Three Essays on the German SME Bond Market

DISSERTATION

zur Erlangung des akademischen Grades

doctor rerum politicarum

(Doktor der Wirtschaftswissenschaft)

eingereicht an der

Wirtschaftswissenschaftlichen Fakultät

der Humboldt-Universität zu Berlin

von

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Tag des Kolloquiums: 26.01.2022

Abstract

Die vorliegende Dissertation befasst sich mit dem Markt für Mittelstandsanleihen, der 2010 in Deutschland etabliert wurde und nur wenige Jahre später, im Zusammenhang mit massiven Anleiheausfällen, zusammengebrochen ist. Ziel der Arbeit ist es zu analysieren, welche Faktoren zum Zusammenbruch des Marktes beigetragen haben könnten, um besser zu verstehen, wie mittelständischen Unternehmen der Zugang zum Kapitalmarkt erleichtert werden kann. Das erste Kapitel analysiert die Entscheidung, sich am Markt für Mittelstandsanleihen zu finanzieren. Verschiedene Theorien versuchen zu erklären, welche Unternehmen sich vorrangig über Banken und welche sich am Kapitalmarkt finanzieren. Entgegen der Theorie haben sich vorwiegend Unternehmen mit schlechterer Kreditwürdigkeit am Markt für Mittelstandsanleihen finanziert. Das zweite Kapitel untersucht, ob der Zugang zum Markt für Mittelstandsanleihen finanzielle Beschränkungen aufheben und so Investitionen anstoßen konnte. Eine alternative Motivation könnte jedoch auch sein, dass Unternehmen sich Geld von gutgläubigen Privatinvestoren geliehen haben, um die Insolvenz zu verschleppen. Emittenten von Mittelstandsanleihen waren zwar finanziell eingeschränkt, investierten jedoch weniger als erwartet. Eine große Anzahl der Emittenten wäre ohne die Mittelstandsanleihe bereits im Jahr der Emission zahlungsunfähig gewesen. Das dritte Kapitel untersucht vor dem Hintergrund der massiven Zahlungsausfälle, ob Investoren in der Lage waren, Unternehmen mit hohem Risiko von solchem mit niedrigerem Risiko zu unterscheiden. Erschwert wurde die korrekte Einschätzung der Risiken durch eine starke Präsenz von Privatinvestoren sowie einer Inflation der Anleiheratings. Die Ergebnisse deuten darauf hin, dass Investoren nicht in der Lage waren, riskante von weniger riskanten Mittelstandsanleihen zu unterscheiden. Dies könnte zum Zusammenbruch des Marktes beigetragen haben, da dieser für hochqualitative Unternehmen letztendlich zu teuer war.

This dissertation explores the German market for SME bonds that was established in 2010 and collapsed soon after, when one third of the listed bonds defaulted. The first paper studies the choice to enter the German MBond market. The results show that MBond issuers in contrast to theoretical predictions and prior empirical findings, have lower credit quality. The second paper examines to the extent to which the main goal of the MBond market, alleviating financial constraints in order to spur firm investment, has been achieved. Indeed, a major fraction of MBond issuers have been financially constrained in the year prior to issuance. However, MBond issuers appear to invest less than expected. The results are more in favor of the alternative explanation that MBond issuers timed the market and exploited a window of opportunity to issue junk bonds to retail investors, in order to finance future losses and avoid or postpone bankruptcy. In the light of the high default rate and the final collapse of the market, the third paper analyzes whether investors were able to distinguish between high and low risk MBonds. Rating inflation in the MBond market could have distorted the information channel, hampering investors' risk assessment of the MBonds. The results indicate that differences in default risk were not adequately reflected in MBond yield spreads. Thus, it appears that MBond investors were not able to distinguish between high and low quality issuers. As a consequence, the MBond market was relatively more expensive for high quality issuers than it was for their low quality counterparts, which may have contributed to the near-total collapse of the market.

Contents

Three Essays on the German Small Volume Bond Market

An Introductory Summary

Small and medium-sized enterprises (SMEs) are considered to be the backbone of the economy in terms of employment, innovation, and economic activity (European Commission, 2015b). At the same time, SMEs are more likely to be financially constrained as opposed to larger companies, as they are usually dependent on financing by their house banks, especially in Europe (Beck & Demirguc-Kunt, 2006; Beck et al., 2008). As a result, SMEs are more vulnerable to a reduction in loan supply due to tightened banking regulation and external credit supply shocks to the banking sector (Beck & Demirguc-Kunt, 2006; Beck et al., 2008). Larger companies can more easily compensate a reduction in bank financing with market-based financing (Becker & Ivashina, 2014; Khwaja & Mian, 2008).

Enabling SMEs to issue public debt might, therefore, reduce their financial constraints and foster overall economic growth. For this reason, the EU founded the initiative of the European Capital Markets Union (EU CMU). The CMU should facilitate the access of SMEs to financial markets to reduce bank dependency and alleviate financial constraints (European Commission, 2015a, 2017)[1].

Similar ideas accompanied the establishment of the German market for small volume bonds (MBond market in the following sections) that was established by five German stock exchanges in 2010 / 2011. In the beginning,

[1] In addition, retail investors should be enabled to participate in the financing of SMEs (European Commission, 2015a, 2017).

the new bond segments were highly welcomed by market participants, as they promised to solve two issues simultaneously. Firstly, the MBond market allowed bank dependent SMEs to issue small volume bonds and, thus, diversify their financing structure. Secondly, it should especially allow retail investors to participate in the economic success of SMEs, in a low interest environment (Bösl & Hasler, 2012). However, in 2012, the number of defaults already started to rise. Ultimately, until the writing of this thesis, one third of all MBonds defaulted. As a consequence, the three largest stock exchanges closed or altered their MBond market segments and the market collapsed.

This dissertaion is composed of three papers that empirically study the example of the German MBond market, which might help evaluate the high hopes associated with the access of SMEs to public debt markets.

The first paper studies the choice of debt, when SMEs gain access to public debt markets via the German MBond market. More specifically it poses the question which companies have actually made use of the newly established MBond market segments and whether these companies are the ones predicted by theory and prior empirical findings.

Theoretical studies predict that for smaller and more opaque firms, younger firms which have not yet built up reputation, and firms with more growth opportunities it is optimal to use private debt financing due to its monitoring advantages as well as the banks' ability to generate and assess private information. Moreover, firms with lower credit quality and a higher probability of financial distress should rely on private debt due to its advantages regarding renegotiation and restructuring.

The results show that MBond issuers are larger on average than standard definitions of SMEs but smaller compared to other companies issuing public debt. Moreover, MBond issuers are also younger, which contradicts theoretical predictions on reputation. Among the small firms, MBond issuers appear to

be less opaque, since they are more likely to be rated. Thus, these segments seem to serve as an entrance to public debt markets, as intended.

The most striking result is that, in contrast to theoretical predictions and prior empirical findings, MBond issuers have lower credit quality. In addition, MBond issuers display higher growth opportunities, which are related to the risk of asset substitution. Hence, despite being marketed as high-quality segments, the segments for MBonds are a high-risk market.

The second paper examines to the extent to which the main goal of the MBond market, alleviating financial constraints in order to spur firm investment, has been achieved. Making use of a novel measure of financial constraints for private companies, the results in the first part of the paper indicate that, indeed, a major fraction of MBond issuers have been financially constrained in the year prior to issuance. However, MBond issuers appear to invest less in fixed assets and hold more cash in the year of issuance compared to a financially constrained control group.

Considering these results and the alarming default rate, a concurrent explanation is explored as well. MBond issuers might have timed the market and exploited a window of opportunity to issue junk bonds to retail investors, in order to finance future losses and avoid or postpone bankruptcy.

Consistent with the concurrent explanation, profitability and financial stability of MBond issuers deteriorate post issuance. Without the proceeds from the bond IPO, a major fraction of them would have already run out of cash in the year of issuance. Thus, the empirical results suggest that, indeed, firms might have timed the market to exploit a window of opportunity to issue junk bonds to retail investors, in order to cover future losses and avoid or postpone bankruptcy.

The example of the German MBond market indicates that facilitating access to debt capital markets for SMEs to alleviate financial constraints alone

is not sufficient to spur firm investment.

In the light of the high default rate and the final collapse of the market, the third paper analyzes whether investors were able to distinguish between high and low risk MBonds. Rating inflation in the MBond market could have distorted the information channel, hampering investors' risk assessment of the MBonds.

The German MBond market might have been prone to rating inflation, for a number of reasons. Solicited ratings were provided by four small competing German rating agencies (Florstedt, 2017; Mausbach & Simmert, 2012; Mietzner et al., 2018), which would allow for rating shopping (Bolton et al., 2012; Mariano, 2012; Skreta & Veldkamp, 2009). Mandatory annual rating updates resulted in repeated interactions between issuers and rating agencies, which might have increased incentives for rating inflation (Frenkel, 2015; Mausbach & Simmert, 2012). Finally, since the MBond market mainly targeted unsophisticated retail investors (Herrmann, 2017), issuers might have preferred less precise and inflated ratings, since reputation costs were lower (Bar-Isaac & Shapiro, 2013; Bolton et al., 2012; Pagano & Volpin, 2010, 2012).

The results indicate rating inflation in the MBond market segments. Realized default rates and implied probability of default were higher for investment grade rated MBonds than they were for non-investment grade rated MBonds. In addition, differences in default risk were not reflected in MBond yield spreads. The average yield spread of a MBond with low default risk was at the same level as the average yield spread of a MBond with high default risk. Thus, it appears that MBond investors were not able to distinguish between high and low quality issuers. As a consequence, the MBond market was relatively more expensive for high quality issuers than it was for their low quality counterparts, which may have contributed to the near-total collapse of the market.

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The Choice to Enter the German Bond Market for SMEs

July, 2021

Abstract

This paper examines the choice of debt, when small- and medium-sized enterprises (SMEs) gain access to public debt markets via the German MBond market. It addresses the question whether the marginal MBond issuer is the one predicted by theory and prior empirical findings. I find that MBond issuers are larger on average than standard definitions of SMEs but smaller compared to other companies issuing public debt. Moreover, MBond issuers are also younger, contradicting theoretical predictions on reputation. Among the small firms, MBond issuers appear to be less opaque, since they are more likely to be rated. Thus, these segments seem to serve as an entrance to public debt markets, as intended. However, in contrast to theoretical predictions and prior empirical findings, MBond issuers have lower credit quality. In addition, MBond issuers display higher growth opportunities, which are related to the risk of asset substitution. Thus, despite being marketed as high-quality segments, the segments for MBonds are a high-risk market.

Keywords: Public debt · Private debt · Debt policy · Capital structure · Small- and medium sized enterprises (SMEs)

JEL classification: G21 · G30 · G32

1 Introduction

With the establishment of the German market for small-volume bonds (MBond market in the following), issuing public debt has been facilitated for small- and medium-sized enterprises (SMEs). This new market gives us the opportunity to study the determinants of the choice between private and public debt for SMEs for the first time. Since debt is the most important financing source for the majority of companies, the determinants of the choice between private and public debt receive considerable attention in the finance literature. However, most prior studies focused on large and publicly traded firms for their analysis of the choice between different types of public and private debt (Arena, 2011; Denis & Mihov, 2003; Gomes & Phillips, 2012; Hale & Santos, 2008; Houston & James, 1996; Krishnaswami et al., 1999; Lin et al., 2013; Rauh & Sufi, 2010). Small- and medium-sized enterprises, often described as the "backbone of the economy" (European Commission, 2015b), have not been included in the analyses. Thus, this paper addresses the question whether the marginal bond issuer, entering the MBond market, is the one we would expect based on theoretical predictions and prior empirical findings.

Analyzing which companies self-selected into this market helps to understand, how a public debt market for SMEs should be structured. This could especially be relevant, since the EU plans to support the development of similar markets with the Capital Markets Union (Haag, 2017), which has two goals. Firstly, it aims at facilitating access of SMEs to capital markets to provide financing alternatives (European Commission, 2015a, 2017). Secondly, retail investors should be enabled to participate in the financing of SMEs (European Commission, 2015a, 2017). Both goals have been realized in the German MBond market. Thus, the German MBond market experience might help to assess which type of SMEs is likely to issue bonds when it becomes feasible.

Traditionally, German SMEs relied heavily on bank lending for financing. However, three concurring developments might have led to SMEs issuing more public debt. Firstly, due to the credit crunch in the aftermath of the financial crisis and the introduction of Basel III, fewer banks were willing to grant or extend loans (Deutsche Bundesbank, 2011). Secondly, at the same time, quantitative easing of the ECB reduced interest rates and investors were searching for alternative investment opportunities, such as bonds issued by SMEs (Mausbach & Simmert, 2012). Thirdly, the introduction of Collective Action Clauses with the new German bond regulation (Schuldverschreibungsgesetz - SchVG) in 2009 facilitated the renegotiation of a bond (Podewils, 2009). These developments might have facilitated the use of public debt for SMEs to diversify their financing mix and reduce bank dependency (Götz & Hartmann, 2012). To cater to the increasing demand, in 2010 and 2011, five German stock exchanges opened special quality segments for bonds issued by SMEs, targeted at retail investors. In the following, these bonds will be referred to as MBonds. Since high flotation costs may be prohibitive for SMEs to issue public debt (Krishnaswami et al., 1999), all five exchanges attempted to keep flotation costs at a minimum (Götz & Hartmann, 2012).

Apart from flotation costs, prior theories analyzing the choice between public and private debt mainly focused on two economic mechanisms and their implications: asymmetric information and efficiency in renegotiation and restructuring of firms in financial distress. Asymmetric information makes information production costly (Diamond, 1984; Leland & Pyle, 1977), proprietary information regarding growth opportunities valuable (Yosha, 1995), and gives rise to moral hazard, which might result in asset substitution (Jensen & Meckling, 1976) or underinvestment (Myers, 1977). Moral hazard problems might be mitigated by monitoring (Berlin & Loeys, 1988; Diamond, 1984; Leland & Pyle, 1977) or reputation if debtors borrow repeatedly (Diamond, 1991). In

terms of renegotiation and restructuring, private debt is thought to be more efficient than public debt due to the dispersed ownership of bonds, which might result in holdout and coordination problems (Chemmanur & Fulghieri, 1994; Gertner & Scharfstein, 1991; Gilson et al., 1990; Roe, 1987). However, creditor concentration can also result in a hold-up problem, providing firms with the incentive to diversify their creditor structure (Rajan, 1992).

To sum up, theoretical studies predict that smaller and more opaque firms, younger firms which have not yet built up reputation, and firms with more growth opportunities should prefer private debt financing due to its monitoring advantages as well as the banks' ability to generate and assess private information. Moreover, firms with lower credit quality and a higher probability of financial distress should rely on private debt due to its advantages regarding renegotiation and restructuring.

Several papers provide empirical evidence for these predictions. They document a positive relation between firm size and other variables indicating lower degrees of information asymmetry and public debt financing (Arena, 2011; Cantillo & Wright, 2000; Denis & Mihov, 2003; Hadlock & James, 2002; Krishnaswami et al., 1999). Reputation seems to have a "U-shaped" effect on the timing of a firm's first bond IPO (Hale & Santos, 2008). Companies issuing public debt are on average of higher credit quality, whereas companies with lower credit quality prefer private debt, since it facilitates renegotiation (Arena, 2011; Cantillo & Wright, 2000; Carey et al., 1998; Denis & Mihov, 2003). Nevertheless, to diversify their creditor structure, companies with low-credit quality also issue arm's-length subordinated bonds (Rauh & Sufi, 2010) and companies with access to public debt still value private debt and keep some portion of long-term bank debt (Johnson, 1997).

In this paper, I assess whether opacity, reputation, growth opportunities, and credit quality of MBond issuers are in line with predictions from theoret-

ical models and prior empirical findings regarding the choice between public and private debt. Based on the theories outlined, I predict that MBond issuers are less opaque, show a lower degree of information asymmetry, and have built up more reputation than issuers of bank and non-bank private debt. In addition, they should display less growth opportunities. Since the introduction of the SchVG in 2009 facilitates restructuring for bonds, I do not expect to find a difference in terms of credit quality compared to other types of public debt, private placements, or bank debt.

I analyze the choice of companies to enter the newly established MBond market, using a large sample of different types of public and private debt issues. Since I am interested in how MBond issuer differ compared to other borrowers, I compare MBond issuers to companies placing other forms of public and private debt in Germany between 2010 and 2018, such as small-volume listed bonds outside the MBond segments, Schuldschein loans (Schuldscheine), private placements, bank loans, or other corporate bonds. In order to model the choice between the different types of debt, a multinomial logit regression model is estimated, using proxies for opacity, reputation, growth opportunities, and credit quality as explanatory variables.

The results indicate that the companies that chose to enter the MBond market differ to some extent from theoretical predictions and prior empirical findings. Although the MBond issuers were advertised as SMEs, I find that they are larger than standard definitions of SMEs but smaller compared to the other companies issuing public debt. Some authors state that the narrative of the German "Mittelstand" (SMEs) was used to market these bonds to retail investors, due to its high reputation (Florstedt, 2017; von Randow, 2017). With respect to reputation in terms of the predictions of the Diamond (1991) model, MBond issuers are less reputable since they are younger on average

compared to most other debtors. Thus, the MBond segments seem to serve as an entrance to the public debt markets. Among the small firms, MBond issuers appear to be less opaque, since they are more likely to be rated. Rating was a requirement on most platforms. However, MBond issuers were usually not rated by one of the big three rating agencies but by smaller, less reputable German rating agencies. Thus, ratings might be less reliable.

Surprisingly, MBond issuers appear to be among the less creditworthy, which contradicts prior empirical findings stating that public debt issuers are on average of better credit quality than issuers of private debt (Arena, 2011; Cantillo & Wright, 2000; Denis & Mihov, 2003).

In addition, MBond issuers display higher growth opportunities, which are related, by theory, with the risk of asset substitution. These growth opportunities correspond to a significantly higher issuance volume relative to existing total debt prior to issuance. Hence, I conclude that, despite being marketed as high-quality segments, the segments for MBonds are a high-risk market. These findings provide an a priori explanation for the series of defaults in the MBond market, with a cumulated realized default rate of 32.8%. They are in line with the findings of Herrmann (2017) who finds that retail investors were heavily invested in MBonds which defaulted, whereas institutional investors were better able to distinguish between high- and low-quality MBond issuers.

The remainder of the paper is organized as follows. Section 2 gives an overview over the existing theoretical and empirical literature regarding the choice between public and private debt, describe the German MBond market setting, and develop the hypotheses, to be tested empirically. In Section 3, I describe the data, the sample selection process, and the choice of variables. Section 4 provides descriptive statistics for the sample. Section 5 presents the primary results and is complemented by robustness and additional tests in Section 6. Finally, Section 7 concludes the study.

2 Prior Literature, Setting, and Hypotheses Development

2.1 Theory and Prior Empirical Evidence Regarding the Choice Between Public and Private Debt

Debt is a major financing source for companies. Since the choice between public debt and private debt, which can be bank or non-bank debt (Carey et al., 1998), is usually an endogenous one, prior theoretical literature identified potential determinants of a company's choice between private and public debt. These factors can be classified into two main sets. The first set is based on information asymmetry whereas the second is based on the efficiency of liquidation or renegotiation in financial distress.

Implications of Information Asymmetry for Lending Relationships

Information asymmetry can affect the choice between private and public debt in different ways. First, if a firm cannot credibly disclose information, they may require a credible financial intermediary to avoid adverse selection (Leland & Pyle, 1977). Since information production is costly and banks are thought to be more efficient in acquiring information from the borrower, smaller, more opaque firms with a high degree of information asymmetry might prefer bank financing (Diamond, 1984; Fama, 1985; Leland & Pyle, 1977). Several papers provide empirical evidence for this prediction and document a positive relation between firm size and other variables indicating lower degrees of information asymmetry and public debt financing (Cantillo & Wright, 2000; Denis & Mihov, 2003; Hadlock & James, 2002; Krishnaswami et al., 1999).

Second, companies might have proprietary strategic information which is valuable for their competitors, for example information on capital expenditures or marketing activities. Therefore, those companies do not want to be required

to disclose their information when issuing public debt and prefer bilateral bank debt instead (Yosha, 1995).

Third, two moral hazard problems might arise: underinvestment and asset substitution. Since equity is subordinated to debt, shareholders might forego positive NPV projects, if they do not exceed the face value of debt, resulting in underinvestment (Myers, 1977). Moreover, shareholders might have an incentive for asset substitution by choosing riskier projects, since their downside risk is bounded by limited liability, whereas they still enjoy the full upside potential (Jensen & Meckling, 1976). Because both moral hazard problems are anticipated by creditors, they require a higher return on debt ex ante. Monitoring can address these moral hazard problems and reduce the cost of debt. Previous studies argue that private debt, especially bank debt, has an advantage over public debt in terms of efficiency of monitoring (Berlin & Loeys, 1988; Diamond, 1984; Leland & Pyle, 1977). Thus, companies with a high degree of information asymmetry may be more inclined to borrow from banks. Asset substitution becomes more likely when a company has high growth opportunities, as implied by Jensen and Meckling (1976) and Myers (1977), since high-growth firms can substitute or forego positive NPV projects more easily. [1]

Diamond (1991) developed a model addressing potential moral hazard problems differently. In this model, the choice to borrow privately or publicly depends on the life cycle of the company (Diamond, 1991). Young firms build up reputation by borrowing from and being monitored by banks. If debtors want to borrow repeatedly, reputation mitigates the moral hazard problem. Subsequently, firms with low and high credit quality enter public debt markets. Firms with high credit quality benefit from lower cost of capital and

[1] Almazan and Suarez (2003) and Meneghetti (2012) developed models in which incentives are aligned by performance-based compensation contracts. They predict that participation in profitable firms incentivizes managers to voluntarily accept bank monitoring and, therefore, choose private debt over public debt (Almazan & Suarez, 2003; Meneghetti, 2012). Meneghetti (2012) also provides supporting empirical evidence for this prediction.

do not have an incentive to pay for monitoring by banks. Low credit quality creditors also do not have an incentive to be monitored. They have less to lose if they default and reveal their low credit quality. Moreover, those borrowers might be screened out by monitoring. Thus, monitoring might not be worth the costs for borrowers with low credit quality. Only firms with medium credit quality rely on banks for monitoring and easier renegotiation in case of financial distress (Diamond, 1991). Similar predictions are made by the subsequent theoretical paper of Rajan (1992). Hale and Santos (2008) find supporting evidence for the role of reputation for choice of debt described by the Diamond model. Reputation seems to have a "U-shaped" effect on the timing of a firm's first bond IPO (Hale & Santos, 2008). However, Johnson (1997) finds that companies with access to public debt still value private debt and keep some portion of long-term bank debt.

Implications of Efficiency in Renegotiation for Lending Relationships

For companies with a high probability of financial distress, the efficiency of renegotiation and liquidation also affects the choice between public and private debt. Banks are considered to be more efficient in renegotiation and reorganization (Chemmanur & Fulghieri, 1994; Gertner & Scharfstein, 1991). This is due to the dispersed holding structure of bonds. Restructuring a bond out of court usually requires unanimous consent of bondholders (Gilson et al., 1990). The dispersed ownership of bonds can, therefore, result in holdout and coordination problems, making renegotiation and restructuring of public debt less efficient (Roe, 1987). Consequently, firms with a higher probability of financial distress should prefer private debt. Gilson et al. (1990) show supporting evidence that companies use private debt restructuring, which is thought to be less costly than formal bankruptcy, more often if they owe more of their debt to banks and owe to fewer lenders. Denis and Mihov (2003) and

Arena (2011) find that firms with the highest credit quality borrow from public sources, firms with medium credit quality borrow from banks, and firms with the lowest credit quality borrow from non-bank private lenders. By comparing public debt issues with bank and non-bank private debt issues, they extend the empirical findings of Carey et al. (1998), who assert that non-bank private lenders finance riskier borrowers than banks. These results are in line with Cantillo and Wright (2000), who reveal that private debt is beneficial if financial distress is more likely, since it facilitates renegotiation. However, creditor concentration can also result in a hold-up problem, providing firms with the incentive to diversify their creditor structure (Rajan, 1992). Indeed, in contrast to the efficient-renegotiation argument, Rauh and Sufi (2010) show that companies with low credit quality also issue subordinated bonds.

To sum up, firms have to consider the benefits and costs of the different types of debt financing (Hadlock & James, 2002). Consequently, the issuance cost seems to play a role as well, since firms try to minimize the costs of issuing securities (Blackwell & Kidwell, 1988). Thus, it is no surprise that prior studies found larger firms and firms with larger issuance volumes to be more likely to issue bonds due to comparatively low flotation costs (Krishnaswami et al., 1999). That is why prior studies argue that large and public firms would be more likely to be confronted with the choice between public and private debt and, therefore, exclude SMEs from the analysis (Houston & James, 1996). However, that changed with the introduction of the MBond market.

2.2 The Development of the German MBond Market

Traditionally, the German Mittelstand relied heavily on bank financing, as nearly 80% of financing volumes for SMEs is provided by their house bank (Blättchen & Nespethal, 2010). It seems, therefore, all the more surprising that in 2010 German stock exchanges established platforms to facilitate is-

suing public debt for small- and medium-sized enterprises. This new market might have been fostered by three concurring developments. Firstly, increased capital requirements for banks, introduced by Basel II regulation in 2007, exacerbated financing for SMEs in Germany (Schindele & Szczesny, 2016). The introduction of Basel III in the aftermath of the financial crisis, threatened to dry up traditional bank financing for SMEs even more (Angelkort & Stuwe, 2011; Schmitt, 2012). This development might have driven companies to search for alternative ways of debt financing and, consequently, increased the demand for bonds with a relatively small issuance volume.

Secondly, in August 2009, a new bond regulation (Schuldverschreibungsgesetz - in the following: *SchVG*) came into force in Germany that aimed at facilitating the renegotiation of public debt (Podewils, 2009). The new bond regulation allowed the introduction of Collective Action Clauses (CACs) (§5 II 1 SchVG). These clauses allow a majority of bondholders, usually at least 75 % of the bondholders attending the bondholder meeting (§5 IV 1 SchVG), to change the terms and conditions of a bond. For instance, they can extend the maturity and defer or decrease interest payments (§5 III 1 SchVG). Since the minority of bondholders is also bound to the decision of the majority, this mechanism helps to solve the holdout problem (Roe, 1987). Moreover, bondholders can elect a creditor representative (§5 I 1 SchVG), who helps to mitigate the coordination problem resulting from dispersed ownership of the bonds (Podewils, 2009).

Thirdly, at the same time, quantitative easing by the European Central Bank reduced credit spreads, which directed investors to new investment opportunities, leading to an increase in credit supply via alternative forms of financing, for example bonds (Mausbach & Simmert, 2012). The combination of reduced availability of bank financing, especially for SMEs, lower yields and facilitated renegotiation might have made the establishment of a new public debt segment interesting.

The Rise of the German MBond Market

In 2010, Stuttgart stock exchange established the first trading platform for bonds issued by small- and medium-sized companies in Germany, known as "Bondm". Stuttgart stock exchange explained the introduction of the new segment with the danger of a credit crunch as a result of the financial crisis and the deteriorating financing conditions, especially for small- and medium-sized companies (Blättchen & Nespethal, 2010; Börse Stuttgart, 2010). Bondm was supposed to offer SMEs an alternative source of financing, while simultaneously allowing retail investors to invest in the "German Mittelstand", the backbone of the economy (Blättchen & Nespethal, 2010; Börse Stuttgart, 2010).

Before long, other German stock exchanges followed the example and set up SME Bond segments. In the same year, the Munich Stock Exchange (Börse München) and Dusseldorf Stock Exchange (Börse Düsseldorf) established their own segments, "m:access" and "der mittelstandsmarkt" respectively (Mausbach & Simmert, 2012). Dusseldorf stock exchange motivated the introduction of the segment with the Basel III regulation, which increased capital requirements for banks and might have exacerbated access to loan financing for SMEs (Angelkort & Stuwe, 2011; Börse Düsseldorf, 2010). In 2011, Hamburg Hannover Stock Exchange (Börse Hamburg Hannover) introduced its segment "Mittelstandsbörse Deutschland" and Frankfurt Stock Exchange (Deutsche Börse AG) opened its junior platform "Entry Standard" for SME bonds.

[Insert Figure 1 here]

A year later, Frankfurt Stock Exchange also opened their "premium" segment "Prime Standard" for bonds. However, since it requires a minimum issuance volume of EUR 100 million it aims at larger companies, and is not directly relevant for SME financing (Blättchen & Nespethal, 2012). Thus, five open market segments for SME Bonds were established in total by German stock exchanges. In the sample, 122 individual MBonds with a volume of EUR

5.1 billion were issued in these five market segments[2].

Regulations of the MBond Segments

The regulation of all five segments is similar (Mausbach & Simmert, 2012). In order to attract issuers, all exchanges tried to keep transaction costs low (Götz & Hartmann, 2012). In addition, the platforms either have no restrictions regarding minimum issuance volume or set very low boundaries.

All of the five segments explicitly target retail investors (Blättchen & Nespethal, 2010; Börse Düsseldorf, 2010; Börse Stuttgart, 2010; Mausbach & Simmert, 2012). Thus, in order to enable retail investors to invest in MBonds in the primary market, the maximum denomination of a bond is only EUR 1,000 on all platforms except for Mittelstandsbörse Deutschland (Börse Düsseldorf, 2010; Börse Stuttgart, 2010; Mausbach & Simmert, 2012). In addition, the stock exchanges implemented technical solutions in order to allow retail investors to participate in the primary market of a bond offering directly (Schmitt, 2012), for example via the "bondm-Zeichnungsbox" of Stuttgart Stock Exchange (Blättchen & Nespethal, 2010; Börse Stuttgart, 2010). Herrmann (2017) finds that 71% of the MBonds investors were retail investors, which might have aggravated information asymmetry.

The Meltdown

Shortly after the establishment of the new market segments, the number of defaults started to rise. Figure 1 presents the issues and defaults of MBonds in the sample. On Bondm, the first mover, 40.6% of the listed bonds defaulted

[2]Germany was not the only country which tried to facilitate debt financing for SMEs via debt capital markets. For example, in 2012, the Italian Government passed two laws (DL 83 June 2012 and DL 221 December 2012), which enabled private SMEs to issue public debt securities (EUR 2.5 to 50 million). The reason for this reform was the limited capability of Italian banks to grant loans (Basel III, growing amounts of non-performing loans, need to increase regulatory capital or reduce assets) and, thus, to diversify private SMEs' funding sources (Altman et al., 2018). Altman et al. (2018) analyze the Italian MBond market and find that even after years, information asymmetry is still high, jeopardizing the functioning of the market.

with a volume of over EUR 815.5 million.

