premium, on the prices and yields of eligible bonds. Finally, there are a few issues that need to be considered with regard to difference-in-difference approach: 1) unknown timing of regulation, i.e. time of treatment; 2) an assumption of parallel trend prior to the treatment should hold. Since Solvency II regulation framework has been developed for over a decade and since the regulator was always consulting the insurance industry and organizing public consultations, it is plausible that insurers might have anticipated the changes. Apart from that, it is important to test the assumption of parallel trend, i.e. that prior to the announcement of new regulation the difference between the treatment and control group is constant over time.

It would be interesting to design a theoretical model of insurer's capital structure that would account for the new regulation and run Monte-Carlo simulations with different amounts of subordinated perpetual debt classified as Tier 1 or 2 capital in order to be able to draw some implications for the insurance companies that issue them. It is also interesting to assess the consequences of simultaneous increase in supply of perpetual subordinated bonds by banks and insurance companies. Finally, it would also be beneficial to employ additional measures of liquidity such as Roll's implicit spread measure and percentage of zero returns.

8 References

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9 Appendix

Table 6: Descriptive Statistics for Tier 1 eligible and non-eligible bonds issued prior to 2011

	<i>Tier 1</i>			<i>Other</i>		
	Mean	Std.Dev.	Obs	Mean	Std.Dev.	Obs
<i>Pricing data</i>						
BidPrice	77.51	18.66	24284	100.89	12.07	15514
AskPrice	78.31	18.59	24258	101.73	12.22	13964
Mid Price	77.91	18.62	24258	101.46	12.21	13964
LogReturn	-0.02	1.52	24238	0.00	0.88	13950
Yield to Maturity	6.39	2.43	9745	6.31	1.71	16820
RollSpread	0.61	1.33	16432	0.50	0.63	7485
Bid-Ask Spread	1.10	1.58	24258	0.55	0.36	13964
Credit Spread	2.33	2.51	9484	2.30	1.77	16437
<i>Issuance Data</i>						
Coupon	2.89	2.20	52042	4.66	3.14	34755
AmountIssuedinMil	322.08	331.28	50954	436.18	457.68	33293
ParAmt	24378.49	31737.68	50954	1663322.95	5882038.80	33293
TimetoMaturity	100.00	0.00	52042	26.19	7.95	36475
<i>Additional Data</i>						
Eurozone	1.00	0.00	52042	1.00	0.00	36475
Perpetual	1.00	0.00	52042	0.00	0.00	36475
Subordinated	1.00	0.00	52042	0.83	0.37	36475
EUR	0.73	0.44	50954	0.55	0.50	33293
Omnibus	0.00	0.00	52042	0.00	0.00	36475

Table 7

Issuer Name	Tier1		
	Non-eligible	Tier 1 eligible	Total
AXA SA	9	3	12
Allianz SE	3	3	6
Assicurazioni Generali SpA	5	1	6
Aviva PLC	3	1	4
BNP Paribas Cardif SA	0	1	1
CNP Assurances	2	0	2
Caisse Nationale de Reassurance Mutuelle Agricole Groupama	0	1	1
Credit Agricole Assurances SA	2	1	3
Mapfre SA	1	0	1
NN Group NV	1	2	3
Scottish Widows Ltd	1	0	1
Talanx AG	1	0	1
Unipol Gruppo SpA	1	0	1
UnipolSai Assicurazioni SpA	0	1	1
Total	29	14	43
	%	%	%
AXA SA	31.0	21.4	27.9
Allianz SE	10.3	21.4	14.0
Assicurazioni Generali SpA	17.2	7.1	14.0
Aviva PLC	10.3	7.1	9.3
BNP Paribas Cardif SA	0.0	7.1	2.3
CNP Assurances	6.9	0.0	4.7
Caisse Nationale de Reassurance Mutuelle Agricole Groupama	0.0	7.1	2.3
Credit Agricole Assurances SA	6.9	7.1	7.0
Mapfre SA	3.4	0.0	2.3
NN Group NV	3.4	14.3	7.0
Scottish Widows Ltd	3.4	0.0	2.3
Talanx AG	3.4	0.0	2.3
Unipol Gruppo SpA	3.4	0.0	2.3
UnipolSai Assicurazioni SpA	0.0	7.1	2.3
Total	100.0	100.0	100.0
	Cum%	Cum%	Cum%
AXA SA	31.0	21.4	27.9
Allianz SE	41.4	42.9	41.9
Assicurazioni Generali SpA	58.6	50.0	55.8
Aviva PLC	69.0	57.1	65.1
BNP Paribas Cardif SA	69.0	64.3	67.4
CNP Assurances	75.9	64.3	72.1
Caisse Nationale de Reassurance Mutuelle Agricole Groupama	75.9	71.4	74.4
Credit Agricole Assurances SA	82.8	78.6	81.4
Mapfre SA	86.2	78.6	83.7
NN Group NV	89.7	92.9	90.7
Scottish Widows Ltd	93.1	92.9	93.0
Talanx AG	96.6	92.9	95.3
Unipol Gruppo SpA	100.0	92.9	97.7
UnipolSai Assicurazioni SpA	100.0	100.0	100.0
Total			

Table 8: Cross-correlation table

Variables	Mid Price	Yield to Maturity	Credit Spread	Bid-Ask Spread
Mid Price	1.000			
Yield to Maturity	-0.339	1.000		
Credit Spread	-0.219	0.779	1.000	
Bid-Ask Spread	-0.388	0.266	0.283	1.000