From the MBonds issuers in the sample, 15 % were active in the renewable energy sector which experienced unexpected policy changes, for example regarding solar energy regulation. However, the fraction is comparable to issuers of small volume listed bonds (13 %). Thus, the high number of defaults in the MBond segment is unlikely to be driven mainly by policy changes in the renewable energy sector.

With many defaults trust in MBonds was lost, especially among retail investors. Herrmann (2017) shows that retail investors were heavily invested in MBonds which defaulted, whereas institutional investors were better able to distinguish between high and low quality MBond issuers. As a consequence, most exchanges closed, moved or altered their segments. In 2014 Stuttgart stock exchange, who were the first to open the platform Bondm, were also the first to close it. Dusseldorf Stock Exchange decided to restructure their MBond segment "der mittelstandsmarkt" and transfer all its MBonds to a new segment called "Primärmarkt" (Börse Düsseldorf, 2015a). In the Primärmarkt, bonds are sorted into three categories, depending on their interest rates (Börse Düsseldorf, 2015a). This should increase the transparency for retail investors and should help them to properly assess the riskiness of their investment in MBonds (Börse Düsseldorf, 2015a). The Entry Standard was restructured and is now called Scale. Scale aims at being a premium segment for SME securities and demands higher standards with regard to transparency and quality of the issuer (Deutsche Börse AG, 2016). Issuers have to meet at least three out of six defined financial KPIs, for example an EBITDA Interest Coverage of at least 2.5 or a Total Net Debt to EBITDA of 5 (Deutsche Börse AG, 2017). Bonds which were listed on the Entry Standard but do not meet the increased standards are only noted in the Basic Board (Deutsche Börse AG, 2016). Only m:access and MSB, the two smallest platforms by issuance number and volume, remained the same.

2.3 Hypotheses Development

With the establishment of the German MBond segments in 2010, two factors hampering bond issuance for SMEs have been addressed. First, all platforms aimed at keeping flotation costs to a minimum. Second, the introduction of Collective Action Clauses and a bondholder representative with the new German bond regulation in 2009 facilitates bond restructuring. The high number of defaults in the MBond segments leads to the question as to whether the marginal bond issuer, entering the MBond market, is the one we would expect based on theoretical predictions and prior empirical findings, or whether low quality firms exploited a window of opportunity to extract funds from uninformed retail investors. In order to help answering this question, this paper analyzes the characteristics of companies which self-selected into this new bond market and compare them to theoretical predictions and prior empirical findings from the literature.

Prior theoretical literature predicts that smaller and more opaque firms with a high degree of information asymmetry should issue private debt instead of public bonds, since private creditors can acquire information more efficiently (Diamond, 1984; Fama, 1985). This gives rise to the following hypothesis:

H1: *MBond issuers are less opaque and show a lower degree of information asymmetry than issuers of bank or non-bank private debt.*

In addition, moral hazard problems such as underinvestment (Myers, 1977) and asset substitution (Jensen & Meckling, 1976) may arise from public debt. The Diamond (1991) model suggests that companies build up reputation by borrowing privately before issuers with good and bad reputation enter the debt capital market, to mitigate moral hazard problems. Therefore, I expect MBond issuers to have built up reputation already, prior to entering the MBond market. This leads to the second hypothesis:

H2: *MBond issuers have built up more reputation than borrowers of bank or non-bank private debt.*

Private creditors, especially banks, are considered to be more efficient in renegotiation and reorganization (Chemmanur & Fulghieri, 1994; Gertner & Scharfstein, 1991). Thus, companies with a high probability of financial distress should favor private debt. However, the introduction of Collective Action Clauses and the possibility of electing a creditor representative with the new bond regulation in Germany might have facilitated restructuring a bond out of court. Consequently, depending on the effectiveness of the new regulation, private creditors might no longer be more efficient in renegotiation and reorganization. Therefore, I expect to find:

H3: *MBond issuers are of equal or higher credit quality than those of bank debt and non-bank private debt and of comparable credit quality of other issuers of public debt.*

Growth opportunities might be valuable private information (Yosha, 1995) and might simultaneously increase the possibility of asset substitution (Jensen & Meckling, 1976; Myers, 1977), since high-growth firms can substitute or forego positive NPV projects more easily. Consequently, firms with high growth opportunities might avoid disclosure requirements of public debt and make use of the monitoring advantages of private debt. This gives rise to the following hypothesis:

H4: *MBond issuers display lower growth opportunities than borrowers of bank or non-bank private debt.*

3 Data

3.1 Sample Selection of Debt Issuers

For the analysis of SMEs issuing public debt, I am interested in companies issuing a so called MBond on one of the five German stock exchange segments. I aim to compare these MBond issuers to companies issuing other types debt. Comparable corporate debt in the sample can be structured as public debt (listed and unlisted bonds), bank debt (loans), or non-bank private debt (private placement and Schuldschein loans). Since MBonds are listed on one of the five stock exchanges and typically do not have a volume larger than EUR 150 million, other listed corporate bonds are divided into two classes: Listed bonds with an amount issued larger than EUR 150 million and listed bonds with an issuance volume smaller or equal to EUR 150 million. I exclude debt issued by financial subsidiaries of manufacturing companies if they are not consolidated in the corporate group (Arena, 2011). In addition, I exclude micro firms as defined in the "User guide to the SME Definition" published by the European Commission (European Commission, 2015b). The European Commission (2015b) defines micro firms as companies with less than 10 employees and less than EUR 2 million in Sales and Total Assets.

Public Debt

Data on MBond characteristics is gathered from the respective exchanges, prospectuses, Bloomberg, Thomson Eikon, as well as informational websites for German SME bonds www.bondguide.de and www.anleihen-finder.de. I rely on Bloomberg and Thomson Eikon to collect information on other German corporate bonds from non-financial, and non-governmental issuers.

Only bonds issued by German companies under German governing law are included to reduce interference resulting from differences in the legal environment that may arise from the introduction of the new bond regulation in

Germany in 2009. Bonds with missing information regarding governing law, which have been issued by a German company, and are classified as domestic bonds in Bloomberg, are assumed to be governed by German law. All bonds included in the sample are denominated in Euro.

In order to ensure comparability in terms and structure, I remove convertible debt, commercial papers, and debt issues with a maturity of less than a year. Bonds issued as an additional raise of capital which are later consolidated onto another bond of the same company, issued in the same year, are not included as a single observation but aggregated. In addition, for a debt issue to be added to the dataset, I require information on the amount issued. Also, companies that are not covered by the Dafne database and only disclose sparse accounting information are, in accordance with the literature (Arena, 2011), removed from the sample.

Bank Loans

Loan data is extracted from Bloomberg and complemented by data from Thomson Eikon. For my analysis I am interested in long-term debt. Therefore, I exclude Revolvers, VAT loans, Guarantees, Standby Agreements, Lines of Credit (LOC), Mezzanine Tranches, and Loan Amendments from the sample. All loans included in the sample loans are denominated in Euro. However, a major drawback for this study on SMEs issuing MBonds is that loans in Bloomberg tend to be quite large with an average (mean) amount issued of EUR 213.4 million. To counter potential bias due to issue size I create an alternative loan data set from balance sheet data from Dafne. An increase in the variable *long-term financial liabilities to financial institutions* of 50 % and at least EUR 1 million, indicates that the company has received a new bank loan. The minimum absolute increase ensures that the relative increase requirement does not capture minor increases of loans by mostly equity financed companies. This way I am able to identify loans to smaller companies as well.

However, this method has the drawback that the refinancing of bank loans is not observable. Using both loan data sets separately in the analysis, I am confident to reduce the potential bias introduced by those drawbacks.

Non-bank Private Debt

Non-bank private debt can be either structured as traditional private placement or as a specific German debt security known as Schuldschein (Schuldschein loan). I identify Private Placements by the Bloomberg "Private Placement Indicator". Schuldschein loans are marked in Bloomberg as "Schuldschein" in the variable "Local Issuing Structure".

Schuldschein loans are a special German financing alternative. As bilateral credit agreements, they are comparable to a loan but can have a dispersed ownership like a bond, even though they are not a security in legal terms (Achleitner & Volk, 2013; Koller, 2014). Therefore, no prospectus is required and general documentation requirements are low compared to a bond (Koller, 2014). In combination with the fact that formally no rating is needed, a Schuldschein can be a comparatively cheap financing alternative with regard to emission costs (Koller, 2014). They can be split up into several tranches with different coupons and maturity (Achleitner & Volk, 2013; Koller, 2014).

Schuldschein loans also allow for more discretion than MBonds, since placement and trading is mostly done by fixed income departments of investment banks, and the counterparties are known (Achleitner & Volk, 2013; Koller, 2014). Such counterparties are usually large institutional investors, like other banks, insurance companies, or pension funds pursuing a "buy-and-hold" strategy (Koller, 2014). Retail investors are not allowed to invest into Schuldschein loans (Koller, 2014). As a consequence, the creditor structure can be expected to be less dispersed and more professional compared to MBonds. Although creditors are smaller in numbers, known to the debtor, and change less frequently, Schuldschein loans might be harder to renegotiate, since the SchVG

is not applicable (Koller, 2014). In addition, since the small number of creditors with their buy-and-hold strategy results in a less liquid secondary market, creditors might require higher returns as a compensation (Koller, 2014). In terms of the creditor structure and reduced documentation requirements, the German Schuldschein is comparable to a US 144A issue, as used by Denis and Mihov (2003) and Arena (2011).

Bloomberg mostly has data for Schuldschein loans starting in 2017 and later. Thus, the data on Schuldschein loan issues is complemented with those from Thomson Eikon. Schuldschein loan issues can be divided in tranches with different maturity. To follow the literature, I aggregate Schuldschein loan issues with different maturities to one observation per issue (Denis & Mihov, 2003). At the same time this procedure also eliminates the problem that Bloomberg falsly shows the aggregated volume for each tranche instead of the single tranche size. Unfortunately, data on coupons of Schuldschein loans is not available on Bloomberg and Thomson Eikon.

For all debt types, I follow Denis and Mihov (2003) and aggregate debt issues of the same type and issuer based on year. This corresponds to the yearly financial data collected from Dafne.

Rating Data

Rating data is provided by Bloomberg and hand collected from prospectuses and rating certificates of MBond issuers. I include ratings by Creditreform, EJR, Euler Hermes, Fitch, Moody's, S&P, and Scope. Some companies, especially those issuing MBonds, are only rated by one of the German rating agencies: Creditreform, Euler Hermes, Feri, or Scope. Following Denis and Mihov (2003) and Arena (2011), the rating is either the rating of the debt security at issuance, issuer rating, or senior debt rating of the debtor if the company had issued rated debt in the past. If an issuer has been rated by mul-

tiple rating agencies in the same year, ratings are mapped to numerical values and averaged. The rounded rating value is then mapped back to S&P-style letter rating.

Financial Data

Balance sheet and other financial data, for the years 2008 to 2018, is extracted from Bureau van Dijk database, Dafne. Hand-collected financial data from the financial statements of MBond-issuers is added when data is missing in the Dafne database.

3.2 Variables

For the analysis, different measures proposed by prior literature serve as proxies for opacity, reputation, credit quality, as well as growth opportunities, and control for other factors that might influence the choice between public and private debt.

For opacity, I use size measured as total assets, the tangibility of assets, and two dummy variables indicating whether the company is publicly listed or rated, as proxies. Larger and / or publicly traded companies are required to disclose more information and are more likely to be covered by analysts (Gomes & Phillips, 2012; Meneghetti, 2012). In addition, the stock price also contains information about a company (Gomes & Phillips, 2012). Tangible assets can be evaluated more easily than intangible assets and, therefore, can be pledged as collateral (Cantillo & Wright, 2000; Johnson, 1997). Collateral can reduce the risk of asset substitution (Johnson, 1997; Stulz & Johnson, 1985). The credit rating of a company reduces information asymmetry regarding its credit quality.

Age and Prior Debt Capital Markets Experience are used as proxies for reputation, as proposed by the model of Diamond (1991). Age is calculated as the difference between the year of the observation and the year of incorporation,

as noted in the Dafne database. Prior Debt Capital Markets Experience is a dummy variable equal to 1 if the company has issued a bond or non-bank private debt prior to issuance.

A higher likelihood of financial distress, as implied by a sub-investmentgrade rating, should be negatively correlated with the issuance of public debt. However, since a large fraction of companies in the sample does not have a credit rating, I also have to rely on other measures to evaluate the credit quality and the risk of financial distress of those companies. As in Arena (2011), Denis and Mihov (2003), and Mietzner et al. (2018) the Altman-Z-Score for private firms (Altman, 2002) is used for that purpose.

Growth opportunities might increase the risk of asset-substitution (Jensen & Meckling, 1976; Myers, 1977) and might also indicate the presence of proprietary information (Krishnaswami et al., 1999; Yosha, 1995). Thus, growth opportunities are expected to be negatively related to public debt. Since the sample has a large fraction of private companies, I cannot rely on Tobin's Q to measure growth opportunities. As proposed by prior literature, capital expenditures (CapEx) is used as a proxy for growth opportunities (Arena, 2011; Denis & Mihov, 2003). Capital expenditures are calculated as the difference between tangible assets in year t and t-1 plus depreciation in year t.

In addition, I control for debt capacity and relative flotation costs using leverage and amount issued as proxies (Krishnaswami et al., 1999).

Defaults are identified by the *Defaulted* variable in Bloomberg, which considers a debt instrument to be in default when the issuer has failed to pay interest or principal when due or filed for bankruptcy. I augment defaults from Bloomberg with insolvency data for all German companies from the Dafne database. Thus, bonds restructured out of court are not flagged as defaulted, since debtor and creditors have agreed on postponing or deferring payments and the issuer is not in formal bankruptcy proceedings. Including debt restructurings out of court would result in a lot more defaults. Thus, my analysis can

be considered conservative in this regard.

Following the literature, continuous variables are winsorized at the 1% level. Table 9 in the appendix provides details on the calculation of the variables.

4 Descriptive Statistics

Table 1 documents the development of debt issues by issue type in the sample. Issues are aggregated by year and company. The total amount of debt raised by firms in the sample is EUR 757.6 billion in 4,946 issues between 2010 and 2018. For comparison, Denis and Mihov (2003) analyzed 1,560 debt issues with a total amount of USD 349.9 billion, for the years 1995 and 1996 and Arena (2011) analyzed 9,478 debt issues between 1995 and 2003. Thus, the sample size is significantly larger than the one used by Denis and Mihov (2003) and spans the same time horizon as Arena (2011). Out of these 4,946 issues, 117 were MBonds with a total amount of EUR 5.1 billion. Although comparatively small overall, between 2011 and 2013, MBond issues were as frequent and large as other types of bond issues in the sample. Overall, between 2010 and 2018 MBonds account for 16.2% of all bond issues in the sample. Thus, MBonds have been a relevant financing alternative for companies.

[Insert Table 1 here]

Table 2 reveals that, between 2010 and 2018, 32.8% of the 122 MBonds[3] in the sample defaulted. Compared to the cumulative realized default rate of 3.1% in the sample, this number is alarming. An investment volume of EUR 1.7 billion was affected by the defaults of MBond issuers. Applying the average recovery rate of a senior unsecured bond in 2013 of 45.0 % (Moody's Investors Service, 2018) as lower bound, this translates into a loss of at least EUR 0.9

[3]Note that the number of issues here (122) is different to the aforementioned number in Table 1 (117). This is because issues in Table 1 are aggregated per year and company, whereas defaults relative to issues in Table 2 show unaggregated numbers of debt securities. To show unaggregated defaults is more accurate than showing aggregated numbers of defaults since aggregating securities with different maturities might overstate the number of defaults.

billion in investment volume.

[Insert Table 2 here]

Table 3 reports characteristics of new debt issues by issue type. Comparing the average loan amount of the two loan types in the sample, it becomes apparent that the loans extracted from Bloomberg and Thomson Eikon with a mean loan size of EUR 213.4 million (median: EUR 60.1 million) are much larger than the loans derived from balance sheet data from the Dafne database, which report a mean loan size of EUR 30.6 million (median: EUR 3.7 million). I use both types of loans in my analyses for robustness to control for the shortcomings and potential bias of the other. With EUR 42.0 million (median: EUR 30.0 million) the average amount issued of an MBond lies between both types of loans.

[Insert Table 3 here]

With an average (mean) coupon of 7.23% (Median: 7.25%) MBonds report the highest coupons in the sample, indicating the riskiness of the investment. Despite high coupons, MBonds were less attractive for large institutional investors, due to the relatively small issuance volumes (Börse Düsseldorf, 2015b). However, the high coupon payments were attractive for retail investors (Hermann, 2017). Since ratings were required for most MBond platforms, 88 % of MBonds report a rating and more than one third even report an investment grade rating.

The maturity of a debt security influences its risk, since credit quality of a debtor is harder to assess in the far future than in the near future. The average maturity of MBonds of 5.4 years (median: 5.0 years) matches the average maturity of other listed bonds with an amount issued less than or equal to EUR 150 million, unlisted bonds and loans. Thus, the maturity structure of MBonds is not riskier. Similar to unlisted bonds and other listed bonds with an amount issued lower-equal EUR 150 million, MBonds were mostly unsecured. Since on most platforms MBonds were not allowed to be subordinated, explicit

subordination does not play a role for MBonds.

Although the MBond market was advertised as market for bonds issued by small- and medium-sized enterprises, Table 4 reveals that MBond issuers are not in fact SMEs in terms of standard definitions, since they are larger. The European Commission (2015b) defines SMEs as companies with less than 250 employees and an annual turnover of less than EUR 50 million or total assets of less than EUR 43 million. However, the median MBond issuer has 429 employees, sales of EUR 103.0 million and total assets of EUR 91.0 million. Thus, more than half of the MBond issuers are not SMEs by definition. Nevertheless, MBond issuers are smaller in terms of sales and total assets than all other bond issuers and significantly smaller than issuers of non-bank private debt.

[Insert Table 4 here]

Although leverage is comparable for MBond issuers and issuers of other bonds in the year prior to the bond issue, MBond issuers issue significantly larger amounts of debt compared to total assets and total debt in t = -1, the year prior to the MBond issue.

5 Results

5.1 Comparison of Debt Issuers

Table 5 reports average values for the variables of interest in the year prior to issuance. In terms of opacity and information asymmetry the picture is not clear. On the one hand, MBond issuers are the smallest among public and private debt security issuers. On the other hand, MBond issuers are larger than borrowers of loans according to the Dafne database and display a relatively high ratio of tangible assets to total assets. In addition, since ratings were required on most platforms, most MBond issuers have a rating. Thus, it appears that MBond issuers are the less opaque from the small firms.

[Insert Table 5 here]

Looking at age as a proxy variable for reputation, I find that MBond issuers are younger than other borrowers except for issuers of other listed bonds with a maximum amount issued of EUR 150 million. In addition, MBond issuers show less prior debt capital markets experience than other issuers of public and private debt securities. However, they have more debt capital markets experience than bank borrowers from both the Bloomberg / Thomson Eikon and the Dafne loan sample.

Credit quality is evaluated by rating and Altman Z-Score. Median rating for MBond issuers, other small listed bonds and loans from the Bloomberg / Thomson Eikon sample is non-investment grade, BB. Only private placements display a worse median rating of B. Other borrowers have median BBB investment grade rating. However, it is worth mentioning that only few Schuldschein loan issuers and bank borrowers were rated. In addition, MBonds were mostly rated by none of the big three rating agencies but by one of the smaller local German rating agencies, Creditreform, Euler Hermes, Feri, or Scope. Thus, rating quality might not be comparable. That is why I also look at how many issuers are in financial distress according to Altman Z-Score. It was found that one third of the MBond issuers and unlisted bond issuers display a Z-Score less than 1.1, which indicates financial distress (Altman, 2002). This is worse than all other debt classes, except for issuers of Private Placements, of which 44% display a Z-Score of less than 1.1. Thus, it appears that MBond issuers are of worse credit quality compared to most other debt classes.

Evaluating growth opportunities, measured as CapEx scaled by total assets, I find that MBond issuers appear to be high growth firms compared to all other borrowers.

5.2 The Choice to Issue an MBond

In order to provide further evidence for the factors influencing the choice to issue a bond in one of the MBond segments, I estimate a multinomial logistic regression model of debt issue type on proxy variables for opacity, reputation, credit quality, and growth opportunities.

$$DIT_{it} = \alpha + \alpha_t + \beta^{op} * OP_{it} + \beta^{rep} * Rep_{it} + \beta^{cq} * CQ_{it} + \beta^{g} * G_{it} + \gamma * X_{it} + \epsilon_{it} \quad (1)$$

The dependent variable debt issue type (DIT) is a nominal variable that can take on seven states: Bonds (listed) with either amount issued larger than EUR 150 M (1) or lower-equal to EUR 150 M (2), unlisted bonds traded over the counter (OTC) (3), traditional private placements (4), Schuldschein (5), bank loans (6) or MBonds (7). *OP* represents a vector of proxies for opacity: size, measured as natural logarithm of total assets, the ratio of tangible assets to total assets, a dummy variable that is 1 if the issuer is publicly listed, and a dummy variable that is 1 if the issuer or the debt security has a credit rating. *Rep* represents a vector of proxies for reputation: age and prior debt capital markets experience. *CQ* represents a vector of proxies for credit quality: Investment Grade is a dummy variable that is equal to 1 if the issuer has an investment grade rating, Altman-Z < 1.1 is a dummy variable equal to 1 if the Altman-Z score is lower than 1.1 which implies financial distress. *G* includes proxies for growth opportunities, that is CapEx scaled by total assets. *X* is a vector of control variables to control for debt capacity, namely leverage and amount issued. I also include time fixed effects. Table 6 reports the regression results. Since I am interested in the difference of MBond issuers compared to issuers of other types of public and private debt, MBonds are defined as baseline for the multinomial logit model. Thus, each column analyzes the probability of issuing the specified type of debt relative to issuing an MBond

on one of the five platforms.

[Insert Table 6]

Regarding Hypothesis 1, mixed results were found. On the one hand, an increase of total assets increases the probability not to issue an MBond across all alternative types of debt. Large firms are thought to be less opaque, since requirements for disclosure increase with size. Consequently, this result indicates a higher opaqueness for MBond issuers, which contradicts predictions, since more opaque firms are expected to issue private debt. On the other hand, controlling for size, MBond issuers are more likely to be publicly listed companies compared to two out of three types of private borrowers, namely bank borrowers and issuers of a Schuldschein. Public companies have to comply with additional disclosure requirements and stock prices contain additional information about the prospects of a company. Thus, being public is associated with a lower degree of information asymmetry and opaqueness. In addition, MBond issuers are more likely to be rated, which is thought to reduce information asymmetry and opaqueness as well. The result that being rated has a significant positive impact on the probability to have issued a MBond is not surprising, since having a rating was a requirement for listing on most of the five MBond platforms. Tangible assets are easier to assess compared to intangible assets and can be pledged as collateral more easily. Therefore, a higher ratio of tangible assets is associated with less opaqueness. MBond issuers display lower tangible assets compared to all other debt issuers, except for private placements.

The results indicate that the MBond market was used by smaller companies with less tangible assets, which are thought to be more opaque than large companies with more tangible assets. However, controlling for size, MBond issuers also display characteristics which are associated with less information asymmetry and opaqueness, such as being a public company. This result is in line with the theoretical predictions stating that if it is costly for firms to cred-

ibly disclose information they are more likely to issue private debt. Companies that are already public have to prepare less additional information compared to private companies. Moreover, obtaining a rating for one of the five platforms was comparatively cheap, since most ratings were issued by one of the small German rating agencies, which are less costly compared to the big three (Hasler, 2012; Standard & Poor's, 2020). Nevertheless, these results contradict prior empirical studies which find a positive relation between the probability to issue public debt and size, measured as total assets (Cantillo & Wright, 2000; Denis & Mihov, 2003; Krishnaswami et al., 1999). I partially attribute the difference to the new market segment here, which allowed smaller companies to issue bonds.

Following prior literature, the age of a company serves as proxy for reputation. In addition, I use prior debt capital markets experience as an indicator of reputation, since repeated borrowing is expected to mitigate the moral hazard problem (Diamond, 1991). I find that MBond issuers are younger than any other type of debt issuer, except for issuers of other small volume bonds with issuance volumes of less than or equal to EUR 150 million. This finding seems to contradict the predictions from the Diamond model (Diamond, 1991). However, the effect of an additional year is small. It has to be noted that in this analysis I investigate the marginal impact of reputation, measured as age. Referring to Tables 4 and 5 it can be seen that the average age of an MBond issuer is 24 (Median: 16). Thus, MBond issuers might be younger relative to issuers of other types of debt but on average they are not young in absolute terms. Thus, the relationship between the proxy variable age and the real variable reputation might be diminishing.

Looking at prior debt capital markets experience as additional measure for reputation, I find that bank borrowers are less likely to have debt capital market experience. This finding is in line with the Diamond model (Diamond,

1991) suggesting that companies gain reputation by borrowing from banks before tapping public debt markets. However, as already stated, bank loans from Bloomberg / Thomson Eikon suffer from a selection issue. In the next section, I will use an alternative set of bank borrowers extracted from Dafne to deal with this selection issue. Interestingly, issuers of listed bonds with a volume up to EUR 150 million are more likely to borrow repeatedly from debt capital markets. This indicates that MBond market segments might serve as entrance to the public debt market for small volume corporate bonds.

Contrary to Hypothesis 3, I find that MBond issuers appear to be of lower credit quality compared to five out of six different issuer types, in terms of at least one of the two measures of credit quality. It is noteworthy that MBond issuers appear to be of lower credit quality compared to issuers of two out of three types of private debt, namely issuers of a Schuldschein and bank borrowers. Issuers of a Schuldschein are more likely to have an investment grade rating and are less likely to be in the high-bankruptcy-risk zone, according to Altman Z-Score (Altman, 2002). Bank borrowers from the Bloomberg and Thomson / Eikon sample are less likely to be in the high-bankruptcy-risk zone, according to Altman Z-Score, compared to issuers of an MBond. Only private placements are of lower credit quality than MBonds.

These results contradict prior empirical findings by Arena (2011) and Denis and Mihov (2003), who identified a pecking order of debt issuance relative to credit quality. The authors find that debtors of the highest credit quality issue public debt, debtors of medium credit quality borrow from banks, and debtors with low credit quality borrow from non-bank private lenders (Denis & Mihov, 2003).

However, it is important to keep in mind that results of the investment grade variable for Listed Bonds ($\leq$ 150 Mill), unlisted bonds, Schuldschein loans and bank loans, might not be meaningful, since only a minority of re-

spective issuers were rated.

Contrary to the expectations on growth opportunities, formulated in Hypothesis 4, I confirm the findings from the prior analysis: MBond issuers appear to be high-growth firms, compared to the other debtors.

In order to control for the possibility that the results are driven by the different size of issuers across different debt types, I will use the alternative loan sample derived from the Dafne database and restrict the sample to issuers of debt smaller or equal to EUR 150 million issuance volume in subsequent analyses discussed in the next section.

6 Robustness

6.1 Alternative Loan Sample Based on Balance Sheet Data from Dafne

The loans extracted from Bloomberg and Thomson / Eikon for the previous analysis suffer from a selection bias, since with an average loan amount of EUR 213.4 million (median: EUR 60.1 million) they are comparatively large. As a consequence, the loan borrowers in the first analysis might significantly differ from the average German SME borrowing from a bank. For example, companies borrowing larger amounts are probably also larger in overall size, measured as total assets. To counteract this shortcoming, I construct an alternative loan sample from balance sheet data for the universe of German companies extracted from the Bureau van Dijk Dafne database. Loans in the Dafne sample are identified by an increase of long-term liabilities owed to financial institutions by at least 50% and EUR 1 million.

[Insert Table 7 here]

Results are presented in Table 7. In general, the prior findings seem to be robust against the aforementioned selection problem. Bank borrowers from the Dafne loan sample are less likely to have prior debt capital market experience.

This result is in line with the predictions from the Diamond model (Diamond, 1991) that reveals that companies borrow from banks to build up reputation before tapping the public debt markets.

For credit quality, the results are confirmed as well. Bank borrowers from the Dafne loan sample are less likely to be in the high bankruptcy risk zone (Altman-Z < 1.1). Only private placements are of worse credit quality than MBond issuers.

Although this approach solves the bias in terms of size, it introduces a different selection problem. By using an increase in long-term liabilities owed to financial institutions the refinancing of bank loans is unobservable. However, companies borrowing additional money might significantly differ from those borrowing to refinance their existing loans. The former might, for example, have more growth opportunities than the latter. For this reason, it is important not to view the analysis of MBond issuers compared to bank borrowers in isolation, since they complement each other.

6.2 Restrict Sample to Issues of Comparable Size

In order to address the problem of excluding the refinancing of a loan in the Dafne loan sample, while simultaneously taking the size selection into account, I restrict the sample to debt issues with a maximum issuance volume of EUR 150 million in the subsequent analysis. Results are presented in Table 8.

[Insert Table 8 here]

The results from previous analyses still appear to hold in the selected subsample, with minor changes. Issuers of small volume listed bonds, Schuldschein loans, and bank loan are still less likely to be in the high bankruptcy risk zone (Altman-Z < 1.1) compared to MBond issuers. However, investment grade

ratings become insignificant, which is probably related to fewer rated issuers in the subsample. In addition, only small volume listed bond issuers and bank loan borrowers display less growth opportunities than MBond issuers. Overall, the robustness tests do not support different conclusions.

7 Conclusion

This study provides empirical evidence on whether the choice of companies to enter the newly established German MBond market is in line with theoretical predictions and prior empirical findings regarding the choice between public and private debt. I use a sample of 4,946 new debt financings between 2010 and 2018 for public and private firms to analyze four determinants of the choice to issue a bond on one of the MBond segments: reputation, opaqueness, credit quality, and growth opportunities. I also add to the literature by analyzing the choice of debt of smaller and private companies for the first time.

With regard to reputation, I find that MBond issuers tend to be younger than other debtors which seems to contradict predictions from the Diamond model (Diamond, 1991). However, although age is a standard proxy for reputation in the literature, it might be the case that the effect of marginal age shows diminishing correlation with actual reputation. For example, the effect on reputation between the age of one and the age of two of a company is probably higher than the effect on reputation between the age of 25 and 26 of a company. In the sample, the average age of an MBond issuer is 24 (median: 16). Although multivariate results in the multinomial logit show that MBond issuers are younger than other debtors, the impact is marginal. In addition, they appear to have less debt capital markets experience compared to issuers of other listed small-volume bonds (with issuance volume lower / equal EUR 150 million). Comparing debt capital market experience of MBond issuers and an alternative sample of bank borrowers, I find that MBond issuers have more

debt capital market experience. This is in line with predictions of the Diamond model which states that debtors build up reputation by borrowing from banks before they tap the public debt markets (Diamond, 1991).

With regard to opaqueness, results are mixed. Although MBond issuers are more likely to be comparatively small in terms of total assets, they are also more likely to be public and rated. Having a rating was a requirement for most of the MBond segments. However, these results assume that ratings are informative. There is evidence that ratings might have been inflated for MBonds (Mietzner et al., 2018).

Comparing the issuance of MBonds with a large sample of public and private debt issues of different type, MBond issuers appear to be of lower credit quality. This finding contradicts theoretical literature arguing that private debt is more efficient in financial distress. In addition, the findings contradict prior empirical studies of Denis and Mihov (2003) and Arena (2011), who conclude that public debtors are of better credit quality than bank borrowers. The authors argue that the dispersed ownership of bonds makes them harder to renegotiate. For this reason, debtors of lower credit quality might prefer to issue private debt instead. However, the introduction of Collective Action Clauses and the possibility to appoint a creditor representative in the new German bond regulation in 2009 facilitated the restructuring of bonds, which might enable companies with lower credit quality to tap the debt capital markets. Nevertheless, the new bond regulation does not justify worse credit quality of MBond issuers compared to issuers of other bonds. Other bond issuers face the same renegotiation problems.

In addition, it has been shown that MBond issuers display more growth opportunities. This result also contradicts theoretical predictions and might increase the risk of asset substitution.

The results are robust to restricting issuers to debt financings with a volume of less than or equal to EUR 150 million and an alternative loan sample, which

is more representative for the universe of German corporations.

Moreover, it is noteworthy that although MBond issuers are smaller than other issuers of public debt, they are still too large to be considered SME, according to standard definitions for SMEs. There is anecdotal evidence that the narrative SME (the German "Mittelstand") was used to market high-yield bonds of comparatively small companies to uninformed retail investors (Florstedt, 2017; von Randow, 2017). Together with the high number of defaults this indicates that some companies with low credit quality took advantage of a window of opportunity to secure funds from retail investors, when they could not obtain any more bank financing. However, this requires that investors were unable to assess the riskiness of the MBonds. The presence of companies with low credit quality is not problematic as long as pricing is efficient and expected returns reflect the riskiness of the respective MBonds. For further research it may be interesting to evaluate whether the default risk has been priced adequately in these market segments, given the fact that these segments targeted retail investors directly. Moreover, it would be interesting to assess whether the proceeds were used for investments, refinancing of bank loans, or to cover prospective losses.

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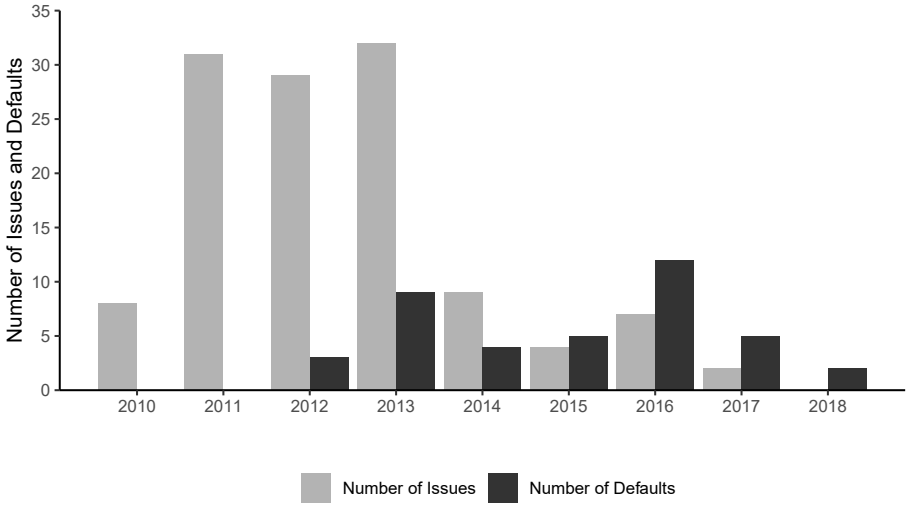
Appendix

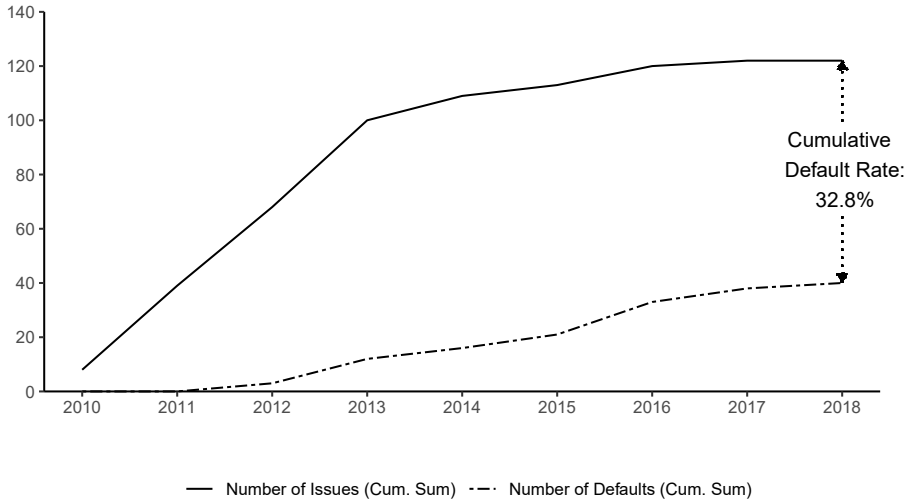
A.I Figures

Figure 1: The Development of the German MBond Market

(a) Number of Issues and Defaults per Year



(b) Cumulative Number of Issues and Defaults



This figure shows the development of the German MBond market from its opening in 2010 to its collapse. The numbers of issues and number of defaults are not aggregated. The *Defaulted* variable in Bloomberg, which considers a debt instrument to be in default when the issuer failed to pay interest or principal when due or filed for bankruptcy, serves to identy defaults. I double check defaults from Bloomberg with insolvency data from the Dafne database. Subfigure (a) presents annual numbers of MBond issues and defaults. Subfigure (b) presents the cumulative numbers of MBond issues and defaults.

A.II Tables

Table 1: Sample of Debt Securities Issued in Germany (2010 - 2018)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Number of Issues										
Bond (listed) > 150 Mill	17	14	23	30	30	30	24	24	25	217
Bond (listed) ≤ 150 Mill	19	25	17	23	24	11	13	18	21	171
MBond	7	30	28	31	9	4	6	2	-	117
Bond (unlisted)	27	31	31	23	26	13	18	20	27	216
Priv. Placement	5	10	14	16	12	16	6	12	11	102
Schuldschein Loans	6	7	29	34	46	70	62	97	92	443
Loans (BBG / Eikon)	75	100	88	120	150	162	150	82	73	1,000
Loans (Dafne)	338	385	343	367	393	299	89	105	71	2,680
Total	**494**	**602**	**573**	**644**	**690**	**605**	**368**	**360**	**320**	**4,946**
Total Issue Volume in EUR million										
Bond (listed) > 150 Mill	15,198	7,088	23,942	27,120	28,164	24,577	30,885	22,666	25,255	204,895
Bond (listed) ≤ 150 Mill	707	963	600	591	707	348	257	716	632	5,522
MBond	648	1,560	1,243	965	218	170	212	110	-	5,126
Bond (unlisted)	2,755	6,003	4,029	1,498	801	596	463	165	941	17,250
Priv. Placement	1,432	4,153	6,490	4,774	4,030	4,568	3,013	3,346	2,246	34,052
Schuldschein Loans	920	360	2,051	2,408	5,077	10,972	12,138	17,600	11,571	63,098
Loans (BBG / Eikon)	22,245	27,750	36,521	46,599	51,973	49,654	39,233	30,493	41,284	345,753
Loans (Dafne)	6,838	7,411	4,670	5,794	9,835	7,137	5,368	15,395	14,889	81,928
Total	**50,744**	**55,289**	**79,546**	**89,748**	**100,803**	**98,022**	**91,569**	**90,493**	**96,818**	**757,624**

The number of issues and issue volume are aggregated by debt type, issuer and year of issuance. Data on all debt securities is provided by Bloomberg and Thomson Reuters Eikon. Only corporate bonds from non-financial German enterprises, issued in Germany, governed by German law and denominated in Euro are included. MBonds are defined as bonds issued in one of the five specialized MBond segments of the respective German stock exchanges (Stuttgart, Frankfurt, Düsseldorf, Hamburg / Hannover and Munich). Missing data on MBonds is replaced by hand-collected data from the prospectuses and exchange segments. I exclude convertible debt and commercial papers, as well as debt securities with a maturity of less than one year. Loan data from Bloomberg and Eikon is only available starting 2009. Loan data covers syndicated or single-lender loans. I exclude Revolvers, VAT loans, guarantees, standby loans, lines of credit (LOC) and loan amendments from the sample. For Schuldschein and term loan tranches with different maturities, aggregated maturities are weighted by tranche size (amount issued). Loans (Dafne) are identified by an increase in Bank liabilities of at least 50% and EUR 1 Million.

Table 2: Defaults of Debt Securities in our Sample (2010 - 2018)

	Issues and Defaults:					
	by Number			by Volume (in EUR Mill)		
	Issues (n)	Defaults (n)	n in %	Issues (Vol)	Defaults (Vol)	Vol in %
Bond (listed) > 150 Mill	348	6	1.7	199,676.8	1,999.8	1.0
Bond (listed) ≤ 150 Mill	283	22	7.8	10,739.4	901.0	8.4
MBond	122	40	32.8	5,126.3	1,709.2	33.3
Bondm	*32*	*13*	*40.6*	*2,038.0*	*815.5*	*40.0*
Entry Standard	*66*	*20*	*30.3*	*2,499.8*	*733.2*	*29.3*
m:access	*3*	*1*	*33.3*	*55.0*	*25.0*	*45.5*
Mittelstandsmarkt	*20*	*5*	*25.0*	*508.5*	*110.6*	*21.7*
MSB	*1*	*1*	*100.0*	*25.0*	*25.0*	*100.0*
Bond (unlisted)	273	16	5.9	17,249.8	272.8	1.6
Priv. Placement	131	4	3.1	34,052.2	68.0	0.2
Schuldschein Loans	1,051	3	0.3	63,097.7	165.0	0.3
Loans (BBG / Eikon)	1,620	26	1.6	345,753.3	2,616.6	0.8
Total	**3,828**	**117**	**3.1**	**675,695.6**	**7,732.5**	**1.1**

The number of issues and number of defaults are not aggregated. Volume is denoted in EUR million. Note that some bonds are reclassified to ≤ 150 M since bonds are not aggregated by issuer, type and year. Thus, for listed bonds volumes differ compared to Table 1. To identify defaults I make use of the *Defaulted* variable in Bloomberg, which considers a debt instrument to be in default when the issuer failed to pay interest or principal when due or filed for bankruptcy. I double check defaults from Bloomberg with insolvency data from the Dafne database. Bonds restructured out of court are not flagged as defaulted, since debtor and creditors agreed on postponing or deferring payments and the issuer is not in formal bankruptcy proceedings.

Table 3: Average Characteristics of Debt Securities in Germany (2010 - 2018)

		Obs.	Amount Issued	Coupon	Maturity	Secured	Subordinated	Rated	Investment Grade
Bond (listed) > 150 Mill	mean	348	573.78	2.73	9.76	0.32	0.06	0.74	0.77
	median	348	500.00	2.12	7.00	0.00	0.00	1.00	1.00
Bond (listed) ≤ 150 Mill	mean	283	37.95	5.11	5.72	0.14	0.08	0.23	0.61
	median	283	25.00	5.30	5.00	0.00	0.00	0.00	1.00
MBond	mean	122	42.02	7.23	5.39	0.16	0.00	0.88	0.38
	median	122	30.00	7.25	5.00	0.00	0.00	1.00	0.00
Bond (unlisted)	mean	273	63.19	6.97	5.69	0.11	0.03	0.11	0.74
	median	273	6.00	6.50	5.00	0.00	0.00	0.00	1.00
Priv. Placement	mean	131	259.94	5.54	6.85	0.70	0.00	0.48	0.24
	median	131	250.00	5.38	6.04	1.00	0.00	0.00	0.00
Schuldschein Loans	mean	1,051	60.04	-	7.38	0.02	0.00	0.09	0.81
	median	1,051	35.00	-	7.00	0.00	0.00	0.00	1.00
Loans (BBG / Eikon)	mean	1,620	213.43	3.84	5.88	0.57	0.00	0.10	0.32
	median	1,620	60.15	3.92	5.00	1.00	0.00	0.00	0.00
Loans (Dafne)	mean	2,680	30.57	-	-	-	-	0.01	0.52
	median	2,680	3.74	-	-	-	-	0.00	1.00

This table reports unaggregated mean / median characteristics of debt issued between 2010 and 2018 on issuance level. Amount Issued is aggregated for different tranches based of the same debt issue. Amount Issued is measured in EUR million; Coupon in %; Maturity in Years; Secured, Subordinated and Investment Grade are dummy variables. Coupon, Maturity, Secured, and Subordinated for aggregated issues are weighted by Amount Issued. Investment Grade is only based on rated securities. Ratings for MBonds are handcollected from prospectuses and / or rating certificates; Ratings for other bonds are taken from Bloomberg. Note that unaggregated values in this table can differ to aggregated values in other tables. See Table 1 for more information on other data sources.

Table 4: Average Firm Characteristics (Median)

	Bonds				Non-Bank Priv. Debt		Bank Priv. Debt	
Median (t = -1)	Listed (> 150 Mill)	Listed (≤ 150 Mill)	MBonds	Unlisted	Private Placements	Schuldschein Loans	Loans (BBG / Eikon)	Loans (Dafne)
Total Assets (in M)	9,801	163	91	150	1,105	990	388	34
Sales (in M)	9,664	110	103	115	769	1,065	411	84
Employees	28,610	243	429	186	2,052	3,273	1,562	223
Age	35	17	16	15	18	30	19	24
CapEx Ratio	0.05	0.03	0.06	0.04	0.05	0.06	0.06	0.05
Sales Growth	0.04	0.03	0.07	0.01	0.04	0.05	0.05	0.04
ROA	0.04	0.01	0.02	0.02	0.01	0.04	0.02	0.05
Altman-Z-Score	2.03	2.00	1.97	2.02	1.18	2.06	2.17	3.34
Tangibles	0.24	0.18	0.27	0.21	0.18	0.28	0.23	0.23
Leverage	0.69	0.78	0.75	0.76	0.73	0.68	0.69	0.62
Bank Debt Ratio	0.09	0.25	0.34	0.24	0.18	0.34	0.39	0.12
Public Debt Ratio	0.25	0.34	0.32	0.22	0.22	0.17	0.22	0.24
Non-Bank Priv. Debt Ratio	0.65	0.35	0.35	0.56	0.50	0.63	0.59	0.67
Amount Issued / TA	0.06	0.15	0.37	0.08	0.17	0.09	0.20	0.13
Amount Issued / TD	0.10	0.18	0.54	0.11	0.20	0.14	0.31	0.22
Observations	169	107	85	99	56	331	616	2,680

This table displays median values for key variables, describing companies issuing different types of debt between 2010 and 2018 in the year prior to issuance (t = -1). "Loans (Dafne)" include companies which saw an increase of 50 % and at least EUR 1 million in their liabilities owed to financial institutions. Total Assets, Sales and Amount Issued denoted in EUR million; Age in years. Capital Expenditures are scaled by total assets. Amount Issued shows aggregated tranches by debt type, issuer and year of issuance. Thus, numbers may differ to tables reporting unaggregated values on debt issue level. A detailed variable description is available in the appendix.

Table 5: Comparison of Debt Issuers

	Bonds				Non-Bank Priv. Debt		Bank Priv. Debt	
	Listed (> 150 Mill)	Listed (≤ 150 Mill)	MBonds	Unlisted	Private Placements	Schuldschein Loans	Loans (BBG / Eikon)	Loans (Dafne)
Opacity								
Total Assets (in M)	9,801	163	91	150	1,105	990	388	34
Tangibles	0.24	0.18	0.27	0.21	0.18	0.28	0.23	0.23
Public	0.77	0.32	0.28	0.31	0.50	0.37	0.28	0.08
Rated	0.61	0.25	0.89	0.19	0.54	0.12	0.12	0.01
Reputation								
Age	62	25	24	34	40	52	37	40
Debt Capital Markets Exp.	0.42	0.34	0.15	0.18	0.20	0.20	0.09	0.01
Credit Quality								
Rating	BBB	BB	BB	BBB	B	BBB	BB	BBB
Inv. Grade	0.70	0.41	0.34	0.63	0.27	0.78	0.43	0.52
Altman-Z-Score	2.09	1.88	1.89	1.85	1.34	2.64	2.36	3.51
Altm. Z < 1.1	0.20	0.27	0.31	0.32	0.44	0.22	0.24	0.15
Growth Opportunities								
CapEx Ratio	0.06	0.05	0.09	0.06	0.07	0.07	0.07	0.07
Control Variables								
Leverage	0.67	0.77	0.72	0.76	0.75	0.66	0.69	0.61
Amount Issued (in M)	500	25	30	10	255	74	100	4
Observations	169	107	85	99	56	331	616	2,680

This table reports average values for the key variables of interest and the control variables for debt capacity. For Total Assets, Tangibles, Amount Issued (in M) and Rating, median values are reported. All other variables are reported as means. "Altm. Z < 1.1" is dummy variable equal to 1, if Altman-Z-Score < 1.10, meaning the company is in the high bankruptcy risk zone (Altman, 2002). Capital Expenditures are scaled by total assets. Note that this table reports values for observations aggregated by debt type, issuer and year of issuance. Thus, numbers may differ to tables reporting unaggregated values on debt issue level. A detailed variable description is available in the appendix.

Table 6: Multinomial Logit - Debt Securities (incl. loans BBG / Eikon) compared to MBonds sample 2010 - 2018

	MBonds as baseline					
	Bonds (listed) > 150 M	Bonds (listed) ≤ 150 M	Bonds (unlisted)	Private Placement	Schuldschein Loans	Bank Loans
ln(TA)	1.257***	0.639***	0.621***	0.631***	1.074***	0.602***
	(0.022)	(0.021)	(0.021)	(0.024)	(0.022)	(0.024)
Tangibles	0.886***	1.061***	0.415***	−0.159**	1.539***	0.723***
	(0.177)	(0.121)	(0.130)	(0.065)	(0.310)	(0.273)
Public	0.009	−0.247	−0.393*	0.184	−0.548***	−0.767***
	(0.205)	(0.230)	(0.225)	(0.268)	(0.147)	(0.132)
Rated	−5.980***	−4.563***	−6.088***	−4.039***	−7.626***	−6.838***
	(0.238)	(0.200)	(0.180)	(0.268)	(0.158)	(0.202)
Age	0.019**	0.007	0.018**	0.019**	0.021***	0.020***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)
Debt M. Exp.	0.179	1.398***	0.353	−0.123	0.115	−0.330*
	(0.211)	(0.257)	(0.280)	(0.333)	(0.178)	(0.172)
Inv. Grade	−0.111	−0.022	1.334***	−0.469*	1.057***	0.129
	(0.257)	(0.150)	(0.149)	(0.266)	(0.142)	(0.266)
Altm.-Z < 1.1	−1.445***	−1.003***	−0.771***	−0.202	−1.120***	−1.056***
	(0.221)	(0.234)	(0.221)	(0.262)	(0.161)	(0.140)
CapEx / TA	−2.372***	−7.264***	−4.954***	−4.658***	−2.356***	−3.210***
	(0.025)	(0.012)	(0.013)	(0.010)	(0.033)	(0.032)
Leverage	1.058***	4.360***	3.003***	2.353***	−0.082	0.408
	(0.053)	(0.041)	(0.043)	(0.052)	(0.213)	(0.289)
Amount Issued	0.012***	−0.006	0.008***	0.011***	0.009***	0.012***
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Year FE	*Yes*					
Observations	1277					
Pseudo R^2	0.27					

*p<0.1; **p<0.05; ***p<0.01

The table presents the results of a multinomial analysis of the choice of debt. The sample includes public and private companies which have issued a bond, a loan or non-bank private debt (i.e. Schuldschein loan or Private Placement) between 2010 and 2018. Loans are from the BBG / Eikon sample. Size is denoted as the natural logarithm of Total Assets; Amount Issued is measured in EUR million, as in Arena (2011). "Altman-Z < 1.1" is equal to 1 if Altman-Z-Score < 1.10, meaning the company is in the high bankruptcy risk zone (Altman, 2002). Debt Markets Exp. indicates whether a company issued a bond, Private Placement or Schuldschein loan prior to current issuance since 2006.

Table 7: Multinomial Logit - Debt Securities (incl. loans Dafne) compared to MBonds sample 2010 - 2018

	MBonds as baseline					
	Bonds (listed) > 150 M	Bonds (listed) ≤ 150 M	Bonds (unlisted)	Private Placement	Schuldschein Loans	Bank Loans
ln(TA)	1.154***	0.590***	0.620***	0.662***	0.956***	0.077*
	(0.040)	(0.047)	(0.044)	(0.054)	(0.036)	(0.039)
Tangibles	0.530	1.936***	1.016**	−0.247	2.211***	0.153
	(0.529)	(0.515)	(0.515)	(0.669)	(0.354)	(0.333)
Public	0.105	0.043	−0.278	0.211	−0.449	−1.405***
	(0.454)	(0.443)	(0.461)	(0.503)	(0.417)	(0.409)
Rated	−5.164***	−4.771***	−6.007***	−3.792***	−7.238***	−7.908***
	(0.368)	(0.410)	(0.467)	(0.403)	(0.391)	(0.367)
Age	0.015**	0.004	0.015*	0.016**	0.019**	0.023***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)
Debt M. Exp.	−0.004	1.319***	0.205	−0.104	−0.062	−1.533***
	(0.302)	(0.296)	(0.341)	(0.403)	(0.260)	(0.299)
Inv. Grade	−0.712	−0.179	0.776	−1.204**	0.637	0.623
	(0.520)	(0.544)	(0.624)	(0.588)	(0.536)	(0.525)
Altm.-Z < 1.1	−1.548***	−1.480***	−1.187***	−0.415	−1.465***	−1.342***
	(0.456)	(0.440)	(0.445)	(0.471)	(0.402)	(0.387)
CapEx / TA	−0.035	−7.407***	−4.525***	−2.429***	−2.691***	−4.099***
	(0.096)	(0.111)	(0.106)	(0.123)	(0.490)	(0.694)
Leverage	2.242***	4.932***	3.672***	3.132***	1.514***	−1.088***
	(0.654)	(0.640)	(0.617)	(0.816)	(0.418)	(0.372)
Amount Issued	0.009***	−0.001	0.006**	0.008***	0.006***	0.009***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Year FE	*Yes*					
Observations	2855					
Pseudo R^2	0.41					

*p<0.1; **p<0.05; ***p<0.01

The table presents the results of a multinomial analysis of the choice of debt. The sample includes public and private companies which have issued a bond, a loan or non-bank private debt (i.e. Schuldschein loan or Private Placement) between 2010 and 2018. Loans are from balance sheet data provided by the Dafne database. Size is denoted as the natural logarithm of Total Assets; Amount Issued is measured in EUR million, as in Arena (2011). "Altman-Z < 1.1" is equal to 1 if Altman-Z-Score < 1.10, meaning the company is in the high bankruptcy risk zone (Altman, 2002). Debt Markets Exp. indicates whether a company issued a bond, Private Placement or Schuldschein loan prior to current issuance since 2006.

Table 8: Multinomial Logit - Debt Securities (incl. loans BBG / Eikon) with Amount Issued ≤ EUR 150 M compared to MBonds sample 2010 - 2018

	MBonds as baseline				
	Bonds (listed) ≤ 150 M	Bonds (unlisted) ≤ 150 M	Private Placement ≤ 150 M	Schuldschein Loans ≤ 150 M	Bank Loans ≤ 150 M
ln(TA)	0.827***	1.294***	0.572***	1.403***	0.846***
	(0.128)	(0.139)	(0.187)	(0.124)	(0.119)
Tangibles	1.217	−0.011	−2.042	1.641	1.342
	(1.291)	(1.385)	(1.865)	(1.291)	(1.258)
Public	−0.420	−0.905	0.914	−0.804	−0.873
	(0.601)	(0.641)	(0.749)	(0.606)	(0.593)
Rated	−4.721***	−6.121***	−3.646***	−8.681***	−6.816***
	(0.711)	(0.991)	(0.938)	(0.975)	(0.756)
Age	0.007	0.016*	0.022**	0.024***	0.022***
	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)
Debt M. Exp.	1.045*	0.188	0.683	−0.536	−1.038*
	(0.553)	(0.657)	(0.752)	(0.618)	(0.614)
Inv. Grade	−0.177	0.598	0.371	1.145	−0.039
	(0.620)	(1.026)	(0.916)	(0.944)	(0.733)
Altm.-Z < 1.1	−1.397**	−0.850	0.024	−1.548**	−1.563**
	(0.640)	(0.682)	(0.795)	(0.648)	(0.630)
CapEx / TA	−7.167***	−3.076	−4.418	−2.669	−3.461**
	(1.959)	(2.069)	(3.220)	(1.647)	(1.473)
Leverage	5.269***	2.652	2.789	1.430	1.080
	(1.727)	(1.817)	(2.489)	(1.669)	(1.611)
Amount Issued	−0.014*	−0.062***	−0.006	−0.007	0.003
	(0.007)	(0.011)	(0.010)	(0.007)	(0.007)
Year FE	*Yes*				
Observations	799				
Pseudo R^2	0.27				

*p<0.1; **p<0.05; ***p<0.01

The table presents the results of a multinomial analysis of the choice of debt for firms issuing comparable amounts of debt to MBond issuers. The sample includes public and private companies which have issued a bond, a loan or non-bank private debt (i.e. Schuldschein loan or Private Placement) between 2010 and 2018 with a total issuance volume of equal or less than EUR 150 million. Loans are from the BBG / Eikon sample. Size is denoted as the natural logarithm of Total Assets; Amount Issued is measured in EUR million, as in Arena (2011). "Altman-Z < 1.1" is equal to 1 if Altman-Z-Score < 1.10, meaning the company is in the high bankruptcy risk zone (Altman, 2002). Debt Markets Exp. indicates whether a company issued a bond, Private Placement or Schuldschein loan prior to current issuance since 2006.

A.III Variable Definitions

Table 9: Definitions for Other Variables

Variable	Definition
Age	Current year of observation - Year of incorporation
Altm. Z Score	Altm. Z Score $= 6.56 * X1 + 3.26 * X2 + 6.72 * X3 + 1.05 * X4$
Altm.-Z < 1.1	Dummy Variable $= 1$ if Altman-Z-Score is < 1.1 and company is in the high bankruptcy risk zone
Bank Debt Ratio	Bank Debt Ratio $= \frac{LiabilitiesToFinancialInstitutions}{CurrentDebt + LongTermDebt}$
CapEx Ratio	Capital Expenditures $= \frac{PPE_t - PPE_{t-1} + Depreciation_t}{TotalAssets}$
Debt M. Exp.	A dummy variable, which equals one if the company issued a Bond or Non-Bank Private Debt (Schuldschein or Private Placement) prior to current issuance (since 2006), and zero otherwise.
Inv. Grade	A dummy variable, which equals one if the issuer or the bond has an investment grade rating, and zero otherwise.
Leverage	Book Leverage $= \frac{CurrentDebt + LongTermDebt}{CurrentDebt + LongTermDebt + Equity}$
Public	A dummy variable, which equals one if the issuer is public or has been public before, and zero otherwise.
Rated	A dummy variable, which equals one if the issuer or the bond has a rating, and zero otherwise.
ROA	Return on Assets $= \frac{NetIncome}{TotalAssets}$
Tangibles	Tangible Assets $= \frac{PPE}{TotalAssets}$

Data for accounting variables is extracted from the Bureau van Dijk, Dafne database. Bond information is extracted from Bloomberg, Thomson Eikon or hand collected. The components of the Altman Z Score for private firms, not limited to manufacturing companies (see Altman et al., 1977; Altman and Saunders, 1998), are the following: X1 = Working Capital / Total Assets, X2 = Retained Earnings / Total Assets, X3 = EBIT / Total Assets, X4 = Equity / Total Liabilities.

The Issuance of German SME Bonds: Investment Financing or Imminent Insolvency?

July, 2021

Abstract

Due to their bank dependency small- and medium-sized enterprises (SMEs) are vulnerable to shocks to the banking sector, which can result in financial constraints hampering investments. The German MBond market enables us to study whether facilitated access for SMEs to public debt markets alleviates financial constraints and spurs firm investment. I find that MBond issuers have indeed been financially constrained but invest less than expected post issuance. In the light of these results and an alarming default rate, the concurrent explanation that MBond issuers timed the market and issued junk bonds to retail investors to finance future losses and avoid bankruptcy is explored. Indeed, profitability and financial stability deteriorate post issuance. Without the proceeds from the bond IPO, 72.4% would have already run out of cash in the year of issuance. The example of the German MBond market indicates that facilitating access to public debt markets for SMEs to alleviate financial constraints is not sufficient to spur firm investment.

Keywords: Public debt · Private debt · Debt policy · Capital structure · Small- and medium sized enterprises (SMEs)

JEL classification: G21 · G30 · G31 · G32

1 Introduction

Small and medium-sized enterprises are the backbone of the economy in terms of employment, innovation, and economic activity (European Commission, 2015b). At the same time, SMEs are more likely to be financially constrained due to their bank dependency and resulting exposure to external credit supply shocks to the banking system (Beck & Demirguc-Kunt, 2006; Beck et al., 2008).

In the aftermath of the financial crisis, five German stock exchanges established new market segments to facilitate bond issuance by SMEs and relieve potential financial constraints resulting from tightened bank credit conditions. This development is particularly surprising since, traditionally, German SMEs (the so called German *Mittelstand*) relied heavily on their house banks for financing their investments and operations (Blättchen & Nespethal, 2010). Therefore, it is worthwhile to explore their motivation to issue bonds in the newly established MBond market segments, as well as the effects of bond IPOs by SMEs on their firm investments. This paper examines the narrative that facilitated access for SMEs to public debt markets, via the MBond market segments, could alleviate financial constraints and spur firm investments and growth. In contrast to that narrative, since about one third of the MBond issuers defaulted on their debt, subsequently a concurrent explanation is explored: MBond issuers could have timed the market and exploited a window of opportunity to issue junk bonds to retail investors in order to finance future losses and avoid or postpone bankruptcy.

The German MBond market was established in 2010 / 2011 by five German stock exchanges. With a typical issuance volume of EUR 10 million to EUR 150 million, it provides small- and medium-sized enterprises with the possibility to issue small volume bonds. The stock exchanges attempted to minimize transaction costs, while simultaneously trying to maximize transparency.

For example, an underwriter was not required for the issuance and mandatory ratings were provided by smaller German rating agencies, which provided comparatively cheap ratings[1]. The denomination of EUR 1,000 aimed at attracting retail investors who could participate in the primary market directly. However, since the beginning of 2012, the number of defaults has started to rise. To date, about one third of MBond issuers defaulted on their debt.

The insights derived in this paper from the German MBond market are also relevant for the development of the EU Capital Markets Union, which has two goals: Firstly, it aims at facilitating access of SMEs to capital markets to provide financing alternatives and spur economic growth (European Commission, 2015a, 2017). Secondly, retail investors should be enabled to participate in the financing of SMEs (European Commission, 2015a, 2017). Both goals are similar to the ideas that accompanied the establishment of the German MBond market. Therefore, the learnings from the German MBond market provided by this study might help to evaluate the high hopes associated with the access of SMEs to public debt markets.

In the analysis I use a sample of 78 MBond issuers and match them to a control group of 234 other debt issuers[2]. In addition, MBond issuers are compared to a second sample of 709 companies issuing debt of comparable size. By only using other companies issuing debt as control group, I address potential bias resulting from different demand for capital of MBond and other debt issuers.

In order to answer the question as to whether the MBond market was

[1]Four of five platforms required ratings. Only Hamburg / Hannover stock exchange refrained from requiring a rating. However, this stock exchange only saw few issues. Ratings for the MBond market were mostly provided by the three local rating agencies Creditreform, Euler Hermes, and Scope Ratings. With a range of EUR 30,000 to EUR 85,000 the ratings were relatively cheap (Hasler, 2012). In comparison, Standard & Poor's charges 7.10 basis points with a minimum fee of USD 110,000 for a corporate bond rating (Standard & Poor's, 2020).

[2]The matched control group is similar based on observables. I apply propensity score matching to construct the control group.

tapped by financially constrained companies to finance investments and growth, I follow the firm balance sheet channel. As a first step, I examine the financial constraint status of MBond issuers in the year prior to the MBond IPO. To measure the unobservable financial constraint status, I utilize the newly developed Financial Constraint Index for Private Firms (FCP index) by Schauer et al. (2019) and complement it with other financial variables indicating financial constraints. Second, I estimate a difference-in-differences (DiD) regression model to compare investment behavior and post-issuance growth of MBond issuers to the two control groups.

Subsequently, I explore the concurrent explanation that MBond issuers timed the market and exploited a window of opportunity to issue junk bonds to retail investors in order to finance future losses and avoid or postpone bankruptcy in two steps. Firstly, I estimate a difference-in-differences model to test the deterioration of profitability and financial stability of MBond issuers post issuance, in comparison to the two control groups. Secondly, I examine the liquidity status of MBond issuers and the two control groups, since illiquidity is the main reason for bankruptcy (§17 InsO). For this purpose, a pro forma cash measure is calculated, which simulates the cash status without the proceeds from the debt issuance[3].

For the year prior to the MBond IPO, I find that MBond issuers have been indeed more likely to be financially constrained when compared to the control group of debtors with comparable issuance volume[4]. MBond issuers had higher costs of debt pre issuance, which they were able to significantly reduce post issuance. In addition, MBond issuers relied more on short-term debt pre issuance and reduced their dependency on short-term debt post is-

[3]The pro forma cash measure is based on the idea of DeAngelo et al. (2010), who use it to examine the motivation for seasoned equity offerings. My pro forma cash measure adjusts cash holdings post issuance for changes in total debt and keeps the capital expenditure ratio constant on the level of the year prior to issuance.

[4]According to the FCP index, as well as the complementing financial variables.

suance. Unsurprisingly, MBond issuers appeared to be equally constrained as the matched control group. Although the major fraction of the MBond IPO proceeds added to total debt and increased leverage significantly, MBond issuers on average repaid 12.1% of their bank debt in the year of issuance. This was possible because the average volume of an MBond was relatively large when compared to the existing total debt level of the average MBond issuer. Thus, these results support the first part of the explanation that financially constrained SMEs decided to tap the MBond markets.

However, examining the investment behavior and growth variables post issuance it was revealed that MBond issuers invest less in fixed assets and hold more cash in the year of issuance compared to both control groups. Lower investments and higher cash holdings indicate that MBond issuers might not have had sufficient positive NPV projects to undertake with the proceeds from their bond IPO. These results contradict the narrative that financially constrained SMEs tap the MBond markets to fund investments. On the contrary, it gives rise to the exploration of the concurrent explanation.

Indeed, for the concurrent explanation, I confirm the predicted deterioration of profitability and financial stability of MBond issuers post issuance. Return on assets, return on capital employed as well as the EBITDA margin drop significantly, relative to the two control groups. Despite lower interest rates, interest coverage deteriorates as well. The rise in total interest expenses due to increased leverage and total debt, as well as the decreased profitability, seem to overcompensate the positive effect of a decrease in interest rates for MBond issuers. In combination with lower investment rates and higher cash holdings, it appears that MBond issuers overstretch and issue too much debt, increasing the likelihood of financial distress. Decreasing profitability supports the hypothesis of a lack of sufficient positive NPV projects. In addition, in the analysis of the pro forma cash measure, I find that 72.4% of MBond issuers would have already run out of cash in the year of the MBond IPO, which is

roughly twice the number of pro forma insolvent companies in the two control groups.

Thus, the empirical results are more in favor of the concurrent explanation. Although it appears that the MBond market has been a financing alternative for financially constrained companies, alleviation of the constraints did not spur investments as expected. It is more likely that firms timed the market to exploit the window of opportunity to issue junk bonds to retail investors, in order to cover future losses and avoid or postpone bankruptcy.

To the best of my knowledge, this is the first analysis of the effect of German SMEs issuing MBonds on firm investment. In order to reduce potential selection issues, I apply propensity score matching, firm fixed effects, and follow the firm balance sheet channel. However, it is worth mentioning that the analysis of the MBond market in this study cannot be generalized easily. In the course of the analysis, it became apparent that MBond issuers might probably have been fundamentally different compared to the two control groups. Thus, the possibility that facilitated access for financially constrained SMEs to debt capital markets might spur investment, employment, and sales growth, cannot be rejected in general. Nevertheless, it can be stated that facilitating access to debt capital markets for SMEs alone is not sufficient to achieve the goal of alleviating financial constraints for SMEs and spur firm investments. In structuring debt market access for SMEs one has to consider the incentives for all market participants carefully.

The remainder of this paper is organized as follows. Section 2 reviews the existing theoretical and empirical literature on financial constraints and their impact on SME investment and connects the study to the literature on the effects of equity and bond IPOs. In addition, I describe the German MBond market setting and develop the hypotheses, to be tested empirically. Section

3 describes the data, the sample selection process, and the choice of variables. Furthermore, this section contains the propensity score matching process and descriptive statistics. Section 4 contains the first step of the analysis of the primary research question as to whether MBond issuers have been financially constrained prior to issuance. Consequently, section 5 contains the second step of the primary research question in which the investment behavior of MBond issuers is compared to the control groups. In Section 6, the alternative explanation is explored. Section 7 concludes.

2 Prior Literature, Setting and Hypotheses Development

2.1 Theory and Prior Empirical Findings on Financial Constraints of SME and Their Impact on Investments

This paper is at the crossroads of different strands of the literature. Asking the question as to whether facilitated access to debt capital markets for SMEs can alleviate financial constraints and spur firm investments, connects this paper to the vast literature on the impact of capital structure on financial constraints and investments. The focus on SMEs relates this paper to the literature on SME financing, their financial constraints, as well as government interventions to alleviate these constraints. Discussing a bond market for SMEs, the paper builds upon the literature on the motivation and real effects of security issuance.

Definition of Financial Constraints

In perfect capital markets, the financing structure of a company does not matter for firm value since external funds are a perfect substitute for internal

funds (Modigliani & Miller, 1958). Consequently, there is no difference between internal and external financing and investment decisions are independent of a company's financial situation (Fazzari et al., 1988). However, since capital markets are not perfect in the sense of Modigliani and Miller (1958), frictions drive a wedge between internal and external financing (Fazzari et al., 1988). In a broader sense, the larger the wedge, the more financially constrained a firm is.

If the supply curve of debt becomes vertical, financial constraints can turn into credit rationing. Stiglitz and Weiss (1981) attribute credit rationing to two mechanisms, resulting from asymmetric information, that influence the riskiness of a bank's loan portfolio: adverse selection and the incentive effect (moral hazard). More risky borrowers are willing to pay higher interest, since they do not expect to repay the full amount anyways. Thus, increasing the interest rate to compensate for risk leads to more risky borrowers. In addition, higher interest payments in combination with limited liability incentivize the borrower to choose projects with a lower success probability but a high payoff in case of success. Thus, instead of granting loans at higher interest rates, banks will stop lending at a certain interest rate level (Stiglitz & Weiss, 1981).

Financial Constraints and Investments

Credit rationing is an important special case of financial constraints and affects investments differently than the more general wedge between internal and external financing. In the latter case, positive NPV projects might become unprofitable if the wedge between internal and external financing leads to an excessive increase in cost of capital. Nevertheless, companies could still borrow at higher costs. However, in the former, more severe case of credit rationing, companies cannot obtain additional capital at all. Thus, they cannot finance investment projects that would even be profitable with higher cost of capital.

Consequently, financially constrained firms which only have limited access to external financing, have to rely more on internal funds to finance investments and might, therefore, not be able to finance all their positive NPV projects (Rahaman, 2011). In addition, Aghion et al. (2010) show that tighter credit constraints might force companies to substitute productive long-term investments with less productive short-term investments to reduce the liquidity risk of the investment. Furthermore, Ferrando and Ruggieri (2018) find supporting evidence that financially constrained firms are less productive.

SME Financing, Credit Supply Shocks and Financial Constraints

SMEs are thought to be even more financially constrained in their investments (Beck & Demirguc-Kunt, 2006; Beck et al., 2008). Since SMEs are considered to be the backbone of the economy (European Commission, 2015b), their aggravated financial constraints might hamper economic growth and are, therefore, of special interest to the finance literature (Beck & Demirguc-Kunt, 2006). In the literature, there are two lines of arguments, as to why SMEs are even more likely to be financially constrained compared to larger companies. The first one is based on inherent characteristics of SMEs, whereas the second is based on external credit supply and the structure of the financial system.

SMEs are thought to be more financially constrained because they are more opaque, have higher growth rates, are less diversified, and have less collateral (Haag, 2017; Kersten et al., 2017). Government interventions aim at compensating for the disadvantageous inherent characteristics of SMEs in order to improve their access to financing sources and alleviate financial constraints. Besides matching grants, facilitating access to bank loans enables SME financing (see for example Banerjee and Duflo (2014) and Zia (2008)). Indeed, interventions to reduce financial constraints for SMEs appear to have a significant positive effect on capital investment, firm performance, and employment within the supported firm (Kersten et al., 2017). In addition, local state-

owned banks can also help to mitigate financial constraints for SMEs because their information production and less cyclical lending behavior improve credit availability (Behr et al., 2013).

The structure and development of the financial system and external shocks to the credit supply can also constrain firms and affect investments. Ivashina and Scharfstein (2010) find that at the peak of the financial crisis banks reduced new loans to large borrowers by 79% and loans for real investment by 14%. Almeida et al. (2012), Campello et al. (2010), and Duchin et al. (2010) also use the financial crisis as a negative credit supply shock and find a resulting drop in firm investment. The decrease in investments was especially severe for financially constrained firms (Campello et al., 2010; Duchin et al., 2010). SMEs are mostly bank financed and, therefore, more heavily affected by shocks to the banking system, like the recent financial crisis (Dwenger et al., 2020; Vermoesen et al., 2013). Vermoesen et al. (2013) show that the credit supply shock of the financial crisis led to a reduction in investments for Belgian SMEs with maturing long-term debt during crisis years. The authors attribute this result to the problems associated with bank-financed SMEs to refinance their long-term debt during crisis years (Vermoesen et al., 2013). Dwenger et al. (2020) find that German SMEs reduce investments and employment, if their house banks suffer losses from proprietary trading activities in the US during the financial crisis.

SMEs are also more likely to be affected by a negative credit supply shock in the banking sector, since their access to debt capital markets is limited (Khwaja & Mian, 2008; Vermoesen et al., 2013). Khwaja and Mian (2008) find that, in contrast to small- and medium-sized firms, large companies are able to compensate the drop in bank credit supply by borrowing from debt capital markets. Moreover, Becker and Ivashina (2014) confirm that companies with access to public debt markets substitute bank loans for bonds, when bank credit supply deteriorates. Casey and O'Toole (2014) provide additional

evidence that market financing is not used by SMEs in 11 euro area member states to compensate for the loss of bank financing. They partly attribute this finding to a lack of supply of market financing to SMEs and call for a more diverse financing environment in bank dependent member states. Reviewing multiple studies on financial constraints and financial markets development, Carreira and Silva (2010) claim that financial market development could help reducing financial constraints for SMEs. Indeed Bongini et al. (2019) find that a large number of SMEs would be suitable for market access, however, this potential of market-ready firms remains largely unexploited. Although access to market-based financing for SMEs can be an important factor for the diversification of funding sources and bank dependence reduction (Bongini et al., 2019), prior research on the real effects of debt market financing for SMEs is limited.

Security Issuance, Investment Financing and Debt Market Timing

Not only for SMEs but in general, little work has been done on the effects of bond IPOs on financial constraints and firm investment. Hale and Santos (2009) analyze the information monopoly of banks and find that firms are able to borrow at lower interest rates following their bond IPO. This effect is larger for firms of higher credit worthiness and firms that obtain a credit rating at the time of the bond IPO. Other papers study the operating performance of security issuers pre and post issuance. Bae et al. (2002) and McLaughlin et al. (1998) show that security issuers have strong operating performance prior to issuance and worse operating performance afterwards. However, the effect is larger for equity issuers than for debt issuers (Bae et al., 2002; McLaughlin et al., 1998). For the German MBond market Feihle and Lawrenz (2017) find that issuers show a worse operating performance post issuance.

Closely similar to this paper are two studies analyzing the use of proceeds of seasoned equity issuances by DeAngelo et al. (2010) and Kim and Weisbach

(2008). The authors find that part of the issuance decision can be explained by market timing and real investment needs. However, DeAngelo et al. (2010) claim that investment financing and market timing do not fully explain seasoned equity offers. They show that a significant fraction of firms are also financially constrained in that they would have quickly run out cash without the equity injection (DeAngelo et al., 2010). Although market timing is an acknowledged reason for equity issuance, literature on debt market timing is surprisingly scarce. Conducting a survey among CFOs, Graham and Harvey (2001) assert that managers attempt to issue debt when market interest rates are particularly low. Confirming evidence is provided by Barry et al. (2008) who find that firms issue more debt relative to investment spending and to equity when interest rates are low relative to historical rates. The authors state that next to capital expenditures, market timing is a major motivation to issue debt (Barry et al., 2008).

This paper adds to the literature by analyzing the effects of bond IPOs by SMEs on financial constraints and investments for the first time. In the course of the analysis, I address the two different motivations, investment need and market timing, to issue bonds in the German MBond market segments.

2.2 The MBond Market as Financing Alternative

The establishment of the German MBond market in 2010 has been accompanied by tighter banking regulation and preceded by the credit supply shock of the financial crisis. Basel II regulation of banks already led to a significant increase in financing costs for SMEs in 2007 (Schindele & Szczesny, 2016). The impending introduction of Basel III regulation, coming into force in 2013, has been expected to further worsen bank financing for SMEs (Angelkort & Stuwe, 2011; Schmitt, 2012). In addition, banks reduced lending in the aftermath of the financial crisis. In the second quarter of 2009, net 50% of German banks re-

ported tightened credit conditions for enterprises (ECB, 2020)[5]. Since SMEs cannot easily substitute bank loans with market based financing, they were more heavily affected by the credit crunch (Becker & Ivashina, 2014; Casey & O'Toole, 2014; Khwaja & Mian, 2008; Vermoesen et al., 2013).

As a consequence, SMEs were looking into alternative sources of financing, for example bonds. As a response to the dangers of a credit crunch and deteriorating financing conditions, five German stock exchanges opened special "quality segments" where SMEs could issue small volume bonds (Börse Düsseldorf, 2010; Börse Stuttgart, 2010; Mausbach & Simmert, 2012)[6]. These MBond segments had more listing and disclosure requirements than the open market, in order to decrease informational asymmetries and improve transparency (Schmitt, 2012). Moreover, an issuer or security rating was mandatory for most issuers in these segments (Blättchen & Nespethal, 2010). At the same time the stock exchanges tried to keep transaction costs to a minimum, for example, no underwriter was required. What was special about these segments was that the MBonds could be issued to retail investors in the primary market directly (Blättchen & Nespethal, 2010; Börse Düsseldorf, 2010; Börse Stuttgart, 2010; Mausbach & Simmert, 2012).

Due to a series of defaults, beginning in 2012, the three largest MBond segments closed or altered their segments in the meantime. Roughly one-third of MBond issuers defaulted on their debt since the establishment of the market in 2010. This paper attempts to shed light on the use of proceeds from the MBond issues to help to understand the high cumulative default rate.

[5]Net percentage of banks is defined as the frequency of tightened minus that of eased credit standards. Thus, the gross number of German banks reporting tightend credit standards is even higher.

[6]The five segments were "Bondm" at Stuttgart stock exchange, "der mittelstandsmarkt" at Dusseldorf stock exchange, "m:access" at Munich stock exchange, "Mittelstandsbörse Deutschland" at Hamburg Hannover Stock Exchange and the "Entry Standard" at Frankfurt Stock Exchange.

2.3 Hypotheses Development

One objective of this study is to determine whether facilitating the issuance of bonds by SMEs via the establishment of the MBond market led to more investment. Financially constrained SMEs might not have received enough funds, or their cost of capital might have been too high to finance all their desired investment projects. Thus, with the alleviation of financial constraints more investment projects could be undertaken. A concurrent explanation could be that firms close to bankruptcy timed the market and exploited a window of opportunity to issue junk bonds to uninformed retail investors.

In order to answer the main research question, the analysis follows the firm balance sheet channel and tracks the usage of the proceeds from the MBond issuances. However, prior to the main analysis, it has to be examined whether MBond issuers were indeed financially constrained.

Financial Constraint Status and Financial Structure

Bank dependent SMEs were heavily affected by tightening credit standards and reduced bank lending in the aftermath of the financial crisis (Dwenger et al., 2020; Vermoesen et al., 2013). At that time, prior literature finds a substitution effect of bank loans and bonds for larger firms(Becker & Ivashina, 2014; Khwaja & Mian, 2008). When bank financing conditions deteriorate, large companies are able to compensate the drop in bank credit supply by borrowing from debt capital markets (Becker & Ivashina, 2014; Khwaja & Mian, 2008). The German MBond market was established as an alternative financing source for bank-dependent SMEs (Börse Düsseldorf, 2010; Börse Stuttgart, 2010; Mausbach & Simmert, 2012). As a result, financially constrained German SMEs now had the possibility to substitute bank financing with public debt financing as well. Thus, the first hypothesis is the following:

H1: MBond issuers were more likely to be financially constrained in the year prior to issuance.

Firm Investment

After examining whether MBond issuers were financially constrained, the central part of the analysis studies whether alleviating financial constraints leads to more firm level investment. The definition of financial constraints implies that a constrained company cannot invest as much as it would prefer to in perfect capital markets. Thus, conditional of MBond issuers being financially constrained and financial constraints being alleviated with the access to the MBond market, I expect to find:

H2: MBond issuers increase their investment post issuance more than a group of unconstrained firms and about the same as a group of equally constrained firms.

Concurrent Explanation

A concurrent explanation could be that companies close to bankruptcy timed the market and exploited a window of opportunity to issue junk bonds to uninformed retail investors, in order to cover future losses. Graham and Harvey (2001) and Barry et al. (2008) find that companies attempt to time the market when issuing debt. However, these studies address market timing with aggregated interest rates, whereas I argue that maybe individual MBonds were not priced adequately given their future prospects. Herrmann (2017) finds that retail investors were overproportionally invested in MBonds which later defaulted. Feihle and Lawrenz (2017) state that MBond issuers display a lower operating performance post issuance. If the alternative explanation is valid, the financial performance and financial stability of an MBond issuer should deteriorate post issuance. This gives rise to the following hypothesis:

H3: MBond issuers become less profitable and less financially stable post issuance.

However, lower profitability and reduced financial stability in itself might not constitute a need to raise capital if they do not lead to a shortage of liquidity. Bankruptcy is usually defined as the inability of a firm to meet its financial obligations due to lack of liquidity (§17 InsO). To further examine the need for liquidity, I test the following hypothesis:

H4: MBond issuers would have run out of cash without the proceeds from the bond issuance.

3 Sample Selection and Description

3.1 Data Sources and Sample Selection

The group of interest to the analysis consists of companies issuing a bond on one of the five German stock exchange segments that constitute the German MBond market. Thus, MBond issuers are considered to be the "treatment" group, even though treatment is self selected. Data on MBond characteristics were gathered from the respective exchanges, prospectuses, Bloomberg, Thomson Reuters Eikon, as well as informational websites for German SME bonds[7]. The "control group" consists of companies issuing debt of comparable volume, that is the maximum issue volume of MBond issues. Comparable corporate debt in the sample can be structured as public debt (listed and unlisted bonds), bank debt (loans), or non-bank private debt (private placement and Schuldschein). Issuance data for the control group were extracted from Bloomberg and Thomson Reuters Eikon. Financial data for all borrowers were obtained from the Bureau van Dijk (Moody's) Dafne database, which provides data from financial statements of German companies. Borrower entity names from Bloomberg and Thomson Reuters Eikon were matched manually to the financial statement data from Dafne. All MBonds and other types of debt had

[7]The two websites www.bondguide.de and www.anleihen-finder.de provide news and information on MBonds. In addition, they collect and provide documents such as prospectuses, financial statements, rating certificates as well as other bond and issuer related documents.

to be issued between 2010 and 2016, to ensure data availability post issuance. Since most MBonds were issued between 2010 and 2015, this restriction does not significantly reduce the treatment group.

Only bonds issued under German governing law are included to reduce interference resulting from differences in the legal environment that may arise from the introduction of the new bond regulation in Germany in 2009. Bonds with missing information regarding governing law but which have been issued by a German company and are classified as domestic bonds in Bloomberg are assumed to be governed by German law. All bonds included in the sample are denominated in EURO. Debt issues by financial subsidiaries of manufacturing companies that are not consolidated in the corporate group are dropped from the sample (Arena, 2011). In addition, non-German issuers and Micro Firms, as defined in the "User guide to the SME Definition" published by the European Commission (2015b)[8], are excluded as well.

In order to ensure comparability in terms and structure, convertible debt, commercial papers and debt issues with a maturity of less than one year were dropped from the sample. Bonds issued as an additional raise of capital which are later consolidated onto another bond of the same company are pooled together. Companies that are not covered by the Dafne database or do not provide information on the amount issued were removed from the sample.

3.2 Variables of Interest

The analysis relies on a variety of variables for different purposes. Firstly, a propensity score matching on variables that influence the likelihood to receive financing is applied, to increase comparability of the control and treatment group. Secondly, various variables are used to examine whether MBond issuers were more likely to be financially constrained. Thirdly, growth variables help to answer the main research question, whether alleviating financial con-

[8]The European Commission (2015b) defines Micro Firms as companies with less than 10 employees and less than EUR 2 million in Sales and Total Assets.

straints through MBond market access can spur firm growth. Finally, variables on profitability, financial stability, and liquidity are used to explore the alternative explanation that firms close to bankruptcy timed the market to issue junk bonds to uninformed retail investors.

Variables for Propensity Score Matching

Feihle and Lawrenz (2017) analyze the post issuance performance of MBond issuers using propensity score matching. The authors identify variables that should be correlated with the probability to issue an MBond and reflect the perspective of a rating agency or investor, who wish to evaluate the issuer prior to issuance based on the information provided in financial statements (Feihle & Lawrenz, 2017). Since the setting is identical, and to ensure comparability, the same variables for propensity score matching are applied in this study.

The proportion of fixed assets, *AST*, reflects the capital that is invested long-term and requires financing of the same time horizon. In addition, fixed assets can be pledged as collateral, which is associated with easier access to financing (Arráiz et al., 2014; Cantillo & Wright, 2000; Johnson, 1997). Leverage, *LEV*, reflects the capacity for additional debt, as well as a potential need for refinancing. In terms of debt capacity, it is closely related to solvency, *SOL*, defined as the interest coverage ratio based on EBIT. The total profitability ratio, *TPR*, measures the distributable income to both equity holders and creditors and, thus, influences the possibility to receive external financing. Size, *SIZ*, has been identified as a central determinant for bond issues, since larger firms are usually less opaque and benefit from lower relative flotation costs (Cantillo & Wright, 2000; Hadlock & James, 2002; Krishnaswami et al., 1999). Liquidity, *LIQ*, serves as a proxy for short-term financing needs. Sales turnover, *STO*, reflects the efficiency of sales generated by the capital employed. Feihle and Lawrenz (2017) argue that sales turnover relates to the decision to issue a bond since the proceeds could be used to either expand sales

or invest in productive capital. Additional variables used for the propensity score matching in this paper are the issuance volume, the year of issuance, as well as two-digit NAICS industry codes.

Variables on Financial Constraints

Unfortunately, the financial constraint status of a firm is not directly observable. That is why the empirical literature relies on proxies to measure financial constraints. Among the most widely used measures of financial constraints are the (modified) KZ index (Baker et al., 2003; Lamont et al., 2001), the WW index (Whited & Wu, 2006), and the SA index (Hadlock & Pierce, 2010). Unfortunately, these measures are not applicable in the MBond setting for different reasons. The KZ index makes use of the market-to-book ratio, which is not applicable for private firms. Since most SMEs are privately held companies, the KZ is not feasible in this setting. For comparable reasons, the WW index is also not applicable in this analysis, since it makes use of dividend payouts which are mostly not reported by the SMEs in the sample. The major component of the SA index is size. Since the focus of this paper are SMEs, size is restricted in the analysis a priori. Therefore, the SA index is also not feasible in this setting.

In addition, Farre-Mensa and Ljungqvist (2016) claim that the KZ index, the WW index, and the SA index are not, in fact, measuring financial constraints. Misspecification might, for example, arise from the common practice of out-of-sample extrapolation of the respective index coefficients since it implies that the coefficients are stable across samples and time (Farre-Mensa & Ljungqvist, 2016).

For these reasons, I apply the newly developed index of financial constraints for private firms (FCP) by Schauer et al. (2019) to measure differences in financial constraint status. This measure has the advantage that it is explicitly

calibrated to be used for private firms (Schauer et al., 2019). In addition, the measure was constructed using German data, which makes it especially suitable for the analysis of the German MBond market[9]. To construct the index, the authors combine survey data from the ifo Investment Survey with accounting data to map self-reported financial constraint status to four accounting variables. Schauer et al. (2019) find that *Size*, measured as the natural logarithm of total assets, *Interest Coverage Ratio*, measured as EBIT over interest expenses, *ROA*, measured as net income over total assets, and *Cash* reflecting cash holdings relative to total assets, are related to the financial constraint status of a company. Thus, the new index is calculated as:

$$FCP_{i,t} = -0.123 * Size_{i,t-1} - 0.024 * Int.Coverage_{i,t-1} - 4.404 * ROA_{i,t-1} - 1.716 * Cash_{i,t-1} \quad (2)$$

To classify companies into more or less financially constrained firms, the sample is divided into terciles according to the FCP index in a given year, as suggested by the authors. Companies in the top tercile are more likely to be financially constrained than companies in the lowest tercile.

In order to support the classification by the FCP index, I examine other financial variables that might also indicate financial constraints, for example the interest rate. According to the definition of financial constraints, which describes them as a wedge between internal and external financing that raises debt cost of capital, the development of the interest rate paid on debt can be an indicator for financial constraints. Since the interest rate is not reported for existing debt, it is approximated by dividing interest expenses by long-term debt. Moreover, financially constrained firms might rely on alternative sources

[9]However, the application is not limited to German companies since the authors also successfully apply the measure to European private and US listed companies. In addition, the authors compare the FCP index to other standard measures of financial constraints, i.e. the modified KZ index (Baker et al., 2003), the WW index (Whited & Wu, 2006), and the SA index (Hadlock & Pierce, 2010), and find it to be more reliable in correctly classifying financially constrained firms (Schauer et al., 2019).

of financing, like trade credit (Casey & O'Toole, 2014). Thus, the relative usage of short-term debt can also be an indicator for financial constraints. For the analysis, the relative usage of short-term debt is defined as short-term debt divided by total debt. Banerjee and Duflo (2014) claim that companies are not financially constrained if they only refinance existing debt. Thus, to test this necessary condition, the net issue ratio is calculated as the difference between total debt in t = 0 and t = -1, divided by the amount issued by the borrower[10]. It describes the proportion of the proceeds that actually led to an increase in net debt.

Variables Measuring Firm Investments

To answer the main research question as to whether alleviating financial constraints of SMEs via access to the MBond market spurs firm growth, three growth variables are examined. Borrowers could use the proceeds to fund investments in tangible assets (e.g. property, plants and equipment), develop their business and increase the number of employees, and expand their business to increase sales. Investment in tangible assets is measured as capital expenditures, scaled by total assets. Business development via employment is measured as annual employment growth. Business expansion is measured as annual sales growth.

Variables Measuring Profitability, Financial Stability, and Liquidity

The alternative explanation states that MBond issuers close to bankruptcy timed the market and issued debt to uninformed retail investors. Thus, the financial performance and financial stability should deteriorate post issuance. Return on assets (ROA), return on capital employed (ROCE), and the EBITDA margin measure profitability. The interest coverage ratio accounts for dynamic debt capacity, and is used to evaluate the financial stability post issuance.

[10]The year of debt issuance is defined as t = 0. Thus, t = -1 is the year prior to debt issuance.

However, the main determinant of bankruptcy is not the declining profitability, but the lack of liquidity (§17 InsO). In order to investigate whether the issuers were close to illiquidity and, thus, close to bankruptcy, I calculate a *pro forma cash* (PFC) measure. The idea for this measure is based on the paper of DeAngelo et al. (2010), however, my definition is more rigorous. DeAngelo et al. (2010) calculate pro forma cash holdings to establish that most companies would have run out of cash without the proceeds of the seasoned equity offering. The authors adjust post cash values for the proceeds from seasoned equity offerings, but maintain all other investment and financing decisions. Subsequently, they analyze how many issuers become pro forma cash negative post SEO. However, this procedure is likely to overstate negative pro forma cash balances, since healthy companies with positive NPV projects probably invest a large fraction of the proceeds. Consequently, subtracting the proceeds from the cash balance post issuance might falsely classify perfectly healthy companies with large investments as pro forma cash negative. My adjusted pro forma cash calculation in this study accounts for this potential shortcoming. Equation 3 states the adjusted calculation of pro forma cash used in the subsequent analysis.

$$PFC_{i,t} = Cash_{i,t} - \overbrace{(TD_{i,t} - TD_{i,-1})}^{\text{Financing CF constant}} - \overbrace{\frac{CapEx_{i,-1}}{TA_{i,-1}} * (TA_{i,t} - (TD_{i,t} - TD_{i,-1}))}^{\text{Investment ratio based on t = -1}} + CapEx_{i,t} \quad (3)$$

The adjusted pro forma cash calculation makes assumptions for two types of cash flows: cash flows from financing activities and investment cash flow. Firstly, for cash flows from financing activities, no additional debt financing, and no repayment of debt are assumed. Therefore, the current cash balance is adjusted for changes in total debt compared to the year prior to debt issuance. Secondly, it is assumed that the capital expenditures ratio remains on the

same level as in the year prior to debt issuance. As a consequence, capital expenditures are replaced by the product of the capital expenditures ratio of t = -1 and total assets of the current period, adjusted for the change in total debt. As a consequence, changes in pro forma cash predominantly result from operating cash flows and potential equity injections or payouts.

Following the literature, continuous variables are winsorized at the 2% level. See appendix for further details on the variables used.

3.3 Propensity Score Matching

A potential concern with the analysis is that MBond issuers are systematically different compared to any control group, since the choice to issue bonds in the MBond market is endogenous. For example, MBond issuers might be more financially constrained. The same factors that drive the choice to issue an MBond could, in principle, influence the outcome variables of interest. In order to reduce this selection problem, propensity score matching is applied to create an artificial counterfactual group of debtors, similar to MBond issuers.

Propensity Score Matching Process

In order to match MBond issuers to a control group of other debt issuers, a k-nearest neighbor matching process based on a logit model is applied. Based on the literature, k is set equal to three, that is using three companies from the control sample for each MBond issuer. In further unreported robustness tests, different numbers for k are used, which do not alter the findings. Companies are matched in the year prior to their respective debt issuance. MBond issuers are removed from the control sample prior to matching. Thus, an MBond issuer that issued a different type of debt security in another year cannot serve as a control company for an MBond issuer.

[Insert Table 1 here]

MBond issuers are matched to issuers of other types of debt based on the

variables described in Section 3.2. Treatment and control group are matched based on the proportion of fixed assets (AST), leverage (LEV), solvency (SOL), total profitability (TPR), size (SIZ), liquidity (LIQ), and sales turnover (STO). The selection of the variables is based on the study of Feihle and Lawrenz (2017), who investigate the post issue performance of MBonds. In addition, companies are matched according to their respective industry, based on the exact two-digit NAICS code. In contrast to Feihle and Lawrenz (2017), I control for the demand for debt by only allowing other issuers of debt to form the control group. As a consequence, additional matching variables in this study are the year of issuance, as well as the amount issued.

Table 1 presents the results of the propensity score matching[11]. From the MBond issuers, 78 companies have been matched to 234 companies from the control group.

The drawback of propensity score matching is that it only matches on observable firm characteristics. Thus, MBond issuers and the matched control group might still differ in unobservable characteristics which might bias the results. To further reduce potential bias by unobservable firm characteristics that might be correlated with the outcome variables, firm fixed effects are introduced to account for unobservable firm characteristics that are stable over time. In addition, the analysis closely follows the firm balance sheet channel to examine how the proceeds have been used. Nevertheless, I am fully aware of the shortcomings of this set-up[12].

[11] In addition, an unreported t-test of mean difference has been undertaken as a further robustness test. The results of the t-test confirm the results presented in Table 1.

[12] Despite the named shortcomings of this research design, using propensity score matching in combination with a difference-in-differences analysis can still be referred to as a standard method applied in the literature of interventions to alleviate financial constraints of SMEs (Kersten et al., 2017). In their review of the SME finance intervention literature, Kersten et al. (2017) find that all of the studies reviewed use a difference-in-differences approach and 75% of the studies combine DiD with propensity score matching. Often there is no alternative approach because the counterfactual of an intervention is usually not observable and the setting does not represent a natural experiment. Nevertheless, it is important to carefully assess the impact of interventions and shocks on investments, despite the less than optimal research setting.

Furthermore, MBond issuers are compared to an unmatched control group of debtors with comparable issuance volume. Comparable issuance volume is defined as the maximum issuance volume of MBond issuers.

3.4 Descriptive Statistics

Table 2 presents descriptive statistics for 78 MBond issuers, 709 debtors with issue volumes of comparable size, and 234 borrowers matched based on propensity scores. Panel A reports descriptives for the matching period prior to debt issuance (t = -1). Panel B reports descriptives for the post period (t = 0 to t = 2).

From Table 2, it becomes apparent that MBond issuers adjusted their capital structure with the emission of the MBond. While all issuers reduce the relative usage of current debt, the current debt ratio drops most for MBond issuers.

[Insert Table 2 here]

In addition, the bank debt ratio drops for MBond issuers but stays largely constant for other borrowers. This is not surprising, given the fact that the control sample also contains borrowers who obtain a new bank loan, whereas MBond issuers raise funds from the debt capital market, and, thus, change the composition of debt-market-based and bank financing. At this point, it does not necessarily imply refinancing of bank debt with the proceeds from the MBond emission. On the contrary, MBond issuers seem to increase their overall debt financing and lever up, compared to the control groups.

It is noteworthy that despite the increase in leverage, the average interest rate drops more heavily for MBond issuers compared to the control groups. This might indicate that MBond issuers suffered from financial constraints and hold-up behavior of their financing banks. The descriptive statistics do not provide a clear picture regarding the development of capital expenditures,

sales growth, or employment growth yet.

However, they show a severe deterioration in the financial performance and stability of MBond issuers. The profitability measures, ROA and ROCE, drop heavily; ROA even becomes negative. Although the average interest rate for MBond issuers fell, their average interest coverage ratio took a hit as a result of increased leverage and worse profitability. The rise in the standard deviation of ROA and ROCE for MBond issuers indicates heterogeneity in terms of post-issue performance, which could be explained by riskier investment projects, for example.

4 Financial Constraint Status

The first step in answering the question as to whether facilitated access to debt capital markets alleviates financial constraints and spurs firm investment requires to establish that MBond issuers were more likely to be financially constrained prior to the issuance of the MBond. For this purpose, MBond issuers are compared to the two different control groups. An univariate analysis of financial constraint status in the period prior to issuance is presented in Table 3.

[Insert Table 3 here]

The main variable to proxy for the financial constraint status of a firm in this paper is the FCP index by Schauer et al. (2019). The variable *Fin. Con. Firms* in Panel A of Table 3 reports the fraction of debtors that are in the top tercile of the FCP index in a given year, and, thus, are considered to be more financially constrained. The findings support the predictions made in Hypothesis 1. According to the FCP index, 46.2% of the MBond issuers are considered to be financially constrained in the year prior to issuance, which is significantly more than the 28.2% financially constrained other debtors with comparable issuance volumes. However, there is no significant difference in the ratio of financially constrained firms compared to the matched control sample.

Thus, the propensity score matching process appears to be able to select control firms with a comparable level of financial constraints in the year prior to issuance.

In Panel B of Table 3, the classification according to the FCP index is supplemented by other financial variables associated with debt capacity and financial constraints. With a leverage ratio of 73.5%, MBond issuers are more highly levered than unmatched debtors issuing debt of comparable size. High existing leverage reduces the capacity to raise additional debt, which can aggravate financial constraints.

In addition, a larger fraction of MBond issuers' debt is short-term. This can be due to two reasons: Firstly, firms that are financially constrained and do not receive sufficient financing from banks use short-term debt, such as trade credit, as financing alternative when bank lending is unavailable (Casey & O'Toole, 2014). However, financing long-term investments with short-term debt can become a critical problem for the firm, when short-term debt cannot be rolled over. Thus, firms have an incentive to keep a balanced debt maturity structure. Secondly, it might be the case that for MBond issuers in the year of issuance a larger fraction of long-term debt matures[13]. Both reasons indicate that the firm requires additional funds.

Considering the definition of financial constraints as a wedge between internal and external financing costs, Table 3 shows that MBonds have, on average, significantly higher costs of debt. This result is in line with the findings from Hale and Santos (2009) who state that firms are able to borrow at lower interest rates following their bond IPO. They attribute their findings to banks pricing their information monopoly and holding up borrowers for higher interest rates. Since SMEs are mostly bank dependent and have even fewer outside financing options available (Becker & Ivashina, 2014; Casey & O'Toole, 2014; Khwaja

[13]If long-term debt becomes due in less than one year, it is considered to be current debt accounting wise.

& Mian, 2008; Vermoesen et al., 2013), they are financially constrained in the sense that the wedge between internal and external financing is particularly large. Interestingly, despite the higher interest payments, there is no significant difference in interest coverage ratio a priori.

To sum up, the additional financial variables in Panel B of Table 3 support the finding of Panel A that MBond issuers are significantly more likely to be financially constrained compared to the control group of other debtors with comparable issue size. Moreover, Table 3 shows that the matched control sample appears to have a similar level of financial constraints, since there is no significant difference between MBond issuers and the control sample for any of the variables in Panel A and Panel B.

5 Primary Explanation - Investment Financing

5.1 Refinancing or Additional Debt

Banerjee and Duflo (2014) argue that firms are not financially constrained if additional credit offered to the borrower at lower interest rates only substitutes existing debt. The key to the identification of financial constraints would be the demand for additional financial resources which is not met (Banerjee & Duflo, 2014). Table 4 reports results for analyzing demand for debt, potential refinancing activities, and changes related to capital structure.

[Insert Table 4 here]

Panel A of Table 4 shows that for all three groups more than 65% of the debt raised is additional debt, with no significant differences among the groups. Thus, MBond issuers not only raise debt for refinancing, as suggested by Banerjee and Duflo (2014). Interestingly, MBond issuers raise larger amounts with the bond IPO compared to the level of total debt prior to issuance and signifi-

cantly more than both control groups. As a consequence, total debt growth of MBond issuers is more than three times the total debt growth of the control groups and leverage rises by 5.8 percentage points, whereas it remains relatively constant for the control groups. Although 65.2% of the MBond is additional debt, MBond issuers repay on average 12.1% of their bank debt, thus reducing their bank dependence. In addition to the hold-up problem of bank financing, bank-dependent firms are more likely to be financially constrained when a shock hits the banking sector, since they cannot easily substitute bank debt with market-based financing. Thus, firms might have an incentive to diversify their financing structure.

Moreover, the relative reliance on current debt also decreases by 13.1 percentage points. In addition, the results in Table 4 show that MBond issuers were able to reduce their costs of debt by 3.5 percentage points. Thus, more investment projects should become profitable.

In addition to the univariate results from Table 4, which only report differences in the year of emission (t = 0), a difference-in-difference model with the following specification is estimated[14]:

$$ReFin_{it} = \beta^{post} * POST_{it} + \beta^{DiD} * POST_{it} * MBond_i + \alpha_i + \alpha_T + \epsilon_{it} \quad (4)$$

The dependent variable $ReFin_{it}$ is one of four variables indicating potential refinancing and analyzing changes in financial structure. In sum, I estimate eight difference-in-difference models. One for each of the four variables indicating potential refinancing and analyzing changes in financial structure for both control groups. $POST_{it}$ is an indicator variable equal to 1 in the periods post issuance. Treatment is denoted by $MBond_i$, which is an indicator variable

[14]Note the different definitions in the time dimensions. T is defined as the years 2009 to 2019, whereas t is defined as the periods relative to debt issuance, i.e. t = {-2, -1, 0, 1, 2}.

equal to 1 if a firm issued an MBond and 0 otherwise. β^{DiD} is the difference-in-difference estimator of interest. The firm-fixed effect α_i absorbs the treatment dummy $MBond_i$. However, note that this is not true for year-fixed effect α_T and the post issuance dummy, since the latter is firm and time specific. For example, the year 2013 can be a post issuance year for one company and a pre issuance year for another. That is why additional annual year-fixed effects α_T are included.

Table 5 reports difference-in-differences OLS regression results for MBond issuers and the control samples between two years prior to the emission (t = -2) until two years after the emission (t = 2).

[Insert Table 5 here]

The results presented in Table 5 confirm the univariate findings in Table 4. MBond issuers increase their leverage, reduce the relative use of bank debt and current debt, and are able to also reduce their cost of debt. While the results presented in Table 3 state that MBond issuers and the matched control sample have been equally financially constrained, the results of tables 4 and 5 indicate that MBond issuers might have been more financially constrained. Even compared to the matched control group, MBond issuers are able to reduce their cost of debt, despite significantly increasing leverage.

Finding a significant decrease in the costs of debt also answers the question that Feihle and Lawrenz (2017) left open for further research, whether the MBond market was actually an attractive way of financing. Feihle and Lawrenz (2017) find that MBond issuers show a higher average interest rate compared to their control group. However, since Feihle and Lawrenz (2017) do not restrict their control group to firms with a demand for debt, the companies in their control group might be more mature with regard to the firm lifecycle and, thus, receive lower interest rates. According to the results presented in tables 4 and

5, for MBond issuers it was an attractive way of financing, since it significantly reduced their average interest rate.

5.2 Investments and Growth

Based on the assessment of financial constraint status in Table 3, and the changes in financing policy in Table 4, MBond issuers have been more financially constrained than the control group of comparable issuance volume, and equally financially constrained as the matched sample. Given the assumption that investments in projects would rise post issuance, when financial constraints have been alleviated, Hypothesis 2 can be refined. MBond issuers are expected to increase their investments more than the unconstrained control group of debtors with comparable issuance volume and about the same as the equally constrained control group of the matched (PSM) sample. In order to test this hypothesis, I estimate the following difference-in-differences model:

$$Growth_{it} = \beta^{post} * POST_{it} + \beta^{DiD} * POST_{it} * MBond_i + \alpha_i + \alpha_T + \epsilon_{it} \quad (5)$$

The structure of Equation (5) is basically the same as in Equation (4). Thus, the same assumptions with regard to post, treatment, and fixed effects still apply. Only the dependent variables of interest have been exchanged for four variables indicating whether the money has been spent for growth or held in cash and cash equivalents.

[Insert Table 6 here]

Table 6 reports difference-in-differences OLS regression results for MBond issuers, other debtors which issued debt of comparable size, and the matched sample for growth variables. For sales growth and employee growth, there appears to be no significant difference between MBond issuers and the matched sample. Moreover, the R-squared is comparatively low, especially for sales growth. Thus, distinguishing between MBond issuers and other debtors pre

and post issuance does not seem to sufficiently explain the variance in sales and employee growth. After examining capital expenditures, however, it becomes apparent that MBond issuers' relative investment into fixed assets is significantly lower post issuance, compared to both control groups. Instead, MBond issuers display more cash and cash equivalents on their balance sheet for the three years post issuance (t = 0 to t = 2). This indicates that MBond issuers might not have had enough positive NPV projects to invest in.

Thus, unmet demand for debt to finance investment projects does not seem to sufficiently explain the motivation to raise debt on the MBond markets. On the contrary, these results of lower investment and higher cash holdings give rise to the alternative explanation of market timing, examined in the following section.

6 Alternative Explanation - Market Timing

6.1 Profitability and Financial Stability

The alternative explanation of market timing implies that the MBond issuers exploit a window of opportunity to issue debt cheaper than future prospects would justify[15]. Consequently, the performance of MBond issuers would decline post issuance. Hypothesis 3 predicts that MBond issuers become less profitable and less financially stable post issuance. To test this hypothesis, I estimate the following difference-in-differences model:

$$Profit_{it} = \beta^{post} * POST_{it} + \beta^{DiD} * POST_{it} * MBond_i + \alpha_i + \alpha_T + \epsilon_{it} \quad (6)$$

[15]Note that DeAngelo et al. (2010) define market timing for seasoned equity offerings differently than I do for bond offerings. They use market-to-book ratios and excess stock returns as indicator for market timing. Since the upside potential for debt is limited, debt can be considered overvalued when the default risk is underestimated. Thus, I argue more broadly that management of MBond issuers expected the profitability as well as financial stability to decline, i.e. default risk to rise, and issued bonds before the expectations materialized.

The structure of Equation (6) is basically the same as in Equations (4) and (5). Thus, the same assumptions with regard to post and treatment indicator variables, as well as fixed effects still apply. Only the dependent variables of interest have been exchanged for four variables indicating changes in profitability and financial stability.

[Insert Table 7 here]

Table 7 reports difference-in-differences OLS regression results for MBond issuers and the control groups for variables of profitability and financial stability. From Table 7, it becomes apparent that MBond issuers' Return on Assets (ROA) drops significantly. One could argue that the drop in Return on Assets is a mechanical effect. Increased cash holdings on the balance sheet, which add to total assets but are not involved in sales generating operations, as well as increased interest expenses due to an increase in debt loading, which diminish net income, could reduce ROA without any change in operational effectivity. However, looking at Return on Capital Employed (ROCE) and the EBITDA Margin, MBond issuers also show a significant decline in operational profitability compared to the two control groups. Both measures are based on earnings before interest (and taxes) and the EBITDA margin is related to sales instead of total assets. Since there was no significant difference in sales growth between MBond issuers and the two control groups, it can be inferred that any growth in sales of MBond issuers might have been less profitable on average.

Arguably, MBond issuers might have invested in positive NPV projects that generate large losses in the beginning and yield large profits later. However, the typical term of MBonds is five years, with only few deviations. Thus, the analysis post issuance spans more than half of the total term of the MBond, leaving only a short period of time to overcompensate the losses before the MBond has to be either repaid or refinanced. Moreover, the payoff schedule is likely to be similar for projects within the same industry. Since industry codes

are used as exact matching variables in the propensity score matching process, payoff schedules for investment projects of MBond issuers and the matched sample are likely to be similar as well. Yet, there are significant differences in profitability between MBond issuers and companies in the matched sample.

With regard to financial stability, Table 7 also reports a significant drop in Interest Coverage for MBond issuers, despite the decrease in the average interest rate, reported in tables 4 and 5. The effect of the lower average interest rate seems to be overcompensated by a decline in operational profitability, since Interest Coverage is based on EBITDA, and an increase in overall interest expenses due to the increase of debt and leverage, reported in tables 4 and 5.

These findings support the predictions stated in Hypothesis 3: MBond issuers become less profitable and less financially stable post issuance.

6.2 Illiquidity Without Proceeds from Debt Issuance

Declining profitability can ultimately result in bankruptcy, if a company does not generate sufficient funds to meet its financial obligations, since the main reason to file for insolvency is illiquidity (§17 InsO). If the management of MBond issuers had anticipated future losses, and, consequently, draining liquidity, it might have undertaken measures that increase liquidity, such as issuing an MBond.

In order to investigate, whether the issuers were close to illiquidity and, thus, close to bankruptcy, the pro forma cash holdings post issuance are examined. The analysis is similar to the analysis of DeAngelo et al. (2010) but more rigorous since it takes changes in financing and investments post issuance into account and adjusts the pro forma cash holdings accordingly. As a consequence, changes in pro forma cash predominantly result from operating cash flows and potential equity injections or payouts.

[Insert Table 8 here]

Table 8 presents the results from the analysis of actual cash and pro forma cash post issuance. Panel A reports the fraction of companies that are pro forma cash negative in the periods t = 0 to t = 2 for MBond issuers and the two control groups. The most striking result from Table 8 is that 72.4% of MBond issuers would have already run out of cash in the year of the MBond IPO. This is roughly twice the number of pro forma insolvent companies in the two control groups.

While in the year of issuance MBond issuers hold more actual cash to total assets than the control groups, pro forma cash to total assets is significantly lower. For MBond issuers, pro forma cash to total assets is even negative on average in the year of issuance, whereas it is positive for the two control groups. These results confirm the predictions from Hypothesis 4, derived for the alternative explanation, that MBond issuers would have run out of cash without the proceeds from the MBond IPO.

Relaxing the assumption of no debt refinancing and no debt repayment, as in DeAngelo et al. (2010), would probably lead to even worse results for MBond issuers. As presented in Table 4, in the year of the Bond IPO, MBond issuers retire on average 12.1% of their bank debt. If the repayment of bank debt was mandatory, most MBond issuers could not have met their financial obligations without the proceeds from the MBond issuance.

Interpreting the deterioration of profitability and financial stability as well as the shortage in liquidity as motivation for MBond issues requires that management could foresee these developments. Given that most companies engage extensively in corporate planning and business forecasting, this assumption seems to be reasonable at least for the first year post issuance. Thus, the results presented in Table 8 indicate that a major motivation to issue MBonds might have been to provide additional liquidity, in order to avoid or postpone insolvency.

7 Conclusion

This paper explores two alternative explanations for raising debt in the MBond markets. The narrative of the introduction of the MBond market in 2010 was that the new market segments provided a financing alternative for bank dependent SMEs who were negatively affected by tightening bank financing conditions in the aftermath of the financial crisis. Facilitating access to debt capital markets for these financially constrained SMEs via the MBond market segments should alleviate financial constraints and spur firm investment, employment, and sales growth. With rising default rates in the MBond market, starting in 2012, an alternative explanation gained traction. The alternative explanation states that MBond issuers timed the market and exploited a window of opportunity to issue junk bonds to retail investors, in order to finance future losses.

Testing the first explanation of financially constrained SMEs using the MBond market as a financing alternative required to determine whether MBond issuers have been financially constrained prior to entering the MBond market. Comparing MBond issuers to a sample of firms issuing debt with comparable volume and a matched sample derived from propensity score matching yields that, indeed, MBond issuers have been financially constrained in the year prior to issuance according to the FCP index and other financial indicators of financial constraints. MBond issuers were using more short-term debt and had higher cost of debt pre issuance. Post issuance, the use of short-term debt and cost of debt fell significantly for MBond issuers, supporting the assumption of their prior financially constrained status. Despite a large increase in total debt due to the issuance of the bond, MBond issuers also retired on average 12.1% of their bank debt in the year of the MBond IPO. These results support the first part of the explanation that financially constrained SMEs tapped the MBond markets.

Subsequently, to test the second part of the first explanation, MBond issuers' investments in fixed assets, sales growth, and employment growth is compared to the two control groups. It was found that MBond issuers invest less in fixed assets and hold more cash on their balance sheet post issuance. Lower investments and higher cash holdings indicate that MBond issuers might not have had sufficient positive NPV projects to undertake with the proceeds from their bond IPO. These results contradict the explanation that financially constrained SMEs tap the MBond markets to alleviate financial constraints and fund investments. On the contrary, it gives rise to the exploration of the alternative explanation.

The concurrent explanation predicts declining profitability and financial stability. Indeed, the results indicate a deterioration of profitability and financial stability of MBond issuers post issuance compared to both control groups. Return on assets, return on capital employed, as well as the EBITDA margin drop significantly, compared to the two control groups. Despite lower interest rates, interest coverage deteriorates as well. The rise in total interest expenses due to increased leverage and total debt, as well as the decreased profitability seem to overcompensate the positive effect of a decrease in interest rates. Decreasing profitability supports the hypothesis of a lack of sufficient positive NPV projects. In addition, 72.4% of MBond issuers would have already run out of cash in the year of the MBond IPO, which is roughly twice the number of pro forma insolvent companies in the two control groups.

Thus, the empirical results are more in favor of the concurrent explanation. Although it appears that the MBond market has been a financing alternative for financially constrained companies, alleviation of the constraints did not spur investments as was initially expected. It is more likely that firms timed

the market to exploit a window of opportunity to issue junk bonds to retail investors, in order to cover future losses and avoid or postpone bankruptcy.

The analysis of the investment behavior of financially constrained MBond issuers post issuance adds to the literature of SME financing and the alleviation of their financial constraints with market-based measures. To the best of my knowledge, this paper is the first to examine the investment behavior of SMEs after a bond IPO. However, due to potential selection issues, the analysis of the MBond market in this study cannot easily be generalized. Over the course of the analysis, it became apparent that MBond issuers might have been fundamentally different compared to other financially constrained issuers in the matched control sample. Thus, the possibility that facilitated access for financially constrained SMEs to debt capital markets might spur investment, employment, and sales growth cannot be rejected in general. Nevertheless, it can be inferred from the results that facilitating access to debt capital markets for financially constrained SMEs alone is not sufficient to spur investment, employment, and sales growth. One has to carefully consider, how screening and monitoring can be implemented in a market, largely populated by retail investors and characterized by the absence of institutional investors. Thus, these findings might be relevant for policies aiming at increasing debt market participation of SMEs and retail investors, such as the EU Capital Markets Union.

Although the findings indicate that MBond issuers might have been able to issue junk bonds to retail investors in order to postpone bankruptcy, resulting from their bad prospects, further inquiry is required. Additional research needs to evaluate the extent to which investors were aware of the questionable quality of the investment prospects of the MBond issuers.

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Appendix

A.I Tables

Table 1: Propensity Score Matching - Results

	Means Treated	Means Control	Std. Mean Diff.
AST	0.427	0.440	-0.067
LEV	0.425	0.489	-0.121
LIQ	2.989	3.521	-0.058
TPR	0.064	0.064	-0.001
SIZ	18.339	18.621	-0.267
SOL	4.354	4.810	-0.033
STO	1.402	1.443	-0.044
Amount Issued (in M)	42.989	47.194	-0.120

This table presents means for the matched treatment and control group. Treatment and control group are matched based on the proportion of fixed assets to total assets (AST), leverage (LEV), solvency (SOL), total profitability (TPR), size (SIZ), liquidity (LIQ) and sales turnover (STO). In addition, companies are matched according to their respective industry, based on the exact matching two-digit NAICS code. Additional matching variables are the year of issuance, and the amount issued. Matching results of industry codes and issuance year are not reported.

Table 2: Summary Statistics Prior to Issuance (t = -1) and Post Issuance (t = 0 to t = 2)

	MBond Issuers (N = 78)			Other Debt (Comp. Iss. Vol.) (N = 709)			Other Debt (PSM Sample) (N = 234)		
	mean	median	sd	mean	median	sd	mean	median	sd
Panel A: Prior to issuance (t = -1)									
Fin. Structure									
Current Debt / TD	0.52	0.56	0.24	0.46	0.44	0.22	0.49	0.47	0.23
Bank Debt / TD	0.35	0.34	0.22	0.37	0.36	0.21	0.39	0.39	0.21
Leverage	0.74	0.76	0.15	0.69	0.69	0.16	0.71	0.71	0.16
Int. Rate	0.12	0.09	0.10	0.08	0.06	0.08	0.10	0.07	0.10
Investment									
CapEx Ratio	0.08	0.06	0.07	0.07	0.06	0.06	0.06	0.05	0.06
Sales Growth	0.10	0.07	0.27	0.09	0.04	0.31	0.10	0.05	0.37
Empl. Growth	0.10	0.02	0.21	0.06	0.03	0.18	0.05	0.02	0.18
Cash Holdings	0.08	0.04	0.10	0.08	0.06	0.08	0.08	0.06	0.07
Fin. Stability									
ROA	0.03	0.02	0.06	0.02	0.02	0.07	0.02	0.02	0.08
ROCE	0.11	0.10	0.14	0.10	0.09	0.15	0.10	0.09	0.18
EBITDA Margin	0.14	0.08	0.19	0.11	0.09	0.14	0.10	0.09	0.12
Int. Cover	7.02	3.20	18.98	9.97	5.12	18.75	8.00	4.59	15.34
Panel B: Post issuance (t = 0 to t = 2)									
Fin. Structure									
Current Debt / TD	0.38	0.38	0.19	0.41	0.39	0.20	0.44	0.41	0.20
Bank Debt / TD	0.21	0.19	0.18	0.37	0.37	0.22	0.41	0.41	0.21
Leverage	0.81	0.80	0.12	0.69	0.69	0.16	0.69	0.69	0.16
Int. Rate	0.09	0.08	0.06	0.06	0.05	0.06	0.08	0.06	0.08
Investment									
CapEx Ratio	0.06	0.05	0.06	0.07	0.06	0.06	0.07	0.06	0.06
Sales Growth	0.11	0.07	0.30	0.08	0.04	0.28	0.10	0.05	0.34
Empl. Growth	0.10	0.03	0.25	0.06	0.03	0.17	0.06	0.03	0.17
Cash Holdings	0.10	0.07	0.10	0.08	0.06	0.07	0.08	0.06	0.07
Fin. Stability									
ROA	-0.02	0.00	0.09	0.02	0.02	0.07	0.01	0.02	0.08
ROCE	0.02	0.06	0.16	0.08	0.08	0.14	0.08	0.08	0.16
EBITDA Margin	0.10	0.07	0.19	0.12	0.09	0.16	0.10	0.09	0.13
Int. Cover	1.97	1.83	3.34	8.90	5.48	14.11	6.70	4.61	9.73

This table presents descriptive statistics for 78 MBond issuers 709 debtors with issues of comparable volume and the matched sample of 234 borrowers, who issued debt between 2010 and 2016. All variables are defined in the appendix.

Table 3: Univariate Analysis of Financial Constraint Status in t = -1

	Means			p-Values	
	MBond Issuers (N = 78)	Other Debt (Comp. Iss. Vol.) (N = 709)	Other Debt (matched Sample) (N = 234)	MBond vs. Other Debt (Comp. Iss. Vol.)	MBond vs. Other Debt (matched Sample)
Panel A: FCP index					
Fin. Con. Firms	0.46	0.28	0.43	< 0.001	0.322
Panel B: Other Financing Variables					
Leverage	0.74	0.69	0.71	0.013	0.192
Current Debt / TD	0.52	0.46	0.49	0.024	0.324
Interest Rate	0.12	0.08	0.10	< 0.001	0.189
Interest Coverage	7.02	9.97	8.00	0.196	0.680

This table reports mean values for different indicators of financial constraints for debt issuers in the year prior to issuance (t = -1). The first control group, Other Debt (Comp. Iss. Vol.), includes other debtors which issued debt of comparable size. Comparable size is determined as debt issues up to the maximum volume of the MBond issuers in the sample. The second control group consists of the matched sample from the propensity score matching. Fin. Con. Firms in Panel A describes the fraction of firms that are considered financially constrained with regard to the terciles of the FCP index. A Pearson's chi-squared test is used, to assess how many MBond issuers have been in the top FCP tercile compared to other matched and unmatched debtors, in the year prior to debt issuance. Panel B presents other financing variables associated with a firm being financially constrained. Leverage is defined as total debt divided by total assets. Interest rate is calculated as interest expenses divided by long-term debt. Interest Coverage Ratio is based on EBITDA. All variables are defined in detail the appendix.

Table 4: Univariate Analysis of Changes in Financial Variables in t = 0 compared to t = -1

	MBond Issuers		Other Debt (Comp. Iss. Vol.)		Other Debt (matched Sample)		MBond vs. Other Debt (Comp. Iss. Vol.)	MBond vs. Other Debt (matched Sample)
	Mean	p-Value	Mean	p-Value	Mean	p-Value	p-Value	p-Value
Panel A: Demand for Debt								
Net Debt Added	0.65	-	0.70	-	0.72	-	*0.742*	*0.728*
Amount Issued / TD_{-1}	0.81	-	0.43	-	0.55	-	*0.005*	*0.060*
Panel B: Financial Structure								
Total debt growth	0.46	*< 0.001*	0.14	*< 0.001*	0.14	*< 0.001*	*< 0.001*	*< 0.001*
Bank debt growth	-0.12	*0.030*	0.14	*< 0.001*	0.17	*< 0.001*	*< 0.001*	*< 0.001*
Δ Bank debt / TD	-0.12	*< 0.001*	0.01	*0.035*	0.01	*0.101*	*< 0.001*	*< 0.001*
Δ Current Debt / TD	-0.13	*< 0.001*	-0.03	*< 0.001*	-0.04	*0.009*	*< 0.001*	*< 0.001*
Δ Leverage	0.06	*< 0.001*	0.01	*0.045*	-0.01	*0.352*	*0.004*	*< 0.001*
Δ Interest Rate	-0.03	*< 0.001*	-0.01	*< 0.001*	-0.01	*0.009*	*0.033*	*0.080*

This table reports mean values for financial variables determining the financial structure in t = 0. Additional Debt describes how many Cents of an additional Euro raised were "fresh money" and added to long-term debt. It is calculated as the difference of long-term debt in t = 0 and t = -1, divided by the amount issued. Amount Issued / Total Debt describes the relative size of the new debt issued compared to total debt outstanding in the year prior to issuance. Total debt and bank debt growth are relative changes in total debt and bank debt. Δ Current Debt / TD, Δ Leverage and Δ Interest Rate are differences of the respective variables between t = 0 and t = -1. The p-values in columns 3, 5 and 7 result from a one sample t-test, with the Null hypothesis that the difference of a variable in a group between t = -1 and t = 0 is equal to 0. The p-values in columns 8 and 9 indicate significant differences between the means of the three groups. Net Debt Added and Amount Issued / Total Debt are only compared across groups, since they are one-time observations. All variables are defined in detail the appendix.

Table 5: Post-Issue Differences in Financial Structure between MBond Issuers and Other Debtors

	Dependent variable:							
	Leverage		'Bank Debt / TD'		'Current Debt / TD'		Interest Rate	
	CIV	PSM	CIV	PSM	CIV	PSM	CIV	PSM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	0.006*	−0.008	0.016***	0.027**	−0.025***	−0.034**	−0.005*	−0.009
	(0.004)	(0.008)	(0.005)	(0.012)	(0.006)	(0.014)	(0.003)	(0.006)
D.DiD	0.053***	0.062***	−0.134***	−0.149***	−0.111***	−0.100***	−0.024**	−0.021**
	(0.014)	(0.015)	(0.020)	(0.021)	(0.020)	(0.022)	(0.010)	(0.011)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,604	1,347	3,264	1,228	3,604	1,347	3,523	1,348
Adjusted R^2	0.780	0.750	0.819	0.791	0.677	0.602	0.514	0.497

*p<0.1; **p<0.05; ***p<0.01

This table presents difference-in-differences OLS regression results analyzing variables associated with the financial structure of MBond issuers and two control groups, two years prior until two years after emission. Post is an indicator variable which equals one in the years post issuance. The year of emission is defined as t = 0 and determines the first year of the "post" period. The first control group, *CIV* (Other Debt (Comp. Iss. Vol.)), includes other debtors which issued debt of comparable size. Comparable size is determined as debt issues up to the maximum volume of the MBond issuers in the sample. The second control groups, *PSM*, consists of the matched sample from the propensity score matching. Leverage is defined as total debt divided by total assets. Interest rate is calculated as interest expenses divided by long-term debt. Standard errors are clustered at the firm level to account for non-independent observations within firms. All variables are described in detail in the appendix.

Table 6: Post-Issue Differences in Investments between MBond Issuers and Other Debtors

	Dependent variable:							
	CapEx Ratio		Sales Growth		Empl. Growth		Cash Holdings	
	CIV	PSM	CIV	PSM	CIV	PSM	CIV	PSM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	0.001	0.004	−0.004	−0.008	−0.003	0.017	0.003	0.006
	(0.002)	(0.004)	(0.012)	(0.027)	(0.007)	(0.014)	(0.002)	(0.004)
D.DiD	−0.012*	−0.018**	0.055	0.054	0.030	0.024	0.023**	0.025**
	(0.007)	(0.007)	(0.039)	(0.045)	(0.020)	(0.023)	(0.009)	(0.010)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,256	1,254	3,195	1,245	3,370	1,265	3,643	1,345
Adjusted R^2	0.532	0.500	0.085	0.017	0.319	0.302	0.680	0.622

*p<0.1; **p<0.05; ***p<0.01

This table presents difference-in-differences OLS regression results analyzing growth variables of MBond issuers and two control groups, two years prior until two years after emission. The year of emission is defined as t = 0 and the first year of the "post" period. The first control group, *CIV* (Other Debt (Comp. Iss. Vol.)), includes other debtors which issued debt of comparable size. Comparable size is determined as debt issues up to the maximum volume of the MBond issuers in the sample. The second control group, *PSM*, consists of the matched sample from the propensity score matching. CapEx ratio is defined as Capital Expenditures divided by total assets. Sales and employment growth are year-on-year growth rates. Cash holdings are defined as cash and cash equivalents divided by total assets. Standard errors are clustered at the firm level to account for non-independent observations within firms. All variables are described in detail in the appendix.

Table 7: Post-Issue Differences in Financial Stability Variables Between MBond Issuers and Other Debtors

	Dependent variable:							
	ROA		ROCE		EBITDA Margin		Int. Cover	
	CIV	PSM	CIV	PSM	CIV	PSM	CIV	PSM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	−0.002	0.001	−0.010**	−0.006	0.003	0.002	−0.949**	−0.418
	(0.002)	(0.005)	(0.004)	(0.009)	(0.003)	(0.007)	(0.421)	(0.571)
D.DiD	−0.033***	−0.036***	−0.061***	−0.064***	−0.034***	−0.033***	−2.630*	−2.865*
	(0.010)	(0.011)	(0.021)	(0.022)	(0.011)	(0.012)	(1.537)	(1.587)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,542	1,349	3,520	1,345	3,462	1,342	3,521	1,347
Adjusted R^2	0.490	0.376	0.581	0.502	0.735	0.556	0.670	0.571

*p<0.1; **p<0.05; ***p<0.01

This table presents difference-in-differences OLS regression results analyzing variables of profitability and financial stability of MBond issuers and two control groups, two years prior until two years after emission. The year of emission is defined as t = 0 and the first year of the "post" period. The first control group, *CIV* (Other Debt (Comp. Iss. Vol.)), includes other debtors which issued debt of comparable size. Comparable size is determined as debt issues up to the maximum volume of the MBond issuers in the sample. The second control group, *PSM*, consists of the matched sample from the propensity score matching. Return on assets (ROA) is defined as net income divided by total assets. ROCE (Return on capital employed) is calculated as EBIT divided by the difference of total assets and current debt. Interest Coverage Ratio is based on EBITDA. Standard errors are clustered at the firm level to account for non-independent observations within firms. All variables are described in detail in the appendix.

Table 8: Illiquidity Without Proceeds from Issuance

Period t	Means			p-Values	
	MBond Issuers	Other Debt (Comp. Iss. Vol.)	Other Debt (matched Sample)	MBond vs. Other Debt (Comp. Iss. Vol.)	MBond vs. Other Debt (matched Sample)
Panel A: Companies with Pro Forma Cash < 0					
0	0.724	0.349	0.369	< 0.001	< 0.001
1	0.792	0.445	0.457	< 0.001	< 0.001
2	0.841	0.489	0.517	< 0.001	< 0.001
Panel B: Actual Cash / TA					
-1	0.077	0.081	0.079	0.717	0.886
0	0.111	0.086	0.084	0.051	0.048
1	0.091	0.080	0.077	0.289	0.228
2	0.083	0.080	0.077	0.837	0.667
Panel C: Pro Forma Cash / TA					
0	-0.086	0.047	0.049	< 0.001	< 0.001
1	-0.152	0.022	0.024	< 0.001	< 0.001
2	-0.186	0.011	0.007	< 0.001	< 0.001

This table reports pro forma cash ratios, if the firms did not receive cash proceeds from the debt issuance. Pro forma cash and total assets assume that total debt, as well as the capital expenditures ratio remain on the same level as in the year prior to debt issuance. Thus pro forma cash adjusts for potentially issuance related changes in cash flow from financing activities and investment cash flow. Panel A reports the fraction of firms that display a negative pro forma cash balance in the periods after the debt issuance (t = 0 to t = 2). Panel B and Panel C report actual / pro forma cash balances relative to total assets.

A.II Variable Definitions

Table 9: Definitions for Propensity Score Matching Variables

Variable	Description	Definition
AST	Asset Tangibility	$\frac{FixedAssets}{TotalAssets}$
LEV	Leverage	$\frac{Equity}{TotalDebt}$
LIQ	Liquidity	$\frac{CurrentAssets}{Short-termDebt}$
TPR	Total Profitability	$\frac{EBIT}{TotalAssets}$
SIZ	Size	$log(TotalAssets)$
SOL	Solvency	$\frac{EBIT}{InterestExpenses}$
STO	Sales Turnover	$\frac{Sales}{TotalAssets}$

Variables for Propensity Score Matching are based on the ones used by Feihle and Lawrence (2017). All data for variables presented here is extracted from the Bureau van Dijk, Dafne database.

Table 10: Definitions for Other Variables

Variable	Description	Defintion
Leverage	Leverage ratio	$\frac{TotalDebt}{TotalAssets}$
Int. Rate	Approx. of Interest Rate	$\frac{InterestExpenses}{Long-termDebt}$
CapEx Ratio	Investments in property, plant and equipment measured as Capital Expenditures relative to Total Assets	$\frac{CapitalExpenditures}{TotalAssets}$
Cash Holdings	Cash and cash equivalents held on balance sheet	$\frac{CashandCashEquiv.}{TotalAssets}$
ROA	Return on Assets	$\frac{NetIncome}{TotalAssets}$
ROCE	Return on Capital Employed	$\frac{EBIT}{TotalAssets-CurrentDebt}$
EBITDA Margin	EBITDA Margin	$\frac{EBITDA}{Sales}$
Int. Cover	Interest Coverage Ratio	$\frac{EBITDA}{InterestExpenses}$
Net Debt Added	Additional Net Debt post issuance	$\frac{TotalDebt_0-TotalDebt_{-1}}{AmountIssued}$

Data for accounting variables is extracted from the Bureau van Dijk, Dafne database. Amount issued is extracted from Bloomberg or Thomson Eikon or hand collected.

Rating Inflation and the Collapse of the German SME Bond Market

July, 2021

Abstract

Improving access to bond financing for SMEs has long been an important goal for policy makers. This paper examines the introduction of the German MBond market, a lightly-regulated small volume bond market. The MBond market sought to fulfill a two-fold goal: enabling SMEs a financing option outside the banking sector, as well as creating a new asset class for retail investors. This paper presents evidence that MBonds defaulted at very high rates. Further evidence suggests that ratings may have been inflated relative to a regular bond market benchmark, preventing retail investors from accurately assessing default risk. As a consequence, the MBond market was relatively more expensive for high quality than for low quality issuers. This may have contributed to the near-total collapse of the market.

Keywords: Public debt · Private debt · Debt policy · Capital structure · Small- and medium sized enterprises (SMEs)

JEL classification: G21 · G30 · G32 · G33

1 Introduction

The German MBond market was highly welcomed by market participants in 2010, as it promised to solve two issues simultaneously. Firstly, in the aftermath of the financial crisis and in the face of increasing regulation due to Basel II and Basel III banks reduced their loans to SMEs (Angelkort & Stuwe, 2011; ECB, 2020; Schindele & Szczesny, 2016; Schmitt, 2012). Secondly, due to the low interest environment, investors were looking into new investment opportunities. The German MBond market should especially allow retail investors to participate in SMEs (Bösl & Hasler, 2012) that are in general considered to be the backbone of the economy (European Commission, 2015). However, in 2012 default rates started to rise. Ultimately, until the writing of this paper, one third of all MBonds defaulted. As a consequence, the major stock exchanges closed or altered their MBond market segments. The market collapsed and only saw few bond IPOs after 2015. Although the MBond market was advertised as "quality segment" (see for example Börse Stuttgart (2010) and Börse Düsseldorf (2010)), ex post it appeared to be a high risk market.

The purpose of this paper is to examine, whether investors in the primary market were aware of the inherent risk of the MBonds. Mietzner et al. (2018), for example, document rating inflation, which could have distorted the information channel. As a consequence, investors - especially retail investors - might have been unable to distinguish between high and low quality MBond issuers. This could have resulted in a "lemons problem", as described by Akerlof (1970) and might have, finally, contributed to the collapse of the MBond market. Thus, this paper examines whether investors were able to distinguish between high and low quality issuers and to which extent differences in default risk were reflected in primary market yield spreads of MBonds.

Rating inflation occurs when credit ratings systematically underestimate default risk and can be driven by different factors. Rating shopping, that is

obtaining solicited ratings from different rating agencies, can lead to rating inflation, since issuers only disclose the most favorable rating (Skreta & Veldkamp, 2009). Rating shopping can occur if ratings are solicited, the rated security is sufficiently complex and there is more than one rating agency (Skreta & Veldkamp, 2009). Competition can induce rating inflation, since it exacerbates rating shopping (Bolton et al., 2012). In addition, even if credit rating agencies maximize reputation, they are incentivized to inflate their ratings in a competitive environment (Mariano, 2012). In repeated relationships between issuer and rating agency, rating agencies are likely to inflate ratings and build-up two-sided reputation (Frenkel, 2015). Issuers know the true risk of their security and recognize rating inflation. Thus, rating agencies can increase their revenue with lower quality issuers (Frenkel, 2015). Investors, however, only learn about rating inflation in case of default (Frenkel, 2015). Rating inflation can be even worse if investors are unsophisticated, since reputation costs are lower (Bar-Isaac & Shapiro, 2013; Bolton et al., 2012; Pagano & Volpin, 2010, 2012).

The German MBond market might have been prone to rating inflation, for the following reasons. Solicited ratings were provided by four small German rating agencies (Mausbach & Simmert, 2012; Mietzner et al., 2018), which would allow for rating shopping. Although the big three rating agencies were not active in the market, competition was still reported to be intense (Florstedt, 2017; Mietzner et al., 2018). Mandatory annual rating updates resulted in repeated interactions between issuers and rating agencies (Mausbach & Simmert, 2012). Finally, the MBond market mainly targeted retail investors, which are considered to be less sophisticated (Herrmann, 2017). Indeed, retail investors were the major investor group in the German MBond market and were more likely to be invested in MBonds which later defaulted (Herrmann, 2017). As a result, rating inflation might have distorted the information channel.

In order to assess whether MBond investors were able to distinguish between issuers with high and low default risk, this study compares IPOs of MBonds and a sample of other listed corporate bonds. For robustness, the MBond sample is also compared to a subset of the control group of other listed corporate bonds, with comparable issuance volume. This way, size related effects can be reduced in the analyses. In addition, this paper focuses on the primary market, since yield spreads in the primary market better represent the actual cost of debt faced by the bond issuer (Gabbi & Sironi, 2005).

In a first step, potential rating inflation is examined. For this purpose, realized default rates are compared across initial credit ratings. Subsequently, implied probability of default is calculated for investment grade and non-investment grade rated bonds. The results indicate rating inflation in the MBond market segments. Realized default rates and implied probability of default are higher for investment grade rated than for non-investment grade rated MBonds. However, the cost-of-debt benefits of rating inflation are small: the difference in yield spreads between investment grade rated and non-investment grade rated MBonds is only 72 basis points. Average yield spreads of investment grade rated MBonds still exceed average yield spreads for non-investment grade rated bonds of the control groups.

Nevertheless, rating inflation has the potential to distort the information channel and hamper the assessment of default risk. Indeed, the results indicate that differences in default risk were not reflected in MBond yield spreads. The average yield spread of a high quality MBond with low default risk was at the same level as the average yield spread of a low quality MBond with high default risk. Thus, it appears that MBond investors were not able to distinguish between high and low quality issuers.

Investors might learn about rating inflation from realized defaults (Frenkel, 2015). As a consequence, they might assess default risk differently. In order to

examine potential learning effects, I split the sample after 2012, when default rates started to rise. Despite rising default rates, I find that MBond investors were still not able to distinguish between high and low quality MBond issuers. To the contrary, the results suggest they relied even more on ratings.

Closest to this study is the paper of Mietzner et al. (2018), who argue that high quality MBond issuers were aware of rating inflation and used underpricing to signal their quality. Their argumentation implies that investors could assess differences in default risk with the help of the underpricing signal. Nevertheless, this potential signal does not alter the interpretation of my findings, for two reasons. Firstly, this signal of quality is only available in the secondary market, whereas, in the primary market it would only be available for subsequent MBond issues, which are scarce. Thus, in the primary market, the vast majority of high quality MBond issuers were still indistinguishable from low quality MBond issuers.

Secondly, underpricing as a signal of quality is costly by design and adds to the already high issuance costs in the MBond market. However, these additional costs need to be overcompensated by lower yield spreads. Even for the minority of issuers who issue multiple MBonds it is questionable whether lower yield spreads of subsequent MBond issues overcompensate the costs of underpricing of the initial MBond IPO. As a consequence, the MBond market is relatively more expensive for high quality issuers than for low quality issuers.

It is plausible that when high quality issuers became aware of the "lemons" in the market due to rising default rates between 2012 and 2015, they withdrew from further bond IPOs in the MBond market. Other sources of financing might have been more cost efficient for high quality issuers. Thus, only low quality issuers would have been left willing to issue more MBonds. Following the argumentation of Akerlof (1970), the market would have collapsed as a result.

The remainder of this paper is organized as follows. Section 2 gives an overview over the literature on ratings and rating inflation. Section 3 describes the MBond market with an emphasis on the issuance process. In section 4, hypotheses are derived. Section 5 describes the sample selection and provides descriptive statistics. The main empirical analysis, documenting rating inflation and the pricing of differences in default risk, is presented in section 6. Section 7 concludes.

2 Credit Ratings and Bond Yields in the Literature

Credit ratings by professional rating agencies (CRA) are a major tool to increase transparency with regard to the default risk of a security or its issuer. A voluntary rating by the issuer can also signal transparency and low default risk and, thus, solve principal agent problems (Gonzalez et al., 2004). In addition, credit ratings obviate the need for every investor to assess the credit worthiness individually. Therefore, they facilitate access to debt capital markets (Gonzalez et al., 2004) and influence bond prices (Gabbi & Sironi, 2005; May, 2010). However, there are different ways how credit ratings can influence bond prices.

2.1 Regulation, Coordination and Information Effects of Credit Ratings

The literature on credit ratings identifies three main channels through which credit ratings can affect bond prices: regulation, coordination and information channel (Jeon & Lovo, 2013).

The Regulation Channel

Some institutional investors are required to only purchase and hold investment grade rated bonds. That is why investment grade rated bonds have a higher price than their non-investment grade rated counterparts, independent of their actual default risk (Jeon & Lovo, 2013). Interestingly, it is not even necessary that the rating agency provides additional information about the issuer's default risk (Jeon & Lovo, 2013). For example, in the case of a downgrading of a security from investment grade to non-investment grade, regulation might force institutional investors to sell this security. This might increase price pressure in addition to the risk of default. Thus, the regulation by itself does not necessarily improve information efficiency. However, the MBond market mainly targeted retail investors, therefore, the regulation channel is of less relevance for the MBond market.

The Coordination Channel

While default risk was irrelevant to the regulation channel, it is the major factor of the coordination channel. In the coordination channel default is considered to be an endogenous choice of the issuer, conditional on the cost of capital (Jeon & Lovo, 2013). As Weber et al. (2018) point out in their experimental study, the relation between default risk of bonds and their initial pricing in the bond IPO works in both directions. On the one hand, the inherent operational default risk accounts for a major fraction of the yield spread between corporate bonds and risk-free sovereign bonds with comparable maturity structure. On the other hand, the initial pricing of the bond also determines the burden of debt payments for the issuer. High interest payments in combination with limited liability might incentivize the debtor to choose more risky projects (Weber et al., 2018). As a consequence, higher yields or issue prices below par might increase default risk (Weber et al., 2018). However, MBond issuers were able to decrease their average debt cost of capital with the MBond IPO (Adam &

Wilimzig, 2021). That is why, the coordination channel is of less importance to the MBond market.

The Information Channel

In contrast to the coordination channel, in the information channel default risk is considered to be exogenous, and largely determined by the quality of the investment project to be financed by the issuer which is unknown to investors (Jeon & Lovo, 2013). Longstaff et al. (2005) argue that default risk is the key determinant for corporate bond yield spreads. Thus, ratings affect bond prices via the information channel, if they reveal additional information about the issuer's default risk that would be otherwise unknown to investors (Jeon & Lovo, 2013). Indeed, May (2010), for example, finds that investors in the bond and stock market react to a rating up- or downgrade. However, whether credit ratings increase information efficiency via the information channel largely depends on the reliability of ratings. The reliability, however, depends on the information acquisition technology of the rating agency, as well as the incentives for rating agencies to provide unbiased ratings and issuers to disclose unbiased ratings as well (Jeon & Lovo, 2013). These factors have the potential to distort the information channel.

2.2 Distortions in the Information Channel due to Rating Inflation

In principle, all three channels assume that rating agencies provide and issuers publish unbiased ratings. This assumption is particularly important for a flawless functioning of the information channel. However, the market structure for credit ratings might distort the information channel. For example, credit rating agencies and issuers might have divergent incentives, which lead to inaccurate or biased ratings.

Rating Shopping

In the case of solicited ratings, which is ratings paid by the issuer, issuers are free to obtain multiple ratings from different rating agencies, a practice known as rating shopping. Unsurprisingly, there is an incentive to only disclose the most favorable rating, prior to the issuance of a security. Skreta and Veldkamp (2009) develop a model, in which ratings differ if assets are sufficiently complex. In this model, rating agencies provide unbiased ratings. If an asset is simple, the ratings of different rating agencies are likely to be similar (Skreta & Veldkamp, 2009). However, if assets become more complex, ratings tend to differ more and issuers have the opportunity to publish the most favorable rating (Skreta & Veldkamp, 2009). Thus, although rating agencies provide unbiased ratings, which only differ due to the asset complexity, the disclosed ratings by the issuer are positively biased, since issuers only disclose the best ratings (Skreta & Veldkamp, 2009).

Competition

Competition among credit rating agencies can exacerbate bias from rating shopping. In their model Bolton et al. (2012) show that increased competition facilitates rating shopping, since issuers have more ratings to choose from. In addition, credit rating agencies might have an incentive to offer favorable ratings for short-term profit, to counter rating shopping in a competitive environment and to increase their market power. That is why, despite the potential increase in informativeness of two ratings, a monopoly credit rating agency may be more efficient than a duopoly (Bolton et al., 2012).

In principle, reputation concerns should mitigate these incentive problems (Mathis et al., 2009). Credit ratings by rating agencies are only in demand, if their reputation indicates that the rating is credible (Mathis et al., 2009). Thus, reputation costs reduce the incentive to provide inflated ratings.

However, even if CRA maximize reputation, competition might lead to

rating inflation (Mariano, 2012). Mariano (2012) developed a model in which rating agencies seek to maximize their reputation while simultaneously protecting their market power. The rating agency receives public and private information. Private information can be either noisy or precise. To protect its reputation the rating agency does not want to be *seen* to make mistakes and aims to *appear* competent (Mariano, 2012). If a rating agency has noisy information, it has an incentive to contradict public information in a competitive market, to pretend it holds precise information and increase its reputation (Mariano, 2012). This illustrates how reputational concerns in a competitive environment might reduce rating accuracy. In addition, the asymmetric effect of a good versus a bad rating might lead to a positive bias (Mariano, 2012). If the incumbent rating agency with noisy information issued a bad rating, the issuer might ask an entrant rating agency to also provide a rating (Mariano, 2012). The entrant rating agency has an incentive to provide a favorably good rating because she gains market share if default does not materialize (Mariano, 2012). An incumbent rating agency with noisy information might anticipate this and try to avoid the entrance of a new agency by also issuing a favorably good rating (Mariano, 2012). That is how competition might lead to rating inflation even though rating agencies also try to maximize reputation.

Thus, in a competitive environment it does not even take bribes[1], conflicts of interest and repeated relationships between rating agencies and their client firms for inflated ratings to occur (Mariano, 2012).

Bae et al. (2019) and Becker (2011) find supporting evidence for the theories linking competition to rating inflation. For example, the increased competition by the entry of Fitch coincides with lower quality ratings: "Rating levels increased, the correlation between ratings and market-implied yields fell, and

[1]In addition, competition among rating agencies might also reduce rating prices. However, honest certification requires high prices that might even exceed monopoly prices (Strausz, 2005). Thus, low rating prices might increase the likelihood of bribery and inflated ratings (Strausz, 2005).

the ability to predict default deteriorated" (Becker, 2011). Bae et al. (2019) use rising market share of S&P in Canada as a measure of competition in the market for ratings of Canadian corporate bonds and find that the rating quality of the incumbent rating agency, DBRS, declines with increased competition by S&P. DBRS's ratings became more favorable and less informative about the credit quality of Canadian bonds when the market share or S&P in Canada increased (Bae et al., 2019).

Repeated Relationships of Issuer and Credit Rating Agency

Repeated relationships of issuer and credit rating agency might also induce rating inflation. Frenkel (2015) examines the effect of repeated interaction of an issuer with a certain credit rating agency. As in Bouvard and Levy (2018), the model of the author predicts that rating agencies build up a two-sided reputation, one for issuers and the other for investors (Frenkel, 2015). Knowing about the true risk of the asset, the issuer knows when the rating agency inflates the ratings (Frenkel, 2015). Thus, to issuers of securities, the rating agency is known to provide favorable ratings. At the same time, investors only learn about the inflated ratings in case of default (Frenkel, 2015). Thus, in the absence of default, the reputation of the credit rating agency to investors remains high. As a consequence, the rating agency becomes more attractive for issuers with assets of low quality and can extend their business.

In addition, in the case of follow-up ratings, the incentive for rating agencies to inflate ratings might increase even more, for two reasons. Firstly, if the initial rating was favorable, the issuer would probably be more willing to stick with that specific rating agency, which increases its revenue. Secondly, the costs and efforts for providing a follow-up rating are probably lower, since basic research about the company, its market and industry, as well as the structure of the security has already been conducted for the initial rating. As a consequence, follow-up ratings are probably more profitable for the rating

agency, which might be a strong incentive to keep the issuer by providing favorable inflated ratings in the first place.

Investor Sophistication

Investor sophistication can also affect the incentives for issuers and credit agencies to publish inflated ratings, since it has an impact on the information asymmetry between issuers and investors. For example, the presence of unsophisticated investors might reduce reputation costs. Pagano and Volpin (2010, 2012) find that issuers prefer a lower degree of rating accuracy if unsophisticated investors are present in the market. The authors define unsophisticated investors as investors who cannot adequately price default risk (Pagano & Volpin, 2010, 2012). When unsophisticated investors are prevalent in the market, opacity benefits the issuer and they prefer inflated ratings to expand their primary market and sell securities to these unsophisticated investors (Pagano & Volpin, 2010). Credit rating agencies might cater to issuers' demand. Bar-Isaac and Shapiro (2013) and Bolton et al. (2012) show that CRA may inflate ratings when there are more naive investors in the market and expected reputation costs are lower. Although increased opacity might reduce secondary market liquidity, the benefit of a broader investor base in the primary market might outweigh associated costs[2] if the ratio of unsophisticated investors is sufficiently high (Pagano & Volpin, 2012).

[2]Investors might require a premium to invest in bonds with lower market liquidity, since they cannot easily trade these securities (Longstaff et al., 2005; Utz et al., 2016).

3 Issuing Bonds in the German MBond Market

In 2010, Stuttgart stock exchange established the first segment for bonds issued by SMEs, called *bondm* (Börse Stuttgart, 2010). Within one year, four other stock exchanges followed suit and opened comparable segments[3]. However, in 2012 already, the number of defaults started to rise. Overall, one third of MBonds defaulted. As a consequence, the three largest stock exchanges, Frankfurt, Stuttgart, and Düsseldorf, closed or altered their MBond market segments[4]. The MBond market collapsed. The high number of defaults leads to the question, whether the default risk has been transparent and known to investors.

3.1 Issuance Process and Disclosure, Listing, and Follow-up Requirements

The German MBond market faced the challenge to meet two goals simultaneously, namely maximizing transparency with regard to default risk while minimizing transaction costs (Blättchen & Nespethal, 2010).

On the one hand, these bonds were issued by SMEs, which are in general more opaque than large, public companies. In addition, these segments explicitly targeted retail investors, who are limited in their information production capabilities, compared to institutional investors (Bösl & Hasler, 2012; Herrmann, 2017). Therefore, the MBond market segments needed to reduce opacity and provide sufficient information to investors.

[3]However, the majority of MBonds were issued on Stuttgart, Düsseldorf or Frankfurt stock exchange, whereas Hamburg / Hannover and Munich only saw few issues.

[4]Stuttgart stock exchange closed its segment in 2015. In 2015, Düsseldorf stock exchange split their segment into different risk segments to increase transparency (Börse Düsseldorf, 2015). The new market was called "Primärmarkt" and succeeded the "mittelstandsmarkt", whose reputation had suffered from the defaults (Börse Düsseldorf, 2015). In 2017, Frankfurt stock exchange renamed the Entry Standard to "Scale" and introduced higher requirements to increase quality (Deutsche Börse AG, 2017).

On the other hand, producing and disclosing information is costly for an MBond issuer and increases transaction costs. In order to allow SMEs to issue small volume bonds transaction costs needed to be minimal (Hasler, 2012; Mausbach & Simmert, 2012). As a consequence, all five stock exchanges attempted to find a balance between these two goals with their disclosure, listing and follow-up requirements (Mausbach & Simmert, 2012).

[Insert Table 1 here]

Table 1 gives an overview over selected disclosure, listing and follow-up requirements of the MBond market and compares the regulation of the new market segments with the regulated and the unregulated / open market.

Disclosure Requirements

In principle, the regulated market has the highest requirements for bond issuers; the open market the lowest. The different MBond segments were thought to represent a "quality segment" within the open market (Blättchen & Nespethal, 2010; Börse Stuttgart, 2010). They had increased disclosure requirements compared to the open market, so as to increase transparency regarding default risk, but less requirements than the regulated market, to keep costs low.

All issuers of MBonds were required to provide a bond prospectus either by the regulation of the stock exchange or by law, due to their inherent characteristics[5]. The prospectus has to be approved by the Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin) (Mausbach & Simmert, 2012). However, the BaFin checks the prospectus for completeness and coherence only (Kuthe, 2012). Approval of the prospectus by the BaFin is not a statement with regard to default risk (Kuthe, 2012).

In addition to the extensive prospectus, a factsheet describing the bond

[5]For example, a prospectus is required by the EU prospectus regulation (Art. 3 I Regulation (EU) 2017/1129) and the German Securities Prospectus Act (Wertpapierprospektgesetz, WpPG) if a bond is issued via a public offer, is to be traded on a stock exchange or sold to retail investors, which usually is the case for MBonds (Kuthe, 2012).

and the issuer was required by the majority of MBond segments. The fact-sheet should provide investors with the key information they need for their investment choice (Mausbach & Simmert, 2012).

Moreover, issuers were required to provide audited financial statements[6]. They can either apply German GAAP (HGB) or IFRS to prepare their financial statements. Allowing HGB as GAAP saves costs for the transition to IFRS, since most SMEs use HGB in the preparation of their financial statements. Besides, medium-sized enterprises[7] in Germany were already required by law to have their financial statements audited (§316 I 1 HGB). Thus, additional effort for disclosing audited financial statements seems bearable. Although the audit certificate may increase trust in the correctness of the numbers provided in the financial statements, it is not a signal of low default risk.

Rating Requirements

Ratings were the major tool to increase transparency with regard to default risk in the MBond market. That is why issuer ratings were required for four of five segments[8]. Düsseldorf stock exchange, the third largest segment, and Munich stock exchange also specified a minimum rating of BB and BB+ respectively. All stock exchanges required annual follow-up ratings, except for Hamburg / Hannover.

It is noteworthy, however, that the stock exchanges only required an issuer rating. Thus, the rating does not reflect security specific structural or contractual risks (Florstedt, 2017).

[6]The three largest stock exchanges Frankfurt, Stuttgart and Düsseldorf also required semi-annual statements post issuance. In contrast to the regulated market, no quarterly statements were required.

[7]According to German GAAP (HGB), a company is defined as medium-sized and not small, if it fulfills two of the following three criteria: (1) EUR 6 Mio. in total assets, (2) EUR 12 Mio. in sales, or (3) on average 50 employees (§267 I, II HGB).

[8]Only Hamburg / Hannover stock exchange does not require a rating. This stock exchange only played a minor role in the MBond market. Frankfurt and Stuttgart stock exchanges did not require a rating if the issuer is a listed company (Mausbach & Simmert, 2012). Therefore, it can be stated that in principle for private companies a rating was required for issuing bonds in the German MBond market.

Ratings were provided by four smaller, less reputable German credit rating agencies: Creditreform, Euler Hermes, Feri and Scope Ratings (Mietzner et al., 2018). Creditreform had the largest market share (Schueler & Aschauer, 2017). The big three, S&P, Moody's and Fitch, were not active in the market, but despite their absence, rating agencies faced a competitive environment (Florstedt, 2017; Mietzner et al., 2018). Rating costs for an MBond range from EUR 25,000 to EUR 85,000[9] (Götz & Hartmann, 2012; Hasler, 2012). Thus, they are significantly cheaper compared to a rating by one of the big three rating agencies. For comparison, S&P charges a minimum fee of USD 110,000 (Standard & Poor's, 2020).

Issuance Process and Associated Costs

Although the stock exchanges tried to keep the issuance costs in their MBond segments low, the listing and disclosure requirements come at a cost. Table 2 gives an overview over the estimated costs for the emission of a bond in one of the MBond segments.

[Insert Table 2 here]

One of the major drivers of emission costs is underwriting services by investment banks (Hasler, 2012). That is why for most MBond segments stock exchanges it was optional to have an investment bank as an underwriter[10]. Even if an investment bank managed the issuance process and acted as an underwriter, it did not actually have to underwrite the prospectus (Florstedt, 2017). Underwriting is only mandatory in the regulated market (§5 IV 3

[9] Götz and Hartmann (2012) even claim a lower upper limit for rating fees of EUR 35,000.

[10] However, this simplified calculation ignores potential benefits from certification. The certification value of underwriting services by a reputable investment bank might overcompensate costs for underwriting. For example, Fang (2005) finds that although reputable investment banks charge higher fees, these fees are offset by lower yields. Carbo-Valverde et al. (2016) compare self-issued bank bonds to bonds underwritten by third parties and find that banks with third-party underwriting save between USD 9 Mio and USD 11 Mio per issue. Chemmanur and Fulghieri (1994) claim that non-underwritten issues would only be conducted by two types of firms: those not facing high information asymmetries and those, unable to obtain services by reputable investment banks. It is unlikely that SMEs issuing an MBond to retail investors did not face high information asymmetries.

WpPG). As a consequence, investment banks are not liable for errors in the prospectus (Florstedt, 2017), which might reduce potential certification values of underwriting. In addition, for an MBond IPO, placement is organized on a "best effort" basis, which reduces incentives to exert effort for the underwriter (Hasler, 2012). Therefore, stock exchanges both promoted and facilitated self-emissions as an alternative way of placement (Blättchen & Nespethal, 2010; Götz & Hartmann, 2012). Only a capital market expert was required to help with the organization of the emission process(Blättchen & Nespethal, 2010).

In order to facilitate self-emission, stock exchanges set up a primary market function, to enable issuers to sell their bonds to investors directly[11]. Stock exchanges charged between 0.5% and 1.0% of the issuance volume for the service to sell and distribute bonds via their primary market function (Götz & Hartmann, 2012). In addition, selling bonds to retail investors requires more spending on marketing activities, to stimulate demand (Götz & Hartmann, 2012).

In summary, stock exchanges tried to maximize transparency with their disclosure, listing and follow-up requirements, while keeping costs to a minimum. Nevertheless, the issuance process in the MBond segments is still expensive, especially when compared to bank financing (Götz & Hartmann, 2012; Hasler, 2012; Schmitt, 2012). Overall estimated emission costs range from 3% to 5% of issuance volume but can exceed 10% in exceptional cases (Götz & Hartmann, 2012; Hasler, 2012). Thus, a potential cost advantage is unlikely to be the motivation of issuing a bond in one of the MBond segments. Indeed, Götz and Hartmann (2012) find that most issuers state that the motivation for the MBond IPO was to diversify the financing mix, open up new financing sources, and decrease their bank dependency. In addition, MBonds were usually unsecured and only had few covenants compared to other high-yield

[11]For example, Stuttgart stock exchange established a primary market function called "Bondm-Zeichnungsbox". Among others this primary market function was directly linked to retail banks (Blättchen & Mahn, 2011). This way retail investors could participate in the MBond IPOs directly .

bonds, giving the management more room to maneuver (Götz & Hartmann, 2012; von Randow, 2017).

3.2 Pricing in the MBond Market

Few papers have analyzed yield spreads of MBonds. Kinateder et al. (2015) compare MBond issuers to blue chips and find that reduced bank lending increases credit spreads for MBond issuers. Moreover, the authors reveal that bond specific illiquidity increases yield spreads for MBonds (Kinateder et al., 2015). Utz et al. (2016) also attribute a significant part of the high yield spreads in the MBond market to illiquidity. However, they exclude MBonds which defaulted from their analysis (Utz et al., 2016). Thus, their evidence with regard to default risk in MBond yield spreads is limited. In his case study Schöning (2014) examines the financial situation of 20 issuers on two dates, 31.12.2012 and 30.06.2013. Using different financial KPIs that are related to default risk, the author claims that interest rates were too low. To the best of my knowledge, this paper is the first to analyze the reflection of bond specific default risk in yield spreads and connect it to rating inflation in the MBond market.

4 Hypotheses Development

With the high number of defaults and the subsequent collapse of the market, some authors claim that the MBond market has been a "lemons market" (Florstedt, 2017; von Randow, 2017), as described by Akerlof (1970)[12]. In Akerlof's (1970) market for lemons, agents are aware of the presence of high and low quality products in the market but cannot distinguish between them. If high and low quality products are indistinguishable, average prices apply

[12]However, as they are legal scholars, their analysis is mainly focused on the legal framework of the MBond market as well as anecdotal evidence and does not include an empirical evaluation.

for both types. As a consequence, high quality products may be driven out of the market by the lemons and the market might finally collapse. For the MBond market to qualify as a lemons market requires that high and low quality MBond issuers are indistinguishable. That is why this paper addresses the question, whether investors could distinguish between high quality and low quality issuers and, consequently, whether default risk is reflected in bond yield spreads.

Two factors may have made high and low quality MBond issuers indistinguishable for investors. Firstly, most investors were unsophisticated retail investors (Herrmann, 2017). Herrmann (2017) finds that retail investors are more likely to be invested in MBonds that later defaulted, whereas institutional investors were better at distinguishing high and low quality issuers. Secondly, ratings might have been inflated (Mietzner et al., 2018). Mietzner et al. (2018) document rating inflation in the German MBond market and acknowledge that it could result in a lemons market.

Rating Inflation

In the absence of a reputable underwriting investment bank, credit rating agencies were the main provider of third-party certification in the German MBond market. Thus, ratings were the major signal of the issuers' default risk. As a consequence, rating inflation might make high and low quality issuers indistinguishable to low quality issuers.

The structure of the rating market for MBonds had some characteristics that are associated with the risk of rating inflation by finance theory. Firstly, ratings in the MBond market are solicited, that is payed by the issuer. Solicited ratings allow for rating shopping, since the issuer can get a rating from different rating agencies and only disclose the best (Skreta & Veldkamp, 2009). Besides, since ratings by the four small German rating agencies were much cheaper than those provided by the big three, rating shopping in the MBond market was

more affordable (Florstedt, 2017).

Secondly, although the big three rating agencies were not active in the MBond market, competition was still fierce (Florstedt, 2017; Mietzner et al., 2018). Competition among rating agencies is associated with rating inflation (Bae et al., 2019; Becker, 2011; Bolton et al., 2012; Mariano, 2012). For example, competition can exacerbate the problem of rating shopping, since there are more rating agencies to choose from.

Thirdly, although reputation concerns should mitigate these incentive problems (Mathis et al., 2009), they might still not be sufficient in the MBond market. In a competitive environment, like the MBond rating market, there might be rating inflation despite rating agencies trying to maximize reputation (Mariano, 2012). In addition, costs for loss of reputation might have been smaller in the MBond market for two reasons. First, the rating agencies active in the MBond market were smaller and less reputable in the first place. Second, the market targeted unsophisticated retail investors (Herrmann, 2017). If unsophisticated investors are present in the market, issuers prefer less precise and inflated ratings, since reputation costs are lower (Bar-Isaac & Shapiro, 2013; Bolton et al., 2012; Pagano & Volpin, 2010, 2012).

Finally, follow-up ratings were mandatory on most MBond platforms, leading to repeated interactions between rating agencies and MBond issuers. Repeated interaction of rating agencies and issuers, however, might also lead to rating inflation, as rating agencies can build up a two-sided reputation so as to attract more business (Bouvard & Levy, 2018; Frenkel, 2015). In addition, follow-up ratings might be more profitable than initial ratings, which increases the incentive for rating agencies to inflate initial ratings and secure follow-up rating mandates. As a consequence, these factors give rise to the following hypothesis:

H1: *MBond issuers are more prone to rating inflation than issuers of other listed corporate bonds.*

Distortions in the Information Channel

Rating inflation might lead to distortions in the rating channel, such that investors could not distinguish between high quality and low quality issuers. As a consequence, default risk might not be reflected in yield spreads, although it should be a major determinant (Longstaff et al., 2005). Mietzner et al. (2018) also document rating inflation in the German MBond market but argue that issuers knew about it. In order to distinguish themselves from low quality issuers, high quality issuers might have tried to signal their quality via underpricing. Thus, although the authors confirm rating inflation, they reject market failure as a consequence.

In their paper, underpricing is measured as an increase in prices in the secondary market during the first trading days, compared to the initial price in the primary market (Mietzner et al., 2018). Thus, the signal of underpricing only emerges post issuance, in the secondary market. In the primary market good and bad issuers might still be indistinguishable. Therefore, in the primary market the signal only works for additional bonds issued by the same company. Indeed, Mietzner et al. (2018) argue that high quality issuers, who want to develop the bond market as a long-term financing alternative, use underpricing as a signal of their quality. However, building up reputation by fulfilling all promised payments of their initial MBond could also be a signal of high credit quality (compare Diamond (1991)). Thus, underpricing in the bond IPO should be most relevant only to the minority of issuers who plan to issue an additional bond during the term of their initial MBond. At the same time, by using underpricing, high quality issuers forego the possibility to use the price itself as a signal[13].

[13]The increase in prices in the secondary market assumes that at least some investors have an understanding of the credit quality of the issuer, in order to recognize that the initial bond price was too low. Thus, differences in coupons could hint at differences in credit quality (since MBonds have been issued at par, the yield to maturity is driven by the coupon). This hint might get muted by underpricing. Consider the hypothetical example of a high quality and a low quality issuer, who happen to have the same investment grade

Thus, despite potential signaling of quality via underpricing in the secondary market, in the primary market the information channel might still be distorted. This gives rise to the following hypothesis:

H2: *In contrast to yield spreads of other listed bonds, yield spreads of MBonds in the primary market do not reflect differences in default risk.*

Potential Learning about Rating Inflation

In 2012, the first MBonds with investment grade rating defaulted. Investors might only learn about rating inflation, when bonds default (Frenkel, 2015). Until then investors might not have been aware of the "lemons" with an investment grade rating in the MBond market. If investors learn about rating inflation and have some capability to assess the credit quality of an MBond issuer, one would expect to find:

H3: *After 2012, ratings have a lower impact on initial yield spreads, while default risk has a higher impact on yield spreads in the MBond market.*

If that is the case, the market mechanism in the MBond market might have been intact after all. Otherwise, if investors still cannot distinguish between high and low quality issuers, yield spreads might be too high for good issuers. The incapability of investors to assess credit quality might then ultimately be a reason for the collapse of the MBond market.

rating due to rating inflation. In principle, if investors knew about the difference in credit quality, the high quality issuer would have a lower coupon. With information asymmetry and the proposed underpricing to signal quality, the high quality issuer offers a higher coupon than justified. Now, the high quality and the low quality issuer not only share the same uninformative investment grade rating, but also offer comparable coupons. As a consequence, in the primary market, issuers might become even more indistinguishable, especially for unsophisticated investors.

5 Sample Selection and Description

5.1 Data Sources and Sample Selection

Data on MBond characteristics is gathered from Bloomberg, Thomson Reuters Eikon, the respective exchanges, prospectuses, as well as informational websites for German SME bonds. Issuance data for the other listed corporate bonds is extracted from Bloomberg and Thomson Reuters Eikon. Financial statement data for all issuers is obtained from the Bureau van Dijk (Moody's) Dafne database, which provides data from financial statements of German companies. Issuer entity names from Bloomberg and Thomson Reuters Eikon are matched manually to the financial statement data from Dafne. Yields for German Government Bonds are also extracted from Bloomberg.

Only bonds issued under German governing law are included to reduce interference resulting from differences in the legal environment that may arise from the introduction of the new bond regulation in Germany in 2009. Bonds with missing information regarding governing law but which have been issued by a German company and are classified as domestic bonds in Bloomberg are assumed to be governed by German law. All bonds included in the sample are denominated in EURO. Debt issues by financial subsidiaries of manufacturing companies that are not consolidated in the corporate group are dropped from the sample (Arena, 2011). In addition, non-German issuers and micro firms, as defined in the "User guide to the SME Definition" published by the European Commission (2015)[14], are excluded as well.

In order to ensure comparability in terms and structure, convertible debt, commercial papers and debt issues with a maturity of less than one year were removed from the sample. Bonds issued as a additional raise of capital which are later consolidated onto another bond of the same company are pooled together. In order to compare the relationship of yields and default risk, I

[14]The European Commission (2015) defines Micro Firms as companies with less than 10 employees and less than EUR 2 million in Sales and Total Assets.

require all bonds to have fixed coupons. Companies that are not covered by the Dafne database or do not provide information on the amount issued were removed from the sample. In addition, bond issues with insufficient information to calculate yield to maturity, for example if the price at issuance or coupon frequency is missing from the database, are excluded.

5.2 Calculation of Yield Spreads and Default Risk

The main variables of interest for the analysis are yield spreads, as the dependent variable, as well as measures of default risk as independent variables.

Dependent Variable: Yield Spread

Yield spreads are calculated as the difference between the initial yields to maturity and a German Government Bond with comparable maturity at the time of the MBond IPO[15]. The yield of maturity is calculated based on the issue price, the coupon, the coupon frequency as well as the maturity.

The analysis focuses on yield spreads in the primary market. The advantage of using primary market spreads is that they represent a better measure of the actual cost of debt faced by the bond issuer (Gabbi & Sironi, 2005). This, in turn, makes initial yield spreads and their incentives for high and low quality MBond issuers more comparable to the setting of the lemons market in Akerlof (1970).

Independent Variables: Ratings and Default Risk

The setting of this paper prevents the use of the two major families of credit risk models, structured and reduced form models, for different reasons. Structural models are based on the idea of Merton (1974) to model debt and equity as options on the firm's assets. In practice, asset value is not directly observable

[15]The sample contains yields for German Government Bonds with a maturity of three months, six months, one year to ten years (for every year), 15 years, 20 years and 30 years. However, most MBond issuers have a maturity of five years.

and, therefore, derived from the market value of equity. However, most of the MBond issuers are private companies, thus market values of equity are unavailable. That is why credit risk models based on structural models are infeasible in this setting. The reduced form models infer default risk from prices. This study, however, attempts to evaluate to which extent default risk for MBonds has been priced.

Similarly, default risk cannot be measured using credit ratings. Hypothesis 1 claims that uninformative and inflated ratings distorted adequate pricing of default risk. Nevertheless, credit ratings enter the analysis in two ways, to examine their impact on yield spreads. Firstly, the variable *Investment Grade* is an indicator variable that is equal to one if the issuer or the bond has an investment grade rating and zero otherwise. Secondly, *Rating (Numeric)* is the mapping of letter style ratings to numbers. The highest rating in the data set AA+ is mapped to 1; the theoretically lowest rating D is mapped to 21[16].

For the reasons described above, this paper has to rely on realized defaults and the implied probability of default to measure default risk. The implied probability is based on the Altman Z-Score for private firms[17], as an accounting-based measure of default risk (Altman, 2000). The implied probability of default is calculated in two steps. First, the Altman Z-score is calculated as follows:

$$Z = 6.56 * X1 + 3.26 * X2 + 6.72 * X3 + 1.05 * X4 \tag{7}$$

where X1 is defined as the ratio of working capital to total assets, X2 is the ratio of retained earnings to total assets, X3 is the ratio of EBIT to total

[16] A change of one in the numerical rating denotes a one-step rating change. For example, going from 10 to 11 indicates a downgrading from BB+ to BB. Since the focus of this paper is mainly on the primary market, the fact that there is no issuer with an initial rating of D indicating default is not surprising. In addition, the mapping of the ratings took place prior to sample selection, thus the highest rating of the initial dataset might not necessarily be the same as in the selected sample.

[17] More precisely the Altman Z-Score for private firms, not limited to manufacturing companies.

assets and X4 is the ratio of equity to total liabilities. The resulting Z-score of Equation 7 is then used to derive the implied probability of default, as in Altman et al. (2010):

$$Impl.PD = \frac{1}{1 + e^{Z}} \tag{8}$$

An additional advantage of using the implied probability of default metric is that it allows to better compare the results of this paper with the findings by Mietzner et al. (2018), who also apply this measure to analyze rating inflation in the German MBond market.

5.3 Descriptive Statistics

Table 3 and Table 4 provide descriptive statistics for the sample. In both tables descriptive statistics are provided separately for the three subgroups. Panel A describes MBonds, Panel B describes other listed bonds, and Panel C describes other listed bonds with an issuance volume comparable to MBonds. Thus, the sample of small volume bonds is a subsample of the other listed bonds, presented in Panel B.

Table 3 provides descriptive statistics for bond characteristics. It becomes apparent that MBonds are of smaller volume than other listed bonds. In order to reduce the effect of size, the subgroup of small volume bonds is also used in the subsequent analyses. Most MBonds have a maturity of five years, which is similar to maturity of the other subsamples. Thus, differences in yields due to different maturity structures are unlikely.

[Insert Table 3 here]

Since all MBonds in the sample were issued at par, yield to maturity is equal to the coupon. With an average yield to maturity of 7.2% (median: 7.3%), MBond issuers promise relatively high returns. This may be a first indicator of their riskiness.

Since rating was mandatory on most platforms with only few exceptions, the vast majority of MBond issuers have a rating. More than one third even display an investment grade rating at issuance.

Table 4 provides descriptive statistics for the variables associated with default. One third of MBond issuers in the sample defaulted on their debt. Although small volume bonds also display a higher cumulative default rate of 8.8%, it is still much lower.

[Insert Table 4 here]

Interestingly, the average implied probability of default (Implied PD) of MBond issuers in the year prior to issuance is comparable to the issuers in the other two samples.

6 Rating Inflation and the Distortion of the Information Channel in the MBond Market

Rating inflation has the potential to distort the information channel in the German MBond market and make high and low quality MBond issuers indistinguishable.

6.1 Rating Inflation

Inflated ratings would, by definition, underestimate the inherent default risk of affected bonds. Therefore, to identify rating inflation in the MBond market, I compare realized cumulative default rates across the three subsamples. Table 5 provides yearly cumulative realized default risk for five years post issuance for all three bond groups[18].

[Insert Table 5 here]

The first observation to be made from Table 5 is the extraordinary high

[18]The Table only covers a subsample of bond IPOs that took place between 2010 and 2015 to fully cover five years post issuance. However, since more than 90 percent of MBond IPOs took place during that subperiod, this selection should not alter the results.

cumulative default rate of MBonds. More than one third of MBonds defaulted. This rate is six times higher than for other listed corporate bonds and still three times the rate of small volume bonds. Moreover, consistent with the hypothesis of rating inflation, the picture is even worse for investment grade rated MBonds. More than half of the MBonds with an initial investment grade rating defaulted.

In general, cumulative realized default rates for MBonds of all rating categories are way higher compared with cumulative default rates provided by Moody's Investors Service (2018)[19].

Comparing defaults of MBonds to the cumulative defaults of other listed bonds, it has to be noted that the latter are mainly driven by small volume bonds. The three listed bonds rated BBB that defaulted were all small volume bonds. Of the two BB rated listed bonds, one was a small volume bond. In general, small volume bonds in the sample, either MBonds or other listed bonds, defaulted more often than large listed bonds. In addition, more investment grade rated than non-investment grade rated small volume bonds defaulted. However, compared to MBonds, only few listed small volume bonds were rated. Overall, the problem of excessive cumulative default rates of investment grade rated bonds has been significantly more severe in the MBond market.

Interestingly, the cumulative default rates for MBond issuers without a rating are comparable to the two control groups. This finding can be attributed to selection. The two largest MBond markets, Frankfurt and Stuttgart stock exchange, did not require a rating if the issuer is a listed company. Thus, not rated MBond issuers are probably different to rated issuers. Moreover, obviously unrated issuers also cannot benefit from rating inflation to disguise as high quality borrowers, decreasing the incentive for low quality issuers to enter the MBond without rating. Since unrated MBond issuers are the minority, the

[19]Table 12 in the appendix provides Moody's Average Cumulative Issuer-Weighted Global Default Rates, 1998-2017 (Moody's Investors Service, 2018).

problem of rating inflation may still be severe in the MBond market.

A valid concern is that using realized defaults for identifying rating inflation is an ex post approach. Therefore, Table 6 compares realized default rates and implied probability of default of investment grade and non-investment grade rated bonds. Using implied probability of default in the year prior to the bond IPO ensures that the analysis is based on the same accounting variables that were also available to the rating agencies at the time of the rating at issuance.

[Insert Table 6 here]

The results of the analysis of defaults among investment grade and non-investment grade rated bonds, issued between 2010 and 2018, in Panel A, are in line with the observations in Table 5. The analysis of the implied probability of default in Panel B reveals that, in contrast to the two control groups, there is no significant difference between investment grade and non-investment grade rated MBonds. Thus, in terms of implied probability of default, MBond ratings were not informative and did not help to distinguish between high and low quality MBond issuers. Moreover, the implied probability of investment grade rated MBond issuers is comparable to non-investment grade rated issuers of other listed bonds and listed small volume bonds. As a consequence, in terms of implied probability of default, investment grade ratings for MBond issuers were inflated.

Interestingly, there is a significant difference in implied probability of default for small volume bonds. Thus, ratings of small volume bonds might not have been inflated ex ante, although rates of defaults were higher ex post.

To sum up, it can be stated that according to both, ex ante and ex post, evaluations, ratings of MBond issuers have been inflated, which confirms Hypothesis 1. The results presented are in line with the findings of Mietzner et al. (2018), who also document rating inflation in the German MBond market.

6.2 Distortions in the Information Channel

While rating inflation has the potential to distort the information channel, it is not inevitable if investors are aware of rating inflation and have the capability to make an informative assessment of the default risk. Consider for example the underpricing hypothesis of Mietzner et al. (2018) that would distinguish high and low quality MBond issuers for subsequent MBond issues. Consequently, if investors can distinguish between high and low quality issuers, default (risk) should be reflected in primary market yield spreads.

Univariate Comparison of Yield Spreads

Table 7 compares yield spreads by the three different measures of default (risk), rating category, realized defaults and implied probability of default, within and across the different bond groups.

Firstly, while MBond issuers display a significant difference in yields between investment grade rated and non-investment grade rated MBond issuers, the difference in yield spreads is small. Yield spreads of investment grade rated MBonds are even higher than yield spreads of non-investment grade rated issuers of the two control bond groups. Thus, although MBond ratings appear to be inflated, the benefit of rating inflation in terms of yield spreads was small. Either investors in MBonds were aware of the rating inflation or considered ratings to be less important in general.

[Insert Table 7 here]

If they were aware of rating inflation, MBond investors might have still been able to distinguish between high quality and low quality issuers. As a consequence, there should be a significant difference in yield spreads of defaulted and not defaulted, as well as issuers with a high and a low implied probability of default. However, as shown in Table 7, it appears that MBond investors were not able to distinguish between high and low quality issuers. There is no significant difference in yield spreads for defaulted and not defaulted, as well

as issuers with a high and low implied probability of default. Average yield spreads of MBonds that did not default are of similar magnitude to defaulted MBonds, as well as to the defaulted bonds in the two control group.

Average yield spreads of MBonds in the lowest implied probability quantile (i.e. lowest probability of default) are also similar to average yields spreads of MBonds in the highest quantile (i.e. highest probability of default). Again MBonds with a low ex ante probability of default have higher yield spreads than other listed corporate bonds with a higher probability of default.

Overall it can be stated that MBond investors were not able to distinguish between high and low quality issuers. Consistent with Hypothesis 2, differences in default risk of MBonds are not reflected in yield spreads. However, although rating inflation did play a role since investment grade rated MBonds display significantly lower yield spreads, the difference to non-investment grade rated MBonds is small. Interestingly, yield spreads of high quality MBonds were at a comparable level than yield spreads of low quality other listed bonds. Thus, the MBond market discriminated against high quality issuers.

Multivariate Analysis of Yield Spreads

In order to provide further evidence of the impact of differences in default risk on bond yield spreads, the univariate analysis presented in Table 7 is extended by a multivariate analysis. Tables 8 and 9 report the results of the multivariate analysis for the impact of credit ratings and other measures of default risk. The following baseline specification is estimated separately for each bond group (models (3) to (8) in tables 8 and 9).

$$YieldSpread_{it} = \beta * DRM_{it} + \gamma * X_{it} + \alpha_T + \epsilon_{it} \tag{9}$$

Default Risk Measure (DRM) is the variable of interest that is associated with default risk. In Table 8 the default risk measure is based on two different rating variables. The first one is *Inv. Grade*, which is an indicator variable

that is equal to one if the issuer or the bond has an investment grade rating and zero otherwise. The second is *Rating (Numeric)*, which is a numerical mapping of the latter based rating, where a lower number indicates a better rating[20]. In Table 9, the default risk measure is based on two different measures of default (risk), *Defaulted* and *Impl. PD*. Defaulted is an indicator variable equal to one, if the bond defaulted and zero otherwise. Implied PD is the implied probability of default, based on the Altman Z score.

X includes control variables to control for heterogeneity in issuer and bond characteristics. Relative issuance volume, measured as amount issued relative to prior total debt *AI / TD*, *Maturity*, and an indicator variable for secured bonds are used as control variables. Relative issuance volume describes the importance of the bond IPO for the future financial structure of the issuer and can be a proxy of future leverage. Maturity is included as control variable since it can have an ambiguous effect on corporate bond yield spreads. While Campbell and Taksler (2003) find a positive relationship between yield spreads and time to maturity for investment grade rated bonds, Chen et al. (2007) document a negative relationship for speculative grade rated bonds. Secured debt should be less risky than unsecured debt ceteris paribus and, consequently, result in lower yield spreads. However, the empirical literature also finds positive relationships between yield spreads and collateralization of debt. This puzzling finding can be attributed to imperfect measures of default risk (John et al., 2003). Debt with higher default risk is also more likely to be secured by collateral (John et al., 2003). If default risk cannot be perfectly controlled for, the secured dummy might pick up some of the impact of default risk on yield spreads. Year fixed effects are also included in the analysis. Standard errors are clustered at the firm level to account for non-independent observations within firms, in case of firms issue multiple bonds in the sample period.

[20] A change of one in the numerical rating denotes a one-step rating change. For example, going from 10 to 11 indicates a downgrading from BB+ to BB.

In addition, the following specification is estimated, to examine the different impact of the default risk measure on MBond yield spreads.

$$YieldSpread_i = \beta_1 * DRM_{it} + \beta_2 * MBond_i + \beta_3 * DRM_{it} * MBond_i + \alpha_T + \epsilon_{it} \quad (10)$$

MBond is an indicator variable that is equal to one if the bond is a MBond. Interaction variables of the respective default risk measure (DRM) and the MBond indicator variable are included in models (1) and (2) to test for the difference in the impact of the default risk measure on MBond yield spreads.

[Insert Table 8 here]

Table 8 presents the impact of credit ratings on yield spreads. Consistent with what one would expect and with prior empirical findings, in principle, an investment grade rating is associated with a lower yield spread. The difference is economically and statistically significant. In addition, a worse rating is associated with a higher yield spread. However, the impact of both rating measures is much less pronounced for MBonds. These findings are in line with the results of the univariate analysis in Table 7.

[Insert Table 9 here]

Table 9 presents the impact of other measures of default (risk) on yield spreads. Consistent with what one would expect and with prior empirical findings, in principle higher default risk is associated with a higher yield spread. Bonds that defaulted later have significantly higher yield spreads. The same holds true for bonds with a high implied probability of default. However, for MBonds this relationship does not hold true. Yield spreads of MBonds do not reflect differences in default risk. Again, these findings are in line with those of the univariate analysis in Table 7.

To sum up, the findings of the multivariate analysis confirm the results of the univarariate analysis in Table 7. Since MBond yield spreads do not reflect differences in default risk, it appears that MBond investors were not able to

distinguish between high and low quality issuers. This finding is consistent with Hypothesis 2. The results also confirm that rating in the MBond market had a smaller impact on yield spreads. Thus, the benefit of rating inflation for low quality issuers is limited.

6.3 Learning Effects

Frenkel (2015) claims that rating agencies benefit from rating inflation if they build up a two-sided reputation, where issuers are aware of rating inflation and investors are not yet, as the latter will only learn about the inflated ratings in case of default (Frenkel, 2015). However, when investors find out about rating inflation, one would expect them to adjust their investment behavior. Specifically, investors should rely less on inflated ratings for bond pricing. In addition, if they have some capabilities to assess default risk on their own and ignore misleading ratings, investors should become better at pricing differences in default risk. At the same time, rating agencies might reduce rating inflation since they have been caught inflating ratings and do not want to be seen making mistakes (Mariano, 2012). The analyses in this section aim to answer the question as to whether MBond investors learned about rating inflation after the first defaults occurred in 2012.

In order to assess, whether investors learned about rating inflation, the sample is split after year 2012, when the first defaults occurred.

[Insert Table 10 here]

Table 10 presents results for a univariate analysis of default risk and yield spreads by rating category for the split sample. It appears that rating inflation in the MBond market did not stop after the first occurrence of defaults. The results presented in Panel A even show a higher implied probability of default for investment grade rated MBonds than for non-investment grade rated MBonds after the sample split. In addition, there is still a significant difference in yield spreads between investment grade and non-investment grade

rated bonds. Thus, it appears that investors still relied on credit ratings for pricing MBonds.

In order to provide further evidence, the univariate analysis is complemented by a multivariate analysis of the split sample. For this purpose, the baseline specification, described in Equation 9, is estimated for the subsample of MBonds for the two subperiods. Table 11 presents the results of the multivariate analysis.

[Insert Table 11 here]

Contrary to what one would expect, MBond investors seemed to rely even more on ratings, when default rates started to rise. Thus, despite the rising default rate, it seems investors were still not aware of rating inflation. Consequently, rating agencies were not incentivized to stop rating inflation. This might be an explanation for the finding of ongoing rating inflation after 2012, presented in Table 10.

Since ratings MBond investors still relied on inflated ratings, despite rising default rates, it is not surprising that they did not manage to better assess default risk after 2012. These findings contradict the predictions stated in Hypothesis 3. It appears that MBond issuers did not learn about inflated ratings when default rates started to rise. As a consequence, they were still unable to distinguish between high and low quality MBond issuers.

7 Conclusion

This study examines whether MBond investors were unable to distinguish between high and low quality MBond issuers, which might have contributed to the collapse of the MBond market. Inflated ratings may have distorted the information channel and hamper the assessment of differences in MBonds' default risk.

The results indicate that credit ratings have been inflated in the MBond market. Default rates and implied probability of default were even higher for

investment grade rated than for non-investment grade rated MBonds. These findings are in line with Mietzner et al. (2018), who also document rating inflation in the German MBond market. However, the benefits of rating inflation in terms of yield spread differences were significant but small. Average yield spreads of investment grade rated MBonds still exceeded average yield spreads for non-investment grade rated other listed corporate bonds.

Since rating inflation might distort the information channel, it is not surprising that differences in default risk were not reflected in MBond yield spreads. Thus, investors were not able to distinguish between high and low quality issuers. As a result, the average yield spread of a high quality MBond with low default risk was at the same level as the average yield spread of a low quality MBond with high default risk.

When the first defaults occurred in 2012, market participants started to notice that there were 'lemons' in the MBond market. However, despite rising default rates, MBond investors were still unable to distinguish between high and low quality MBond issuers. They even relied more on ratings.

Mietzner et al. (2018) argue that high quality issuers use underpricing to signal their quality. However, this signal is only available in the secondary market, as in the primary market the signal of quality would only be available for subsequent MBonds, which are a minority. Thus, in the primary market, most high quality MBond issuers were indistinguishable to low quality MBond issuers.

Even if one follows the argumentation of Mietzner et al. (2018), underpricing as a signal of quality is costly and adds to the already high issuance costs. As a consequence, the MBond market is relatively more expensive for high quality issuers than it is for low quality issuers. Therefore, it is plausible that when high quality issuers became aware of the lemons in the market, due to rising default rates between 2012 and 2015, they withdrew from the market. As a consequence, as predicted by Akerlof, only low quality issuers would have

been willing to issue MBonds and the market would have finally collapsed.

The mechanisms documented in this study might also have had real effects. In their recent paper, Goldstein and Huang (2020) show that inflated ratings might allow firms close to bankruptcy to gamble for resurrection. In unpublished work, Adam and Wilimzig (2021) find that without the proceeds from the issuance a large fraction of MBond issuers would have run out of cash in the year of their bond IPO. Thus, access to the MBond market with its inflated ratings might have allowed these firms to gamble for resurrection.

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Appendix

A.I Tables

Table 1: Selected Listing and Follow-Up Requirements for Corporate Bonds in Germany on Different Market Segments

	Regulated Market	**Unregulated / Open Market**					
			MBond Segments				
		Frankfurt		Stuttgart	Düsseldorf	Hamburg / Hannover	Munich
			Entry Standard	Bondm	Mittelstandsmarkt	MSB	m:access
Listing Requirements							
Prospectus	+	(-)	+	+	+	+	+
Rating	+	-	+	+	Min.: BB	-	Min.: BB+
Factsheet Bond | Issuer	-	-	+ | +	+ | +	+ | +	+ | +	+ | -
Capital Markets Expert	-	-	+	+	+	-	+
Min. Amount (EUR Mill)	-	-	-	25	10	-	25
Max. Nominal (EUR)	-	-	1,000	1,000	1,000	-	1,000
GAAP	IFRS	IFRS / HGB	IFRS / HGB	IFRS / HGB	IFRS / HGB	IFRS / HGB	IFRS / HGB
Special Characteristics	-	-	No subordination	No subordination	-	-	Age > 3 years
Follow-Up Requirements							
Audited Fin. Statement	Yes, w/i 4m	-	Yes, w/i 6m	Yes, w/i 9m	Yes, w/i 6m	Yes, w/i 6m	Core Statements
Semi-annual Statement	Yes, w/i 2m	-	Yes, w/i 3m	Yes, w/i 3m	Yes, w/i 3m	-	-
Quarterly Statements	+	-	-	-	-	-	-
Financial Calendar	+	-	+	+	+	+	+
Follow-up Rating	+	-	+	+	+	-	+
Ad-hoc Disclosure	+	-	(+)	(+)	(+)	(+)	(+)
Annual Analyst Conference	+	-	-	-	-	-	+

All MBond platforms are special segments within the open market of their respective stock exchange. The "Open Market" of Frankfurt Stock Exchange is the largest open market in Germany and was therefore chosen as a representative example. The other exchanges also have open markets. Required without further information is denoted as "+", not required or not applicable is denoted as "-"; Less strict regulation is denoted as "(+)". The table is based on Blättchen & Nespethal (2010), Mausbach & Simmert (2012), and Bösl & Hasler (2012).

Table 2: Costs of Issuing a Bond in the German MBond Market

		Fixed Costs in EUR	Costs in % of Issuance Volume
Placement Fees			
Listing Fee Stock Exchange	Mandatory	1,000 - 3,000	
BaFin Check of Prospectus	Mandatory	2,500 - 7,500	
Paying Agent	Required		0.2% - 1.0%
Primary Market Function	Optional		0.5% - 1.0%
Underwriter / Selling Agent	Optional		3.5% - 6.0%
Advisory Services			
Capital Markets Expert	Mandatory		0.5% - 1.5%
Rating Agency	Mandatory	25,000 - 85,000	
Legal Counsel	Required	30,000 - 100,000	
Auditor	Mandatory	150,000	
External Research	Optional	10,000 - 25,000	
Communications / PR /Website	Required	5,000 - 20,000	
Other Costs			
Printing Prospectus	Required	10,000	
Travelling / Management Roadshow	Required	15,000 - 25,000	
Marketing Campaign	Optional	$>$ 150,000	

This table presents approximate fees for services related to issuing a bond in the German MBond market. Services are *mandatory*, if they are required by law or the regulation of the stock exchange. Services are *required*, if the emission is largely impossible without the respective service. The term "Underwriter" might be misleading in the case of the MBond market, since investment banks did not actually have to underwrite the prospectus (Florstedt, 2017). Underwriting is only mandatory in the regulated market (§5 IV 3 WpPG). As a consequence, they are also not liable for errors in the prospectus (Florstedt, 2017). Legal Counsel includes costs for the preparation of the prospectus. The table was adapted from Hasler (2012) and Götz & Hartmann (2012).

Table 3: Descriptive Statistics for Bond Characteristics

	Mean	Median	Min	Max	SD	Obs
Panel A: MBonds						
Amount Issued (in M)	42.65	30.00	7.50	225.00	36.79	119
Maturity	5.33	5.00	1.00	10.00	1.16	119
Issue Price	100.00	100.00	100.00	100.00	0.00	119
Coupon	7.22	7.25	3.60	11.50	1.14	119
YTM	7.22	7.25	3.60	11.50	1.14	119
Y.Spread	6.25	6.58	3.06	10.97	1.30	119
Rated	0.88	1.00	0.00	1.00	0.32	119
Inv. Grade	0.34	0.00	0.00	1.00	0.48	119
Secured	0.16	0.00	0.00	1.00	0.37	119
Subordinated	0.00	0.00	0.00	0.00	0.00	101
Panel B: Bonds (listed)						
Amount Issued (in M)	354.98	300.00	0.43	1,600.00	340.41	449
Maturity	6.88	6.00	1.00	60.00	4.42	449
Issue Price	99.83	100.00	97.39	107.83	0.94	449
Coupon	4.06	3.88	0.00	11.00	2.48	449
YTM	4.08	3.88	-0.05	11.50	2.46	449
Y.Spread	3.48	2.95	0.49	10.70	2.41	449
Rated	0.48	0.00	0.00	1.00	0.50	449
Inv. Grade	0.32	0.00	0.00	1.00	0.47	449
Secured	0.24	0.00	0.00	1.00	0.43	438
Subordinated	0.03	0.00	0.00	1.00	0.17	365
Panel C: Small Vol. Bond						
Amount Issued (in M)	38.89	25.00	0.43	150.00	39.90	181
Maturity	5.66	5.00	1.00	20.87	3.50	181
Issue Price	100.10	100.00	98.61	105.75	0.76	181
Coupon	5.51	5.70	0.62	11.00	2.09	181
YTM	5.49	5.70	0.65	11.00	2.08	181
Y.Spread	4.99	4.81	0.74	10.70	2.16	181
Rated	0.18	0.00	0.00	1.00	0.39	181
Inv. Grade	0.08	0.00	0.00	1.00	0.28	181
Secured	0.15	0.00	0.00	1.00	0.36	171
Subordinated	0.07	0.00	0.00	1.00	0.26	138

This table reports descriptive statistics for bond characteristics of MBonds and other listed bonds issued between 2010 and 2018. Small Vol. Bonds are defined as bonds with an issuance volume smaller or equal to EUR 150 million. They are a subset of Bonds (listed). Yield spreads are calculated as the spread between yield to maturity and German sovereign bonds with matching maturity structure. Subordinated is an indicator variable that is equal to one if the bond was subordinated. However, subordination was not allowed on most MBond platforms. All variables are described in detail in the appendix.

Table 4: Descriptive Statistics on Default Variables

	Mean	Median	Min	Max	SD	Obs
Panel A: MBonds						
Defaulted	0.33	0.00	0.00	1.00	0.47	119
Time to Def.	2.90	2.67	0.67	6.33	1.21	39
Inv. Grade	0.34	0.00	0.00	1.00	0.48	119
Altm. Z Score	1.92	1.99	-2.21	6.37	1.76	83
Implied PD	0.21	0.12	0.00	0.90	0.23	83
Amount Iss. / TD	3.23	0.54	0.05	206.94	21.01	97
Panel B: Bonds (listed)						
Defaulted	0.05	0.00	0.00	1.00	0.21	449
Time to Def.	2.80	2.41	0.65	7.42	1.90	21
Inv. Grade	0.32	0.00	0.00	1.00	0.47	449
Altm. Z Score	2.08	2.16	-2.21	6.37	1.34	345
Implied PD	0.17	0.10	0.00	0.90	0.16	345
Amount Iss. / TD	1.44	0.07	0.00	206.94	15.26	369
Panel C: Small Vol. Bond						
Defaulted	0.09	0.00	0.00	1.00	0.28	181
Time to Def.	2.14	1.83	0.65	3.96	1.17	16
Inv. Grade	0.08	0.00	0.00	1.00	0.28	181
Altm. Z Score	1.70	1.36	-2.21	6.33	1.58	125
Implied PD	0.23	0.21	0.00	0.90	0.20	125
Amount Iss. / TD	3.39	0.10	0.00	206.94	23.93	149

This table reports descriptive statistics for variables associated with default and default risk, for MBonds and other listed corporate bonds issued between 2010 and 2018. Small Vol. Bonds are defined as bonds with an issuance volume smaller or equal to EUR 150 million. They are a subset of Bonds (listed). Defaulted is an indicator variable equal to one if the bond was in default. Time to Def. is the time to default in years, if the issuer defaulted. Inv. Grade is an indicator variable that is equal to one if the issuer or the bond has an investment grade rating and zero otherwise. Altm. Z Score is the Z Score for private firms, not limited to manufacturing firms (see Altman et al., 1977; Altman and Saunders, 1998). Impl. PD is the implied probability of default based on the Altman Z Score. All variables are described in detail in the appendix.

Table 5: Cumulative Default Rates for Bonds issued between 2010 and 2015

Rating	Issues	Year 1	Year 2	Year 3	Year 4	Year 5
Panel A: MBonds						
A	4	0.00	0.00	25.00	25.00	25.00
BBB	37	0.00	8.11	32.43	51.35	54.05
BB	46	0.00	8.70	15.22	21.74	26.09
B	11	9.09	9.09	18.18	18.18	27.27
NR	12	0.00	0.00	8.33	8.33	8.33
IG	41	0.00	7.32	31.71	48.78	51.22
Non-IG	57	1.75	8.77	15.79	21.05	26.32
All	**110**	**0.91**	**7.27**	**20.91**	**30.00**	**33.64**
Panel B: Bonds (listed)						
AA	7	0.00	0.00	0.00	0.00	0.00
A	43	0.00	0.00	0.00	0.00	0.00
BBB	38	2.63	5.26	5.26	7.89	7.89
BB	23	0.00	0.00	0.00	8.70	8.70
B	16	0.00	0.00	0.00	0.00	0.00
CCC	3	0.00	0.00	0.00	0.00	0.00
NR	166	1.20	3.61	5.42	7.23	7.23
IG	88	1.14	2.27	2.27	3.41	3.41
Non-IG	42	0.00	0.00	0.00	4.76	4.76
All	**296**	**1.01**	**2.70**	**3.72**	**5.74**	**5.74**
Panel C: Small Vol. Bond						
A	5	0.00	0.00	0.00	0.00	0.00
BBB	9	11.11	22.22	22.22	33.33	33.33
BB	3	0.00	0.00	0.00	33.33	33.33
B	7	0.00	0.00	0.00	0.00	0.00
NR	98	2.04	6.12	8.16	10.20	10.20
IG	14	7.14	14.29	14.29	21.43	21.43
Non-IG	10	0.00	0.00	0.00	10.00	10.00
All	**122**	**2.46**	**6.56**	**8.20**	**11.48**	**11.48**

This table presents cumulative realized default rates by rating class for the five years following the bond IPO. Only rated bonds issued until 2015 are included to ensure five-year coverage. Ratings reflect issuer ratings or respective security ratings at issuance date. Only rating categories that are present in the sample are included. All data is in %.

Table 6: Realized Defaults and Average Implied Probability of Default by Rating Category

	Differences by Rating Category:		
	Investment Grade	Non-Investment Grade	p-Value
Panel A: Realized Defaults			
MBond	0.54	0.22	$> \textit{0.999}$
Bond (listed)	0.02	0.06	*0.040*
Small Vol. Bond	0.20	0.08	*0.868*
Panel B: Implied PD			
MBond	21.95	21.27	*0.551*
Bond (listed)	9.79	20.78	$< \textit{0.001}$
Small Vol. Bond	13.94	24.16	*0.008*

This table presents differences in realized defaults and implied probability of default for investment grade and non-investment grade rated MBonds and other listed corporate bonds, issued between 2010 and 2018. Small Vol. Bonds is a subset of Bonds (listed) that only includes bonds with a volume up to EUR 150 million. In Panel A, a Pearson's chi-squared test is used to assess whether investment grade rated bonds defaulted less frequently. Investment Grade is a dummy variable that is equal to one if the bond has an investment grade rating and zero otherwise. Implied PD is the implied probability of default based on the Altman Z Score for private firms, not limited to manufacturing firms (see Altman et al., 1977; Altman and Saunders, 1998). All variables are described in detail in the appendix.

Table 7: Average Yield Spreads for Different Measures of Default (Risk)

	Yield Spread Comparison:				
	Within Bond Group			Across Bond Groups	
	MBonds	Bonds (listed)	Small Vol. Bonds	MBonds vs. Bonds (listed	MBonds vs. Small Vol. Bonds
				p-Value	p-Value
Panel A: Rating Category					
Inv. Grade	5.77	1.39	2.95	*< 0.001*	*< 0.001*
Non-Inv. Grade	6.49	4.44	5.17	*< 0.001*	*< 0.001*
p-Value	*< 0.001*	*< 0.001*	*0.002*		
Panel B: Realized Defaults					
Not Defaulted	6.34	3.34	4.85	*< 0.001*	*< 0.001*
Defaulted	6.05	6.22	6.36	*0.744*	*0.547*
p-Value	*0.873*	*< 0.001*	*0.003*		
Panel C: Implied PD Quantiles					
Lowest Quant.	6.06	2.89	4.88	*< 0.001*	*0.036*
Highest Quant.	6.68	4.81	5.21	*< 0.001*	*< 0.001*
p-Value	*0.066*	*< 0.001*	*0.254*		

This table presents average yield spreads by rating category, realized default status and quantiles of implied probability of default. Average yield spreads are compared within and across the different bond groups. Small Vol. Bonds is a subset of Bonds (listed) that only includes bonds with a volume up to EUR 150 million. Yield Spreads are calculated as the difference between yield to maturity and the yield of a German sovereign bond with matching maturity. Investment Grade is a dummy variable that is equal to one if the bond has an investment grade rating and zero otherwise. Defaulted is a dummy variable indicating default. Implied PD is the implied probability of default based on the Altman Z Score for for private firms, not limited to manufacturing firms (see Altman et al., 1977; Altman and Saunders, 1998). The lowest quantile indicates low probability of default; the highest quantile indicates the highest probability of default in the sample. All variables are described in detail in the appendix.

Table 8: Relation between Yield Spread and Credit Rating

	All Bonds		MBonds		Bonds (listed)		Small Vol. Bonds	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inv. Grade	−2.582***		−0.652***		−2.519***		−1.957**	
	(0.287)		(0.174)		(0.301)		(0.788)	
Rating (Numeric)		0.516***		0.221***		0.487***		0.472***
		(0.050)		(0.035)		(0.057)		(0.120)
MBond	2.115***	5.980***						
	(0.278)	(0.606)						
Inv. Grade * MBond	1.911***							
	(0.367)							
Rating * MBond		−0.301***						
		(0.067)						
AI / TD	0.005	0.001	−0.0003	−0.001	0.010***	2.629***	0.003	6.578*
	(0.003)	(0.001)	(0.001)	(0.001)	(0.003)	(1.002)	(0.004)	(3.274)
Maturity	−0.124***	−0.020	−0.293**	−0.263	−0.124***	−0.001	−0.145**	−0.068
	(0.038)	(0.022)	(0.135)	(0.160)	(0.037)	(0.015)	(0.067)	(0.076)
Secured	0.722**	−0.225	−0.015	−0.029	0.865**	−0.798**	0.817*	−2.198***
	(0.315)	(0.247)	(0.191)	(0.181)	(0.395)	(0.318)	(0.419)	(0.498)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	456	266	97	88	359	178	140	30
R^2	0.565	0.839	0.548	0.584	0.419	0.706	0.380	0.768

*p<0.1; **p<0.05; ***p<0.01

This table presents OLS regression results analyzing the relationship between yield spreads and credit ratings for MBonds and other corporate bonds traded on exchanges. Small Vol. Bonds is a subset of Bonds (listed) that only includes bonds with a volume up to EUR 150 million. Inv. Grade is a dummy variable that is equal to one, if the bond has an investment grade rating. Rating (Numeric) is numeric mapping of letter based ratings, where the highest rating in the sample, AA+, has the lowest number, and is defined as one. AI / TD is the volume of the bond issuance divided by the level of total debt in the year prior to issuance. Maturity describes the term of the bond in years. Secured is a dummy variable that is equal to one, if the bond is secured. Standard errors are clustered at the firm level to account for non-independent observations within firms. Variables are described in detail in the appendix.

Table 9: Relation between Yield Spread and Default (Risk)

	All Bonds		MBonds		Bonds (listed)		Small Vol. Bonds	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Defaulted	2.839***		−0.164		2.731***		1.362***	
	(0.479)		(0.199)		(0.524)		(0.362)	
Impl. PD		4.399***		0.762		4.611***		2.132*
		(1.086)		(0.471)		(1.097)		(1.101)
MBond	2.977***	3.092***						
	(0.350)	(0.415)						
Defaulted * MBond	−2.965***							
	(0.530)							
Impl. PD * MBond		−3.333***						
		(1.209)						
AI / TD	0.009*	0.633	0.0003	−0.037	0.015***	3.950***	0.007*	2.003***
	(0.005)	(0.456)	(0.001)	(0.095)	(0.002)	(0.741)	(0.004)	(0.669)
Maturity	−0.217***	−0.157***	−0.265*	−0.237	−0.217***	−0.126***	−0.198***	−0.112*
	(0.040)	(0.030)	(0.146)	(0.171)	(0.040)	(0.033)	(0.058)	(0.064)
Secured	1.005**	1.094***	−0.087	−0.091	1.207**	0.685	0.795*	0.758
	(0.399)	(0.413)	(0.203)	(0.220)	(0.492)	(0.465)	(0.419)	(0.586)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	456	419	97	83	359	336	140	117
R^2	0.454	0.507	0.497	0.510	0.274	0.403	0.354	0.360

*p<0.1; **p<0.05; ***p<0.01

This table presents OLS regression results analyzing the relationship between yield spreads and default (risk) for MBonds and other corporate bonds traded on exchanges. Small Vol. Bonds is a subset of Bonds (listed) that only includes bonds with a volume up to EUR 150 million. Default is a dummy variable that is equal to one if the bond defaulted. Impl. PD is the implied probability of default based on the Altman Z Score. AI / TD is the volume of the bond issuance divided by the level of total debt in the year prior to issuance. Maturity describes the term of the bond in years. Secured is a dummy variable that is equal to one if the bond is secured. Standard errors are clustered at the firm level to account for non-independent observations within firms. Variables are described in detail in the appendix.

Table 10: Aver. Yield Spread and Impl. PD by Rating Category for the Split Sample

	Bonds issued 2010 - 2012			Bonds issued 2013 - 2018		
	Inv. Grade	Non-Inv. Grade	p-Value	Inv. Grade	Non-Inv. Grade	p-Value
Panel A: Implied PD						
MBond	18.29	19.09	*0.441*	38.04	23.17	*0.853*
Bond (listed)	11.93	17.66	*0.031*	8.95	22.15	*< 0.001*
Small Vol. Bond	15.61	20.81	*0.217*	11.44	25.79	*0.007*
Panel B: Yield Spread						
MBond	5.74	6.20	*0.061*	5.91	6.73	*0.003*
Bond (listed)	1.76	4.09	*< 0.001*	1.27	4.58	*< 0.001*
Small Vol. Bond	2.51	4.60	*0.005*	3.62	5.41	*0.112*

This table presents differences in mean for yield spreads and implied probability of default for investment grade and non-investment grade rated MBonds and other corporate bonds traded on exchanges for the split sample. The sample is split into two subsamples after 2012, since in 2012 the first MBonds defaulted and investors potentially learned from the defaults. Small Vol. Bonds is a subset of Bonds (listed) that only includes bonds with a volume up to EUR 150 million. Investment Grade is a dummy variable that is equal to one if the bond has an investment grade rating and zero otherwise. Yield Spreads are calculated as the difference between yield to maturity and the yield of a German sovereign bond with matching maturity. Implied PD is the implied probability of default based on the Altman Z Score for private firms, not limited to manufacturing firms (see Altman et al., 1977; Altman and Saunders, 1998). The reported p-values refer to differences in mean between investment grade and non-investment grade rated bonds of the same period. All variables are described in detail in the appendix.

Table 11: Relation between Yield Spread and Credit Rating for the Split Sample of MBonds

	MBonds issued 2010 - 2012				MBonds issued 2013 - 2018			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Defaulted	−0.130				−0.032			
	(0.227)				(0.372)			
Impl. PD		0.827				0.789		
		(0.727)				(0.585)		
Inv. Grade			−0.337*				−1.151***	
			(0.199)				(0.305)	
Rating (Numeric)				0.140***				0.324***
				(0.047)				(0.060)
AI / TD	−0.016	−0.023	−0.015	−0.030**	0.001	0.283	−0.0004	−0.001
	(0.018)	(0.062)	(0.017)	(0.014)	(0.001)	(0.408)	(0.001)	(0.001)
Maturity	−0.041	0.012	−0.066	−0.094	−0.490***	−0.606***	−0.482***	−0.434*
	(0.097)	(0.060)	(0.095)	(0.120)	(0.139)	(0.194)	(0.154)	(0.224)
Secured	−0.076	−0.136	−0.019	0.040	−0.107	0.013	−0.068	−0.054
	(0.186)	(0.317)	(0.211)	(0.210)	(0.325)	(0.331)	(0.279)	(0.257)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54	48	54	49	43	35	43	39
R^2	0.565	0.588	0.583	0.638	0.398	0.465	0.515	0.500

*p<0.1; **p<0.05; ***p<0.01

This table presents OLS regression results analyzing the relationship between yield spreads and credit ratings for MBonds. The sample is split into two subsamples after 2012, since in 2012 the first MBonds defaulted. Inv. Grade is a dummy variable that is equal to one if the bond has an investment grade rating. Rating (Numeric) is numeric mapping of letter based ratings, where the highest rating in the sample, AA+, has the lowest number, and is defined as one. AI / TD is the volume of the bond issuance divided by the level of total debt in the year prior to issuance. Maturity describes the term of the bond in years. Secured is a dummy variable that is equal to one if the bond is secured. Standard errors are clustered at the firm level to account for non-independent observations within firms. Variables are described in detail in the appendix.

A.II Supplemental Material

Table 12: Moody's Average Cumulative Issuer-Weighted Global Default Rates, 1998-2017

Rating.Class	Year.1	Year.2	Year.3	Year.4	Year.5
Aaa	0.00	0.03	0.03	0.03	0.03
Aa1	0.00	0.00	0.00	0.00	0.03
Aa2	0.00	0.01	0.14	0.29	0.38
Aa3	0.05	0.13	0.18	0.25	0.39
A1	0.11	0.25	0.43	0.64	0.89
A2	0.07	0.20	0.39	0.58	0.85
A3	0.07	0.19	0.42	0.63	0.95
Baa1	0.15	0.39	0.64	0.91	1.10
Baa2	0.19	0.43	0.69	0.97	1.20
Baa3	0.25	0.60	0.96	1.35	1.81
Ba1	0.31	1.20	2.15	3.01	4.15
Ba2	0.68	1.60	2.84	4.12	5.24
Ba3	0.96	2.67	4.65	6.85	8.42
B1	1.33	4.06	7.10	10.13	12.86
B2	2.79	7.28	11.95	16.47	19.93
B3	3.84	9.31	15.25	20.17	24.60
Caa1	4.78	11.14	17.18	22.42	26.88
Caa2	9.46	17.86	25.19	31.72	36.83
Caa3	19.70	31.91	40.07	45.14	49.15
Ca-C	32.87	43.91	51.64	56.52	59.58

This table presents average cumulative default probabilities by year and rating class. The table was adapted from Moody's Average Cumulative Issuer-Weighted Global Default Rates By Alphanumeric Rating, 1998-2017 (Moody's Investors Service, 2018). All data is in %.

A.III Variable Definitions

Table 13: Definitions for Other Variables

Variable	**Definition**
Y.Spread	Yield Spread = YTM - Yield of German Sovereign Bond
Altm. Z Score	Altman Z Score $= 6.56 * X1 + 3.26 * X2 + 6.72 * X3 + 1.05 * X4$
Impl. PD	Implied Probability of Default based on Altman Z Score $= \frac{1}{1+e^Z}$
Time to Def.	Time span between issuance date and default date in years.
Defaulted	A dummy variable, which equals one if the issuer failed to pay interest or principal when due or filed for bankruptcy, and zero otherwise.
Rated	A dummy variable, which equals one if the issuer or the bond has a rating, and zero otherwise.
Inv. Grade	A dummy variable, which equals one if the issuer or the bond has an investment grade rating, and zero otherwise.
Secured	A dummy variable, which equals one if the bond is secured with collateral, and zero otherwise.
Subordinated	A dummy variable, which equals one if the bond is subordinated or junior debt, and zero otherwise.

Data for accounting variables is extracted from the Bureau van Dijk, Dafne database. Bond information is extracted from Bloomberg, Thomson Eikon or hand collected. Yields for German government bonds are also extracted from Bloomberg. Yield to maturity (YTM) is approximated using the Newton-Raphson method as numeric root-finding technique. The components of the Altman Z Score for private firms, not limited to manufacturing companies (see Altman et al., 1977; Altman and Saunders, 1998), are the following: X1 = Working Capital / Total Assets, X2 = Retained Earnings / Total Assets, X3 = EBIT / Total Assets, X4 = Equity / Total Liabilities.